

# TEXAS<sup>1</sup>

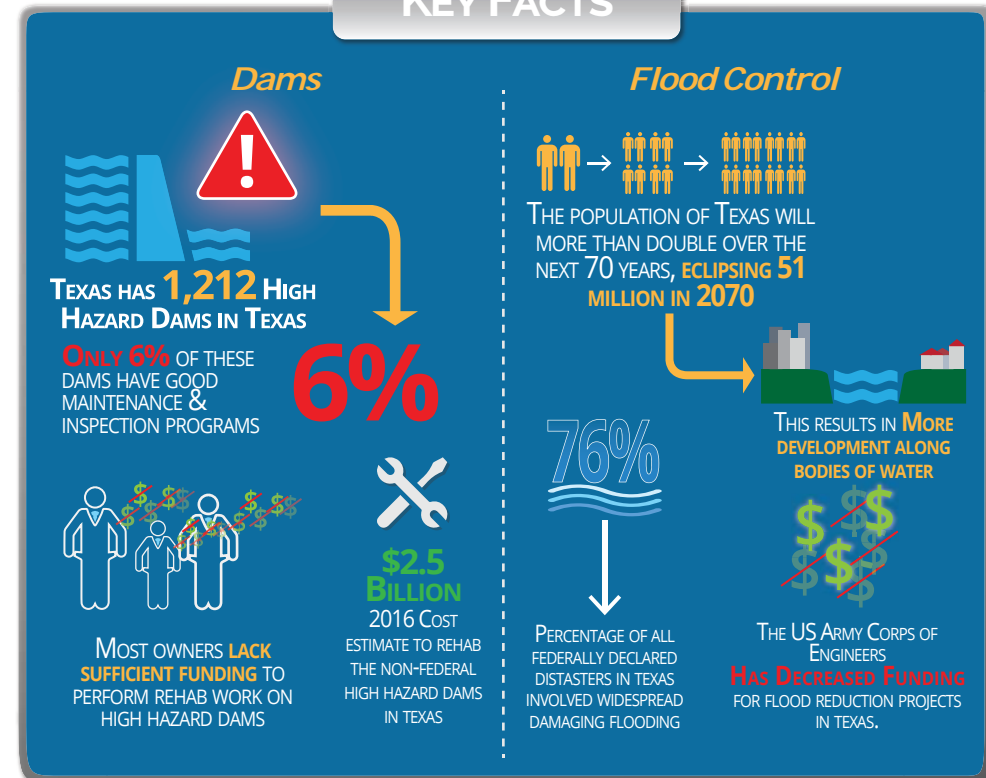
## INFRASTRUCTURE REPORT CARD



IN 2017, THE AMERICAN SOCIETY OF CIVIL ENGINEERS TEXAS SECTION GRADED SEVEN CATEGORIES IN ITS REPORT CARD FOR TEXAS INFRASTRUCTURE: AVIATION, BRIDGES, DAMS, DRINKING WATER, FLOOD CONTROL, HIGHWAYS/ROADS AND WASTEWATER. THESE GRADES WERE DEVISED FROM KEY FACTS AND DATA POINTS ABOUT EACH AREA OF INFRASTRUCTURE. FLOOD CONTROL AND DAMS, TWO CATEGORIES OF INFRASTRUCTURE CRITICAL TO RESILIENCY AND STORM MANAGEMENT, RECEIVED GRADES OF D, MEANING THE INFRASTRUCTURE IS POOR AND AT RISK.

FOR MORE INFORMATION ABOUT THE TEXAS REPORT CARD, PLEASE VISIT [infrastructurereportcard.org/Texas](http://infrastructurereportcard.org/Texas)

### KEY FACTS



# So... HOW DO WE RAISE THE GRADE?

<p><b>1,212 High Risk Dams</b></p> <p><b>WHY</b></p>	<p><b>76% of Texas Federal Distasters are Flood Related</b></p>	<p><b>Infrastructure Approaching the End of its Service Life</b></p>
<p><b>LEADERSHIP &amp; PLANNING</b> SMART INVESTMENT WILL ONLY BE POSSIBLE WITH LEADERSHIP, PLANNING, AND A CLEAR VISION FOR OUR NATION'S INFRASTRUCTURE.</p> <p><b>WHAT</b></p>	<p><b>PREPARING FOR THE FUTURE</b> WE HAVE TO UTILIZE NEW APPROACHES, MATERIALS, AND TECHNOLOGIES TO ENSURE OUR INFRASTRUCTURE IS MORE RESILIENT.</p>	<p><b>INVESTMENT</b> WE CAN NO LONGER AFFORD TO DEFER INVESTMENT IN OUR NATION'S CRITICAL INFRASTRUCTURE SYSTEMS.</p>
<p><b>1 TELL CONGRESS</b> TELL CONGRESS TO MAKE LARGE-SCALE FEDERAL INVESTMENTS IN INFRASTRUCTURE. THIS WILL ALLOW STATES TO LEVERAGE LOCAL AND PRIVATE FUNDING AND RAISE THE CURRENT GRADES.</p> <p><b>HOW?</b></p>	<p><b>2 TALK ABOUT THE REPORT CARD GRADE</b> WHILE WE HAVE MADE SOME PROGRESS, REVERSING THE TRAJECTORY AFTER DECADES OF UNDERINVESTMENT IN OUR INFRASTRUCTURE REQUIRES TRANSFORMATIVE ACTION.</p>	<p><b>3 ASK FOR FUNDING</b> WRITE YOUR MEMBERS OF CONGRESS AND ASK THEM TO FUND THE NATIONAL DAM REHABILITATION PROGRAM SO THAT OUR STATE'S "D" DAMS CAN RECEIVE THE INVESTMENT THEY NEED.</p>

## RECOMMENDATIONS

<p><b>DAMS</b></p> <ul style="list-style-type: none"> <li>• REQUIRE MAINTENANCE AND INSPECTION PROGRAM FOR ALL HIGH HAZARD DAMS IN THE STATE.</li> <li>• INCREASE FUNDING FOR <b>DAM SAFETY PROGRAM</b></li> <li>• DEVELOP EMERGENCY ACTION PLANS FOR ALL SIGNIFICANT AND HIGH HAZARD POTENTIAL DAMS</li> <li>• CREATE A STATE LOAN OR GRANT PROGRAM</li> <li>• DEVELOP REGULATION IN HIGH HAZARD AREAS</li> <li>• STATE AUDITOR'S OFFICE AUDIT REPORT ON THE DAM SAFETY PROGRAM</li> </ul>	<p><b>FLOOD CONTROL</b></p> <ul style="list-style-type: none"> <li>• FUND EARLY WARNING SYSTEMS</li> <li>• DEVELOP STATE-WIDE FUNDING PROGRAM</li> <li>• PROVIDE ADDITIONAL FEDERAL FUNDING TO UPDATE FLOODPLAIN MAPPING THROUGHOUT THE STATE</li> <li>• INVESTMENT IN INFRASTRUCTURE TO REDUCE FLOODING</li> </ul>
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SOURCES  
 1. ASCE | "2017 INFRASTRUCTURE REPORT CARD"  
 2. HARRIS COUNTY FLOOD CONTROL DISTRICT (HCFCD) | [https://www.hcfcd.org/media/2423/history/timeline-24x36\\_feb2018.pdf](https://www.hcfcd.org/media/2423/history/timeline-24x36_feb2018.pdf)  
 3. <https://tshaonline.org/handbook/online/articles/ybr-01>  
 4. NOAA | [http://www.crh.noaa.gov/hgx/?n=hurricanes\\_climatology](http://www.crh.noaa.gov/hgx/?n=hurricanes_climatology)  
 5. <http://www.wxresearch.com/almanac/houflood.html>  
 \*GRAPHICS CREATED AND PRODUCED BY EHRA ENGINEERING

**HOUSTON THROUGH THE YEARS**  
*Building Resilience Through Infrastructure Improvements*

1800s

1800

1800

1800

1800

**1837 October:** Racer's Hurricane led Buffalo Bayou to inundate Main Street in Houston with 4' of water.

**1839 February:** 5 months after opening, the Milam Street Bridge over Buffalo Bayou was severely damaged by flooding.

**1841 February:** Storms caused flooding that washed out two bridges and destroyed buildings and homes along Buffalo Bayou and White Oak Bayou.

**1843 October:** Flooding occurs on Buffalo, White Oak, and Brays Bayou. Bridges leading into the city were submerged.

**1875 September:** Indianola hurricane caused White Oak and Buffalo Bayou to be over 30 feet above normal. Bridges over Buffalo Bayou were swept away and there was major flooding in Greens & Halls Bayou.

**1879 February/August:** Devastating flooding on Buffalo Bayou. Flooding downtown Houston. Major flooding on Greens & Halls Bayou.

**1900 May:** Flooding in Houston and region.

**1900 September:** The Great Galveston Hurricane caused over 6,000 deaths when it made landfall and led to widespread flooding in Harris County.

**1907 May:** Flooding in Houston and region similar to 1879.

**1913 October/December:** Southwest and Northeast Harris County flooding caused bayous to be out of their banks, flooding downtown and citizens to be evacuated.

**1915 August:** Galveston Hurricane causes widespread flooding in Houston.

**1919 September:** Hurricane near Corpus Christi causes great flooding in Brays Bayou with canoes and boats traveling on Main Street.

**1929 April:** Gulf storm rainfall had duration of 14 hours and caused all bayous to be over their banks.

**1929 May:** Flooding caused closure of the Central Water Plant. Saturated soils and full Bayous from April storm caused extensive flooding. San Jacinto River was reported to be 30 feet above normal.

1930

1940

1950

1960

**1930 May:** A three day stationary storm over Harris County estimated an average of 8-inches of rain over the 580-square mile area Houston.

**1932 August:** Freeport Hurricane caused widespread flooding on all of the bayous. Downtown Houston was flooded.

**1933 July:** Tropical Storm flooded Houston bayous & region.

**1935 December:** "The Great Flood of 1935" inundated Houston Lighting and Power Ship Channel Station & downtown buildings up to third floors. Houston's Central Water Plant went under and was nonoperational for weeks.

**1940 November:** Five day rain event in NE Houston causes San Jacinto and Trinity River watershed residents to be evacuate and rescued.

**1941 Sept:** Hurricane in Matagorda causes Houston flooding.

**1942 July:** Buffalo & White Oak Bayous flood out of their banks.

**1943 July:** Hurricane makes landfall near Galveston and moved inland, flooding Harris County.

**1943 October:** Hurricane makes landfall near Freeport. Over 11,500 homes flooded in Harris County.

**1945 August:** Hurricane near Port Aransas produced record rainfalls. More than 15-inches in 24 hours and caused major flooding on all bayous and streams.

**1946 May:** Storms cause flooding in Brays, Greens, & Sims Bayous.

**1949 Oct:** Storms cause flooding in Brays & Greens Bayou.

**1950 February:** Thunderstorms ahead of a cold front caused rainfall over Greens Bayou. Kenwood Subdivision residents evacuated.

**1955 May:** Thunderstorm over North Harris County precipitated 10 inches of rain in less than 24 hours. Streets and homes flooded.

**1957 June:** Hurricane Audrey made landfall close to the Texas/Louisiana border. Flooding reported throughout Harris County.

**1957 October:** Garden Oaks, Oak Forest & Spring Branch areas flooded.

**1959 October:** Thunderstorms caused flooding homes along the Brays Bayou and Kegans Bayou.

**1960 June:** Cypress and Spring Creeks and San Jacinto River and Sims Bayou were out of their banks. 150 families evacuated near Almeda Plaza and Sunnyside.

**1961 July:** Storms led to Cypress Creek flooding.

**1961 September:** Hurricane Carla caused heavy flooding in Houston area. Rainfall amounts of 8 to 10 inches with high winds. Bayous and streams were flooded. Lives were lost and homes damaged.

**1964 May:** Over 200 residents along Greens Bayou flooded.

**1966 April:** Cypress Creek & Greens Bayou flood.

**1969 February:** Thunderstorms flooded homes and businesses in south and southeast Harris County.

1970

1980

1990

**1972 March:** Thunderstorms led to evacuation of 700 families in northeast Harris County.

**1972 April:** Flooding along Cypress Creek and Greens Bayou.

**1972 Nov:** Thunderstorms cause street flooding and damage.

**1973 June:** Sims and Greens Bayous out of their banks. Families evacuated in Beechnut and Hillcroft area. Lives lost due to drownings and millions in damages reported.

**1975 June:** Families evacuated in Harris County.

**1976:** Multiple storms cause flooding & extensive damage.

**1978 November:** Brays, Greens bayous flood, causing street flooding.

**1979 April:** Severe storms cause over \$40m in damages.

**1979 September:** Tropical Storm Elena causes extensive flooding & 2 drownings.

**1980 January:** Heavy rains. Sims & Hunting bayou overflow.

**1981 May:** Storms cause flooding in South East Houston.

**1983 May:** Storms caused flooding along several Harris County creeks and bayous. Flooding along San Jacinto River upstream and downstream of Lake Houston.

**1983 August:** Hurricane Alicia caused extensive flooding throughout Harris County. Greens Bayou bridge on Ley Road measured 19.72 inches of rain.

**1983 September:** Thunderstorms south of downtown Houston cause more than 1,000 structures to flood along Brays Bayou.

**1984 October:** Flooding in Cypress Creek, Greens and White Oak Bayous. Residents evacuated and homes flooded. Estimated Damage was \$36.2 million.

**1989 May:** Storms result in 1,400 homes flooded. 7-14 inches of rain over much of Harris County. Buffalo Bayou and Greens Bayou had levels above flood stage.

**1989 June:** Tropical Storm Allison causes extensive flooding.

**1992 March:** White Oak Bayou flowed out of its banks and flooded I-10. Record floods on upper Brays Bayou and many bayous are out of their banks. Over 1,500 structures flooded.

**1994 October:** Over 80 subdivisions were flooded with 3,400 structures reporting damages. 19 reported deaths.

**1996 Sept:** Widespread street flooding in Downtown Houston.

**1997 March / May:** Heavy rains flood streets, bayous, & homes.

**1998:** Multiple floods 1400+ homes flooded throughout year.

**1998 September:** Tropical Storm Frances 7"-12" of rain over Houston. Homes in Jersey Village were flooded. Buffalo Bayou was 13.33' above flood stage. Along White Oak Bayou 1300 homes were flooded. Buffalo Bayou at Milam was 8.77' above flood stage. White Oak Bayou at Heights was over its banks.

2000

2000

2008

2008

**2000**  
Project Brays initiated to complete 75 individual projects for regional detention and stream enhancements

**2001**  
Initiation of the Tropical Storm Allison Recovery Project (TSARP). Large network of benchmarks known as Floodplains Reference Marks

**2008**  
Extensive power outages caused by Hurricane Ike, result in improvements to Houston area power grid.

**2000 May:** Storms cause major flooding on roadways.

**2001 June 6-9:** Tropical Storm Allison, widespread flooding, >35" of rain. White Oak Bayou was above flood stage and Buffalo Bayou was 3.05' above flood stage. More than 6000 homes were flooded along Brays Bayou. Greens Bayou at 59 was 6.81' above flood stage. Greens Bayou out of its banks. White Oak at Heights 9.5' above flood stage.

**2003 November:** 300 homes flooded. 100's of vehicles flooded.

**2006 June:** Upper Level low remains over Houston causing flooding. 11" of rain fell south and east of Harris County. 3000 homes were flooded.

**2008 September:** Hurricane Ike Strikes Galveston Island. Storm surge swamps 2,500 structures. Major power outages. 11 deaths in Harris County >\$28 Billion in damages.

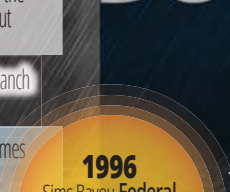
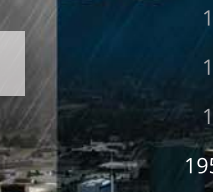
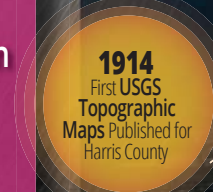
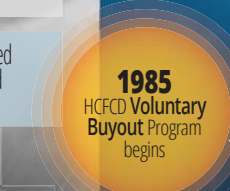
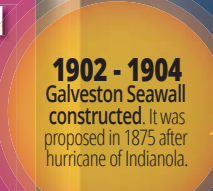
**2009 April:** 2100 homes flooded. Freeways flooded.

**2012 July:** 71 homes in Harris County and 334 homes flooded by training thunderstorms.

**2015 May:** "Memorial Day Flood" Large thunderstorm complex stalls over Houston causing most freeways to be flooded. Homes in Meyerland area flooded.

**2016 April:** "Tax Day Flood" Thunderstorms stream across the upper Texas coast causing wide spread flooding - Jersey Village, along Cypress Creek and in Meyerland area.

**2017 August:** Hurricane Harvey produced record rainfall, and is now recognized as a historic economic disaster. Massive amounts of rainfall forced the Army Corps of Engineers to begin controlled water releases from Addicks & Barker Reservoirs in an attempt to manage flood levels.



# HOUSTON RESILIENCY