American Society of Civil Engineers

March 21, 2017 Luncheon

Russ Poppe, P.E.
Executive Director
Harris County Flood Control District
Agenda

- What is a HCFCD?
- Recent Floods Review
- Infrastructure Impacts
- Major Projects and Programs
- Avoided Damages
Governance

- Special District of the State
- Created in 1937 after severe floods in 1929 and 1935
- Commissioners Court is Governing Body
- Executive Director is Appointed
Jurisdiction

“control, storing, preservation and distribution of …flood waters, and the waters of the rivers and streams…and their tributaries for domestic, municipal, flood control purposes…”
Jurisdiction Example

Street Drainage
Managed by county or a municipality

Bayou Drainage
Managed by the Flood Control District
Harris County Open Channel Network
2,500 Miles of Bayous and Creeks

Area = 1,756 Square Miles
± 1,500 Channels
± 2,500 Miles of Channels
Maintain 142 detention basins
(regional & developer basins)
Greens Bayou Wetlands Mitigation Bank
Provide flood damage reduction projects that work, with appropriate regard for community and natural values.
DEVISE

IMPLEMENT

$60M + Grants

MAINTAIN

$60M

The Flood Control District

$60M
- May 1989
- June 1989 (TS Allison # 1)
- March 1992
- October 1994
- September 1998 (TS Frances)
- October 1998
- November 1998
- June 2001 (TS Allison # 2)
- October 2002
- November 2003
- June 2006
- October 2006 (2)
- August 2007 (TS Erin)
- September 2008 (Hurricane Ike)
- April 2009 (2)
- January 2010
- July 2012
- May 2015 (2)
- October 2015
- April 2016
- May 2016

5 of 24 (21%) Tropical Cyclone
10 of 24 (42%) (Sept, Oct, Nov)
10 of 24 (42%) (Apr, May, June)
<table>
<thead>
<tr>
<th>Date</th>
<th>1-hr</th>
<th>3-hr</th>
<th>6-hr</th>
<th>12-hr</th>
<th>24-hr</th>
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</thead>
<tbody>
<tr>
<td>6/8/01 (Allison)</td>
<td>6.3</td>
<td>13.5</td>
<td>21.2</td>
<td>28.3</td>
<td>28.5</td>
</tr>
<tr>
<td>4/18/09</td>
<td>6.9</td>
<td>9.2</td>
<td>9.9</td>
<td>10.0</td>
<td>11.0</td>
</tr>
<tr>
<td>5/26/15 (Memorial Day 2015)</td>
<td>4.8</td>
<td>8.0</td>
<td>10.1</td>
<td>11.0</td>
<td>11.0</td>
</tr>
<tr>
<td>4/18/16 (Tax Day)</td>
<td>4.7</td>
<td>8.3</td>
<td>13.9</td>
<td>16.7</td>
<td>17.4</td>
</tr>
<tr>
<td>1% Design Storm</td>
<td>4.3</td>
<td>6.7</td>
<td>8.9</td>
<td>10.8</td>
<td>13.2</td>
</tr>
</tbody>
</table>
## April 2016 Structure Flooding Estimates

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Structure Count</th>
<th>Watershed</th>
<th>Structure Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Oak Bayou</td>
<td>2,080</td>
<td>Willow Creek</td>
<td>240</td>
</tr>
<tr>
<td>Cypress Creek</td>
<td>1,680</td>
<td>S Mayde Creek</td>
<td>220</td>
</tr>
<tr>
<td>Brays Bayou</td>
<td>1,380</td>
<td>Bear Creek</td>
<td>130</td>
</tr>
<tr>
<td>Buffalo Bayou</td>
<td>950</td>
<td>Cane Island Branch</td>
<td>120</td>
</tr>
<tr>
<td>Langham Creek</td>
<td>810</td>
<td>Barker Reservoir</td>
<td>90</td>
</tr>
<tr>
<td>Greens Bayou</td>
<td>600</td>
<td>San Jacinto Bayou</td>
<td>90</td>
</tr>
<tr>
<td>Horsepen Creek</td>
<td>510</td>
<td>Sims Bayou</td>
<td>50</td>
</tr>
<tr>
<td>Little Cypress</td>
<td>430</td>
<td>Spring Creek</td>
<td>40</td>
</tr>
<tr>
<td>Halls Bayou</td>
<td>370</td>
<td>Other</td>
<td>50</td>
</tr>
</tbody>
</table>

*FEMA flood insurance claims account for 4,030

**TOTAL 9,840***

Number of structures in 2016 per HCAD: 1,300,000
Flood Damage Reduction Tools

- Widen and deepen bayous and creeks
- Excavate large stormwater detention basins
- Relocate residents out of the floodplain
Voluntary Buyout Program

Over the last 30 years:

• $207M for over 2,000 structures via FEMA grants – 75% Federal Share ($155M)
  • Must meet FEMA criteria
  • ‘Hopelessly deep’ in floodplain
• More than 900 other properties purchased with District funds ($100M)
• Over 2,500 structures will never flood again
Avoided Damages Profile - Buyout
## Recent Avoided Damages

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Return Period</td>
<td>Avoided Losses</td>
<td>Return Period</td>
<td>Avoided Losses</td>
<td>Return Period</td>
<td>Avoided Losses</td>
</tr>
<tr>
<td>Halls Bayou</td>
<td>259</td>
<td>About 10-Yr</td>
<td>160</td>
<td>Over 5-Yr</td>
<td>36</td>
<td>About 10-Yr</td>
<td>93</td>
</tr>
<tr>
<td>Greens Bayou</td>
<td>649</td>
<td>About 10-Yr</td>
<td>145</td>
<td>Over 5-Yr</td>
<td>12</td>
<td>Over 5-Yr</td>
<td>12</td>
</tr>
<tr>
<td>San Jacinto River</td>
<td>251</td>
<td>Under 10-Yr</td>
<td>55</td>
<td>About 5-Yr</td>
<td>1</td>
<td>Over 5-Yr</td>
<td>7</td>
</tr>
<tr>
<td>White Oak Bayou</td>
<td>1079</td>
<td>About 10-Yr</td>
<td>40</td>
<td>About 5-Yr</td>
<td>2</td>
<td>Under 5-Yr</td>
<td>1</td>
</tr>
<tr>
<td>Brays Bayou</td>
<td>29</td>
<td>About 50-Yr</td>
<td>26</td>
<td>Under 10-Yr</td>
<td>0</td>
<td>Under 10-Yr</td>
<td>6</td>
</tr>
<tr>
<td>Armand Bayou</td>
<td>114</td>
<td>About 50-Yr</td>
<td>25</td>
<td>Under 10-Yr</td>
<td>0</td>
<td>Under 10-Yr</td>
<td>0</td>
</tr>
<tr>
<td>Clear Creek</td>
<td>48</td>
<td>Around 50-Yr</td>
<td>15</td>
<td>Under 10-Yr</td>
<td>0</td>
<td>Under 10-Yr</td>
<td>0</td>
</tr>
<tr>
<td>Hunting Bayou</td>
<td>108</td>
<td>Over 25-Yr</td>
<td>3</td>
<td>Under 10-Yr</td>
<td>2</td>
<td>About 10-Yr</td>
<td>29</td>
</tr>
<tr>
<td>Sims Bayou</td>
<td>18</td>
<td>About 10-Yr</td>
<td>0</td>
<td>Under 10-Yr</td>
<td>0</td>
<td>About 10-Yr</td>
<td>0</td>
</tr>
<tr>
<td>Cedar Bayou</td>
<td>11</td>
<td>Under 10-Yr</td>
<td>0</td>
<td>Under 10-Yr</td>
<td>0</td>
<td>About 10-Yr</td>
<td>7</td>
</tr>
<tr>
<td>Other Watersheds</td>
<td>265</td>
<td>-</td>
<td>16</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>2831</td>
<td>-</td>
<td>485</td>
<td>-</td>
<td>53</td>
<td>-</td>
<td>155</td>
</tr>
</tbody>
</table>
# Home Buyouts

that *Would Have Flooded* (Tax Day 2016)

<table>
<thead>
<tr>
<th>Homes</th>
<th>Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>505</td>
<td>Greens Bayou</td>
</tr>
<tr>
<td>400</td>
<td>White Oak Bayou</td>
</tr>
<tr>
<td>220</td>
<td>Cypress Creek</td>
</tr>
<tr>
<td>180</td>
<td>San Jacinto River</td>
</tr>
<tr>
<td>150</td>
<td>Halls Bayou</td>
</tr>
<tr>
<td>35</td>
<td>Brays Bayou</td>
</tr>
<tr>
<td>10</td>
<td>Other Watersheds</td>
</tr>
<tr>
<td>~ 1,500</td>
<td>TOTAL for 1 event</td>
</tr>
</tbody>
</table>

At $50k per home, savings of $75M
Structural Projects
Sims Bayou Corps Project

Project Cost

Federal Cost to Date $263M
HCFCD Cost to Date $129M

- 19.3 miles of Channel Improvements
- 3 Detention Basins
- 22 Bridge Replacements
- 21 years to build ‘94-’15
- $18.5M/year average
White Oak Bayou Corps Project

- 15.3 miles of Channel Improvements
- 4 Regional Detention Basins
- $124M total cost

Federal Cost to Date: $3M
HCFCD Cost to Date: $82M
White Oak Bayou Corps Project

Jones Rd

Fairbanks-N. Houston

W. Little York

Hollister Rd.
Brays Bayou Corps Project

- 21.2 miles of Channel Improvements
- 4 Regional Detention Basins
- 30 Bridge Modifications & Replacements

Federal Cost to Date: $167M
HCFCD Cost to Date: $141M
Planned Bridge Work

BRAYS BAYOU
Eight Bridges in COH TWDB Application
Service Area - Entire Watershed

PRELIMINARY

SEQUENCE 1
- Forest Hill 2018
- South 7th 2019
- Lawndale 2020
- Telephone 2021

SEQUENCE 2
- Buffalo Speedway 2018
- Stella Link (bridge extension only) 2019
- Greenbriar 2020
- Almeda 2021

LEGEND
- Under construction or completed bridge replacement/extension/modification
- Proposed bridge replacement/extension/modification
- Proposed bridge replacement/extension COH TWDB Application

VICINITY MAP

HARRIS COUNTY

PRELIMINARY
City of Houston Offer

- January 24, 2017 Council Action
  - Texas Water Development Board Loan
- $42 million available for bridge replacement
- Plan/construct bridges now vs. timing for reimbursements
- District responsible for design and construction
- City gets paid back upon District reimbursements
- Bridge work concurrent with channel work
Effective Brays Floodplain Map
Conditional Letter of Map Revision (CLOMR) Floodplain Map
Losses Avoided due to Structural Projects
6-hr Peak Rainfall – May 2015
### Avoided Damages Due to Structural Projects in Sims Bayou Watershed

<table>
<thead>
<tr>
<th></th>
<th>May 25</th>
<th>October 25</th>
<th>October 31</th>
<th>Tax Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sims Bayou</td>
<td>1,700</td>
<td>---</td>
<td>1,700</td>
<td>---</td>
</tr>
</tbody>
</table>

(30) (0) (60) (30)
6-hr Peak Rainfall – May 2015
Avoided Damages Due to Structural Projects in White Oak Bayou Watershed

<table>
<thead>
<tr>
<th>White Oak Bayou</th>
<th>May 25</th>
<th>October 25</th>
<th>October 31</th>
<th>Tax Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,600</td>
<td>350</td>
<td>350</td>
<td>1,800</td>
</tr>
<tr>
<td></td>
<td>(130)</td>
<td>(0)</td>
<td>(16)</td>
<td>(1270)</td>
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</tbody>
</table>
6-hr Peak Rainfall – May 2015
Brays Bayou May 2015 Flood Evaluation

Prevented Flooding of 5,000 Structures
Avoided Damages Due to Structural Projects in Brays Bayou Watershed

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5,000</td>
<td>210</td>
<td>210</td>
<td>2,300</td>
</tr>
<tr>
<td></td>
<td>(3,874)</td>
<td>(0)</td>
<td>(36)</td>
<td>(1,758)</td>
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</table>
## May 2015 Storm Event Summary

<table>
<thead>
<tr>
<th></th>
<th>May 25</th>
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</thead>
<tbody>
<tr>
<td>Brays Bayou</td>
<td>5,000</td>
<td>(1185)</td>
</tr>
<tr>
<td>Sims Bayou</td>
<td>1,700</td>
<td>(30)</td>
</tr>
<tr>
<td>White Oak Bayou</td>
<td>1,600</td>
<td>(130)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>8,300</strong></td>
<td><strong>(1,345)</strong></td>
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