MEMORANDUM

HARRIS COUNTY FLOOD CONTROL DISTRICT
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DATE: October 10, 2017

TO: HCFCD Flood Watch/Partners

FROM: Jeff Lindner
Director of Hydrologic Operations/Meteorologist

Steve Fitzgerald
Chief Engineer

RE: Immediate Report – #2
Hurricane Harvey - Storm and Flood Information

This is the second report summarizing the catastrophic flooding produced by the landfall and slow movement of Hurricane Harvey.

GENERAL FLOODING STATEMENT

The tropical wave that would eventually develop into Hurricane Harvey moved off the west coast of Africa on August 11th and tracked westward across the tropical Atlantic becoming a tropical storm on August 17th and then moved into the Caribbean Sea where Harvey became disorganized and was downgraded to a tropical wave. The tropical wave entered the Gulf of Mexico on the afternoon of the 22nd and was upgraded again to tropical depression Harvey on the morning of the 23rd. Over the next 48 hours Harvey would undergo a period of rapid intensification from a tropical depression to a category 4 hurricane and make landfall along the Texas coast near Port Aransas around 10:00 p.m. on August 25th. The upper air steering patterns that moved Harvey toward the Texas coast weakened and Harvey's forward motion slowed to near 5 mph after landfall and then to a meander just north of Victoria, TX on the 26th. Rain bands on the eastern side of the circulation of Harvey moved into southeast Texas and Harris County on the morning of the 25th and continue through much of the night and into the 26th. A strong rainband developed over Fort Bend and Brazoria Counties during the evening hours of the 26th and spread into Harris County and slowed while training from south to north. Flash flooding developed rapidly between 8:00 p.m. and 11:00 p.m. as tremendous rainfall rates occurred across much of Harris County. Additional rain bands continued to develop into the morning hours of the 27th producing additional excessive rainfall amounts.

As the center of Harvey slowly moved east-southeast and back offshore, heavy rainfall continued to spread across Harris County through much of the 29th and the 30th exacerbating the ongoing widespread and devastating flooding. Harvey maintained tropical storm intensity the entire time while inland over the Texas coastal bend and southeast Texas. After moving offshore, Harvey made another landfall just west of Cameron, Louisiana on the morning of the 30th.

As of September 25th, the Harris County Medical Examiner's Office has confirmed 36 flood related deaths across Harris County. Unlike with recent flooding across Harris County, the majority of the fatalities associated with Harvey were not from drowning in vehicles, but instead

from people outside in the fast moving or high water levels. Additionally, Harvey is one of the only flood events where a few people drowned in their home or work place.

It is estimated that over 600,000 vehicles were flooded across Harris County many of which were in homes, parking garages, and dealership lots.

Early damage estimates suggest hurricane Harvey's landfall in Texas and flooding across the Houston area will likely become one of the most costliest disasters in US history potentially surpassing that of hurricane Katrina's $160.0 billion damages in 2005. Current damage estimates for Harvey range from 80-190 billion dollars.

RAINFALL

Peak total rainfall for the various time periods are listed below for HCFCD gages across Harris County.

Time	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr	2-day	4-day
Peak Rainfall (inches)	6.8	11.9	14.8	18.9	20.9	25.6	35.2	47.4

Duration – Rain began Friday morning, August 26th across the county with the first heavy band entering the county Saturday night, August 27th. Heavy rain bands continued to sweep across the entire county through Monday, August 28th. The majority of the rainfall occurred during a 4 day period and breaks in rainfall between bans were short and infrequent.

Total Amounts – Total rainfall amounts ranged from 26 to 47 inches across the county for 4 days. The 2 day amount ranged from 20 to 35 inches and the 1 day from 13 to 25 inches. The lowest totals occurred over the northwest and northeast part of the county with the highest totals focused across the southeast part of the county along I-45 from near the City of South Houston and Pasadena southward to Friendswood and Webster and eastward to I-10 and Baytown.

A maximum 2 day rainfall total of 34.5 inches was recorded at Clear Creek and I-45 and 35.2 inches at Berry Bayou and Forest Oaks Blvd.

A maximum 4 day rainfall total of 47.4 inches was recorded at Clear Creek and I-45

Exceedance Probability – Rainfall was generally less than a 2% (50-yr) event for the time 15-min to 6-hr time periods for most areas except southeast Harris County and Brays Bayou where 1% (100-yr) to 0.2% (500-yr) and greater rainfall occurred. Rainfall for the 12-hr to 4 day time periods ranged from 1% (100-yr) to 0.2% (500-yr) and greater for all watersheds.

The maximum and weighted ranges shown below are county-wide and recurrence intervals greater than 500-yr are approximate.

The 47.4 inches of rainfall at I-45 and Clear Creek over a 4 day period is 95% of the Probable Maximum Precipitation (PMP).

Duration	Rainfall Amount	Return Interval – years (exceedance probability)
1-Hour		
Maximum	6.8”	1,500 (0.0667%)
Weighted Range	4-5”	50-500 (2.0% - 0.2%)
24-Hour		
Maximum	28.6”	5,000 (0.02%)
Weighted Range	16-20”	200-1,000 (0.5%-0.1%)
2-Day		
Maximum	35.2”	12,000 (0.08%)
Weighted Range	23-30”	1,500-5,000 (0.067%-0.02%)
4-Day		
Maximum	47.4”	50,000 (0.002%)
Weighted Range	30-40”	3,000-20,000 (0.033%- 0.005%)

Two other rainfall factors that influence flood levels is the intensity (inches per hour) variation over time and the distribution in the watershed (area distribution). For Hurricane Harvey, the intensity was moderate to high most of the time. Due to the length of the rainfall event and the numerous bands that developed, the areal distribution in most a watersheds did not vary significantly.

The following table compares the extraordinary rainfall associated with Harvey against Tropical Storm Allison in June 200, the Tax Day Flood of April 2016, and the October 1994 Flood for various time periods. It is interesting that Tropical Storm Allison exceeds Harvey’s rainfall in the 12 and 24-hr periods. In the 2 day period Harvey produced 6.0 inches more than Allison and 8.9 inches more over 4 days.

	Max Rainfall (inches)			
Duration	**Harvey**	**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
1 day	25.6	28.4	17.4	20.9

2 days	35.2	28.5	17.5	23.1
4 days	47.4	38.5	N/A	28.9

A total of 1 trillion gallons of water fell across Harris County over the 4 day period which would fill the Houston Astrodome 3,200 times and cover Harris County's 1,777 sq. miles with an average of 33.7 inches of water. This volume of water would also run Niagara Falls for 15 days.

RAINFALL HISTORICAL CONTEXT

There are three ways to examine a rainfall event to determine its historic nature and comparison to other previous events. This includes duration, amount, and spatial coverage of rainfall. Texas A&M State Climatologist Dr. Nielson Gammon examined all of the largest rainfall events ever recorded in United States history and compared against Hurricane Harvey for durations of 48, 72, and 120 hrs and in spatial coverage of 1,000, 2,000, 5,000, 10,000, 20,000, and 50,000 square miles. Harvey exceeded the previous record in all of the 18 different combinations except one. The most astounding statistic is that for the 120 hr duration over 10,000 square miles, Harvey exceeded the previous record from June 1899 by 13.33 inches or 62%. The rainfall amounts and spatial coverage of those amounts have never been experienced across the United States since the late 1800's.

Additionally, the average 33.7 inches of rainfall from Harvey across Harris County exceeds the worst storm event ever recorded for a similar square mile area as Harris County in the state of Louisiana in August of 1940 by 3.9 inches.

The following table shows the 120 hr rainfall average for Harvey compared against the previous record for various coverage areas:

Area (Sq Mi)	Event	Average Rainfall (in)	Over Previous Record
1000	Harvey	45.71	40%
	Louisiana 1940	32.64	
2000	Harvey	43.69	47%
	Louisiana 1940	29.80	
5000	Harvey	39.72	55%
	TX June 1899	25.60	
10000	Harvey	34.72	62%
	TX June 1899	21.39	
20000	Harvey	28.22	51%
	Beulah 1967	18.70	
50000	Harvey	19.05	19%
	Beulah 1967	16.00	

For Harris County, the 33.7 inches averaged over 1,777 square miles was 68% of the annual rainfall of 49.77 inches at Bush IAH in a 4 day period.

Over a 50,000 square mile area, Harvey dropped upwards of 16.6 trillion gallons of water which could supply the entire US water needs for 280 days and fill Lake Conroe 116 times.

CHANNEL FLOODING

Disastrous flooding occurred on many of the watersheds in Harris County except Sims Bayou, portions of White Oak Bayou and Horsepen Creek. Historical records held by previous massive floods in October 1994, Tropical Storm Allison, and April 2016 (Tax Day) were exceeded by Harvey at many locations.

Clear Creek

Record flooding occurred along the entire channel and the major tributaries of Turkey Creek, Chigger Creek, Cowart Creek, and Mary's Creek and upper Beamer Road Ditch. Hurricane Harvey exceeded the previous water level records establish by Tropical Storm Claudette in 1979 by as much as 2.0-3.0 feet. Water levels in Clear Lake averaged 1.0-2.0 feet lower than Hurricane Ike's storm surge in 2008. Harvey water levels along Turkey Creek (A119) and upper Beamer Road Ditch (A120) exceeded those levels recorded during both Tropical Storm Claudette and Tropical Storm Allison. Water levels along all of Clear Creek, Turkey Creek, and Mary's Creek equaled or exceeded the .2% (500-yr) annual exceedance probability. Flooding of structures along Clear Creek and its tributaries in both Harris County and portions of Brazoria and Galveston Counties was the worst ever recorded.

Armand Bayou

Flooding along upper Armand Bayou surpassed previous records from Tropical Storm Claudette and Tropical Storm Allison with water surface elevations at or slightly above the .2% (500-yr) level for the middle and upper portions of the watershed or upstream of Genoa Red-Bluff. Water levels in the lower portion of Armand Bayou were nearly equal to the storm surge produced by Hurricane Ike in 2008. Horsepen Bayou (B104) a tributary to Armand Bayou established new record levels along the entire channel surpassing both Tropical Storm Allison and Hurricane Ike's storm surge. Water levels along Big Island Slough (B106) for Harvey did not break previous records established during Tropical Storm Claudette, but were similar to those levels experienced during Tropical Storm Allison. Water levels along Willow Spring Bayou (B112) exceeded all previous records held by Tropical Storm Claudette and surpassed the .2% (500-yr) annual exceedance probability at each bridge crossing.

Sims Bayou

Sims Bayou was one of the few channels in the entire county that did not suffer widespread and extensive overbank channel flooding largely due to the completion of the federal flood risk reduction project and three HCFCD regional detention basins. Water levels for Harvey were generally below the historical records of Tropical Storm Allison and averaged between a 2.0% (50-yr) and 1.0% (100-yr) level downstream of Martin Luther King Blvd and generally below a 10% (10-yr) annual exceedance probability from Airport Road upstream to the headwaters. Significant flooding occurred along Berry Bayou, a tributary, to Sims Bayou which runs northward along the east side of SH 3. The period of record along Berry Bayou is short, only extending back to the early 2000's, and Harvey exceeded all previous events including Tropical Storm Erin (2007), Hurricane Ike (2008) and flooding in June 2006, but it is not known if Harvey exceeded level during Tropical Storm Allison (2001) since no data from Allison is available.

Brays Bayou

Water levels along Brays Bayou upstream of Calhoun were the highest ever recorded surpassing previous historic floods in September 1983, Tropical Storm Allison and Memorial Day 2015. Downstream of Calhoun to the mouth, Tropical Storm Allison water levels were

higher. Water levels along Brays Bayou in the Texas Medical Center exceeded Tropical Storm Allison water levels by .5 to 1 foot. Upstream of the 610 Loop including Meyerland, water levels exceeded the September 1983, Memorial Day 2015, and Tax Day 2016 by an average of 1.0-2.0 feet. Harvey was one of the most significant flooding events ever recorded along Brays Bayou with water levels generally averaging between the 2% (50-yr) and 1% (100-yr) annual exceedance probability in the middle reach of the channel. The lower and upper reaches were below the 2% (50-yr) annual exceedance probability primarily due to the completion of the federal project in those reaches.

Flooding along Willow Waterhole (D112) also established new records for Harvey and exceeded the previous record event on Memorial Day 2015 by an average of 1.0-3.0 ft. Water surface elevations along Willow Waterhole were generally at or above the .2% (500-yr) annual exceedance probability.

Additionally, significant backwater flooding occurred along several lateral channels and tributaries that drain to Brays Bayou as a result of high flows in Brays Bayou.

Keegans Bayou
Water levels along much of Keegans Bayou were similar to the Memorial Day 2015 flood. Generally, Harvey did not set new records along Keegans Bayou as most records continue to stand from the Memorial Day 2015 flood. Water surface elevations averaged between the 2% (50-yr) and 1% (100-yr) along much of the channel.

White Oak Bayou
Record flooding occurred along the lower portion of White Oak Bayou from the confluence with Buffalo Bayou in Downtown Houston upstream to Shepherd Dr. Water levels in Downtown Houston upstream to near I-45/I-10 exceeded the previous records during Tropical Storm Allison by 2.0-4.0 ft. Upstream of Shepherd Dr. water levels averaged below Tropical Storm Allison levels, and in Jersey Village well below the 2016 Tax Day, Tropical Storm Allison, and Tropical Storm Frances levels. Water surface elevations from Downtown Houston to Shepherd Dr. averaged between the 1% (100-yr) and .2% (500-yr) annual exceedance probabilities and generally between the 10% (10-yr) and 2% (50-yr) upstream of Ella Blvd and less than the 10% (10-yr) upstream of North Houston Rosslyn including the Jersey Village area.

Water levels on the major tributaries of White Oak Bayou including Little White Oak Bayou, Brickhouse Gully, Cole Creek, and Vogel Creek all averaged below the historic records held by Tropical Storm Allison. Although records from Allison are few, where marks were obtained in 2001, suggest Allison averaged 1.0-2.0 feet higher than Harvey. Water surface elevations averaged between the 1% (100-yr) and .2% (500-yr) from Downtown Houston to the 610 North Loop on Little White Oak Bayou and the entire reach of Brickhouse Gully.

San Jacinto River
Catastrophic record flooding occurred along the entire San Jacinto River system including the West Fork, East Fork, mainstem below Lake Houston, and major tributaries along the river including Gum Gully. Massive flooding occurred throughout Humble, Kingwood, Huffman, Crosby, Highlands, and portions of Sheldon. Extreme flows on the lower portion of the San Jacinto River around Banana Bend completely lifted houses off their elevated pilings and resulted in severe damage to roadway access into that subdivision. The previous record flood levels of October 1994 were exceeded at all locations along each section of the river. Along the West Fork of the San Jacinto River water levels surpassed October 1994 by 3.0-4.0 ft, and as much as 5.0 ft along the East Fork of the San Jacinto River. Mainstem river flooding below Lake

Houston exceeded the previous record in October 1994 by 1.0-3.0 ft and at the I-10 crossing water levels exceeded Hurricane Ike's storm surge by 4.0 ft. Water levels along the West Fork of the San Jacinto River averaged above the .2% (500-yr), along the East Fork of the San Jacinto River were 5.0 ft above the .2% (500-yr) level and along the mainstem of the river below Lake Houston averaged between the 1% (100-yr) and .2% (500-yr) annual exceedance probabilities. Several locations along the river system experienced water levels into the second floor of homes or the first floor of elevated structures requiring extensive water rescue efforts. Additionally, large amounts of debris and heavy sedimentation upwards of 4.0-6.0 ft in some locations have been noted especially along the West Fork of the San Jacinto River.

Lake Houston
A record pool elevation of 53.1 ft was recorded at the Lake Houston Spillway surpassing the previous record of 52.3 ft in October 1994. An estimated discharge of 425,000 cfs or 5.0 times the average flow of Niagara Falls occurred at the peak flow over the Lake Houston spillway. This amount of flow would fill the Houston Astrodome in less than two minutes.

Hunting Bayou
Water levels along Hunting Bayou were near or slightly above those of Tropical Storm Allison and generally averaged between the 1% (100-yr) and .2% (500-yr) annual exceedance probability downstream of Wallisville Rd. and 2% (50-yr) to 1% (100-yr) upstream to US 59. Flooding along Hunting Bayou was similar to Tropical Storm Allison and did reach near the rooftop of homes just north of I-10. Record flood levels were established in the upper portion of the watershed from near Lockwood Dr west to just downstream of the headwaters.

Vince Bayou
Water levels along both Vince and Little Vince Bayous in Pasadena established new record levels surpassing those of Tropical Storm Allison. Levels along Vince Bayou exceeded Tropical Storm Allison by 2.0-4.0 ft and Tropical Storm Claudette by 5.0-7.0 ft and averaged 1.0-3.0 ft above the .2% (500-yr) annual exceedance probability except from SH 225 to the Ship Channel where water levels were in the 1% (100-yr) and .2% (500-yr) range. Along Little Vince Bayou water levels exceeded Tropical Storm Allison at all locations, but did not exceed Tropical Storm Claudette at the headwaters of the watershed. Water surface elevations along the entire reach of Little Vince Bayou exceeded the .2% (500-yr) annual exceedance probability including several locations where the values were exceeded by 2.0-4.0 ft. Flooding across much of Pasadena was significantly more widespread and deep compared to Tropical Storm Allison.

Spring Creek
Flooding along Spring Creek was slightly higher than the devastating flooding of May 2016, and many of the same structures that flooded one year ago were flooded again. Harvey water levels did not exceed the October 1994 flood levels at most locations, and based on this Harvey is not a record flood along Spring Creek, but the second surpassing that of May 2016. Significant backwater from the West Fork of the San Jacinto River into lower Spring Creek surpassed the October 1994 flood elevation by 5.0 ft at the end of Lee Rd north of Bush IAH. Water surface elevations along Spring Creek generally averaged between the 1% (100-yr) and .2% (500-yr) elevations. As noted during the May 2016 flooding, water reached near the rooftops of some homes south of The Woodlands and west of I-45 and velocities led to extensive damage to fences and brick privacy walls as well as some outside facing walls of homes.

Flooding along Spring Creek was a direct result of the 20.0-28.0 inches of rainfall cross the watershed and not a result of releases from Lake Conroe. Releases from Lake Conroe do not affect water surface elevations along Spring Creek.

Cypress Creek
Record flooding occurred along Cypress Creek and many of its tributaries from the confluence with Spring Creek upstream to near US 290. Water levels west of US 290 to the headwaters in eastern Waller County were generally equal to or slightly below levels recorded last year during the April 2016 Tax Day flood. Flooding along the middle and lower portions of Cypress Creek east of US 290 was the highest ever recorded and exceeded the Tax Day flooding by 2.0-5.0 feet. Water levels were generally between the 1% (100-yr) and .2% (500-yr) annual exceedance probabilities from the confluence with Spring Creek upstream to Aldine Westfield. Upstream of Aldine Westfield to Barker Cypress water levels exceeded the .2% (500-yr) annual exceedance probability with location upstream of US 290 to the headwaters averaging between a 1% (100-yr) and .2% (500-yr) annual exceedance probability. 24 of the 20 high water marks collected along Cypress Creek were new records. Additionally, record flooding also occurred along several of the tributaries including (K111, K133, and K142). Water levels on K111 exceeded the previous record during the Tax Day flooding of 2016 by 4.0 ft.

Little Cypress Creek
Significant flooding occurred along much of Little Cypress Creek, but high water marks compared against the historical record indicate that Harvey did not exceed water levels during the Tax Day flooding of 2016 which remains the record for all of Little Cypress Creek except for the Kluge bridge crossing which exceeded Tax Day 2016 by .60 of a ft. The flooding at Kluge Rd was likely a combination of flow down Little Cypress Creek and backwater flooding from Cypress Creek. Water levels averaged near or above the .2% (500-yr) annual exceedance probability along the entire channel.

Willow Creek
Record flooding occurred along Willow Creek from SH 249 downstream to the confluence with Spring Creek, surpassing previous record floods in October 1994 and Tax Day 2016. Harvey water levels exceeded the previous record flood levels by 2.0-3.0 ft from October 1994. Water levels upstream of SH 249 to the headwaters were below those of the flooding in October 1994, October 1998, Tropical Storm Allison, and the 2016 Tax Day flooding. Water levels east of SH 249 averaged generally between the 1% (100-yr) and .2% (500-yr) annual exceedance probability and west of SH 249 generally below the 2% (50-yr) annual exceedance probability

Carpenters Bayou
Record flooding generally occurred along the entire channel, except from I-10downstream to the mouth where the previous historic record during Tropical Storm Allison holds. Out of eight bridge crossings five exceeded the previous records of Tropical Storm Allison and the water level at the Sheldon bridge crossing exceeded the storm surge elevation recorded during Hurricane Ike. Water levels along the bayou averaged between the 2%% (50-yr) and 1% (100-yr) annual exceedance probability from the mouth to Woodforest Dr. and 1% (100-yr) and .2% (500-yr) upstream of Woodforest Dr.

Goose Creek
Record flooding occurred along Goose Creek upstream of HWY 146 to the headwaters surpassing the previous record of Hurricane Alicia (1983) and the October 1994 flooding by 2.0-4.0 ft. South of HWY 146, water levels exceeded all previous rainfall events, but did not exceed the storm surge levels produced by both Hurricane Ike (2008) and Hurricane Alicia (1983). Harvey's rainfall run-off averaged nearly 50% of Hurricane Ike's storm surge values. Water surface elevations generally averaged between 1% (100-yr) and .2% (500-yr) annual exceedance probability north of HWY 146 and generally at or below the 10% (10-yr) south of HWY 146

Greens Bayou
Record flooding occurred along Greens Bayou from E Mount Houston Pkwy downstream (south) to the Houston Ship Channel exceeding Tropical Storm Allison by an average of 1.0-2.0 ft. Upstream (west) of E Mount Houston Pkwy water level were below Tropical Storm Allison and near the October 2002 flood. Harvey water levels were above the .2% (500-yr) annual exceedance probability downstream of E Mount Houston Pkwy, generally between the 10% (10-yr) and 2% (50-yr) upstream of I-45, and 2% (50-yr) to 1% (100-yr) in between.

Halls Bayou
Water levels were similar to Tropical Storm Allison along much of the channel, but at most locations, Allison exceeded Harvey and remains the flood of record. One exception is in the reach from Airline Dr. upstream to just west of I-45 where Harvey did surpass the previous record water levels of Tropical Storm Allison by an average of .5 of a foot. While high water marks are not available for Mesa Dr. for Tropical Storm Allison, the next upstream bridge at Tidwell did exceed the Tropical Storm Allison mark and it is possible that Mesa also exceeded Tropical Storm Allison especially given the record flooding on the lower portion of Greens Bayou. Water levels were above the .2% (500-yr) annual exceedance probability downstream of Wayside, generally between the 10% (10-yr) and 2% (50-yr) upstream of Wayside to the Hardy Toll Rd, and 1% (100-yr) and .2% (500-yr) upstream of the Hardy Toll Rd.

Garners Bayou
Record flooding occurred along the entire channel from Bush IAH downstream to the confluence with Greens Bayou. Harvey water levels exceeded previous records held by Tropical Storm Allison and flooding in October 2002. Tropical Storm Allison records were generally exceeded by 2.0-3.0 ft along the entire channel. Water levels averaged between the 1% (100-yr) and .2% (500-yr) annual exceedance probabilities along the entire channel.

Cedar Bayou
Record flooding occurred along the entire channel and surpassed the previous record from October 1994 by 3.0-4.0 ft. Additionally, Harvey exceeded Hurricane Ike's storm surge at the HWY 146 bridge by an astounding 5.0 ft. All eight bridge crossing over Cedar Bayou exceeded the .2% (500-yr) annual exceedance probabilities including over 6.0 ft at the I-10 crossing. Flow from the bayou overtopped both east and west bound mainlanes of I-10 and water reached to rooftop levels and higher in some locations between US 90 and HWY 146. The Conoco Phillips refinery just north of I-10 was completely flooded.

Mason Creek
Harvey's rainfall produced the highest known water levels along the entire channel of Mason Creek exceeding the previous record levels from the 2016 Tax Day flood by 1.0-2.0 ft. Water levels averaged between the 1% (100-yr) and .2% (500-yr) annual exceedance probabilities along the entire channel

Upper Buffalo Bayou/Cane Island Branch
Record flooding occurred along upper Buffalo Bayou and Cane Island Branch from southeast Waller County through the City of Katy to Barker Reservoir. Water levels generally exceeded the previous record from the 2016 Tax Day flood by 1.0-2.0 ft especially in the City of Katy which resulted in widespread devastating flooding. The majority of the flooding from Harvey along Cane Island Branch and its tributaries occurred from the channel exceeding their banks. Extreme amounts of overland flow flooding occurred in the 2016 Tax Day flooding in rural portions of extreme western Harris and southeast Waller Counties that was not as high, nor as widespread with Harvey. This is likely due to lower short duration rainfall intensities compared to Tax Day 2016 when the core of maximum rainfall occurred just northwest of this area. Along upper Buffalo Bayou through portions of Cinco Ranch east of SH 99, a record pool elevation in

Barker Reservoir resulted in water levels overtopping the banks of the bayou near Fry Rd and east of SH 99 from a combination of both a high pool level in Barker Reservoir and upstream inflows draining from southeastern Waller County, northeast Fort Bend County, and western Harris County.

Langham Creek
Record flooding occurred along much of the creek from Addicks Reservoir to the upstream headwaters near Fry Rd. Water levels were generally 1.0-2.0 ft higher than the previous record flooding on Tax Day 2016 and averaged between a 1% (100-yr) and .2% (500-yr) annual exceedance probability. A record pool elevation in Addicks Reservoir resulted in backwater flooding along the lower portions of Langham Creek at Addicks Satsuma Rd and upstream to HWY 6.

Langham Creek also experienced significant flooding on the downstream (south) side of Addicks Dam to the confluence with Buffalo Bayou. Harvey exceeded the previous record at Memorial Dr. established in April 2009 by over 6.0 ft as a result of backwater flooding from Buffalo Bayou and Corps of Engineers releases from Addicks Dam.

South Mayde Creek
Record flooding occurred at all 13 bridge crossings over South Mayde Creek surpassing the previous records established during the 2016 Tax Day flood, October 1998, and October 1994. On average water levels were 2.0-3.0 ft higher than the 2016 Tax Day flooding and were generally between the 1% (100-yr) and .2% (500-yr) annual exceedance probabilities. Large volumes of Cypress Creek overflow affected the upper portions of South Mayde Creek and the lower portion of the creek was heavily affected by the record pool elevation in Addicks Reservoir. Record levels at Barker Cypress and Groeschke matched closely to the Addicks peak pool elevation.

Bear Creek
Harvey flooding along Bear Creek was generally worse than 2016 Tax Day flooding downstream of FM 529 and the very upper end. Water levels at Clay Rd. and FM 529 bridges did not exceed the 2016 Tax Day flooding. Water level elevations were generally between the 1% (100-yr) and .2% (500-yr) annual exceedance probabilities upstream of FM 529 and greater than the .2% (500-yr) downstream.

Horsepen Creek
The only bridge that recorded a record water level for Harvey was W Little York and this was likely a direct result of the record pool elevation of Addicks Reservoir. On average the 2016 Tax Day flood was 2.0-3.0 ft higher than the levels recorded during Harvey at the bridges upstream of Huffmeister and were generally between the 10% (10-yr) and 2% (50-yr) annual exceedance probabilities. This channel is susceptible to intense short duration rainfall rates which in the past have caused significant house flooding, but in this particular area, Harvey's short duration intense rainfall rates were low enough to prevent significant flooding along much of the channel.

Buffalo Bayou
Record flooding occurred at every bridge crossing along Buffalo Bayou as Harvey water levels exceeded previous floods of record from Tax Day 2016, March 1992, and Tropical Storm Allison (2001). In Downtown Houston, water levels exceeded the previous record from Tropical Storm Allison by 5.0-7.0 ft. From Downtown Houston westward to the 610 West Loop water levels

exceeded Tropical Storm Allison by 2.0-4.0 ft and the March 1992 flooding by 4.0-6.0 ft. West of the 610 West Loop water levels exceeded the previous record from Tax Day 2016 by 5.0-8.0 ft. Water levels were generally above the .2% (500-yr) annual exceedance probabilities from HWY 6 downstream to Father Point and between the 1% (100-yr) and .2% (500-yr) downstream of Father Point to east of Downtown Houston.

Water levels recorded at the Houston Ship Channel Turning Basin were 5.0 ft above the 2016 Tax Day flooding, and only 3.0 ft lower than levels recorded during Hurricane Ike.

Water level elevations and duration were influenced by Corps of Engineers emergency releases during the extreme rainfall event as well as the subsequent releases to empty the Addicks and Barker Reservoirs (see Addicks and Barker Reservoirs below).

Houston Ship Channel

Incredible amounts of rainfall run-off were discharged into the Houston Ship Channel from many of the bayous and creeks draining Harris County. The NOAA tide gage at Manchester (610 E Loop) recorded a peak water surface elevation of 12.01 ft on August 29th. Hurricane Ike's storm surge flooding at the same tide gage was 12.30 ft suggesting Harvey's rainfall run-off was only .29 of a foot lower than Ike's storm surge.

Lake Conroe

A new record pool elevation of 206.20 ft was recorded for Lake Conroe surpassing the previous record pool of 205.60 ft in October 1994. A peak release rate of 79,141 cfs was passed through the Lake Conroe flood gates into the West Fork of the San Jacinto River in accordance with emergency procedures for an extreme event to protect the integrity of the dam structure. While Lake Conroe released 79,141 cfs, three other uncontrolled watersheds: Spring Creek, Cypress Creek, and Lake Creek contributed a total of 168,200 cfs into the West Fork of the San Jacinto River. It is estimated that 200,500 cfs flowed through the West Fork of the San Jacinto River at Humble (US 59) of which 39% was water from Lake Conroe. Of the total estimated inflow of 444,200 cfs into Lake Houston 17.8% was from Lake Conroe. The table below shows the peak discharge rates into Lake Houston from the major watersheds that drain into the lake.

Watershed	Peak Discharge (cfs)
E Fork of San Jacinto River	119,000
Peach Creek	31,300
Caney Creek	20,900
Cypress Creek	28,100
Spring Creek	82,100
W. Fork of San Jacinto River (Porter)	130,000
Luce Bayou	32,800
Total	**444,200**

HOUSE FLOODING ESTIMATES

Harvey produced the largest and most devastating structure flooding event ever recorded in Harris County. Structure flooding occurred from both overflowing creeks and bayous as well as internal drainage system being overwhelmed by the intense short duration rainfall rates.
Various jurisdictions continue to assess flood damages as a result of Harvey and some jurisdictions have not completed a full assessment of the damages within their area of responsibility. The numbers listed below are preliminary damage numbers from some of the jurisdictions across Harris County. These numbers are from damage assessment team inspections only, and additional data from FEMA claims have yet to be incorporated at this time. The estimates provided in the table will change as additional data becomes available.

Jurisdiction	Structure Flooding	Jurisdiction	Structure Flooding
Harris County (unic)	29,790	Nassau Bay	380
City of Houston	28,880	Seabrook	120
Deer Park	285	Humble	390
Katy	(420 / 265)	Missouri City	(0 / 200)
Pasadena	1,030	La Porte	460
Bellaire	4,600	Waller	5
League City	(40 / 7,910)	Bunker Hill Village	5
Friendswood	(1,290 / 970)	Pearland	(5 / 1,625)
The Woodlands	(200 / 400)	Taylor Lake Village	20
Galena Park	245	West University Place	100
		Total	**(68,265 / 11,370)**

Note: some of the flooding estimates include flooded structures outside of Harris County, but within the watersheds that border the Harris County boundary. The table above lists the structure flooding as (Harris County / other Counties) where city jurisdictions cross the county line.

Harvey flooding was unusually deep in some areas, due in part to the intense short duration rainfall rates and the record flood levels along several creeks and bayous. Water levels rose to the second story of some structures near Hobby Airport, lower Cedar, Hunting and Greens Bayous, and along many portions of the San Jacinto River system. This event was one of the only times where HCFCD and emergency management officials urges residents to climb on to their roofs to escape the increasing depths of the flood waters.

ADDICKS AND BARKER RESERVOIRS

The Corps of Engineers owns, operates, and maintains the Addicks and Barker stormwater detention reservoirs constructed in the 1940's to reduce flows downstream on Buffalo Bayou.

Addicks Reservoir peaked at a record elevation of 109.10 ft at 7:00 a.m. on August 30th surpassing the previous record of 102.65 ft last year during the "Tax Day" Flood of 2016 by 6.45 ft. At maximum pool the reservoir was impounding 217,726 acre feet of water. The pool reached an elevation of 108.0 ft on August 29th at 7:15 a.m. which resulted in uncontrolled flow over the natural ground at the end of the north spillway for the first time ever. This flow out of the reservoir impacted several subdivisions and businesses on either side of Tanner Rd from Eldridge Pkwy to Brittmore Park Dr. The pool elevation fell to 107.99 ft on September 1st at 8:30 p.m. ending the flow around the north end spillway. The pool elevation did not exceed the elevation of the south spillway.

A peak maximum inflow of 72,200 cfs was flowing into Addicks Reservior on the morning of August 28th from Bear, Langham, and South Mayde Creeks (flows not available from Horsepen Creek). This included a peak flow on Bear Creek of 41,000 cfs. Harvey exceeded the previous maximum inflows recorded during last year's Tax Day flood by 31,300 cfs. In fact the flow down Bear Creek alone exceeded the entire combined peak inflow of the 2016 Tax Day flood.

Barker Reservoir reached a peak pool elevation of 101.56 ft on August 30th at 6:00 a.m. impounding 171,000 acre feet of water. Barker Reservoir exceeded its previous record pool of 95.22 ft during the 2016 Tax Day flood by 6.34 ft. The pool of Barker Reservoir did not exceed the elevations of the north or south spillways.

Widespread flooding of homes and streets occurred within the pools upstream of Addicks and Barker Reservoirs as well as flooding of major roadways within the reservoirs. Additionally, house flooding occurred near the northern spillway of Addicks as flow left the reservoir pool and flowed east along Tanner Rd. With the Harvey record rainfall, this was the first time that homes had ever flooded from the pools of either reservoir.

Downstream on Buffalo Bayou, the Harvey flood event produced a peak flow at the USGS Piney Point gage of about 12,200 cfs (provisional) at 1:15 am on the 28th. Because of the severity of the actual and forecasted rainfall in the upstream watersheds, overflow from Cypress Creek, and forecasted reservoir water levels, the Corps made the decision to release a combined 16,000 cfs based on their Water Control Plan criteria. This is the highest release rate since the outlets were fully gated in 1963.

Thankfully, there were only a few minor rainstorms in the watersheds after Harvey so the reservoir water levels dropped below critical elevations and the releases were slowly reduced in a relatively short timeframe. House flooding ceased upstream of the reservoirs about September 7 and downstream about September 12th. State Highway 6 in Addicks Reservoir was fully opened on September 25th. The reservoirs are getting close to being empty.

CYPRESS CREEK OVERFLOW

Data collected from the Cypress Creek overflow zone indicates that Harvey exceeded the 2016 Tax Day flood levels by 4-6 inches suggesting that Harvey was a record overflow event. High water marks along and south of Cypress Creek and west of Barker Cypress indicated water levels were 1.0-2.0 ft higher than the April 2016 Tax Day flooding and this was also verified from structure flooding along the west side of Barker Cypress from the overflow that did not occur in 2016. Large amounts of Cypress Creek overflow progressed down South Mayde, Bear, Langham, and Horsepen Creeks into Addicks Reservoir. An estimated 65,000 acre feet of water flowed out of the Cypress Creek watershed into the Addicks Reservoir watershed and eventually the Addicks Reservoir pool.

Per observations and gage readings along Cypress Creek at Huffmeister Rd. and Eldridge Pkwy extremely high water levels in Cypress Creek flowed southward across the Cypress Creek watershed divide and into the upper portions of White Oak Bayou along and west of Eldridge Pkwy. Water levels in the Cypress Creek watershed exceeded the natural height of the ground along Cypress N Houston Rd. allowing Cypress Creek flow to move southward into the Barwood subdivision from the north and enter HCFCD lateral channels E133-00-00 and E132-00-00 and eventually White Oak Bayou. This overflowing of water from Cypress Creek into White Oak Bayou lasted approximately 24 hrs and is the most significant overflow event ever recorded in this area given the record water levels along Cypress Creek.

HIGH WATER MARKS

Hurricane Harvey resulted in the largest high water marking effort ever attempted by HCFCD, with a total of 588 marks collected. The previous record was post Hurricane Ike (2008) when 496 marks were collected of which 131 were storm surge marks. The table below indicates a breakdown of the high water mark effort across Harris County post Harvey.

HCFCD Channels	451
Detention Basins	71
Cypress Creek Overflow	20
Addicks Spillway	13
Addicks Pool	10
Barker Pool	6
Inverness Forest Levee	5
Northgate Levee	12
Total	**588**

Of the 451 channel high water marks collected 228 or 51% were new record levels.

HARRIS COUNTY FLOOD CONTROL DISTRICT ACTIONS

- The HCFCD Flood Operations and Hurricane Response teams were activated on Wednesday August 23rd and returned to normal operations on Friday, September 15th.
- Clear Creek Second Outlet Gates were opened on the afternoon of August 24 and were closed on September 13.
- HCFCD phone bank operators answered an estimated 12,000 calls over a 3 day period.
- HCFCD has conducted over 275 media interviews related to Harvey.
- HCFCD performed a helicopter survey on Wednesday August 30th, a second survey on the 31st, and a 3rd survey on September 8th.
- Approximately 60 HCFCD staff worked throughout the duration of Harvey and the following recovery.

HARRIS COUNTY FLOOD CONTROL DISTRICT FACILITIES

All channels and detention basins were in good condition prior to the start of the rainfall and flooding. The second HCFCD mowing cycle of 2017 was 70% complete. Vegetation growth along the channels did not impede storm water flows. Bridge and culvert crossings were checked county-wide and debris was removed where found.

The extended record excessive rainfall coupled with the extreme record flows and long duration of those flows resulted in damage to HCFCD infrastructure, gage monitoring equipment, and portions of the Inverness Forest Levee.

Back flow of water through the Inverness Forest pump station at the height of water levels along Cypress Creek resulted in erosion near a portion of the levee toe and the concrete structure housing the pumps. A mandatory evacuation order was issued for that part of the subdivision that would be affected if the levee breached or overtopped on August 27th at 10:10 p.m. and that order was lifted on August 31st at 7:15 p.m. HCFCD contractors completed repairs to the levee in 3 days at a cost of $50,000.

The Harris County Flood Warning System suffered damage to several sites mainly due to the rise of water to heights that flooded the gage structure and the electronics housed. At total of 7 HCFCD gages were completely destroyed with an additional 5 suffering partial damage mainly to the water level measuring devices. HCFCD crews with the help of out of state contractors began repairs on September 3rd, and all damaged sites were restored to full service by September 14th.

HCFCD infrastructure crews are actively checking channels for debris and blockages. A total of 4,000 locations have been identified so far to have damage including erosion, slope failures, sink holes, silt deposits, concrete failures, and drainage pipe separations. 1,800 locations of debris have been found by damage assessment teams across HCFCD infrastructure with a total of 11,020 cubic yards having been removed as of October 6th.

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Clear Creek, A100													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
100	0.6	1.5	2.5	4.0	6.6	9.1	12.8	14.8	18.3	24.8	33.6	A100 Clear Lake 2nd Outlet @ SH 146	68%
110	0.7	2.0	3.2	5.9	10.8	14.6	18.9	20.9	25.6	34.5	47.4	A100 Clear Creek @ I-45	95%
115	0.7	1.6	2.8	4.8	6.4	8.9	10.5	12.5	15.2	25.2	35.4	Cowart Creek @ Baker Road	71%
120	0.6	1.6	3.0	5.7	10.5	13.5	16.2	19.2	22.6	33.5	42.8	A100 Clear Creek @ FM 528	86%
125	0.6	1.6	2.6	4.1	5.6	8.2	9.9	12.4	15.7	25.3	37.2	Chigger Creek @ Windsong Lane	75%
130	0.7	2.0	3.3	6.4	11.9	14.8	17.3	19.4	23.2	33.5	44.0	A100 Clear Creek @ Bay Area Boulevard	88%
140	0.7	1.7	3.2	5.2	9.7	12.2	14.8	17.6	20.5	31.8	40.9	A119 Turkey Creek @ FM 1959	82%
150	0.6	1.6	2.8	5.1	6.5	8.7	10.8	14.2	16.6	28.0	37.0	A100 Clear Creek @ Country Club Drive	74%
160	0.7	1.9	3.6	6.8	9.7	13.2	15.7	18.6	22.2	31.8	39.1	A120 Beamer Ditch @ Hughes Road	78%
170	0.7	1.8	3.0	5.2	8.0	10.4	14.9	16.4	21.5	28.9	36.3	A100 Clear Creek @ Nassau Bay	73%
180	0.6	1.7	2.8	4.2	5.8	6.5	8.4	13.2	15.8	25.5	33.8	A100 Clear Creek @ Mykawa Road	68%
190	0.6	1.5	2.6	3.0	4.3	5.6	6.6	10.6	13.2	23.8	28.9	A100 Clear Creek @ SH 288	58%
200	0.6	1.4	2.4	4.3	6.2	8.1	12.1	14.2	19.1	30.0	39.7	A104 Taylor Lake @ Nasa Road 1	80%

Armand Bayou, B100													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
210	0.8	1.5	2.9	5.1	7.5	8.9	13.5	15.7	21.2	30.8	40.6	B100 Armand Bayou @ Pasadena Lake (Nasa Road 1)	82%
220	0.8	1.6	2.7	4.9	7.4	9.7	13.3	15.2	21.3	30.8	41.6	B100 Armand Bayou @ Genoa-Red Bluff Road	84%
230	0.7	1.4	2.3	3.4	5.0	5.8	9.2	11.6	18.2	28.0	38.0	B106 Big Island Slough @ Fairmont Parkway	76%
240	0.5	1.4	2.7	4.6	8.4	11.4	14.3	16.7	20.1	31.8	42.6	B100 Armand Bayou @ Beltway 8	86%
250	0.6	1.6	2.9	4.6	8.0	10.8	14.6	16.5	22.5	33.9	44.7	B104 Horsepen Creek @ Bay Area Boulevard	90%
270	0.7	1.8	2.8	5.2	7.4	9.2	12.6	14.6	21.6	32.1	42.9	B112 Willow Spring Bayou @ Fairmont Parkway	86%

Sims Bayou, C100													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
310	0.6	1.8	3.4	6.0	10.5	14.2	17.0	20.1	23.2	34.6	43.9	C106 Berry Bayou @ Nevada Avenue	88%
320	0.9	2.0	3.6	6.1	9.6	12.8	15.6	19.4	23.0	35.2	44.4	C106 Berry Bayou @ Forest Oaks Boulevard	89%
340	0.7	1.9	3.0	5.1	7.1	9.1	11.3	16.3	19.2	29.4	37.2	C100 Sims Bayou @ Telephone Road	75%
360	0.7	1.8	3.4	4.5	5.1	5.5	6.6	12.3	14.5	24.2	32.6	C100 Sims Bayou @ Martin Luther King Road	65%
370	0.5	1.3	2.2	2.9	4.7	6.3	7.3	11.4	13.8	23.0	30.0	C100 Sims Bayou @ SH 288	60%
380	0.5	1.5	2.6	3.6	4.3	4.9	5.8	10.6	13.4	21.9	29.2	C100 Sims Bayou @ Hiram-Clarke Road	59%

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Brays Bayou, D100													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1020	0.6	1.4	2.4	3.2	5.2	6.5	7.8	12.8	15.9	25.0	32.4	NRG Park	67%
400	0.8	1.4	1.9	3.2	5.5	7.3	8.4	12.9	16.0	25.9	33.4	D109 Harris Gully @ South McGregor Way	70%
410	0.7	1.9	2.4	4.0	5.8	7.5	9.5	14.3	17.2	28.8	35.2	D100 Brays Bayou @ Lawndale Street	73%
420	0.4	1.2	1.8	3.2	5.1	6.4	7.4	11.5	14.2	22.8	29.1	D100 Brays Bayou @ South Main Street	61%
430	0.5	1.2	2.0	3.1	4.9	5.7	6.8	11.2	13.8	23.4	30.0	D100 Brays Bayou @ Stella Link Road	62%
435	0.6	1.8	2.9	4.4	4.9	5.4	7.0	13.0	16.6	24.8	32.1	D112 Willow Water Hole @ Willowbend Boulevard	67%
440	0.7	1.8	3.2	4.6	5.2	5.3	7.6	13.6	17.8	27.0	34.1	D100 Brays Bayou @ Rice Avenue	71%
445	0.6	1.7	2.6	3.8	4.4	4.5	7.3	12.4	17.2	25.8	33.5	D112 Willow Water Hole @ Landsdowne Drive	70%
460	0.6	1.4	2.4	3.4	4.5	5.7	10.0	14.0	18.1	27.7	34.9	D100 Brays Bayou @ Gessner Road	73%
465	0.4	1.2	2.0	3.5	4.9	6.0	10.1	14.0	17.6	27.6	34.7	D100 Brays Bayou @ Beltway 8	72%
470	0.6	1.4	2.3	3.1	5.5	6.7	10.2	14.0	17.7	26.6	33.8	D100 Brays Bayou @ Belle Park Drive	70%
475	0.4	1.2	1.9	2.7	4.2	5.3	8.2	11.6	14.9	24.3	30.8	D100 Brays Bayou @ Bellaire Boulevard	64%
480	0.4	1.3	2.3	3.3	6.0	7.3	11.0	14.4	18.1	27.0	35.4	D118 Keegans Bayou @ Roark Road	74%
485	0.6	1.2	1.6	2.4	3.5	4.1	5.8	9.8	16.0	23.3	31.2	D100 Brays Bayou @ SH 6	65%
490	0.6	1.4	2.2	2.8	4.7	5.5	8.6	12.2	15.5	24.7	32.1	D118 Keegans Bayou @ Keegan Road	67%
495	0.4	1.0	1.5	2.2	3.2	3.8	5.0	8.8	14.1	22.2	30.6	D118 Keegans Bayou @ Rocky Valley	64%

White Oak Bayou, E100													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
510	0.4	1.1	1.9	3.3	5.1	6.0	7.6	12.7	16.8	25.4	31.6	Harris County Flood Control @ Brookhollow	66%
530	0.4	1.1	2.1	3.2	4.8	5.4	6.4	10.2	14.7	23.3	28.8	E100 White Oak Bayou @ Ella Boulevard	60%
535	0.4	1.0	1.9	3.4	5.2	6.0	8.0	12.8	17.7	26.3	32.8	E100 White Oak Bayou @ Pinemont Drive	68%
545	0.3	0.9	1.6	2.4	3.5	3.9	6.1	11.2	16.3	23.8	29.1	E100 White Oak Bayou @ Fairbanks North Houston Road	61%
550	0.3	0.9	1.6	2.6	3.8	4.3	7.0	11.0	16.0	24.0	29.7	E100 White Oak Bayou @ Lakeview Drive	62%
555	0.4	0.9	1.5	2.7	3.8	4.4	6.6	10.0	15.2	21.7	27.4	E100 White Oak Bayou @ Jones Road	57%
560	0.6	1.5	2.5	4.0	4.8	5.2	6.5	12.4	16.8	27.0	33.6	E101 Little White Oak Bayou @ Trimble Street	70%
570	0.6	1.4	2.1	3.6	4.7	6.3	7.6	14.2	18.0	28.5	35.0	E101 Little White Oak Bayou @ Tidwell Road	73%
575	0.5	1.0	2.0	3.6	4.9	5.8	8.0	12.8	18.0	25.7	31.6	E100 White Oak Bayou @ Tidwell Road	66%
580	0.4	1.0	1.8	3.1	4.6	5.4	7.6	11.7	16.6	24.9	30.8	E115 Brickhouse Gully @ Costa Rica Road	64%
585	0.4	1.1	2.0	3.6	4.8	5.5	7.9	12.4	18.4	27.2	34.0	E121 Vogel Creek @ Victory Drive	71%
590	0.4	0.9	1.5	2.5	3.8	4.7	7.1	11.3	16.6	25.6	31.7	E117 Cole Creek @ Deihl Road	66%
595	0.4	1.2	2.0	3.4	4.6	5.5	7.6	12.2	18.2	26.7	33.1	E121 Vogel Creek @ Gulf Bank Road	69%

Little Cedar Bayou, F216													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
610	0.6	1.3	2.2	3.8	7.0	9.7	13.1	15.0	19.3	29.8	40.6	A104 Taylor's Bayou @ Shoreacres Boulevard	82%
620	0.6	1.4	2.3	4.2	5.8	8.6	12.0	14.3	19.6	30.6	41.4	F216 Little Cedar Bayou @ 8th Street	83%
640	0.5	1.4	2.1	3.5	5.4	7.6	10.6	12.9	19.8	30.9	40.8	F101 Lateral @ Sens Road	82%

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San Jacinto River, G103

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
720	0.5	1.2	1.9	2.8	4.1	5.0	6.4	10.5	16.8	22.1	31.4	G103 San Jacinto River @ US 90	63%
750	0.4	1.0	1.3	2.1	2.6	3.3	5.8	8.8	14.3	20.4	30.0	G103 Lake Houston Dam Spillway	60%
760	0.4	0.9	1.4	2.4	4.0	4.4	6.0	11.2	17.8	24.3	32.7	G103 San Jacinto River @ US 59	68%
790	0.5	0.8	1.4	1.7	2.2	3.0	5.0	8.0	15.5	20.4	27.2	G103 East Fork San Jacinto @ FM 1485	57%

Hunting Bayou, H100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
820	0.7	1.7	3.2	4.3	7.8	9.9	12.1	14.5	19.2	29.8	39.1	H100 Hunting Bayou @ I-10	81%
830	0.6	1.5	2.6	4.4	7.1	9.1	11.8	15.5	19.6	29.2	37.2	H100 Hunting Bayou @ Loop 610 East	77%
840	0.6	1.2	2.0	3.7	5.3	7.2	9.4	14.2	18.8	28.7	36.2	H100 Hunting Bayou @ Lockwood Drive	75%

Vince Bayou, I100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
920	0.6	1.7	3.0	4.9	8.8	12.3	15.2	18.0	21.2	32.8	42.0	I100 Vince Bayou @ West Ellaine Down Stream	84%
940	0.6	1.4	2.6	4.2	8.0	11.4	14.1	16.8	20.2	31.6	42.1	I101 Little Vince Bayou @ Jackson Avenue	84%

Spring Creek, J100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1040	0.4	1.0	1.5	2.3	3.4	3.8	6.0	10.7	16.4	22.5	26.8	J100 Spring Creek @ FM 2978	56%
1050	0.4	0.8	1.4	2.6	3.5	4.4	6.4	10.8	17.3	24.3	29.4	J100 Spring Creek @ I-45	62%
1060	0.5	1.2	2.0	3.4	4.0	4.3	5.1	8.5	14.3	22.4	26.9	J100 Spring Creek @ Kuykendahl Road	56%
1070	0.4	0.9	1.5	2.7	3.8	4.5	6.7	10.2	15.6	21.6	25.6	J100 Spring Creek @ SH 249	53%
1074	0.5	1.2	2.1	3.0	3.9	4.8	7.4	12.8	17.0	25.5	28.0	Walnut Creek @ Joseph Road	59%
1076	0.4	1.0	1.8	2.7	3.6	4.8	8.4	13.4	18.4	26.5	28.4	Birch Creek @ Riley Road	59%
1084	0.4	1.0	1.5	2.5	3.9	4.3	6.9	11.5	16.4	24.4	26.6	Threemile Creek @ Joseph Road	56%
1086	0.6	1.2	1.8	2.6	3.4	3.9	6.7	11.1	17.2	26.2	27.8	Threemile Creek @ FM 362	58%
1090	0.4	0.9	1.6	2.9	4.4	4.8	7.6	11.5	16.3	24.9	27.8	J100 Spring Creek @ Hegar Road	58%

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Cypress Creek, K100													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1110	0.4	1.2	1.8	2.5	4.1	5.5	7.0	12.2	19.4	28.0	34.9	K100 Cypress Creek @ Cypresswood Drive	73%
1115	0.4	0.8	1.3	2.4	3.4	4.5	6.4	10.6	17.3	24.4	31.1	K600 Cypress Creek @ Inverness Forest	65%
1120	0.4	0.9	1.3	2.3	3.5	4.5	6.4	10.3	17.0	25.0	30.9	K100 Cypress Creek @ I-45	65%
1130	0.5	1.0	1.4	2.2	3.4	4.1	5.6	10.0	16.1	23.8	29.4	K100 Cypress Creek @ Kuykendahl Road	62%
1140	0.3	0.8	1.3	2.0	3.2	3.9	5.9	10.8	16.4	23.9	30.1	K100 Cypress Creek @ Stuebner-Airline Road	63%
1150	0.4	1.0	1.3	2.1	3.2	4.0	6.0	10.1	16.3	23.4	28.9	K100 Cypress Creek @ SH 249	61%
1165	0.4	0.9	1.6	2.9	3.9	4.3	6.2	9.2	13.3	19.3	24.6	K100 Cypress Creek @ Eldridge Parkway N.	51%
1170	0.4	0.9	1.6	2.9	3.9	4.6	7.0	10.4	15.3	22.6	28.6	K100 Cypress Creek @ Huffmeister Road	60%
1180	0.4	1.2	1.8	2.6	3.8	5.1	7.2	10.2	18.2	27.8	31.9	K100 Cypress Creek @ Katy-Hockley Road	67%
1185	0.6	1.6	2.3	2.9	4.2	5.8	8.4	11.3	19.9	28.3	33.0	K100 Cypress creek @ Sharp Road	69%
1186	0.4	1.0	1.6	2.1	3.0	4.4	7.3	10.5	17.0	23.2	26.6	Live Oak Creek @ Penick Road	56%
1190	0.5	1.4	2.6	3.5	4.2	4.5	6.4	9.7	17.1	25.8	29.0	K166 Little Mound Creek @ Mathis Road	61%
1195	0.8	1.7	3.0	4.1	4.8	5.2	6.5	10.8	16.8	23.6	25.8	Mound Creek @ FM 362	54%
1210	0.4	1.0	1.8	3.1	4.0	4.6	6.6	9.8	15.6	22.6	28.6	L100 Little Cypress Creek @ Kluge Road	60%
1220	0.5	1.2	1.9	2.5	3.4	4.4	7.2	11.0	15.8	24.2	29.2	L100 Little Cypress Creek @ Cypress Rosehill Road	61%
1230	0.4	1.0	1.8	3.3	4.9	5.2	8.0	11.7	16.4	26.0	29.8	L100 Little Cypress Creek @ Becker Road	62%

Willow Creek, M100													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1320	0.5	1.0	1.4	2.0	2.9	3.6	5.6	8.9	15.3	22.0	27.2	M100 Willow Creek @ Kuykendahl Road	57%
1340	0.4	0.9	1.5	2.6	3.7	4.4	6.6	10.0	15.2	21.6	26.6	M100 Willow Creek @ SH 249	56%

Carpenters Bayou, N100													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1420	0.6	1.4	2.5	3.8	4.8	5.8	8.5	10.8	18.4	28.2	38.9	N100 Carpenters Bayou @ I-10	81%
1440	0.5	1.2	2.2	3.6	5.5	6.2	7.5	10.4	18.6	27.4	36.8	N100 Carpenters Bayou @ Wallisville Road	77%
1460	0.5	1.3	2.2	3.9	5.9	6.5	7.9	11.6	18.3	25.5	35.2	N100 Carpenters Bayou @ US 90	73%

Goose Creek, O100													
Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1520	0.6	1.5	2.5	4.1	7.2	9.3	12.6	15.0	20.3	29.6	37.8	O100 Goose Creek @ SH 146	76%
1540	0.6	1.6	2.3	4.1	7.6	10.5	14.2	16.0	24.0	33.0	42.9	O100 Goose Creek @ Baker Road	86%

Rainfall Intensity Report

12AM 8-25-17 thru 10PM 8-29-17

Greens Bayou, P100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1600	0.5	1.2	1.6	2.6	3.2	4.5	6.1	8.6	15.2	22.8	31.4	P100 Greens Bayou @ Mount Houston Parkway	65%
1610	0.6	1.2	2.1	3.2	6.3	9.3	11.8	14.8	20.3	30.8	40.6	P100 Greens Bayou @ Normandy Street	84%
1620	0.4	1.0	1.8	2.9	4.9	7.1	10.2	13.8	20.8	29.4	38.3	P100 Greens Bayou @ Ley Road	80%
1630	0.3	0.7	1.3	2.3	4.3	5.0	6.5	9.6	16.4	23.1	32.0	P130 Garners Bayou @ Beltway 8	67%
1640	0.4	1.2	2.0	3.2	4.6	5.9	8.3	13.4	20.0	28.2	37.2	P100 Greens Bayou @ US 59	77%
1645	0.4	1.2	1.7	2.9	4.1	5.4	7.2	11.7	17.7	25.3	34.2	P100 Greens Bayou @ Beltway 8	71%
1650	0.4	1.0	1.4	1.8	3.1	4.6	6.4	10.2	18.0	25.7	35.4	P130 Garners Bayou @ Rankin Road	74%
1660	0.4	0.9	1.4	2.4	3.8	4.7	6.1	10.7	16.5	24.4	31.1	P100 Greens Bayou @ Knobcrest Drive	65%
1665	0.4	1.0	1.3	2.2	3.5	4.2	6.4	10.9	16.5	24.3	30.1	P100 Greens Bayou @ Bammel N Houston Road	63%
1670	0.4	0.9	1.4	2.6	3.4	3.7	6.2	11.0	16.5	23.8	29.6	P100 Greens Bayou @ Cutten Road	61%
1695	0.4	0.9	1.4	2.4	4.0	5.9	7.6	12.6	18.3	26.7	35.2	P138 @ Aldine Westfield Road	73%

Halls Bayou, P118

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1675	0.4	1.2	2.3	3.9	6.1	7.9	10.7	14.8	20.6	29.5	38.2	P118 Halls Bayou @ Tidwell Road	79%
1680	0.4	0.9	1.5	2.6	4.1	6.2	8.2	13.0	17.7	26.8	34.4	P118 Halls Bayou @ Jensen Drive	72%
1690	0.3	0.8	1.3	2.5	4.0	5.7	7.3	12.6	17.8	26.8	34.3	P118 Halls Bayou @ Airline Drive	71%

Cedar Bayou, Q100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1720	0.6	1.4	2.3	3.6	5.7	8.0	12.5	14.5	21.8	27.5	35.8	Q100 Cedar Bayou @ SH 146	72%
1725	0.6	1.4	2.8	5.3	8.4	10.0	16.4	18.6	28.6	33.4	41.7	Smith Gully @ SH 146	84%
1740	0.5	1.4	2.5	3.6	5.5	7.2	11.6	14.1	23.2	28.3	37.0	Q100 Cedar Bayou @ US 90	74%

Jackson Bayou, R100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1840	0.5	1.2	2.1	3.5	5.0	6.1	7.6	12.1	21.8	27.5	37.5	R102 Gum Gully @ Diamond Head Boulevard	75%

Luce Bayou, S100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1940	0.4	1.0	1.4	2.1	3.3	4.0	5.5	9.5	17.5	22.9	31.8	S100 Luce Bayou @ FM 2100	66%

Rainfall Intensity Report

12AM 8-25-17 thru 10PM 8-29-17

Barker Reservoir, T100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
2010	0.4	1.0	1.6	2.4	4.0	4.9	7.3	11.7	18.1	27.7	36.3	Barker Dam	76%
2020	0.6	1.2	1.8	3.1	5.1	6.2	8.0	10.0	16.8	24.6	32.1	T101 Mason Creek @ Prince Creek Drive	67%
2025	0.4	1.0	2.0	3.4	6.0	7.5	9.4	11.0	17.6	24.4	32.4	T100 Buffalo Bayou @ Peek Road	68%
2030	0.4	1.2	2.0	3.4	5.4	6.9	9.3	11.2	18.0	26.6	33.2	T100 Buffalo Bayou @ Greenbusch Road	70%
2040	0.4	1.0	1.8	3.0	4.9	6.5	9.0	11.2	16.8	22.9	29.0	T100 Buffalo Bayou @ US 90	61%
2050	0.5	1.0	1.8	3.1	5.2	6.8	9.8	13.0	20.2	27.0	32.8	Cane Island Branch @ Clay Road	69%
2060												Willow Fork Creek @ Pederson Road	
2090	0.4	0.9	1.5	2.0	3.2	4.6	8.4	11.9	16.7	23.0	27.0	Brookshire Katy Drainage District @ Morrison Road	56%

Addicks Reservoir, U100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
2110	0.5	1.2	2.0	2.6	5.1	5.8	8.1	11.7	18.2	26.4	33.2	Addicks Dam	70%
2120	0.5	1.0	1.7	2.9	4.1	5.1	7.6	11.2	16.9	25.8	32.3	U100 Langham Creek @ West Little York Road	68%
2130	0.4	1.1	1.9	2.7	4.3	5.2	8.3	11.6	16.0	24.1	29.6	U106 Horsepen @ Trailside Drive	62%
2140	0.5	1.1	1.7	3.0	4.5	5.6	7.0	10.0	17.2	26.4	32.5	U100 Langham Creek @ Longenbaugh Road	68%
2150	0.4	1.2	1.6	2.3	3.6	4.8	6.5	9.4	16.5	24.8	31.8	U101 South Mayde @ Greenhouse Road	67%
2160	0.4	1.1	1.7	2.4	4.0	5.1	6.5	9.4	16.6	25.1	32.3	U102 Bear Creek @ Clay Road	68%
2170	0.6	1.4	2.1	3.0	4.1	5.4	7.7	10.3	17.5	26.7	33.1	U101 South Mayde @ Morton Road	69%
2180	0.6	1.5	2.1	3.0	4.4	5.4	7.7	10.6	17.7	27.0	32.9	U102 Bear Creek @ FM 529	69%
2190	0.6	1.4	2.2	3.0	4.4	5.8	8.1	11.0	18.0	26.7	32.8	U101 South Mayde Creek @ Peek Road	69%

Buffalo Bayou, W100

Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Site	4-Day %PMP
1000	0.6	1.5	2.3	3.4	4.8	5.9	7.4	13.2	17.5	27.2	34.4	Houston Transtar	71%
2210	0.6	1.2	2.0	3.6	5.8	8.0	10.4	15.0	19.2	28.7	34.4	W100 Buffalo Bayou @ Turning Basin	71%
2240	0.5	1.2	2.2	3.5	5.1	6.6	7.8	13.5	16.5	26.2	32.9	W100 Buffalo Bayou @ Shepherd Drive	68%
2250	0.5	1.1	2.1	2.8	3.6	4.4	7.2	12.3	17.1	25.5	31.4	W140 Spring Branch @ Bingle Road	65%
2255	0.4	1.1	2.0	2.8	3.5	4.1	6.8	11.7	16.5	24.8	30.4	W140-01 Briar Branch @ Campbell Road	63%
2260	0.5	1.2	2.2	3.0	3.6	4.0	7.0	11.6	16.2	24.3	29.7	W100 Buffalo Bayou @ San Felipe Drive	62%
2270	0.5	1.2	2.3	3.9	4.8	5.7	10.4	14.2	18.6	29.4	36.9	W100 Buffalo Bayou @ West Beltway 8	77%
2280	0.4	1.2	2.2	3.5	4.6	5.5	9.6	13.1	17.5	27.2	34.2	W156 Rummel Creek @ Brittmoore Road	71%
2290	0.5	1.3	2.1	3.0	5.1	6.2	9.3	13.1	19.0	27.8	35.4	W100 Buffalo Bayou @ Dairy Ashford Road	74%

Rainfall Intensity Report

12AM 8-25-17 thru 10PM 8-29-17

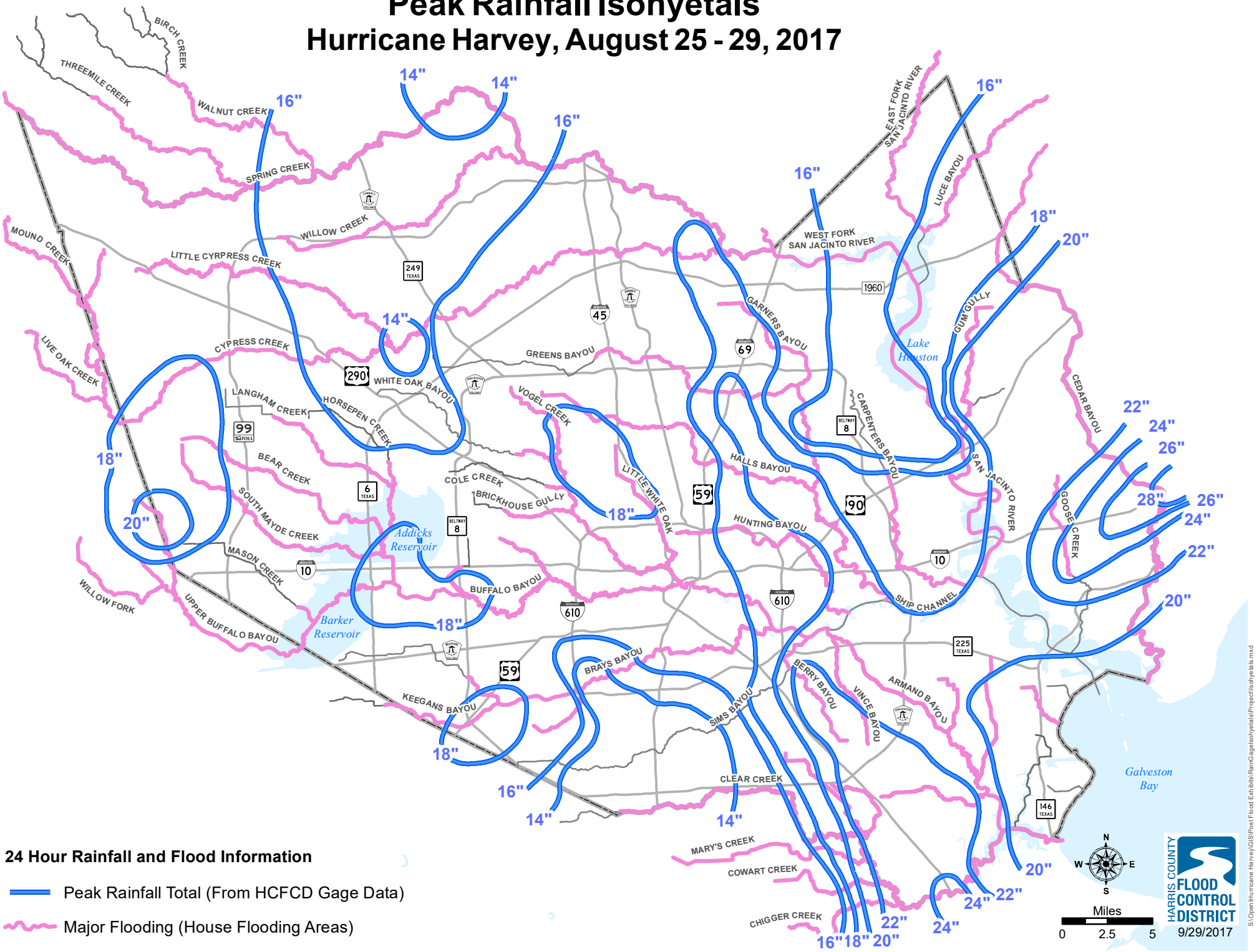
Region 1--Addicks, Barker, Cypress, Spring, and Willow											
Period	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day
2-year	0.7	1.1	1.4	1.9	2.2	2.5	2.9	3.4	4.1	4.7	5.4
5-year	0.9	1.4	1.8	2.5	3.0	3.3	4.0	4.8	5.8	6.6	7.6
10-year	1.0	1.5	2.1	2.8	3.5	3.9	4.9	5.9	7.1	8.1	9.2
25-year	1.1	1.8	2.4	3.4	4.2	4.8	6.1	7.4	9.0	10.1	11.3
50-year	1.2	2.0	2.7	3.8	4.9	5.6	7.2	8.7	10.6	11.8	13.1
100-year	1.3	2.2	3.0	4.2	5.5	6.5	8.5	10.2	12.4	13.6	14.9
500-year	1.5	2.7	3.9	5.5	7.5	9.0	12.2	14.7	17.7	18.7	19.8
1000-year	1.7	3.0	4.3	6.1	8.3	9.9	13.4	16.2	19.8	21.1	22.5
2000-year	1.8	3.3	4.8	6.7	9.3	11.1	15.1	18.3	22.4	23.8	25.2
5000+-year	2.0	3.7	5.4	7.7	10.7	12.9	17.6	21.4	26.2	27.7	29.3
PMP				13.8	20.2	23.6	30.2	38.2	45.9	47.8	47.8

*2-Day and 4-Day same based on PMP Development Methods

Region 2--Brays, Buffalo, Greens, Hunting, Luce, West Fork San Jacinto, and White Oak											
Period	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day
2-year	0.7	1.1	1.4	2.0	2.3	2.6	3.1	3.7	4.4	5.0	5.8
5-year	0.8	1.4	1.8	2.5	3.1	3.5	4.3	5.1	6.2	7.1	8.1
10-year	0.9	1.5	2.1	2.9	3.6	4.1	5.1	6.2	7.6	8.6	9.8
25-year	1.0	1.8	2.4	3.4	4.3	5.0	6.4	7.8	9.6	10.8	12.1
50-year	1.1	2.0	2.7	3.8	5.0	5.8	7.6	9.2	11.3	12.5	14.0
100-year	1.2	2.2	3.0	4.3	5.7	6.7	8.9	10.8	13.2	14.5	15.9
500-year	1.4	2.7	3.9	5.5	7.6	9.2	12.8	15.5	18.9	20.0	21.1
1000-year	1.5	3.0	4.3	6.1	8.4	10.1	14.0	17.1	21.1	22.5	24.0
2000-year	1.7	3.3	4.8	6.7	9.4	11.3	15.8	19.3	23.9	25.4	26.9
5000+-year	1.9	3.7	5.4	7.7	10.8	13.1	18.4	22.5	27.9	29.6	31.2
PMP				14.2	20.6	24.1	30.3	38.2	45.9	47.9	48.1

Region 3--Armand, Carpenters, Ceder, Clear, Galveston Bay, Goose, Jackson, Lower San Jacinto River,											
Period	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day
2-year	0.7	1.1	1.5	2.0	2.4	2.7	3.2	3.8	4.5	5.3	6.2
5-year	0.8	1.4	1.9	2.5	3.1	3.5	4.4	5.3	6.4	7.5	8.7
10-year	0.9	1.5	2.1	2.9	3.7	4.2	5.3	6.4	7.8	9.0	10.5
25-year	1.0	1.7	2.4	3.4	4.4	5.1	6.6	8.0	9.8	11.2	12.9
50-year	1.1	1.9	2.7	3.8	5.0	5.9	7.7	9.5	11.6	13.1	14.8
100-year	1.2	2.1	3.0	4.3	5.7	6.8	9.1	11.1	13.5	15.1	16.9
500-year	1.4	2.5	3.7	5.5	7.7	9.4	13.1	15.9	19.3	20.7	22.3
1000-year	1.5	2.8	4.1	6.1	8.5	10.4	14.4	17.5	21.6	23.3	25.3
2000-year	1.7	3.0	4.5	6.8	9.5	11.6	16.2	19.7	24.4	26.2	28.4
5000+-year	1.9	3.4	5.1	7.7	10.9	13.4	18.9	23.0	28.6	30.5	32.9
PMP				14.8	21.5	25.1	30.3	38.2	46.4	48.7	49.8

Peak Rainfall Isohyetals
Hurricane Harvey, August 25 - 29, 2017



24 Hour Rainfall and Flood Information

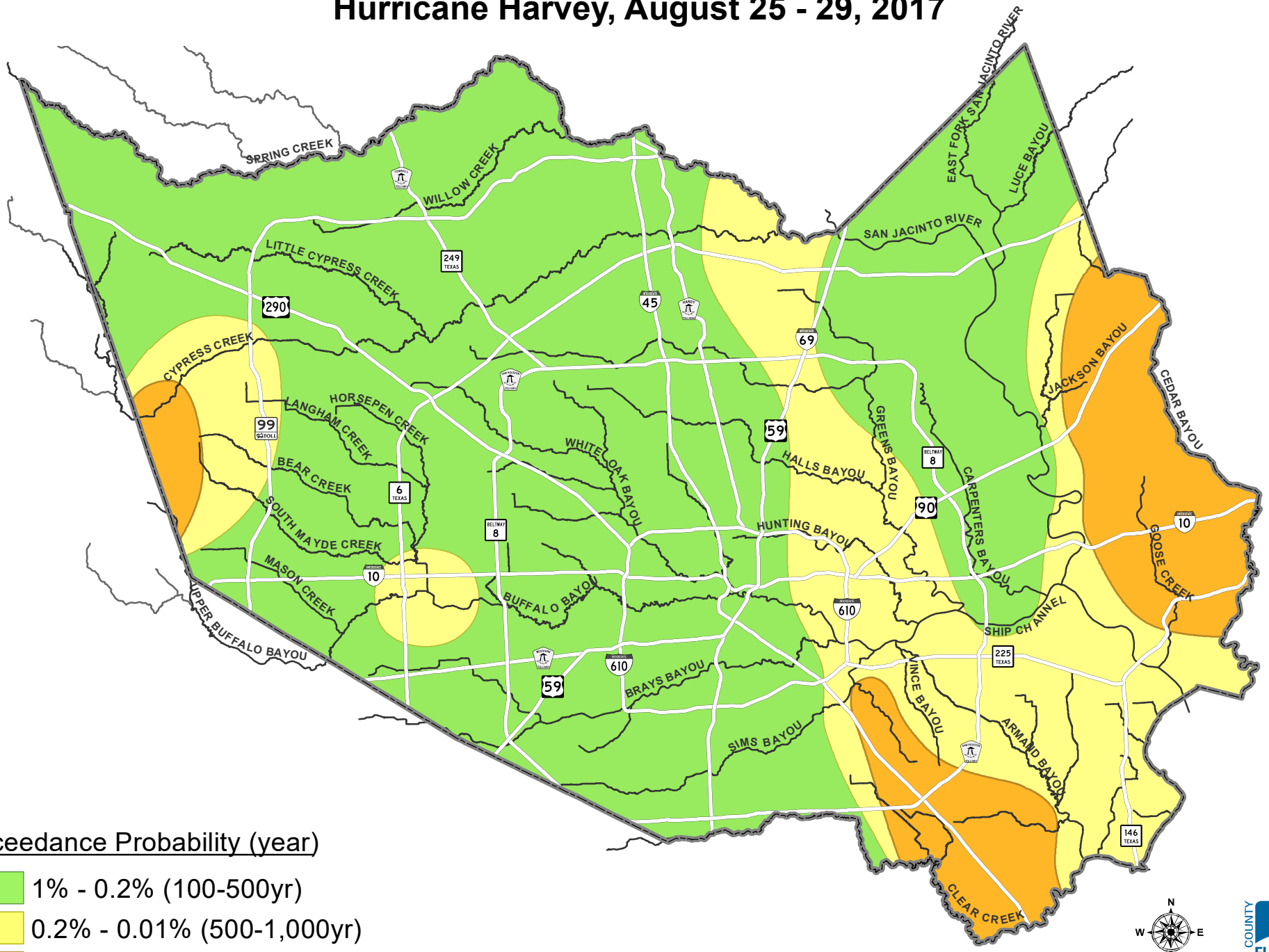
Peak Rainfall Total (From HCFCD Gage Data)

Major Flooding (House Flooding Areas)

DRAFT

One Day Peak Rainfall Frequency

Hurricane Harvey, August 25 - 29, 2017



Exceedance Probability (year)

- 1% - 0.2% (100-500yr)
- 0.2% - 0.01% (500-1,000yr)
- 0.1% - 0.05% (1,000 – 2,000yr)

Based on HCFCD Rainfall Gages

N W E S

Miles

0 2.5 5

HARRIS COUNTY FLOOD CONTROL DISTRICT

10/2/2017

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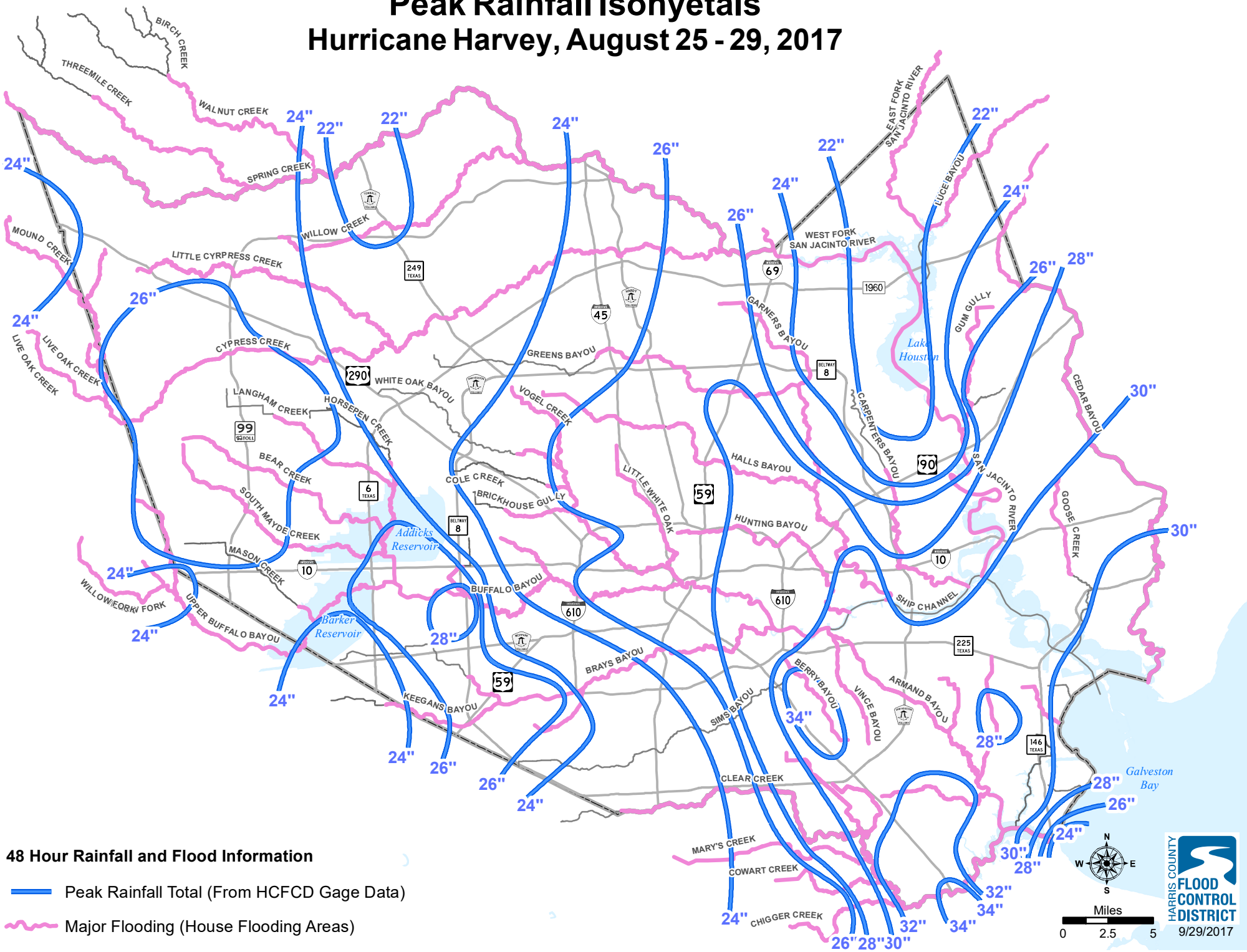
Peak Rainfall Isohyetals
Hurricane Harvey, August 25 - 29, 2017



48 Hour Rainfall and Flood Information

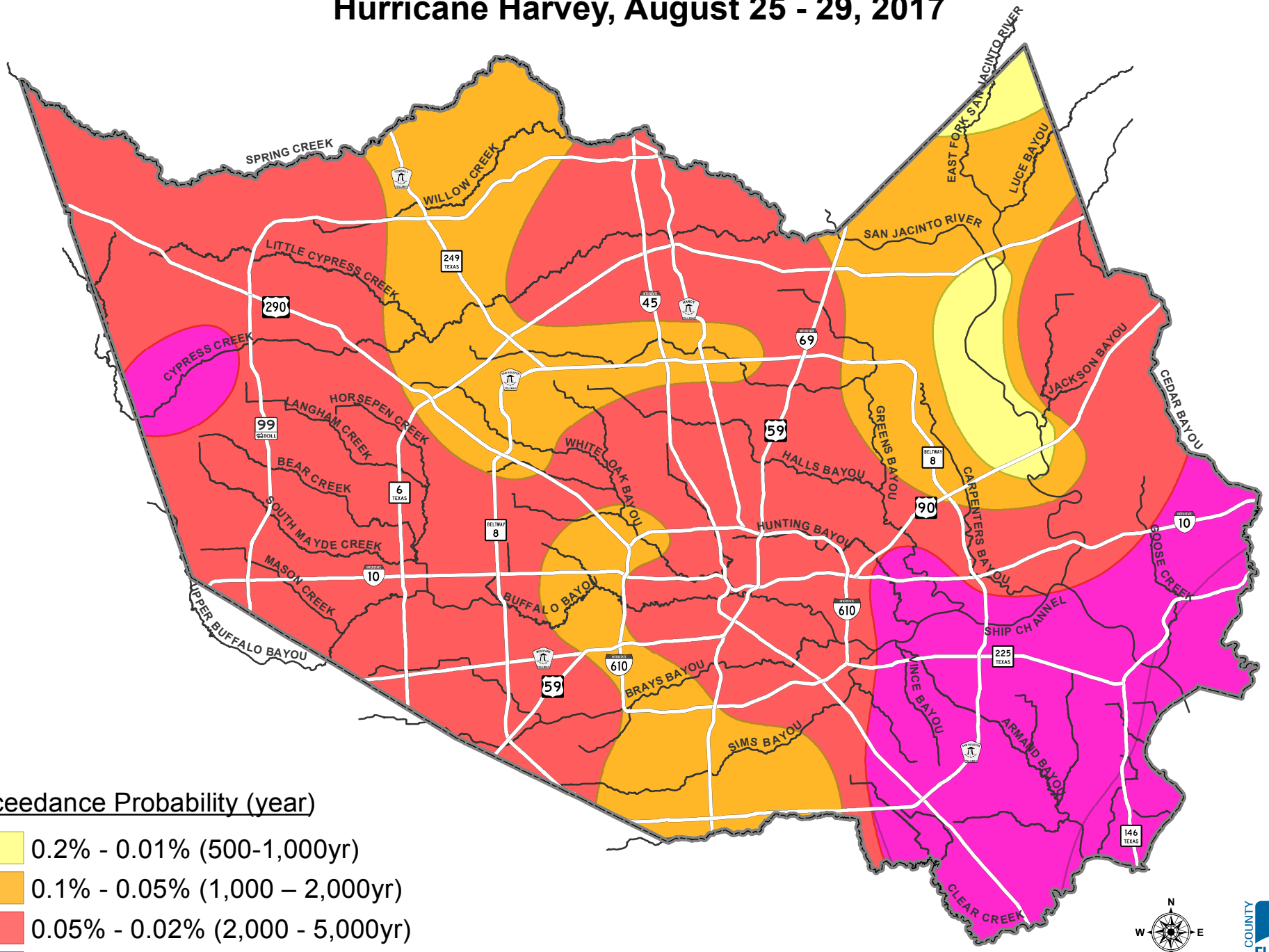
Peak Rainfall Total (From HCFCD Gage Data)

Major Flooding (House Flooding Areas)

DRAFT

Two Day Peak Rainfall Frequency

Hurricane Harvey, August 25 - 29, 2017



Exceedance Probability (year)

- 0.2% - 0.01% (500-1,000yr)
- 0.1% - 0.05% (1,000 – 2,000yr)
- 0.05% - 0.02% (2,000 - 5,000yr)
- 0.02%+ (5,000yr+)

Based on HCFCD Rainfall Gages

N W E S

Miles

0 2.5 5

HARRIS COUNTY FLOOD CONTROL DISTRICT

9/18/2017

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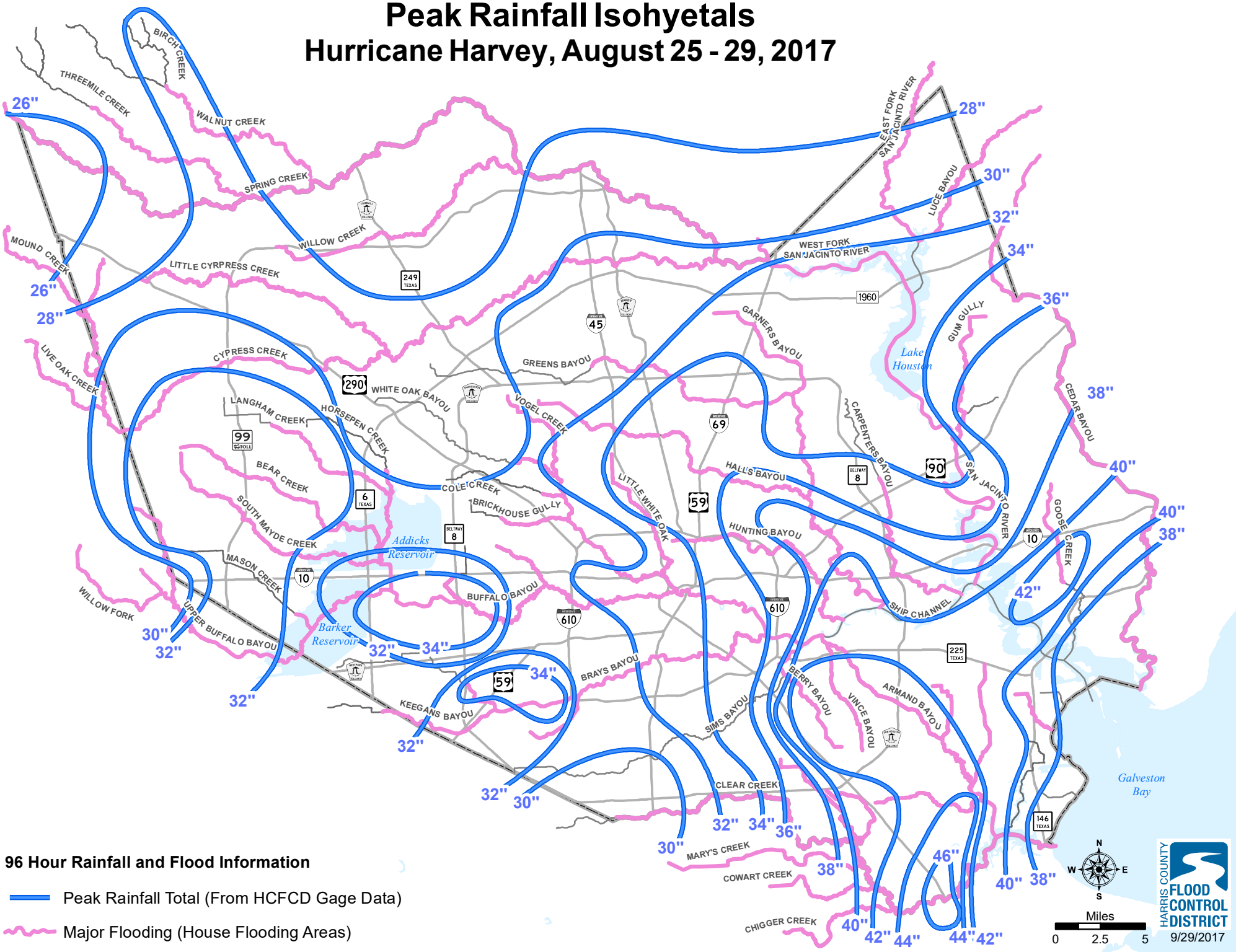
Peak Rainfall Isohyetals
Hurricane Harvey, August 25 - 29, 2017



96 Hour Rainfall and Flood Information

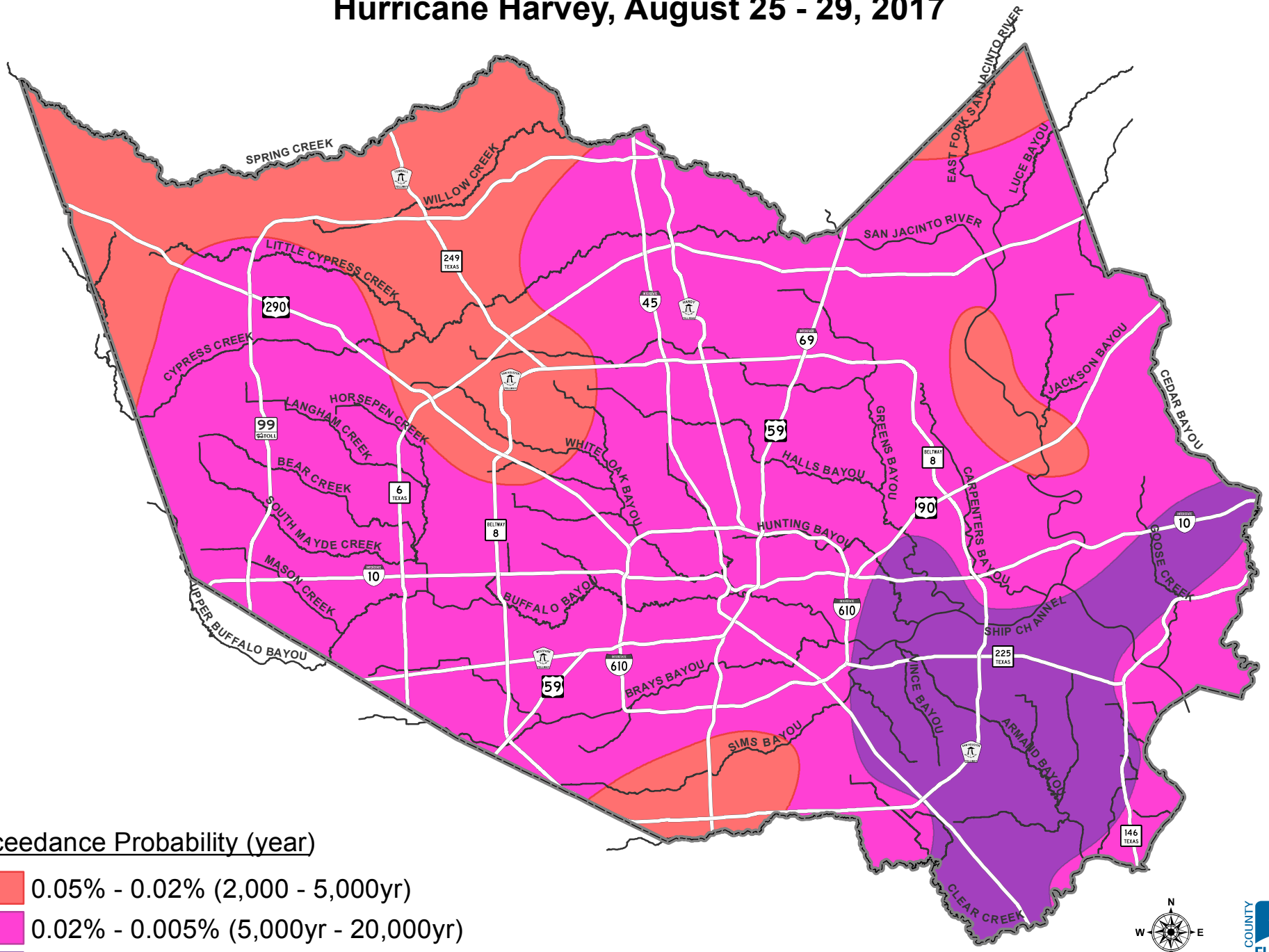
Peak Rainfall Total (From HCFCD Gage Data)

Major Flooding (House Flooding Areas)

DRAFT

Four Day Peak Rainfall Frequency

Hurricane Harvey, August 25 - 29, 2017



Exceedance Probability (year)

- 0.05% - 0.02% (2,000 - 5,000yr)
- 0.02% - 0.005% (5,000yr - 20,000yr)
- .005%+ (20,000yr+)

Based on HCFCD Rainfall Gages

N W E S

Miles

0 2.5 5

HARRIS COUNTY FLOOD CONTROL DISTRICT

9/18/2017

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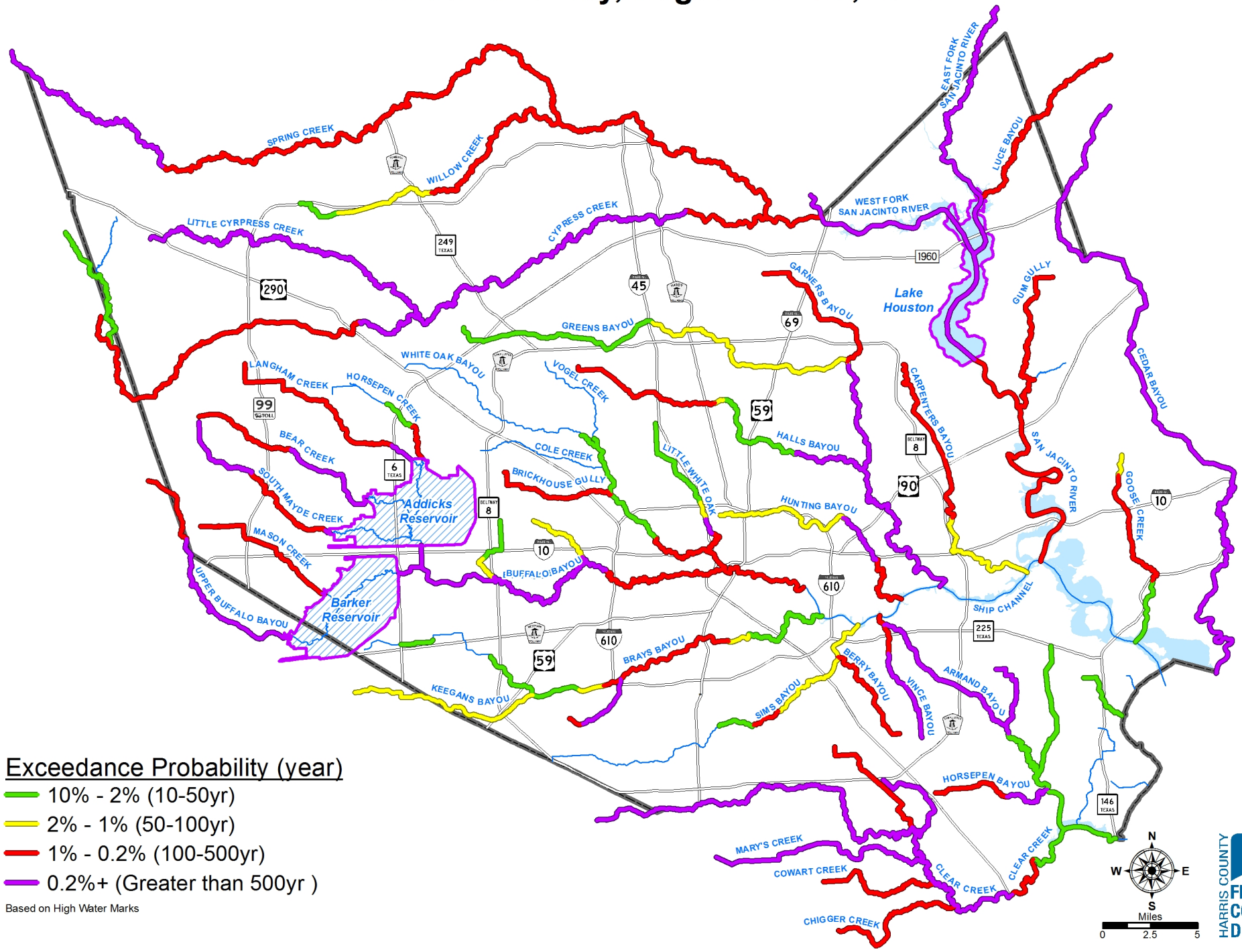
Peak Channel Water Surface Elevation Frequencies

Hurricane Harvey, August 25 - 29, 2017



Exceedance Probability (year)

- 10% - 2% (10-50yr)
- 2% - 1% (50-100yr)
- 1% - 0.2% (100-500yr)
- 0.2%+ (Greater than 500yr)

Based on High Water Marks

HARRIS COUNTY FLOOD CONTROL DISTRICT

10/9/2017

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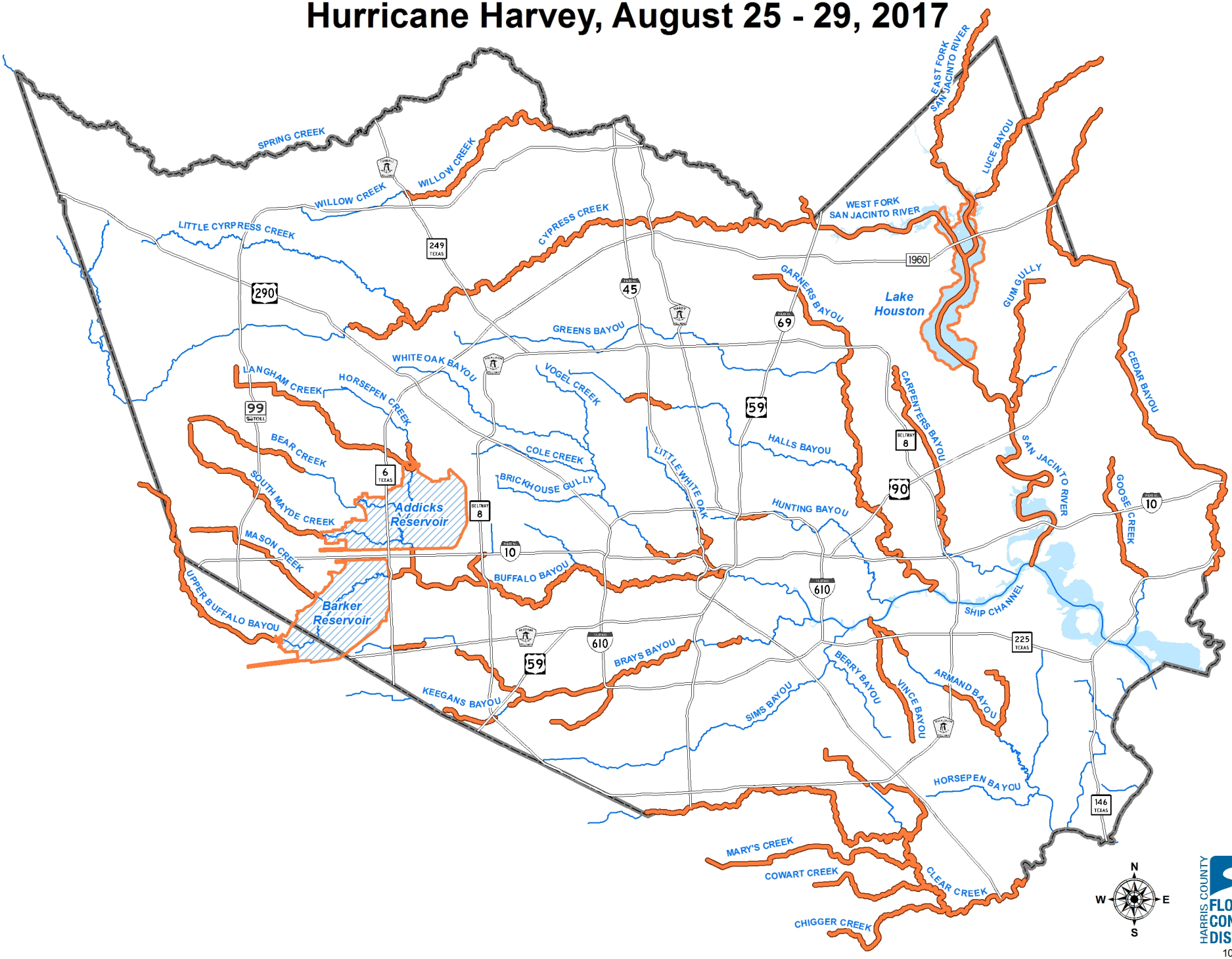
Record Flood Levels

Hurricane Harvey, August 25 - 29, 2017



HARRIS COUNTY FLOOD CONTROL DISTRICT

10/2/2017

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