2018 FloodWarn Training

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Outline

Flooding Importance

Flooding Types and Causes

Flood Products

River Flooding

Trinity River

Flood Safety

Reporting Flooding

Flood Risk

(REUTERS/Richard Carson)
Flooding Importance
Flooding is Deadly!

In the 5 year period from 2013 to 2017*, more people have died in Texas from flooding than all other weather hazards combined.

*2017 Data: 70 Flood Related Deaths in TX out of 138 Total Weather-Related Fatalities

Data from NWS National Hazard Statistics
Flood Fatalities

Texas Flood Fatalities by Shelter from 2013-2016

- Vehicle: 51.0%
- Permanent Home: 10.6%
- In Water: 26.0%
- Other: 12.5%

Over half of the flood fatalities in Texas occurred while people were in their car.
Houston Floods: April 18, 2016
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
Types of Flooding

**Ponding & Sheet Flow Flooding**
Flooding that occurs gradually over time, usually 6 hours after the rain begins or longer (longer duration).

**Flash Flooding**
Flooding that develops quickly (typically 6 hours or less) either from heavy rainfall or dam/levee failure (shorter duration).

**River Flooding**
Flooding that occurs from water escaping river banks.

**Coastal Flooding**
Flooding along a coastline either from high tides or storm surge during a tropical storm or hurricane.
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.

Example only

Counties in Flash Flood Watch

Example only

Flash Flood Warning (green polygon)
A Flood is an overflow of water onto normally dry land likely caused by rising water in a river/bayou or poor drainage. 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:

- $\geq 3$ feet of standing water (less if threatening life or property), and/or
- $\geq 6$ 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>&lt;br&gt;Flooding of small streams, streets and low-lying areas.</td>
<td><strong>WHAT IS IT?</strong>&lt;br&gt;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>&lt;br&gt;Flash flooding is possible – typically 6 to 48 hours before rain is expected to reach the area.</td>
<td><strong>WHAT IS IT?</strong>&lt;br&gt;Flooding impacts are occurring or imminent.</td>
<td><strong>WHAT IS IT?</strong>&lt;br&gt;Flood flooding impacts are occurring or imminent.</td>
<td><strong>WHAT IS IT?</strong>&lt;br&gt;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>&lt;br&gt;Stay away from areas that are prone to flooding and stay clear of rapidly moving water.</td>
<td><strong>WHAT TO DO?</strong>&lt;br&gt;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>&lt;br&gt;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>&lt;br&gt;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>&lt;br&gt;Immediately reach higher ground by any means possible.</td>
<td></td>
</tr>
</tbody>
</table>
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.
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)
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 and Weather Apps
- TV and Radio
- Social Media

NWS Website: https://www.weather.gov/hgx/
River Flooding
Llano 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.
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
Hydrograph Basics

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
Hydrograph Basics

FORECAST: Forecast River Stages

CREST: Peak Stage
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

Partners

Roles of Primary River Forecast Partners

- Operate Flood Control Reservoirs
- Manage Other WR Projects

- U.S. Stream Gage Network
- Water Science Studies

- Issue Weather & Water Forecasts, Watches, Warnings & Data

Shared Data and Resources

- Assist w/Gage Maintenance
- Assist w/Stream Measurements
- Assist w/Funding Data Networks

- Gage Maintenance
- Stream Measurements
- Focus Stream Gage Network

- Cooperative Data Network
- NOAA/NWS Satellite Transmission
- Forecasts/Data for Operations
USGS Water Alerts

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

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

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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/
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.

- A watershed can flow into another watershed.
- Watersheds vary in shape and size which ultimately lead to unique challenges.
- Topography plays a big role in how watershed boundaries are defined.
- Walker County deals with 2 primary watersheds: Trinity River and San Jacinto River
Diverse Watershed Characteristics in Texas

- Snowpack: Water Supply
- Forest Hydrology: Slower River responses
- Complex Reservoir Operations
- International Border Water Allocation
- Coastal Hydrology: Hurricanes, Tropical Cyclones, Storm surge, Coastal flooding
- Prolonged River Flooding
Watershed

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- Walker County deals with 2 primary watersheds: Trinity River and San Jacinto River
- NWS issues river forecasts for 2 sites in Walker County.
Trinity River Basin Overview
Basin Facts

• Nearly 18,000 square miles
• More water storage than any other river system in Texas
Basin Facts

20 reservoirs ranging from 1,000 to 83,000 acres

- 12 Water Conservation
- 8 Flood Control
Basic Components of a Dam
Flood Control Reservoir
Flood Control Reservoir

• Built to regulate flood waters

Examples:

1. Lake Grapevine
   • Storage-535 MSL
   • Flood Pool-560 MSL
   • Surcharge-582 MSL

2. Lake Lewisville
   • Storage-522 MSL
   • Flood Pool-532 MSL
   • Surcharge-552 MSL

Figure 7.5 Classification of principle storage zones in a cross section of a multipurpose reservoir.
Water Conservation Reservoir
Water Supply Reservoir

- Designed to stay near full
- Have very limited capacity to capture storm inflows
- Designed to pass inflows from storms (with some reduction in peak flow)
- Structurally, the gates must open gradually as lake rises
- Still reduces flooding downstream
Lake Livingston

**WATER CONSERVATION RESERVOIR** is responsible for the safe storage of water and providing drinking water to more than two million southeast Texans.

- 83,000 surface acres
- 1,750,000 acre feet
- More than 350,000 CFS spillway discharge capacity
- Conservation Pool – 131 MSL
- Flowage Easement – 135 to 140 MSL
Gate Operations

- Manage outflow in order to mimic river flows
- Calculate releases adequate to keep pace with increasing inflows without causing sudden surges and without exceeding computed inflows until the peak inflow has been reached.
- Once reservoir elevation has peaked, excess inflow will be released from surcharge storage in an orderly fashion to reduce pool to conservation pool of 131 MSL.
Lake Livingston Emergency Action Plan

- Implemented at discharge of 20,000 cubic feet/second (CFS)
- Who do we contact?
  - Emergency Management Coordinator for Walker, Polk, San Jacinto, Trinity, Liberty and Chambers counties
  - NWS and WGRFC
  - DPS-Lufkin
  - Liberty radio
- Methods of notification
  - Phone
  - Email
  - Twitter
Hydrology and History of the Trinity River
Trinity River Travel Times

- Travel times are to/from Lake Livingston
<table>
<thead>
<tr>
<th>RANK</th>
<th>YEAR</th>
<th>STAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1942</td>
<td>142.61</td>
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<tr>
<td>2</td>
<td>1945</td>
<td>141.69</td>
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<tr>
<td>3</td>
<td>1957</td>
<td>139.61</td>
</tr>
<tr>
<td>4</td>
<td>1908</td>
<td>139.56</td>
</tr>
<tr>
<td></td>
<td>1968</td>
<td>GATES AT DAM CLOSED</td>
</tr>
<tr>
<td>5</td>
<td>1990</td>
<td>139.08</td>
</tr>
</tbody>
</table>
No Two Floods Are The Same

- What part of the watershed is the flood event originating?
  - Rain event in Dallas
  - Local Rain
- How much of the watershed was covered by precipitation?
- What are the current conditions?
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 deposit box.
- 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 Flash Flood

- Turn around, don’t drown when encountering flooded roads.
- Be especially cautious at night when it is harder to recognize the dangers of flooding.
- Stay away or be swept away. River banks and culverts can become unstable and unsafe.
- You should monitor the latest forecasts and be prepared to take action should additional Flash Flood Warnings be issued.
- Have multiple ways to receive weather information (cell phone, NOAA weather radio, television, etc.)
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! Don’t Rely on Your Big Vehicles. Flooded roads may have hidden dangers, such as washed out road beds or underwater obstructions. If your vehicle is caught in rising water, leave it immediately and seek higher ground.
Safety During a Flood

- Have multiple ways to receive weather information (cell phone, NOAA weather radio, television, etc.)
- Do not sightsee!
- Evacuations are ongoing and first responders are working hard to get people to safety. Do not get in their way!
- Flood waters from creeks, bayous and rivers will be swiftly moving. *Do not go near the flood waters!* They will sweep you away if you go in the water.
- Roads may still be closed as they could be damaged or still under water. *Barricades are for your protection; do not drive around them!*
Safety During a Flood

- Stay out of the flood waters!
- Floodwaters can contain chemicals, sewage, disease, and animals
- Unseen underwater debris can be sharp and cause injury
- Downed power lines under the water could lead to death or injury from electrocution
- Water depth can change unexpectedly (storm drains, washed-out roads)
Safety After a Flood

- Don’t put yourself in danger.
- Return home only when authorities indicate it is safe.
- Stay away from damaged areas unless your assistance has been specifically requested by police, fire, or a relief organization.
- Use extreme caution when entering buildings; there may be hidden damage, particularly in foundations.
Safety After a Flood

- Don’t leave lit candles unattended
- Cut power to flooded areas of your home
- Only use generators in well-ventilated areas—never in a closed garage!
- Take breaks and drink plenty of fluids
- Do not use power tools while standing in water
- If you smell or hear gas, call the Fire Department.
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
Formatting Reports

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
CoCoRaHS
“Because every drop counts”
Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 10/31/2015

CoCoRaHS.org

National
Measure & Report Daily Rainfall on Interactive Web site: www.cocorahs.org
Flood Risk
FloodWarn Workshop
Topics

• NFIP – National Flood Insurance Program.
• What is Flood Risk?
• Flood Hazard Mapping and FIRMs
Flood Insurance

A tool for individuals to manage risk.

- Everyone is at risk for flooding.
  - For most events 26% of NFIP claims are outside the SHFA.

- A few inches can cause tens of thousands in damage.

- If you mortgage company “forced” you to buy flood insurance, check that structure and CONTENTS are covered. Most cover structure only.
What is the NFIP definition of A Flood Defined?

Inundation of 2 or more acres of normally dry land or of two or more properties (one of which is your property) from:

- Overflow of inland or tidal waters;
- Unusual, rapid accumulation or runoff of surface waters from any source;
- Mudflow; or
- Collapse or sinking of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated levels that result in a flood.
NFIP Flood Insurance Coverages

- **Structure Coverage**
  - Replacement Cost on single-family, primary residence (structure) if insured to at least 80% of replacement cost.
  - 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 (depreciation applies.)

- **Wait Period**
  - Typically - 30-days from purchase until effective.
  - Exceptions:
    - Flood Insurance required by a federally regulated and insured lender — 0 days.
    - Wildfire 30-day waiting period exception — 0 days.
    - Initial purchase of flood insurance as the result of a map revision — 1 day.
Misconception: Homeowners Insurance is Enough

- **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.
**Group Flood Insurance Policy (GFIP)**

**IF** in the 1% risk area (100yr floodplain) **AND** received FEMA Individual Assistance (IA),

A GFIP policy was purchased

*(if they did not have flood insurance.)*

GFIP is a 3 yr. abridged Flood Insurance Policy. The policy is paid for from the IA funds.

You can purchase the standard NFIP policy to increase your coverage. *(GFIP cancels)*
**Requirement** - property owner MUST purchase and maintain a traditional NFIP policy when GFIP expires.

If not...they are not eligible for IA that would cover the replacement of real or personal property for the damaged location with a future event.

The insurance requirement is forever – including new homeowners.
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.”
What is a FIRM?

Flood Insurance Rate Map

- Identifies the Special Flood Hazard Area (SFHA) and Non-SFHA’s
- Used for rating flood insurance policies
- Mandatory purchase requirement if property is in SHFA AND is a federally backed mortgage.

FIRM’s show Coastal and Riverine flood risk.
What is a Flood Zone?

Zones on a FIRM:

- **SFHA (high risk)**
  - A, AE, AO, AH, VE, V etc. (Aqua)
    - 1% annual chance flood
    - 26% chance of flooding in a 30-yr mortgage

- **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.

Find your zone at [https://msc.fema.gov/portal](https://msc.fema.gov/portal)
Flood Hazard Mapping

- The maps are **NOT** a prediction or forecast.
- Flood waters are not confined to the at the 1% risk line (aka 100yr flood) on the FIRM.

"Yes, this is a beautiful river. But it wasn’t here when we purchased the land. Maybe we should’ve checked to see if it was in a flood zone before investing in it."
FIRMs are subdivided by panels to cover a jurisdictional boundary (each has a unique panel number.)

- Each panel has a specific code and effective date.
- FIRMs are a single snapshot for one scenario.
Flood Hazard Mapping

- Assumptions are made in the river modeling
  - Precipitation input the 100 year/24 hr. design storm *(actual events rain intensities vary - not consistent rate over a 24 hr. period.)*
  - Assumptions about the vegetation in the flood plain – do NOT differentiate dead vs growing vegetation (increased friction during growing season)
  - Snapshot of land use when the models were developed – a challenge in rapidly developing areas
- One event is never the same as another, FIRMs will not exactly match an individual event.
Misconception: Only 100yr Floodplain is at Risk

- **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>
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<tr>
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<td>$23,720</td>
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<td>48&quot;</td>
<td>$53,355</td>
<td>$50,000</td>
<td>$103,355</td>
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</tbody>
</table>
Structure Elevation Impact Insurance Rates

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

High Risk = $$$
Medium Risk = $$
Lower Risk = $

Every structure has a risk…
generally the higher the structure the less the risk.
Harvey Numbers

Insurance claims

- Harris Co (includes cities such as Houston) – all claims 55,570**
- Walker County (unincorporated only) – 1 (Losses over 125K)

Harris County Numbers**

- 154,170 Homes 48,850 in 1% Risk Area (100-yr)
- 34,970 in 0.2% (500-yr) floodplain
- 68% OUTSIDE of the 1% Risk Area.

New GFIP’s Due to Harvey

- Walker County – 6

Summary

- 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.
  - FIRMs focus on river flooding and some overland flow.

- Flood insurance allows individual property owners to manage their risk.
  - Buy policies that cover the structure **AND** contents.
Contact Information

Angela Harrison, Insurance  
Cell 470-557-2794 | Angela.Harrison@fema.dhs.gov

Yho-Meka Conway, Insurance  
Cell 470-572-0803 | Yho-Meka.Conway@fema.dhs.gov

Lauren Schmied, PE, Floodplain Management  
Cell 202-812-6164 | Lauren.Schmied@fema.dhs.gov

Larry Fordham  ANFI, CFM, ACA  
Acting Senior Regional Insurance Specialist, FEMA Region 6  
Phone: 940-383-7253 | Cell: 202-394-4483  
Larry.Fordham@fema.dhs.gov

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

National Weather Service
FEMA