2019 FloodAware Training

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National Weather Service - Houston/Galveston, TX
Outline

Flooding Importance
Flooding Types and Causes
Flood Products
River Flooding
Partners
Flood Safety
Reporting Flooding
Flood Risk
Flooding Importance
Flooding is Deadly!

In the 4 year period from 2014 to 2017, more people have died in Texas from flooding than all other weather hazards combined.

Data from NWS National Hazard Statistics
Flood Fatalities

TEXAS FLOOD FATALITIES BY SHELTER FROM 2014-2016

- Vehicle: 50%
- In Water: 25%
- Home: 12%
- Other: 13%

Half of the flood fatalities in Texas occurred while people were in their car.

2017 was skewed due to Hurricane Harvey. In 2017, there were 33 flood fatalities in the water and 19 in vehicles.

Data from NWS National Hazard Statistics
Houston Floods: April 18, 2016
Flood Fatalities

2018 U.S. Flood Fatalities Activity of Victims

- Driving: 69%
- At Home: 8%
- Walking: 6%
- Fell In: 6%
- Other: 11%

Source: NOAA/National Weather Service
Recent Big Floods...

Memorial Day 2015
Tax Day 2016
Brenham 2016
Harvey 2017

And other historic floods...
Tropical Storm Allison
1994 Flood
Tropical Storm Claudette
Flooding Types and Causes
What Causes Flooding?

- Intense rainfall
- Rain over several days
- Dam/levee failures
- High tides or storm surge
- Snowmelt
- Ice or debris jams
Flood Products
Watch vs Warning

A **Watch** is issued when conditions are favorable to occur.

A **Warning** is issued when the threat is *occurring or imminent*, threatening life or property.
Flood vs. Flash Flood

A **Flood** is an overflow of water onto normally dry land likely caused by rising water in a river/bayou, poor drainage, or high tides/surge. Flooding is a longer term event than flash flooding. It may last days or weeks.

A **Flash Flood** is a flood caused by heavy or excessive rainfall in a short period of time, typically 6 hours or less. Flash floods are defined as:

- ≥ 3 feet of standing water (less if threatening life or property), and/or
- ≥ 6 inches of fast flowing water across a road or bridge, or
- Water in a stream or bayou flowing rapidly out of its banks, or
- A dam break (even on a sunny day)
# Understanding Flooding

<table>
<thead>
<tr>
<th>Urban / Small Stream Advisory</th>
<th>Flood Watch</th>
<th>Flash Flood Watch</th>
<th>Flood Warning</th>
<th>Flash Flood Warning</th>
<th>Flash Flood Emergency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WHAT IS IT?</strong> Flooding of small streams, streets and low-lying areas.</td>
<td><strong>WHAT IS IT?</strong> Flooding is possible – typically within a 6 to 48 hours before rain is expected to reach the area.</td>
<td><strong>WHAT IS IT?</strong> Flash flooding is possible – typically 6 to 48 hours before rain is expected to reach the area.</td>
<td><strong>WHAT IS IT?</strong> Flooding impacts are occurring or imminent.</td>
<td><strong>WHAT IS IT?</strong> Flash flooding impacts are occurring or imminent.</td>
<td><strong>WHAT IS IT?</strong> Flash flood situation that presents a clear threat to human life due to extremely dangerous flooding conditions</td>
</tr>
<tr>
<td><strong>WHAT TO DO?</strong> Stay away from areas that are prone to flooding and stay clear of rapidly moving water</td>
<td><strong>WHAT TO DO?</strong> Stay tuned to local river forecasts; prepare for areas near rivers to spread towards nearby roads and buildings</td>
<td><strong>WHAT TO DO?</strong> Have a way to receive local warnings, expect hazardous travel conditions and have alternate routes available</td>
<td><strong>WHAT TO DO?</strong> Stay alert for inundated roadways and follow all local signage! Additional impacts include homes and structures could become flooded and need to be evacuated</td>
<td><strong>WHAT TO DO?</strong> Conditions will rapidly become hazardous! Do not cross flooded roadways or approach inundated areas as water may still be rising</td>
<td><strong>WHAT TO DO?</strong> Immediately reach higher ground by any means possible</td>
</tr>
</tbody>
</table>
You make the call...
Urban / Small Stream Flood Advisory

This image depicts what conditions may look like during a flood advisory.
Flash Flood Warning

This image depicts what conditions may look like during a Flash Flood Warning.
Flash Flood Emergency

This image depicts what impacts may result from a Flash Flood Emergency. A rapidly moving flood wave resulted in this roadway being completely washed out.
Flood Warning
(Areal/River/Bayou)
Flood Timeline

Before Event Onset → Flood Advisory → Flash or Areal Flood Warning → River Flood Warning → Flash Flood Emergency

Increasing Impact Potential
ALL Situations Represent Threatening Conditions to Life and/or Property

Note: Flooding can (and does) occur without a Flash Flood Watch!
Ways to Receive a Warning

- **NOAA Weather Radio**
- **Wireless**
  - Emergency Alerts
  - Weather Apps

**Be sure to have multiple ways to receive warnings.**

**NWS Website:** [https://www.weather.gov/hgx/](https://www.weather.gov/hgx/)

**TV and Radio**

**Social Media**
River Flooding
River flooding occurs when water escapes the river banks. There are different thresholds for river flooding: action, minor, moderate, major and record flooding. This image depicts what a river flooding looks like.
A watershed, or basin, is an area of land that drains runoff from rainfall (stormwater) to a body of water, either a river, bayou, creek, or lake.

Topography plays a big role in how watershed boundaries are defined.

Watersheds vary in shape and size which ultimately lead to unique challenges.

A watershed can flow into another watershed.

Brazoria County deals with 2 primary watersheds: Brazos River and San Bernard River.
Diverse Watershed Characteristics in Texas

- **Snowpack** - Water Supply
- **Hill Country Hydrology**
  - Flash Flood threats
  - Rapid River responses
  - Cycles of Flood/Drought
- **Complex Reservoir Operations**
- **Forest Hydrology**
  - Slower River responses
- **International Border Water Allocation**
- **Coastal Hydrology**
  - Hurricanes
  - Tropical Cyclones
  - Storm surge
  - Coastal flooding
- **Prolonged River Flooding**
Watershed

- A watershed, or basin, is an area of land that drains runoff from rainfall (stormwater) to a body of water, either a river, bayou, creek, or lake.
- Topography plays a big role in how watershed boundaries are defined.
- Watersheds vary in shape and size which ultimately lead to unique challenges.
- A watershed can flow into another watershed.
- Brazoria County deals with 2 primary watersheds: Brazos River and San Bernard River.
- NWS issues river forecasts for 3 sites in Brazoria County.
River Forecast Process

Rainfall Analysis

Rainfall estimates and forecasts merged into continuous dataset

Hydrologic Modeling

Rainfall ingested into hydrologic model. Forecasters adjust model parameters in real time

Forecast

Warning

River Forecast Process
LOCATION:
Of the gage the forecast is made, AT means the gage is in the limits of the town/city, NEAR or NR means that town/city has the closest post office.
Hydrograph Basics

OBSERVATIONS:
Past river stages

DATUM:
Adjustment to mean sea level
Hydrograph Basics

FORECAST:
Forecast River Stages

CREST:
Peak Stage
Hydrograph Basics

STAGE VS FLOW: Hydrologists, models, reservoirs work in flow. Emergency managers, media, general public work in stage.

What is flow or a cubic foot per second?
Hydrograph Basics

A basketball is roughly a cubic foot, so 20,000 cfs is 20,000 basketballs of water passing the gage every second.
Understanding River Criteria Levels

**BELOW CRITERIA**

**Impact:** Water is within the banks of the river with no impacts to the surrounding area. Flow speeds may still be high during rainfall or releases which could impact recreational activities.

**ACTION**

**Impact:** Water is over the banks and into the flood plain, but not a threat to structures or roadways. Some action may be required such as moving farm equipment or increasing awareness.

**MINOR**

**Impact:** Typically water is impacting areas inside of floodplain which can vary by location. Some low water crossings covered by water, agricultural flooding, water approaching public areas (parks, sidewalks etc.). Areas frequently flooded can expect to be impacted.

**MODERATE**

**Impact:** Water now reaching areas only impacted by significant rain events. Structures can be inundated, several roads covered with water, water may cut off certain areas, widespread agricultural flooding.

**MAJOR**

**Impact:** Water is near the highest it’s ever been representing rare flooding and significant widespread impacts. Most roads will be covered by water in the area cutting off if not completely flooding subdivisions, rivers can be several miles wide in areas. Homes and structures underwater, bridges inundated and in danger of being hit by debris. Impacts may be greater than ever experienced.
Advanced Hydrologic Prediction System

USGS Water Alerts

- Set alerts when a gauge reaches certain water surface elevations.
- Identify the gauge nearest you

USGS Water Alerts: https://maps.waterdata.usgs.gov/mapper/wateralert/
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- Identify the gauge nearest you.
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USGS Water Alerts

- Set alerts when a gauge reaches certain water surface elevations.
- Identify the gauge nearest you
- Click on the gauge and select “Subscribe to WaterAlert”
- Define how you want to receive the information:
  - Email or phone
  - Frequency
  - Stage or Discharge
  - Stream Elevation(s)
- Note: Use Internet Explorer

USGS Water Alerts: https://maps.waterdata.usgs.gov/mapper/wateralert/
Partners

Roles of Primary River Forecast Partners

- US Army Corps of Engineers
  - Operate Flood Control Reservoirs
  - Manage Other WR Projects
- USGS
  - U.S. Stream Gage Network
  - Water Science Studies
- National Weather Service
  - Issue Weather & Water Forecasts, Watches, Warnings & Data

Shared Data and Resources

- US Army Corps of Engineers
  - Assist w/Gage Maintenance
  - Assist w/Stream Measurements
  - Assist w/Funding Data Networks
- USGS
  - Gage Maintenance
  - Stream Measurements
  - Focus Stream Gage Network
- National Weather Service
  - Cooperative Data Network
  - NOAA/NWS Satellite Transmission
  - Forecasts/Data for Operations
Brazos River Authority Operations
2019 FloodAware Training

Presented by
Brad Brunett, Regional Manager – Central & Lower Basins
Aaron Abel, Water Services Manager
Chris Higgins, Senior Hydrologist
Our Mission

To develop, manage, and protect the water resources of the Brazos River basin

- Oldest river authority in Texas
- Created by the Texas Legislature in 1929
- First entity of its kind in the nation
- Self-funded (not appropriated), do not levy taxes
- 21 member Board appointed by Governor

Territory:
- Extends from the Texas-New Mexico state line west of Lubbock to the Gulf of Mexico near Freeport
- More than 42,000 square miles
- All or part of 76 counties
Our Business

- Raw Water Supply
- Water & Wastewater Treatment
- Water Quality & Environmental Stewardship
• Brazos Basin Corps of Engineers Reservoirs have prevented $1.6 billion in flood damages as of the end of 2017
1.55 million AF of Water in Conservation Storage

2.15 million AF of Water in Flood Water Storage

Lake Somerville Emergency Spillway, Late May, 2016
The Drought, 2011 – 2015...(RIP!)

Brazos River at Seymour – August 3, 2011
TOTAL DIVERSIONS AUTHORIZED UNDER EXISTING CONTRACTS

1. Possum Kingdom Lake 74,186 10. Lake Proctor
2. Possum Kingdom Lake dam to Palo Pinto gage 4,800 11. Lake Proctor dam to Leon Rv at Gatesville gage
3. Palo Pinto gage to Dennis gage 1,050 12. Leon Rv at Gatesville gage to Lake Belton dam
4. Dennis gage to Lake Granbury dam 89,244 13. Lake Belton dam to Leon Rv nr Belton gage
5. Lake Granbury dam to Glen Rose gage 1,200 14. Leon Rv nr Belton gage to Little Rv gage
6. Glen Rose gage to Lake Whitney dam 11,510 15. Stillhouse Hollow Lake
7. Lake Aquilla 6,500 16. Stillhouse Hollow Lake dam to Lampasas Rv nr Belton gage
8. Lake Whitney dam to Brazos nr Aquilla gage 11,403 17. Lake Georgetown

values are acre-feet per year aggregated by stream segment reaches
10. Little-San Gabriel conf. to Little Rv at Cameron 5,000
20. Brazos-Little conf. to Bryan gage 1,700
21. Bryan gage to Brazos-Yegua conf. 150
22. Lake Somerville 4,200
23. Brazos-Yegua conf. to Brazos-Navasota conf. 540
24. Lake Limestone 50,875
25. Easterly gage to Brazos-Navasota conf. 7,600
26. Humpstead gage to Richardson gage 113,070
27. Richardson gage to Gulf of Mexico 48,780

source: Brazos River Authority
Reservoir Operations

• BRA reservoirs contain no flood storage space
• What comes in must go out real-time
Significant Operating Rules

- Don’t release based on weather forecasts
- Don’t make flooding worse downstream than it would have been without the reservoir being present
- Prevent water overtopping flood gates
- Attempt to minimize flood potential on upper end of lakes
- Ensure good communication
  - BRA Central Office and Lake Office staff
  - Downstream Call Lists
  - West Gulf River Forecast Center
    & Other Agencies
  - Emergency Management Officials
  - General Public
  - Social Media

Morris Sheppard Dam at Possum Kingdom Lake
Lower Brazos Flood Study

• Why?
  – High growth area with outdated and inconsistent Brazos River floodplain information

• Who?
  – Texas Water Development Board, lower basin entities, BRA, & Halff Associates, Inc.

• What?
  – New models
  – New estimates of how much water, how fast, and how high
  – New maps
  – Alternatives to reduce/mitigate future damages
Flood Safety

What to do before, during, and after a flood?
Safety Before a Flood

- Prepare a family disaster plan.
- Check if your insurance covers flood damages. If not, get flood insurance.
- Keep insurance and other important documents, such as copies of driver's licenses and credit cards, and other valuable items, in a safe place.
- Assemble a disaster supplies kit. Be sure to include prescription medications, food, and water.
- Find out where you can go if ordered to evacuate.
- Arrange to keep in contact with relatives and friends.
- Know your resources.

Knowing what to do when a flood occurs will increase your family’s safety and possibly its survival.
Safety During a Flood

• Monitor warnings and be prepared to take action.
• Have multiple ways to receive weather information.
• Turn around, don’t drown!
• Stay away or be swept away. Flood waters will be moving swiftly and river banks/culverts can become unstable.
• **Barricades are for your protection; do not drive around them!**
• Do not sightsee!
• If evacuations are ongoing, don’t get in the way of first responders.
• Stay out of the flood waters!
Most flood deaths occur in vehicles.
It only takes six inches of water for a vehicle to lose contact with the road surface.
Most vehicles can be swept away in just 18 to 24 inches of water!
Flooded roads may have hidden dangers, such as washed out road beds or underwater obstructions.
Be especially cautious when traveling at night.
If your vehicle is caught in rising water, leave it immediately and seek higher ground.

Turn Around, Don’t Drown!
Stay away from damaged areas unless your assistance has been specifically requested by police, fire, or a relief organization.

Return home only when authorities indicate it is safe.

Use extreme caution when entering buildings; there may be hidden damage, particularly in foundations.

Cut power to flooded areas of your home.

Only use generators in well-ventilated areas—never in a closed garage!
Reporting/Wrap Up
What to Report

Flash Flooding

- Underpasses filling with water
- Impassible roadways
- Any fast-moving water greater than 6 inches in depth

Any River or Bayou Flooding

Any Coastal Flooding
Reports should include the following information:

**WHO** is calling

**WHERE** the flooding is located

**WHAT** type of flooding is occurring (flash, river, or bayou)

**WHEN** the flooding occurred (is it ongoing?)

**HOW** deep is the water (if you can *safely* evaluate this)
The Good

“I’m a storm spotter located in Sealy at the intersection of Meyer and FM 2187. Water is flowing over curbs; it’s at least 6-8 inches deep in some locations on the road.”

The Bad

“Hey, we got some flooding here a few minutes ago!”

The Ugly

“My sister-in-law said the bayou got really closer to her house, did you have a warning out for that?”
How to Report

Call us!
Spotter line: 1-800-846-1828

Report via amateur radio
Call sign WX5HGX

Email
sr-hgx.nws@noaa.gov

Social Media
Twitter: @NWSHouston
Facebook: NWSHouston

Spotter Tip
Set up SKYWARN as a contact in your smartphone

Work
1 800-846-1828

Email / Work
sr-hgx.nws@noaa.gov

Website
http://weather.gov/houston

Website
https://facebook.com/NWSHOUSTON

Groups
Flood Risk
Flood Risk?

Any situation involving exposure to a flood danger, harm or loss.

“While levees can help reduce flood risk...they do not eliminate the risk.”
Insurance Misconception

**Misconception:**

“I’m already covered—my homeowners policy covers flooding.”

**Fact:**

Most insurance policies do not cover flooding; only flood insurance covers flood damage.

Renters and Business owners should also consider flood insurance for contents.

**Misconception:**

“I don’t live in a flood zone.”

**Facts:**

- Floods are the #1 natural disaster in the United States.
- If it can rain, it can flood.
- FIRMs do not show localized flooding from drainage ditches/sewers/road ponding.
- To some degree overland flooding…but not property to property drainage problems.
### Cost of Flood Damage?

2,500 sqft, one-story home with possessions worth $50,000

<table>
<thead>
<tr>
<th>Interior Water Depth (Inches)</th>
<th>Cost to Home</th>
<th>Cost to Personal Property</th>
<th>Combined Loss Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>$23,635</td>
<td>$3,172</td>
<td>$26,807</td>
</tr>
<tr>
<td>2&quot;</td>
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<td>$3,172</td>
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<tr>
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<tr>
<td>48&quot;</td>
<td>$53,355</td>
<td>$50,000</td>
<td>$103,355</td>
</tr>
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</table>
Flood Insurance/Group Flood Insurance

Everyone is at risk for flooding

- Brief definition of flooding is any forms of rising water in which 2 properties are affected-one being yours

  - **Structure Coverage**
    - Max coverage $250,000

  - **Contents coverage**
    - Contents is an optional addition, except for Preferred Risk Policy.
    - Max coverage $100,000 coverage for Actual Cash Value

- **Wait Period**
  - Typically - 30-days from purchase until effective.

- **Average NFIP pay out for Harvey was $112K (March 2018)**

- **Group Flood Insurance**
  - Available during a Presidential Declared event
  - If qualified for a IA grant a GFIP will be purchased in the amount of $600
  - Policy is good for 3 years
  - Must maintain insurance on the property forever
  - Max amount on the policy is 33,500 this includes structure and dwelling
  - Average pay out for Harvey for IA was $6000
What is a FIRM?

Flood Insurance **Rate** Map

- Identifies the flood zones
- SFHA (high risk)
  - A, AE, AO, AH, VE, V etc. (Aqua)
    - 1% annual chance flood
- Non-SFHA (low to moderate risk)
  - B, C and X (Shaded – orange or gray color & non-Shaded)
    - Orange/Gray area – outlines areas protected by Levees
    - Even the non-shaded is a flood zone – a minimal risk.

- Used for rating flood insurance policies
- Are subdivided by panels to cover jurisdictional boundary.
- Shows what the BFE within the zones
- FIRM’s only show Costal and Riverine flood risk

Find your zone at https://msc.fema.gov/portal/home
Structure Elevation Impact Insurance Rates

The elevation is just one factor, others include: when was the structure, has it flooded in the past, etc.

EVERY Structure has a risk…

*generally the higher the structure the less the risk.*
Living in Texas means we have a flood risk even with heavy rain.

- Tax Day 2016 and Memorial Day 2015 – not with a tropical system

Flood Risk is from multiple sources.

Flood insurance allows individual property owners to manage their risk.

- Buy policies that cover the structure AND contents.
Contact Information

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NFIP Hotline
1-800-427-4661
www.fema.gov/nfip
Questions

National Weather Service
Brazos River Authority