Storm Events – Past 13 months

June 24–June 25, 2019
• 12-15 inches of rainfall in 3.5 hours
• Various areas of localized flooding - West / Northwest
• Floodwaters up to 3-4 feet depth on roadways
• More than 4,000 homes sustain water damage
• Over the charts classification; 500 year plus storm event

September 12 – September 13, 2018
• 3.79 Inches of rainfall in 1 hr. period
• Various areas of localized flood - east / northeast
• Floodwaters up to 2-3 feet depth on roadways
• Classified as a 25 – 50 year storm event

June 18 – June 21, 2018
• 16.85 Inches of rainfall in 72 hr. period
• Various areas of localized flood - city wide
• Floodwaters up to 4 feet deep on roadways
• Classified as a 100 to 500 year storm event
June 24, 2019 – 500 Year Storm

June 24–June 25, 2019
- 12-15 inches of rainfall in 3.5 hours
- Some areas in the region saw winds of 65 to 75 mph
- The Arroyo Colorado crested at 22.67 feet, the highest level since June 2018 and the fourth highest on record.
Olympic Size Pool – 164 feet long, by 82 feet wide, and 6 feet deep. Holds 660,253 gallons of water.

1 inch of rain over 1 square mile area produces – 17,380,000 gallons of water.

13 inches of rain of 1 sq. mile area produces – 225,940,000 gallons of water; equal to 342.2 Olympic sizes pools;
Storm Characteristics

Generally a storm is characterized based on:

- **Intensity** - amount of rain it drops in inches/hour
- **The surface area covered by the storm; acres or sq. miles**
- **Characteristics of the surface: soil type, pervious, impervious**
- **Amount of runoff / flows it produces**

These hydrological factors have been taken into consideration to produce the Rainfall Depth – Duration Frequency Table for Harlingen

<table>
<thead>
<tr>
<th>Storm</th>
<th>15-min</th>
<th>1 Hr.</th>
<th>2 Hr.</th>
<th>3 Hr.</th>
<th>6 Hr.</th>
<th>12 Hr.</th>
<th>24 Hr.</th>
<th>48 Hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Year</td>
<td>1.0</td>
<td>1.9</td>
<td>2.4</td>
<td>2.5</td>
<td>2.8</td>
<td>3.2</td>
<td>3.5</td>
<td>4.1</td>
</tr>
<tr>
<td>5 Year</td>
<td>1.4</td>
<td>2.5</td>
<td>3.1</td>
<td>3.3</td>
<td>3.8</td>
<td>4.4</td>
<td>5.1</td>
<td>6.0</td>
</tr>
<tr>
<td>10 Year</td>
<td>1.3</td>
<td>3.0</td>
<td>3.7</td>
<td>3.9</td>
<td>4.6</td>
<td>5.3</td>
<td>6.0</td>
<td>7.0</td>
</tr>
<tr>
<td>25 Year</td>
<td>1.9</td>
<td>3.5</td>
<td>4.5</td>
<td>4.6</td>
<td>5.7</td>
<td>6.5</td>
<td>7.5</td>
<td>9.0</td>
</tr>
<tr>
<td>100 Year</td>
<td>2.3</td>
<td>4.5</td>
<td>5.8</td>
<td>6.2</td>
<td>8.0</td>
<td>9.0</td>
<td>10.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

*USGS – Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas, 2004*
## Depth – Duration Classification

<table>
<thead>
<tr>
<th>Storm</th>
<th>15-min</th>
<th>1 Hr.</th>
<th>2 Hr.</th>
<th>3 Hr.</th>
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<th>12 Hr.</th>
<th>24 Hr.</th>
<th>48 Hr.</th>
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</thead>
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<td>1.9</td>
<td>2.4</td>
<td>2.5</td>
<td>2.8</td>
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<td>9.0</td>
<td>10.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>
So what is a 100-Year Storm?

<table>
<thead>
<tr>
<th>Recurrence interval, in Years STORM</th>
<th>Probability of occurrence in any given year</th>
<th>Fraction multiplied by 100</th>
<th>Percent chance of occurrence in any given year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1 in 2</td>
<td>$\frac{1}{2} \times 100$</td>
<td>50%</td>
</tr>
<tr>
<td>5</td>
<td>1 in 5</td>
<td>$\frac{1}{5} \times 100$</td>
<td>20%</td>
</tr>
<tr>
<td>10</td>
<td>1 in 10</td>
<td>$\frac{1}{10} \times 100$</td>
<td>10%</td>
</tr>
<tr>
<td>25</td>
<td>1 in 25</td>
<td>$\frac{1}{25} \times 100$</td>
<td>4%</td>
</tr>
<tr>
<td>50</td>
<td>1 in 50</td>
<td>$\frac{1}{50} \times 100$</td>
<td>2%</td>
</tr>
<tr>
<td>100</td>
<td>1 in 100</td>
<td>$\frac{1}{100} \times 100$</td>
<td>1%</td>
</tr>
<tr>
<td>500</td>
<td>1 in 500</td>
<td>$\frac{1}{500} \times 100$</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

A 100 year storm, has a 1% chance of occurring any given year
Important to Notes:

• Street, Curb & Gutter are part of the storm sewer conveyance system.

• A system that is design for a 5 year storm has a 10-20% chance of exceeding its capacity at any given rain event.

• Maintenance of system is important to preserve capacity.

• Condition, and water level of receiving body of water will affect function of storm sewer system.

• Drainage in Municipalities
June 25, 2019 - Photos

Canal – North of Secluded Acres S/D

Detention Pond – S.W. of Convention Center
Reports of Damage

Jackson St & C St

Harrison and S. B Street

22834 Breedlove Street.
June 25, 2019 - Response

Traxler Way and FM 800

Dewatering Pumping Operations

Business 77 and Vinson Rd

East end of Barcelona Street

Debris Collections
June 25, 2019 - Response
How has the City Prepared?

- 2008 Study covered city limits and 3 ½ ETJ

- Delineated 49 drainage (ditch) systems;
  - 9 systems within study area were analyzed with hydraulic models

- Delineated 128 storm drainage (pipe/box) system;
  - 59 systems were identified with less than 5 year storm capacity

- Capital Improvements Projects identified & prioritized. (In 2008 dollars)
  - $8.7 Million for drainage ditches
  - $35.6 Million for storm sewer
  - $8.7 Million contingency
### Projects Completed to Date

<table>
<thead>
<tr>
<th>Year Const.</th>
<th>Project</th>
<th>Project Cost/Est.</th>
<th>Bond/ G.F.Cost</th>
<th>Grant Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Downtown Drainage Improvements</td>
<td>$4,300,000</td>
<td>$4,300,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Matz/New Combs Drainage Improvements</td>
<td>$852,000</td>
<td>$852,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7th &amp; Bowie Drainage Improvements</td>
<td>$447,000</td>
<td>$447,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Green Acres Drainage Improvements</td>
<td>$587,000</td>
<td>$587,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Northwest Drainage Improvements Phase I</td>
<td>$406,000</td>
<td>$406,000</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Northwest Drainage Improvements Phase II</td>
<td>$613,000</td>
<td>$613,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lipscomb Drainage Ditch</td>
<td>$43,200</td>
<td>$43,200</td>
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</tr>
<tr>
<td>2010</td>
<td>Northwest Drainage Improvements Phase III</td>
<td>$1,250,000</td>
<td>$1,250,000</td>
<td></td>
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<tr>
<td>2012</td>
<td>Northwest Drainage Improvements Phase IV</td>
<td>$480,000</td>
<td>$480,000</td>
<td></td>
</tr>
</tbody>
</table>
## Projects Completed to Date

<table>
<thead>
<tr>
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<th>Project</th>
<th>Project Cost/Est.</th>
<th>Bond/ G.F.Cost</th>
<th>Grant Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Buchanan, Hays, &amp; M Street Drainage Improvements Phase I &amp; II</td>
<td>$539,000</td>
<td></td>
<td>$539,000</td>
</tr>
<tr>
<td>2012</td>
<td>Jefferson Drainage Ditch</td>
<td>$2,300,000</td>
<td>$575,000</td>
<td>$1,725,000</td>
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<tr>
<td>2013</td>
<td>Buchanan, Hays, &amp; M Street Drainage Improvements Phase III</td>
<td>$471,000</td>
<td></td>
<td>$471,000</td>
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<tr>
<td>2013</td>
<td>Buchanan, Hays, &amp; M Street Drainage Improvements Phase V</td>
<td>$420,000</td>
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<td>$420,000</td>
</tr>
<tr>
<td>2014</td>
<td>Buchanan, Hays, &amp; M Street Drainage Improvements Phase IV</td>
<td>$190,000</td>
<td></td>
<td>$190,000</td>
</tr>
<tr>
<td>2014</td>
<td>3rd Street Drainage Ditch Imp. Project</td>
<td>$530,000</td>
<td>$132,500</td>
<td>$397,500</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td><strong>$13,428,200</strong></td>
<td><strong>$6,936,700</strong></td>
<td><strong>$6,491,500</strong></td>
</tr>
</tbody>
</table>
Downtown Drainage & Laterals Storm Sewer Drainage Project

Items in green show improvements completed.
Project Cost = $4,300,000
Buchanan, Hays, & M Street
Storm Sewer System Project

Items in yellow show improvements completed.
Project Cost = $1,620,000
32\textsuperscript{nd} Drain – Jefferson Drainage Ditch

Items in yellow show improvements completed.
Project Cost = $2,300,000
3rd Street Drainage Ditch

Items in yellow show improvements completed.
Project Cost = $530,000
Northwest Drainage Improvement Project

Highlighted areas show improvements completed. Project Cost = $1,600,000
### Proposed Projects – Seeking Funds

<table>
<thead>
<tr>
<th>Year</th>
<th>Project Name</th>
<th>Cost Estimate</th>
<th>Possible Funding Source</th>
<th>Funding Agency</th>
<th>Application Submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>General Fund</td>
<td>Grant Funds</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>13th Street Drainage Ditch Improvement Project</td>
<td>$ 730,489</td>
<td>$ 182,622</td>
<td>$ 547,867</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Dixieland Drainage Ditch Improvement Project</td>
<td>$ 2,060,954</td>
<td>$ 515,239</td>
<td>$ 1,545,716</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>9th &amp; 13th Street Storm Sewer Improvement Project</td>
<td>$ 1,547,987</td>
<td>$ 386,997</td>
<td>$ 1,160,990</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>5th &amp; 7th Storm Sewer Improvement Project</td>
<td>$ 1,700,343</td>
<td>$ 425,086</td>
<td>$ 1,275,257</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Business 77 &amp; 13th Street Storm Sewer Improvement Project</td>
<td>$ 3,875,731</td>
<td>$ 968,933</td>
<td>$ 2,906,798</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Treasure Hills / 25th Street</td>
<td>$690,836</td>
<td>$172,709</td>
<td>$518,127</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>$10,606,340</strong></td>
<td><strong>$2,651,586</strong></td>
<td><strong>$7,954,755</strong></td>
<td></td>
</tr>
</tbody>
</table>
13th Street Drainage Ditch Improvement

Items in yellow show proposed improvements.
Est. Project Cost = $730,000
Dixieland Road Drainage Ditch Improvement

Items in yellow show proposed improvements.
Est. Project Cost = $2,060,954
9th & 13th St. Storm Sewer Improvements

Items in yellow show proposed improvements.

Est. Project Cost = $1,547,987

TDEM has funded engineering study and design.
5th & 7th Storm Sewer Improvements

Items in yellow show proposed improvements.
Est. Project Cost = $1,700,343
Bus. 77 & 13th Street
Storm Sewer
Improvements

Items in yellow show proposed improvements.
Est. Project Cost = $3,875,731
Treasure Hills / 25th Street
Storm Sewer
Improvements

Items in yellow show proposed improvements.
Est. Project Cost = $690,836
Important Notes:

• City is eligible for grant funds through TDEM/FEMA
  • Need to update Hazard Mitigation Action Plan. Due 2020

• Update to 2008 Master Drainage Plan
  • Update hydraulic models
  • Include new developments and annexed areas
  • Update construction estimates

• Continual collaboration with drainage districts, adjoining cities, and county.

• Dependence on CCDD #5 Canal System and Arroyo Colorado.
Cameron County Drainage District #5
CCDD # 5 Drainage Improvements

- **Regional Detention Facilities**
  - Off Lafayette Rd - completed
  - Off Brazil Road - completed
  - Off Briggs Coleman Road - on-going excavation
  - North of 13th Street - excavation to begin in 12 months

- **Concrete Line North Main Canal - Wilson Road to Business 77 - On-going**

- **Excavation of 13th Street; south of Loop 499. Excavation to be done by City.**
CCDD # 5 Drainage Improvements
USIBWC – ONGOING DISCUSSIONS

- Divisor Dike
  - Uncontrolled flows – split of floodwaters
- Arroyo Colorado
  - Design Capacity / Present Capacity
- North Main Floodway
  - Design Capacity / Present Capacity
- Gate Structure into North Main Floodway
  - Structure 520L
  - Installation of bypass pump
Lower Rio Grande Flood Control Project
Divisor Dike – Mercedes, TX
June 26, 2019:
Water Surface Elevation = 22.67 feet
Flow at 5,226 cfs

June 21, 2018:
Water Surface Elevation = 23.98 feet
Flow at 5,069 cfs

July 21, 2010 (Hurricane Alex):
Water Surface Elevation = 24.22 feet
Flow at 5,509 cfs

Historic Crests:
1. 24.22 ft on 07/21/2010
2. 23.98 ft on 06/21/2018 (P)
3. 18.47 ft on 10/09/2010 (P)
4. 17.37 ft on 10/26/2015 (P)
5. 16.91 ft on 09/16/2014
Arroyo Colorado – June 25, 2019
Arroyo Colorado - Design

Robert Runyon: Texas Photography, Reporting Texas
Lower Rio Grande Flood Control Project

- 105,000 cfs
- 21,000 cfs
- 84,000 cfs
Did your home receive damage during the recent floods in the RGV? Habitat for Humanity of the RGV is currently accepting applications for families whom were affected by the June 2019 floods. Qualified applicants may be eligible to receive assistance with replacement and installation of refrigerator and dryer; sump, mattresses, box springs, refrigerators and stoves.

¿Su casa recibió daños durante las recientes inundaciones en el RGV? Habitat for Humanity of the RGV está aceptando solicitudes para familias que fueron afectadas por las inundaciones de junio de 2019. Los solicitantes calificados pueden ser elegibles para recibir asistencia con el reemplazo e instalación de refrigerador y secadora; sumidero, colchones,ajes, refrigeradores y estufas.

For more information/Para más información
www.habitatrgv.org
hanse@habitatrgv.org
(956) 686-7455
Drainage System – S

* Provides relief to Harlingen, Combes, County, and State Roadways
* Outfalls into North Main Floodway at Gate Structure 520L
* Needs installation of bypass pump structure
Gate 520 L – Pump Bypass
Collaborate with USIBWC - Objectives

- Update the 2014 hydraulic model studies that utilize achievable field conditions (hydraulic coefficients) and elevation control parameters to determine capacity of Arroyo Colorado,

- Conduct hydraulic model studies for the North Floodway to develop capital improvement projects that would increase diversion rates into the North Floodway

- Develop and construct capital improvement projects that:
  - Improve structural integrity and operational “controls” of the diversion dike,
  - Improve capacity of North Floodway to increase is conveyance capacity.
Collaborate with USIBWC - Objectives

- Assist communities and drainage districts to improve drainage infrastructure that:
  - Provide the ability for communities to discharge into the Arroyo before diversion flows reach populated areas.
  - Provide for construction of gates structures and installation of bypass pump structures that preserve the communities’ ability to discharge into the Arroyo.
  - Identify location for regional detention facilities that would mitigate peak flows discharging into the Arroyo.
Questions & Discussion