

HOUSTON/GALVESTON

HURRICANE GUIDE



> TROPICAL STORM BILL 2015

Introduction

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Hurricanes and tropical storms have brought damaging winds, devastating storm surge, flooding rains and tornadoes to Southeast Texas over the years. The 1900 Galveston Hurricane remains the deadliest natural disaster on record for the United States with an estimated 8000 deaths. In 2008 Hurricane Ike brought a deadly storm surge to coastal areas and damaging winds that led to extended power loss to an estimated 3 million customers in southeast Texas. A powerful hurricane will certainly return but it is impossible to predict when that will occur. The best practice is to prepare for a hurricane landfall ahead of each hurricane season every year.

This guide is designed to help you prepare for the hurricane season. There are checklists on what to do before, during and after the storm. Each hurricane hazard will be described. Maps showing evacuation zones and routes are shown. A hurricane tracking chart is included in the middle of the booklet along with the names that will be used for upcoming storms. There are useful phone numbers for contacting the local emergency manager for your area and web links for finding weather and emergency information. Another great way to prepare for hurricane season is to attend a hurricane workshop or town meeting in your area. The Houston/Galveston Regional Workshop at the George R. Brown Convention Center (hurricaneworkshop.com) is one of the largest public hurricane workshops in the nation and a great place to gather information. Check with your emergency management office for workshops or town meetings in your area.

In this guide we will also look back at 2015 and some weather events that impacted the area. This includes Tropical Storm Bill, which made landfall near Matagorda Bay and brought 50 mph winds and a modest storm surge to coastal areas, especially near landfall, and flooding rains inland. We will remember the deadly Memorial Day floods that impacted much of the Greater Houston area. Although those floods were not related to a tropical cyclone, lessons learned can be applied to the flash flood hazard that occurs with tropical weather systems.

We hope you find this guide useful and will share the information with your family, friends and coworkers. An electronic version of this guide will be found on the National Weather Service Houston/Galveston Office web site <http://weather.gov/houston> and also at the hurricane workshop page <http://hurricaneworkshop.com>.

Daniel Reilly
Warning Coordination Meteorologist
National Weather Service Houston/Galveston

Graphic design courtesy of:



About the Hurricane



Hurricane Katrina

A tropical cyclone is a weather system that forms over the warm tropical waters and is characterized by a closed counter-clockwise circulation in the Northern Hemisphere. It typically has a cluster of thunderstorms around the center and bands of showers and thunderstorms spiraling out from the center. The tropical cyclone is called a tropical depression, tropical storm or hurricane depending on the strength of the winds in the storm. The strongest of these, the hurricanes, have maximum sustained winds 74 mph or greater and often have an eye, a rain free area in the center of the storm where the winds are very light. The greatest threat of a landfall for the Texas coast is during August and September although hurricanes have struck the Upper Texas coast during every month from June to October.

Definitions

L TROPICAL DEPRESSION: A tropical cyclone with maximum sustained winds of 38 mph or less.

6 TROPICAL STORM: A tropical cyclone with maximum sustained winds between 39 and 73 mph

9 HURRICANE: An intense tropical cyclone with sustained winds of 74 mph or higher.

TROPICAL CYCLONE: An organized weather system with a closed circulation that forms over warm tropical waters. These systems rotate counter-clockwise in the Northern Hemisphere.

HURRICANE/TROPICAL STORM WATCH: Hurricane or Tropical Storm conditions are possible in the watch area within 48 hours

HURRICANE/TROPICAL STORM WARNING: Hurricane or Tropical Storm conditions are expected in the warning area within 36 hours.

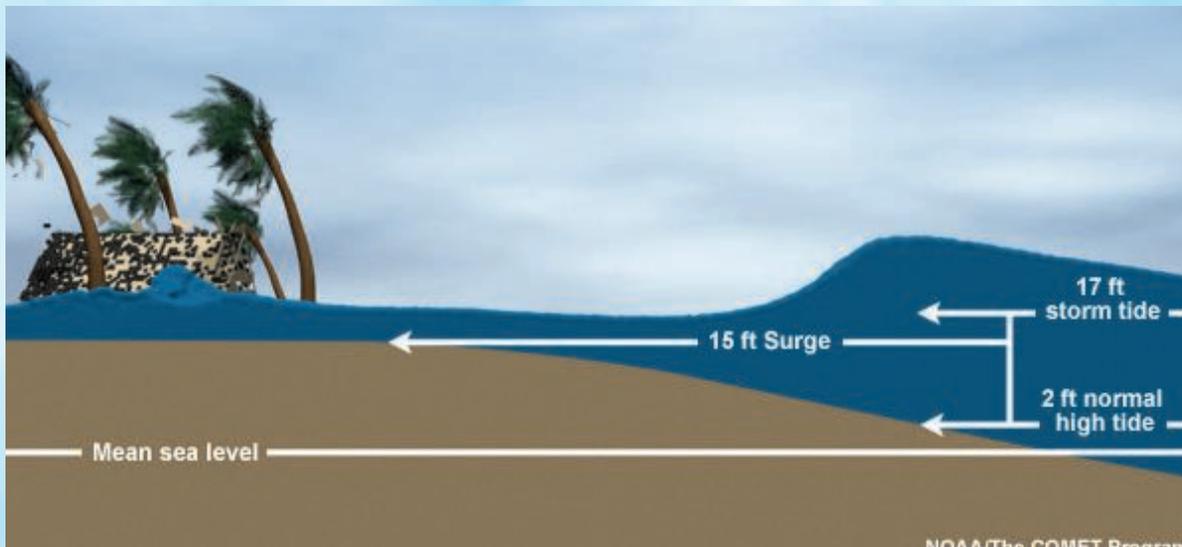
Saffir Simpson Hurricane Wind Scale

- | | | | |
|--------------|----------------------|--------------|-------------------------|
| ● Category 1 | Winds 74 to 95 mph | ● Category 4 | Winds 130 to 156 mph |
| ● Category 2 | Winds 96 to 110 mph | ● Category 5 | Winds 157 mph or higher |
| ● Category 3 | Winds 111 to 129 mph | | |

<http://www.nhc.noaa.gov/aboutshws.shtml>

Storm Surge

Storm surge is the abnormal rise of water generated by a storm, over and above the predicted astronomical tides. The storm tide is the water level that includes storm surge and astronomical tide. An 8-foot wave crest on top of a 17-foot storm tide implies a total water level of 25 feet. The combination of storm surge flooding and battering waves can be very destructive as seen with Hurricanes Ike (2008), Carla (1961), the 1900 Galveston Storm and many others. Storm surge flooding can penetrate well inland. With Hurricane Ike some locations of coastal Texas and Louisiana were flooded greater than 20 miles inland from the coast.



Storm Surge Can be Deadly! Here are 8 Tips to be Ready

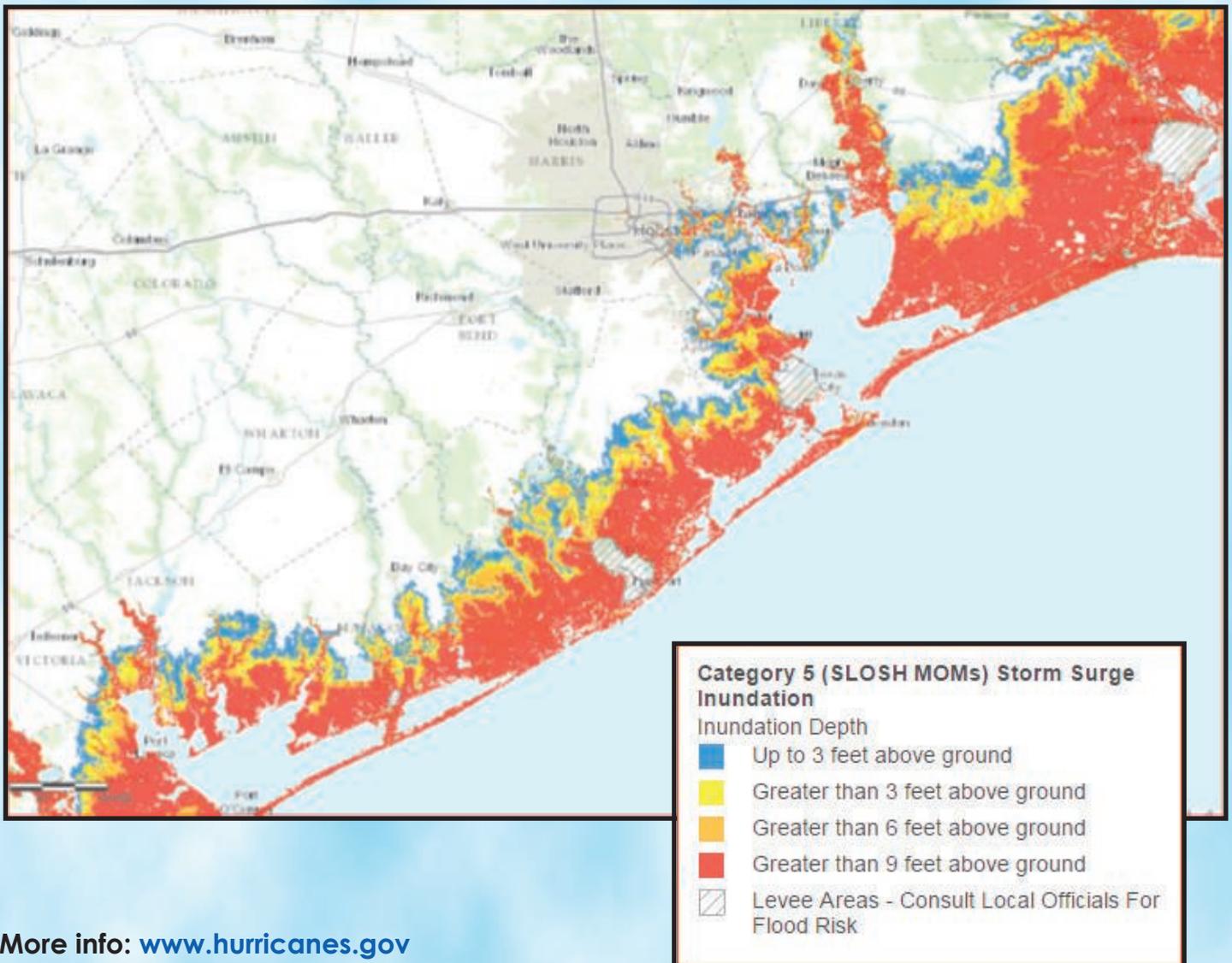
1. Storm surge flooding is often the greatest threat to life and property from a hurricane. It poses a significant threat for drowning. A mere six inches of fast-moving flood water can knock over an adult. It takes only two feet of rushing water to carry away most vehicles-including pickups and SUVs.
2. Storm surge can cause water levels to rise quickly and flood large areas, sometimes in just minutes. You could be left with no time to take action if you haven't already evacuated as instructed.
3. Storm surge depends on more than the category of the storm. These categories (Saffir-Simpson Hurricane Wind Scale) are based on winds and do not necessarily reflect the storm surge threat.
4. Tropical storms and hurricanes of any wind category can cause life-threatening storm surge.
5. Many Gulf Coast areas are vulnerable to storm surge including areas many miles inland from the coastline. Find out today if you live in an evacuation zone (see pages 6 and 7 of this guide).
6. Storm surge can occur before, during and after the center of the storm passes through an area, and can sometimes cut-off evacuation routes. The water can rise well in advance of the coming storm, in some cases 36 hours or greater prior to landfall. Do not wait until the last minute to leave when an evacuation is ordered or you may become trapped.
7. During the peak of a storm surge event, it is unlikely that emergency responders will be able to reach you if you are in danger.
8. Your Mayor and/or County Judge could issue evacuation or other instructions for many reasons. Always follow the instructions of these local officials.

More info: www.hurricanes.gov or www.nhc.noaa.gov/surge

Storm Surge Potential Flood Areas

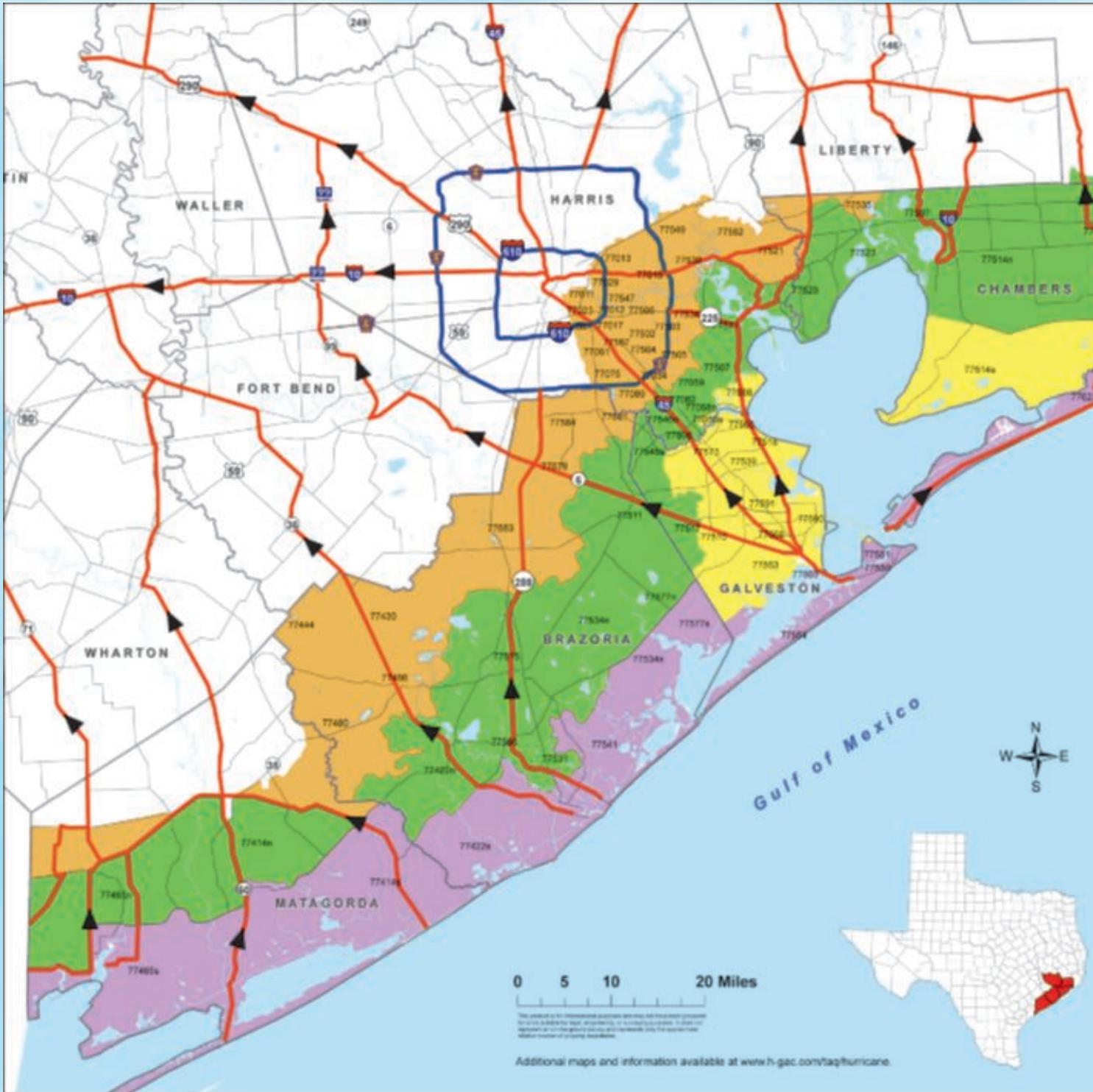
Storm Surge Flooding Map

The map below shows areas at risk of storm surge flooding from a very strong hurricane, a category 5 on the Saffir Simpson Hurricane Wind Scale (SSHWS). Although storm surge depends on more than the scale, this map does show what areas may be at risk for the strongest of hurricanes. Another important part of this map is noting the areas that are not shaded in. These are areas that are generally not susceptible to storm surge but may still be impacted by the other hazards of wind, flooding rains or tornadoes. The evacuation zones are closely related to storm surge risk (see next page). National Hurricane Center may issue storm surge watches or warnings if life threatening surge is expected.



More info: www.hurricanes.gov
www.nhc.noaa.gov/surge
www.nhc.noaa.gov/experimental/surgewarning

Zip Zone Evacuation



ZipZone evacuation zones roughly correspond to the following hurricane categories. However because surge depends on more than category, this is not always the case. Hurricane Ike was a category 2 but had a surge more like a typical 3 or a 4: Coastal-cat 1; Zone A-cat 1 or 2; Zone B-cat 3; Zone C-cat 4,5.

Brazoria, Chambers, Galveston, Harris and Matagorda Hurricane Evacuation Zip-Zones Coastal, A, B, C

ZIP ZONE COASTAL				
77414s	77422s	77465s	77534s	77541
77550	77551	77554	77563	77577s
77623				
ZIP ZONE A				
77058s	77510	77514s	77518	77539
77563	77565	77568	77573	77586
77590	77591			
ZIP ZONE B				
77058n	77059	77062	77414n	77422n
77465n	77507	77511	77514n	77515
77517	77520	77523	77531	77534n
77546n	77546s	77566	77571	77577n
77597	77598	77665		
ZIP ZONE C				
77011	77012	77013	77015	77017
77023	77029	77034	77049	77061
77075	77087	77089	77430	77444
77480	77486	77502	77503	77504
77505	77506	77521	77530	77535
77536	77547	77562	77578	77581
77583	77584	77587		

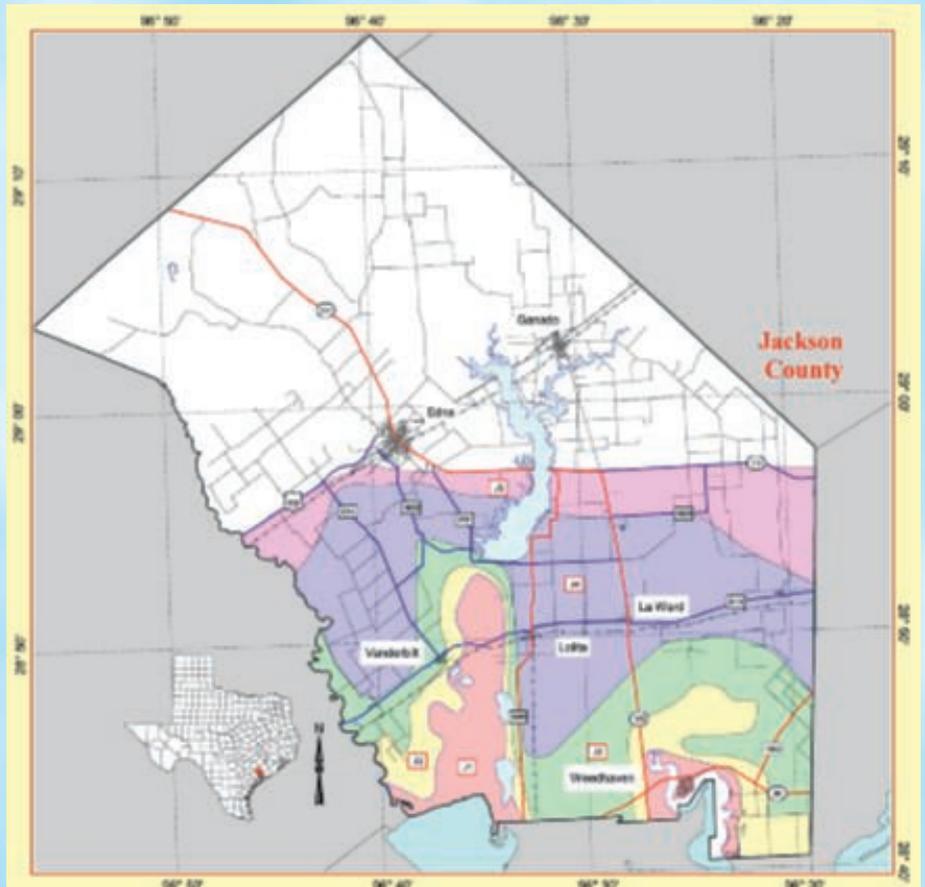
Some zipcodes are split into north (n) and south (s) for evacuation purposes.

Route Designation

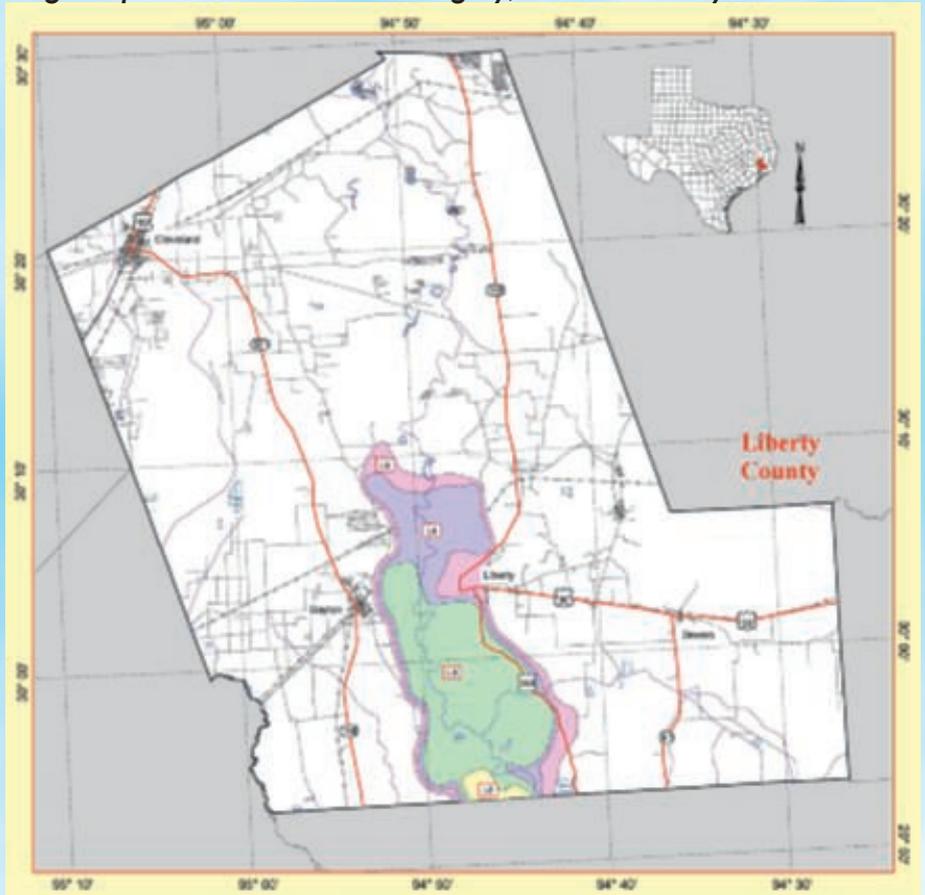
-  Evacuation Corridors
-  Evacuation Connections
-  Other Roads
-  County Boundary



 Expiration Date: December 31, 2016
 Map Created by:
 Houston-Galveston Area Council



Different colors/zones roughly correspond to surge flooding for different hurricane categories (J1 corresponds to cat 1, etc). However because surge depends on more than category, this is not always the case.



Flooding



Photo: Harris County Flood Control District

Flooding from Heavy Rain

There are numerous examples of significant flooding caused by landfalling tropical cyclones in Texas. Storms with a slow forward motion are the most dangerous as heavy rains persist for a longer period of time. Tropical Storm Allison was such a storm. Allison meandered across Southeast Texas for several days in early June 2001, dumping 35 to 40 inches of rainfall in some areas. These extreme rainfall totals produced devastating flooding, especially across the Houston metropolitan area. Of the 23 deaths attributed to Allison in Texas, 20 were related to persons who drowned while driving or walking through flood waters.

Five Practical Ways to Protect Yourself From the Dangers of Flooding

● Protect Your Personal Documents and Special Items

- ✓ Store valuables in plastic tubs with locking tops
- ✓ In case of evacuation, you should be able to secure and move all your valuables within 15 minutes

● Buy Flood Insurance: A Plan for Replaceable Items

- ✓ The National Flood Insurance Program (NFIP) is available from an insurance agent or the NFIP. There will be a 30 day waiting period before policy goes into effect so the time to buy is before hurricane season. For more information see www.floodsmart.gov

● Flood Proof Your Home - Take Steps to Minimize Flood Damage

- ✓ Shut off the main circuit breaker to prevent short circuiting and eliminate the threat of electrocution
- ✓ Raise outside air conditioning units onto platforms above ground level
- ✓ Store rarely used or expensive items in the attic or on high shelves

● Develop a Family Flood Plan

- ✓ Develop a plan of action to keep from panicking during an emergency
- ✓ Have an evacuation route and alternatives planned in the event you are asked to evacuate
- ✓ Communicate your plans with friends or family outside of your home area
- ✓ Know your risk. Is your home, business or school in a floodplain? Where is water likely to collect on the roadways you most often travel? What is the fastest way to get to higher ground? Knowing the answers to these questions ahead of time can save your life

● Never Drive on Flooded Roads

- ✓ Driving into flooded roadways puts your life and the lives of others at risk
- ✓ Unless you are in a flood plain and flood waters threaten you directly, you are probably safest staying at your current location and off the roadways
- ✓ **If you encounter flood waters when driving, Turn Around, Don't Drown!**



Destructive Winds and Tornadoes



Above: Wind damage to home from Hurricane Alicia in August 1983.

Hurricane force winds of 74 mph or more can destroy buildings, mobile homes, trees and power poles. Debris such as signs, roofing material, siding, and small items left outside become flying missiles in a hurricane. The strongest winds occur in a region of the hurricane called the eyewall. Wind gusts in the right side of the eyewall are the most destructive. Hurricane force wind gusts can be felt well inland, far from the coast, especially for stronger fast moving hurricanes.

It is imperative to ensure your home or business is well constructed to minimize the damage from the wind. See the Planning and Preparing section in this guide for cost effective home improvement tips that can help you reduce your damage from a hurricane.



MOBILE HOME RESIDENTS MUST EVACUATE!

- No mobile home or manufactured home - no matter how new it is - can provide safe shelter from hurricane force winds.
- Straps or other tie-downs **will not** protect a mobile home from the high winds associated with a hurricane.
- Mobile home residents **must evacuate** when told to do so by local authorities.



Tornadoes

Tropical cyclones can also produce tornadoes. These tornadoes most often occur in thunderstorms embedded in rain bands well away from the center of the hurricane; however, they can also occur near the eyewall. Tornadoes produced by tropical cyclones are relatively weak and short-lived, but still pose a threat. A tornado that developed in one of Hurricane Carla's outer bands killed 6 in Galveston in 1961.



Planning and Preparing

Preparing Your Home Before the Storm

Proper hurricane preparations made ahead of time will not completely protect your property from damage. However, following a few simple tips may greatly reduce the damage to your home and property.



Important Home Preparation Tips

Elevation Matters

- Know the elevation of your home! Are you in a surge, flood and/or evacuation zone?

Mobile Homes

- Check tie-downs for rust or breakage.
- Residents of mobile homes must evacuate when told to do so!

Landscaping

- Trim trees, shrubbery and dead limbs, especially ones close to your home.
- Repair or replace broken or damaged fences.
- Shredded bark is preferred instead of small gravel or stone bedding.

Roofing

- Inspect the roof for loose tiles, shingles or debris. Consider replacing old or damaged shingles with new ones rated for hurricane force winds.
- Check for and/or install hurricane clips to secure roof trusses to side walls.
- Clear loose and clogged rain gutters and downspouts.

Doors

- Reinforce garage doors and tracks or replace with a hurricane tested door. (See above image)
- Reinforce double entry doors with heavy duty foot and head bolts.
- Use a security dead bolt with a one inch minimum bolt length.
- Doors may be shuttered, but one entry must be left easily accessible.

Windows

- If possible, install tested/manufactured hurricane shutters.
- Inspect existing shutters to ensure they are in good working order.
- Alternative: Use 5/8" or greater exterior grade plywood secured by 2 1/2" screws and/or special clips. Obtain wood and fasteners, cut wood to size, pre-drill holes and place anchors on homes.
- Store shutters or plywood lying flat to avoid warping when not in use.

For more information on how to prepare your home visit www.flash.org

Planning and Preparing

Business and Employee Preparation



Tips for Businesses

- Establish a temporary location for business operations in case your facility is damaged.
- Give employees enough time to secure their homes and families.
- Consider paying employees before they leave to prepare their homes.
- Identify and protect vital records. Backup and store key files off site.
- Protect electronic equipment from possible water damage.
- Have extra cash and blank checks in case extra money is needed after the storm.
- Identify a safe room for employees who must remain in the building.
- Develop a 24-hour emergency contact with phone numbers of key employees.
- Set up telephone numbers for employees to check in and receive company information.

Protecting Your Boat - Marine Preparations



Tips for Boat Owners

- Purchase necessary hurricane materials such as additional mooring lines, crew anchors, fenders, fender boards, chafing gear, and anchors.
- Safe storm moorings should consist of good condition ropes of sufficient diameter and length, with at least three or four substantial anchor points.
- Do not moor parallel to bank. Receding tides often capsize boats in this type of anchorage.
- Check your marina contract for policies and procedures for hurricanes.
- Check with the manufacturer for proper ways to secure your boat during a storm.
- Consider moving arrangements well in advance of an approaching storm.
- Trailer boats should be removed from the water and securely stored at least 48 hours before a hurricane is expected to make landfall.

For Those Needing Extra Assistance

Preparations for People with Medical, Functional or Access Needs



FEMA News Photo

If you or someone you know have medical, functional or access needs, such as impaired vision, hearing loss, or limited mobility, it is important to make sure there is a support structure in place to help that person respond to a hurricane threat. Such individuals can often benefit from a caretaker or “hurricane helper,” someone who can look out for that individual and ensure they have the necessary resources to evacuate and/or shelter when the storm threatens. For more information: www.togetheragainsttheweather.com



Important Tips

- Identify things you need every day such as food, medicines, water and other items you may rely on such as a walker, oxygen tanks or medical equipment. Start building up a supply before the hurricane season of non-perishable food items, bottled water, medicines, etc. that can be used in the event you lose power and/or water supply. Have at least two weeks' supply of food and water, and 1 month supply of medications. If you have vital medical equipment that you rely on that requires power, be sure to have a back-up source of power such as a battery or generator.
- Store important documents in a plastic bag such as prescriptions, emergency contact information for family and doctor, insurance cards, identification etc.
- If evacuation is necessary, identify where you will evacuate to, who you will stay with and how you will get there. If you cannot drive, make sure you have someone designated who will drive you where you need to go in advance of the hurricane. Make sure your transportation can accommodate any equipment or other supplies that need to be taken with you.



State of Texas

Emergency Assistance Registry (STEAR) - Dial 211

If you will need help evacuating from a hurricane or any other hazard, dial 2-1-1 to register in advance. You will be asked a series of questions which will allow emergency managers to identify those who need extra assistance evacuating. It is recommended to do this each calendar year. There is also an option to register online.

The City of Galveston has a separate “need a ride” number for their residents which is 409-621-3179. Once you register contact your emergency management office (pp.28-30) for more information on what type of assistance will be offered in your jurisdiction.

<https://STEAR.dps.texas.gov>

<https://www.txdps.state.tx.us/dem/stear/public.htm>

<http://www.houstonoem.org/go/doc/4027/1130387/State-of-Texas-Emergency-Assistance-Registry>

Preparing Pets and Livestock

Preparing for Your Pet's Safety

Your pet should be part of your overall hurricane preparation plans. Below are a few important things to help you prepare:

- Make sure your pet's vaccinations are current and have proof they are current. **DO NOT** assume that a public shelter or hotel will accept your pet.
- Be sure to have a current photo of your pet.
- Each animal should have a properly sized pet carrier. The carrier should be large enough for the animal to stand up and turn around.
- Make sure your pet has a proper ID collar.
- Pack enough food and bottled water for the duration of your evacuation. **DO NOT** let your pet eat food or drink water from outside that may have become contaminated.
- Be sure to pack all medications your pet may need along with a muzzle, collar, leash, paper towels, and trash bags.



Preparations for Livestock



- Ensure all animals have some form of visible identification.
 - Evacuate animals whenever possible. Arrangements for evacuation, including routes and host sites, should be made in advance.
 - The evacuation sites should have or be able to readily obtain food, water, veterinary care, handling equipment and facilities.
 - Obtain vehicles and trailers needed for transporting each type of animal. Also make available experienced handlers and drivers.
- If evacuation is not possible, a decision must be made whether to move large animals to available shelter or turn them outside. This decision should be determined based on soundness and location of the shelter (structure).
 - When necessary, move livestock to higher ground and deny access to flood prone pastures, barns, and other structures.
 - It is important that livestock have plenty of food and clean water.

Insurance Tips

Insurance Tips - Before the Storm

- Keep a written inventory of your possessions. Take photos or videotape of each room and the exterior of your home to keep with your inventory.
- Gather important documents and insurance cards and policies. Unless they are stored in a safe place, take them with you if you evacuate along with an inventory of your possessions, including receipts and photos or videos.
- Know what your policy covers. Check your auto policy to see if you have comprehensive coverage "other than collision." Comprehensive coverage pays if a storm, fire, or flood damages your car. Find out how much coverage you have for "additional living expenses" to cover lodging, food, and other expenses if you're forced to vacate your residence after suffering a covered loss.
- Know your policy limits. Your limits may be too low if replacement costs have risen because of new additions, improvements, or inflation.
- Review your health coverage. Find out if you'll be able to receive non-emergency care from out-of-network providers, if needed, without accruing additional out-of-pocket costs.
- Consider renters insurance if you don't have it. If you rent an apartment, duplex, house, or townhouse, you may need renters insurance to protect your belongings.
- Consider purchasing flood, wind and hail coverage. You may have to buy separate policies to cover wind, hail, and flood damage. Homeowners, farm and ranch, renters, windstorm, and condominium policies do not cover damage from rising waters.

National Flood Insurance Program (NFIP)

Homeowners and commercial property policies specifically exclude coverage for damage from flooding from rising waters. To protect yourself from losses caused by most flooding, you'll need to purchase a separate flood insurance policy from the National Flood Insurance Program (NFIP). For more information about flood insurance, contact the NFIP 1-800-638-6620. www.floodsmart.gov

Texas Windstorm Insurance Association (TWIA)

If your property is located in one of Texas' 14 coastal counties, or parts of southeastern Harris County, you will likely only be able to obtain insurance coverage for windstorm or hail damage from a special insurance pool called the Texas Windstorm Insurance Association (TWIA.) To qualify for TWIA coverage, your property must pass a windstorm inspection and must meet certain windstorm-resistant building standards. You cannot buy or change TWIA coverage once a hurricane has entered the Gulf of Mexico. For more information about windstorm coverage call TWIA or visit its website 1-800-788-8247. www.twia.org

Insurance Tips - After the Storm

Contact your insurance agent or company promptly. Keep a record of all contacts you have with your company. Be prepared to answer questions about the extent and severity of the damage.

If your home is not insured, contact your local Red Cross or FEMA Disaster Recovery Center for assistance. Call FEMA at 1-800-621-FEMA (3362).

Make a list of your damaged property. Photograph or videotape the damage if possible. Don't throw away damaged items until your insurance adjuster has had a chance to view them.

If there is partial damage to your home, take reasonable and necessary repairs to protect your home and property from further damage. Cover broken windows and holes to keep rain out. Don't make permanent repairs until instructed by your insurance company. Keep a record of your repair expenses and save all receipts.

Contacts and Disaster Supply Kit

The Greater Houston Area Chapter of the American Red Cross recommends that you have the following items in your Hurricane Supply Kit. Do not forget to have a family meeting before hurricane season and review your communication information and evacuation plan. Make sure the contact information such as home, work, school, cell phone numbers, and your "Out of Town" contact person's information is current.



Emergency Contact Information

Out of Town Contact Address: _____
Out of Town Contact Phone Number: _____
Work Telephone Number: _____
Cell Number/Spouse Cell Number: _____
Children Cell Number: _____
School Telephone Number: _____
Doctor Telephone Number: _____
Bank/Credit Card Telephone Number: _____
Insurance Company Information: _____



HURRICANE SUPPLY KIT



- At least a 7-day supply of non-perishable food and a manual can opener
- At least a 7-day supply of water. One gallon per person per day is recommended
- Battery powered portable television or radio with extra batteries
- Flashlight with extra batteries
- First Aid kit and manual
- Sanitation and hygiene items such as instant hand sanitizing gel, moist towelettes, toilet paper, and feminine hygiene products
- Matches in a waterproof container
- Whistle
- Kitchen accessories and cooking utensils
- Cash
- Extra clothing, blankets, and sleeping bags
- Photocopies of identification, insurance, prescriptions, household inventory, credit cards, and your latest utility bill
- CD or photocopies of important documents such as birth/marriage certificates and titles
- Prescription medications, eyeglasses, contact lens solution, and hearing aid batteries
- Formula, baby food, diapers, and pacifiers
- Pet carriers, leashes, shot records, and food for each animal evacuating with you
- A good map showing county roads and highways
- Tire repair kit, booster cables, pump, and flares
- White distress flag
- Toys and games for children
- List of family phone numbers and addresses outside the area



ATLANTIC HURRICANE TRACKING CHART

Always remember

If you live along the coast or in a low-lying area, if you live in a mobile home in an area subject to hurricane water or wind, or if authorities tell you to... Go!

Storm Surge

A storm surge is a dome of water often 50 miles wide that comes sweeping across the coastline near the area where the eye of the hurricane makes landfall. The surge, aided by the hammering effect of breaking waves, acts like a giant bulldozer sweeping away everything in its path. Nine out of ten hurricane deaths are caused by storm surge. That's why it's important to leave well before a hurricane may come your way.

Wind Damage

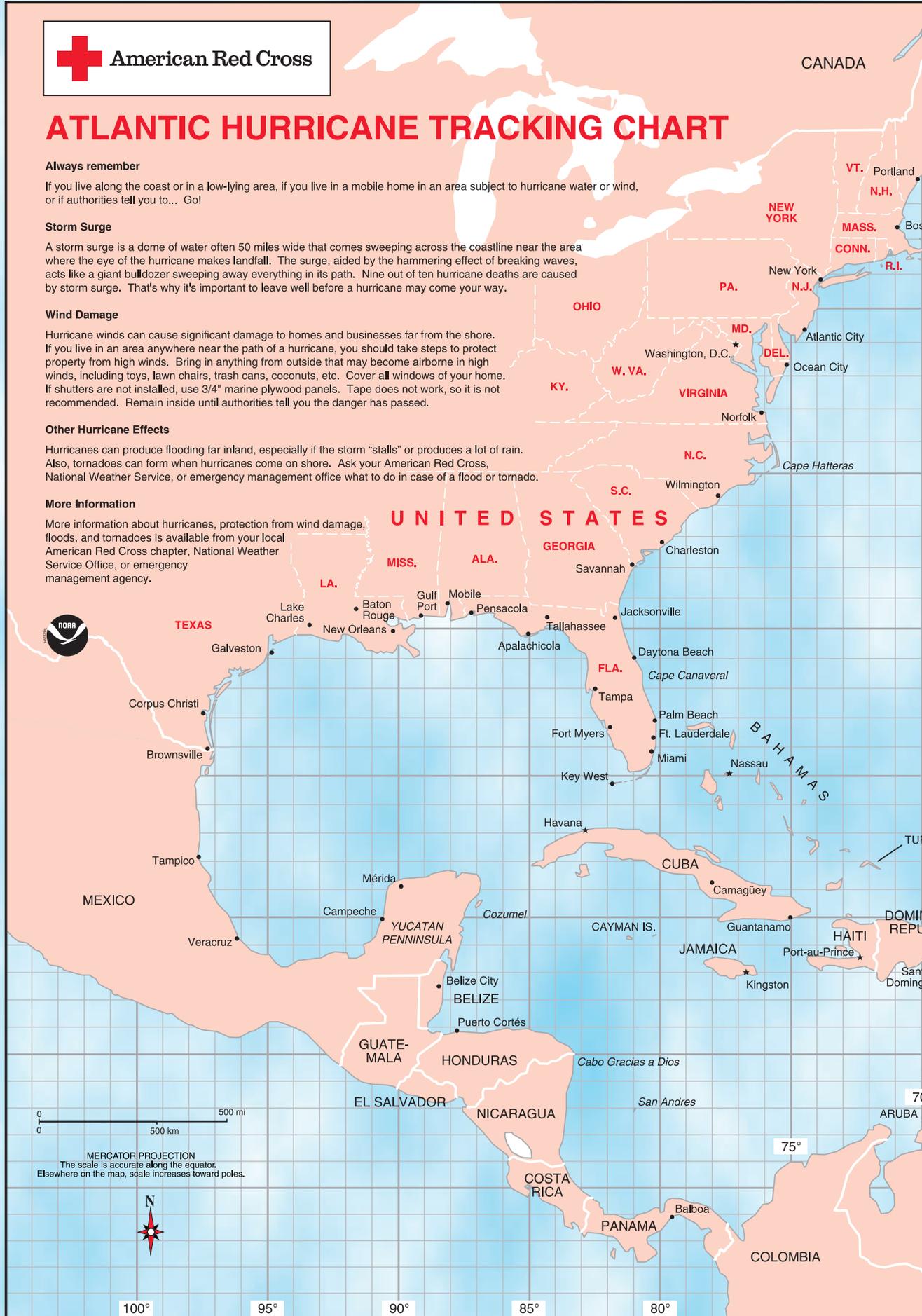
Hurricane winds can cause significant damage to homes and businesses far from the shore. If you live in an area anywhere near the path of a hurricane, you should take steps to protect property from high winds. Bring in anything from outside that may become airborne in high winds, including toys, lawn chairs, trash cans, coconuts, etc. Cover all windows of your home. If shutters are not installed, use 3/4" marine plywood panels. Tape does not work, so it is not recommended. Remain inside until authorities tell you the danger has passed.

Other Hurricane Effects

Hurricanes can produce flooding far inland, especially if the storm "stalls" or produces a lot of rain. Also, tornadoes can form when hurricanes come on shore. Ask your American Red Cross, National Weather Service, or emergency management office what to do in case of a flood or tornado.

More Information

More information about hurricanes, protection from wind damage, floods, and tornadoes is available from your local American Red Cross chapter, National Weather Service Office, or emergency management agency.

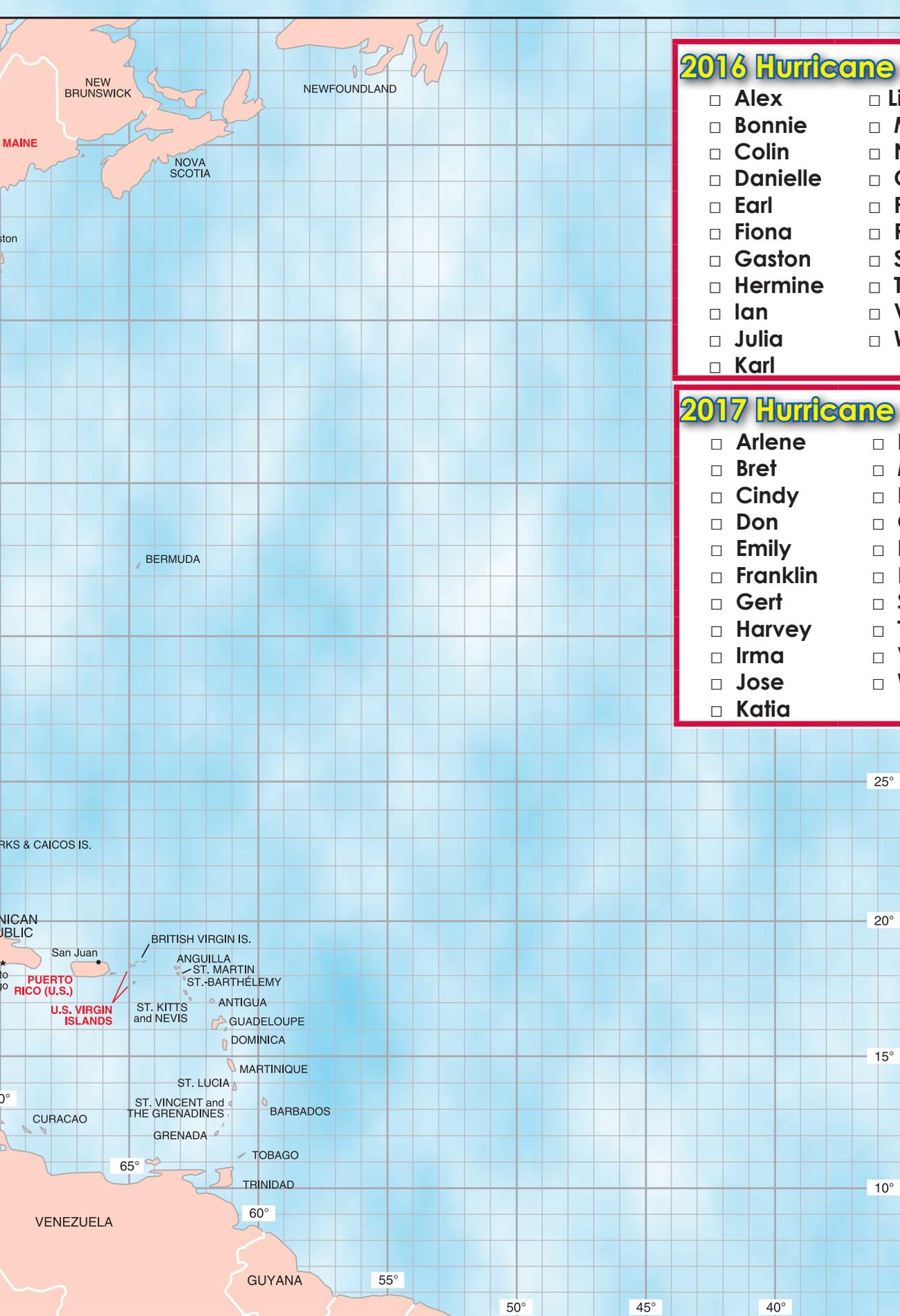


0 500 mi
0 500 km

MERCATOR PROJECTION
The scale is accurate along the equator.
Elsewhere on the map, scale increases toward poles.



100° 95° 90° 85° 80°



2016 Hurricane Names

- | | |
|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> Alex | <input type="checkbox"/> Lisa |
| <input type="checkbox"/> Bonnie | <input type="checkbox"/> Matthew |
| <input type="checkbox"/> Colin | <input type="checkbox"/> Nicole |
| <input type="checkbox"/> Danielle | <input type="checkbox"/> Otto |
| <input type="checkbox"/> Earl | <input type="checkbox"/> Paula |
| <input type="checkbox"/> Fiona | <input type="checkbox"/> Richard |
| <input type="checkbox"/> Gaston | <input type="checkbox"/> Shary |
| <input type="checkbox"/> Hermine | <input type="checkbox"/> Tobias |
| <input type="checkbox"/> Ian | <input type="checkbox"/> Virginie |
| <input type="checkbox"/> Julia | <input type="checkbox"/> Walter |
| <input type="checkbox"/> Karl | |

2017 Hurricane Names

- | | |
|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> Arlene | <input type="checkbox"/> Lee |
| <input type="checkbox"/> Bret | <input type="checkbox"/> Maria |
| <input type="checkbox"/> Cindy | <input type="checkbox"/> Nate |
| <input type="checkbox"/> Don | <input type="checkbox"/> Ophelia |
| <input type="checkbox"/> Emily | <input type="checkbox"/> Philippe |
| <input type="checkbox"/> Franklin | <input type="checkbox"/> Rina |
| <input type="checkbox"/> Gert | <input type="checkbox"/> Sean |
| <input type="checkbox"/> Harvey | <input type="checkbox"/> Tammy |
| <input type="checkbox"/> Irma | <input type="checkbox"/> Vince |
| <input type="checkbox"/> Jose | <input type="checkbox"/> Whitney |
| <input type="checkbox"/> Katia | |

Hurricane Forecast Resources

The National Hurricane Center (NHC) in Miami, FL is the official source for tropical cyclone advisories and forecasts and is responsible for issuing tropical cyclone watches and warnings for the United States.

Weather Information

National Weather Service
www.weather.gov/houston
National Hurricane Center
www.hurricanes.gov

Graphical Tropical Weather Outlook

- Provides an overview of all tropical cyclone activity.
- Indicates areas of interest where tropical cyclones could develop over next 5 days. A percent chance that it will develop is assigned.
- Moving the cursor over the highlighted areas will provide a more detailed text description.

NHC Forecast Advisory

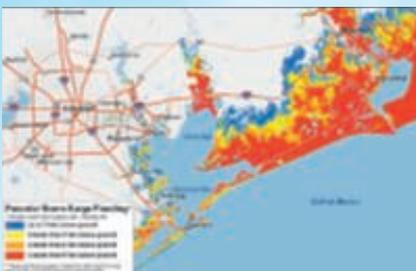
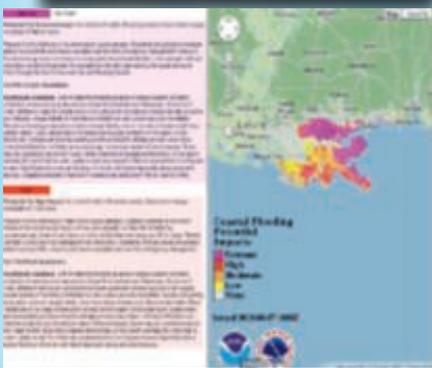
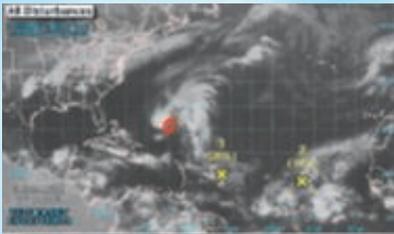
- Most recent position for a storm along with all coastline watches and warnings. Includes a 3 or 5 day track with error cone.
- Error cone represents a 5 year average error. Storms only stay within the error cone 67% of the time.
- DO NOT focus too closely on the exact track forecast - the little black line. If you are in or near the cone, the center of the storm could head your way. Impacts are often felt outside the cone entirely.

Hurricane Threats and Impacts

- Colorized maps showing different threat levels for each hazard (damaging winds, storm surge flooding, tornadoes and rainfall flooding)
- Threats levels rated as none, low, moderate, high and extreme. A key or legend explains the meaning of each threat level in terms of expected impacts.
- For more information go to: <http://www.weather.gov/hti/>

Potential Surge Inundation graphic

- Issued by National Hurricane Center about 48 hours prior to impacts being felt at the coast.
- Shows reasonable worst case for the amount of flooding from ocean water surging over land. Data is plotted as depth of water above ground.
- Storm Surge watch/warning also may be issued.



Final Checklist

Actions to Take When a Storm is in the Gulf

- Listen frequently to radio, TV, or NOAA weather radio for bulletins and forecasts of the storm's progress.
- Double check items in your emergency supply kit.
- Fuel and service your vehicles.
- Inspect and secure mobile home tie-downs.
- Make sure you have supplies to survive on your own for at least one week if you plan on staying.
- Board up windows (if shutters do not exist) in case storm moves quickly and you have to leave.
TAPE PROVIDES NO PROTECTION!
- Store lawn furniture and other loose, light weight objects, such as garbage cans and garden tools.
- Get plenty of extra cash in case power goes out and ATMs do not work.
- Garage or store vehicles that are not being used.
- Follow instructions issued by local officials. **EVACUATE IMMEDIATELY IF ORDERED TO DO SO!**

Final Actions to Take if Leaving

- Turn off propane tanks.
- Unplug small appliances.
- Turn refrigerator and freezer to lowest setting.
- Turn off utilities if ordered to do so.
- Notify family members of your evacuation plans.
- Lower water level in swimming pool by one foot.
- Lock home securely.
- Board up remaining doors and brace garage door.
- Take pets with you.



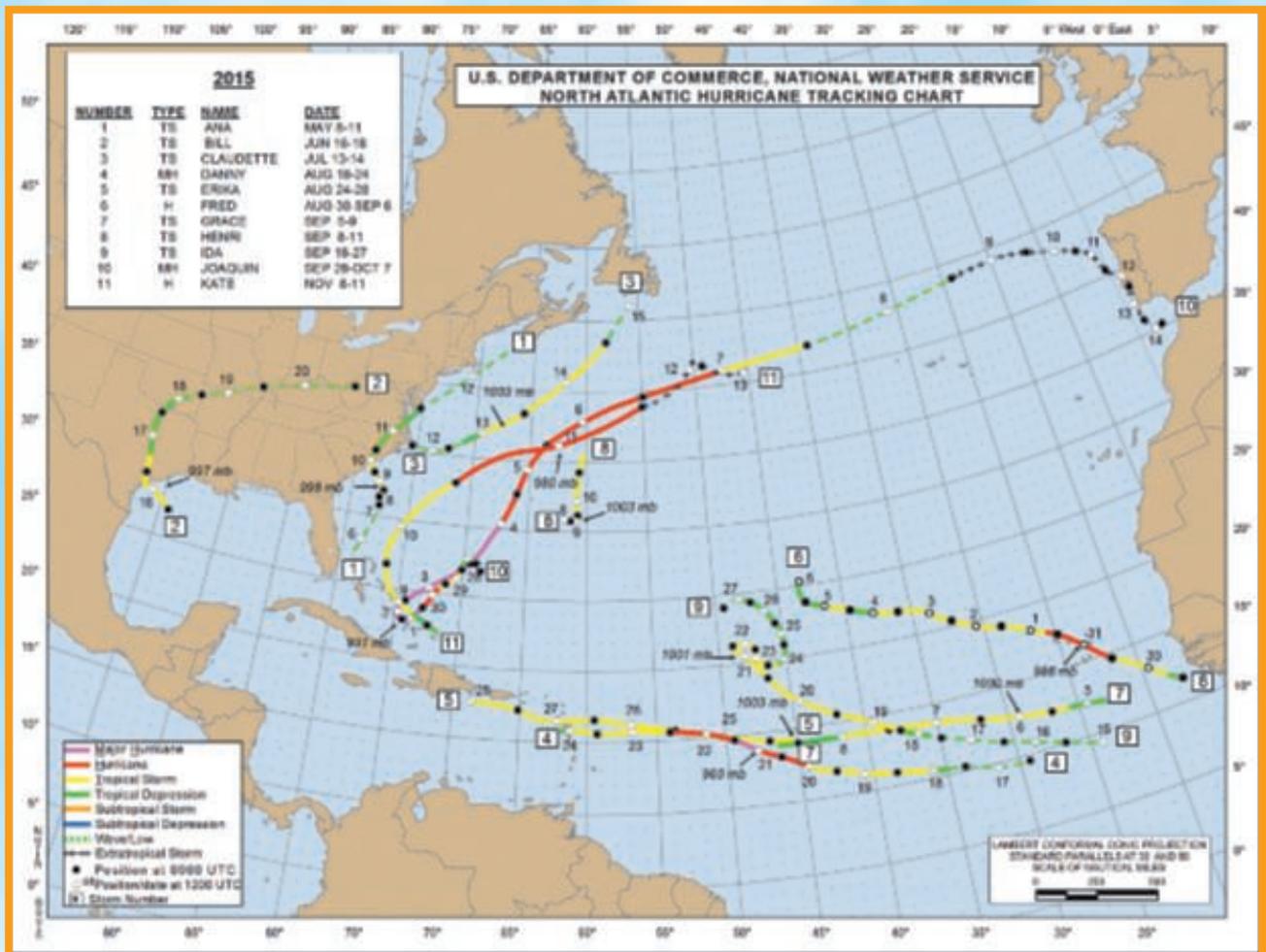
Final Actions to Take if Staying

- Close storm shutters.
- Turn refrigerator or freezer to coldest setting and open only if necessary.
(25 pounds of dry ice will keep a 10-cubic foot freezer below freezing for 3-4 days.)
- Follow instructions from emergency managers and be prepared to turn off utilities if ordered to do so.
- Board up remaining doors, brace garage door, and remain inside. Stay away from boarded up windows.
- Beware of the calm winds in the eye of the storm and do not venture outside. Some of the strongest winds may occur shortly after the eye passes.
- **DO NOT EXPECT EMERGENCY RESPONDERS TO BE OF ANY ASSISTANCE DURING A LANDFALLING HURRICANE!**

2015 Hurricane Season Review

In 2015, 4 hurricanes, 2 of which were major (category 3 or greater) and 7 tropical storms formed over the tropical Atlantic for a total of 11 named storms. This is slightly below the longer term averages of 6 hurricanes, 3 major hurricanes, and 12 named storms. The first two named storms of the season impacted the United States with Tropical Storm Bill making landfall on the Texas coast on June 16th and Tropical Storm Ana coming ashore near Myrtle Beach South Carolina on May 10th, the earliest U.S. landfall of a tropical cyclone on record. For the remainder of the season tropical cyclones tended to develop over the Atlantic and either dissipate or recurve before reaching the U.S. mainland. An unusual number of storms developed over the far eastern tropical Atlantic near and even east of the Cape Verde islands. Also of note, Hurricane Joaquin was the strongest October hurricane to have impacted the Bahamas since 1866. For more information on 2015 storms see the seasonal review and tropical cyclone reports at the following link: <http://www.nhc.noaa.gov/data/tcr/>

What will 2016 bring? It is difficult to say. The NOAA seasonal outlook will be released in late May. Whatever the seasonal prediction for the Atlantic it is important to prepare for a hurricane landfall each year. In 1983 the season overall was very quiet overall with only 4 named storms, yet one was Hurricane Alicia which struck the Houston area in August of that year.



Evacuation

Evacuees need to consider the projected path of the hurricane when choosing an evacuation route and destination. Evacuation studies estimate that it takes between 23 and 42 hours to evacuate southeast Texas in advance of tropical storm force winds. This underscores the need for coastal residents to have an evacuation plan. When evacuating, be sure to check local weather and highway conditions before departing. When local authorities order an evacuation of your area, leave immediately!



Texas Road Information

TXDOT Road Conditions

1-800-452-9292 or www.txdot.gov

drivetexas.org



Final Actions before Evacuating

- Follow evacuation orders provided by your local officials. Once the evacuation order has been given, leave as soon as possible to avoid heavy traffic and hazardous weather.
- Take your Hurricane Supply Kit with you (as described on page 15).
- Do not stay in a mobile home near the coast under any circumstance.
- See TXDOT map on the previous page for an illustration of evacuation routes.
- Prepare to stay at your evacuation destination for a week or more if necessary, as re-entry into the affected area may be restricted.

Returning Home

IF YOU EVACUATED THE AREA, WAIT FOR AN ALL CLEAR FROM THE CITY OR COUNTY BEFORE ATTEMPTING TO RETURN TO YOUR HOME. BE PREPARED TO SHOW PROOF OF RESIDENCE.

FEMA News Photo



Debris Cleanup

- Cities and counties will publish a schedule for debris pick-up and removal. Debris cannot be removed from private property.
- Construction materials, vegetative debris, household hazardous waste and household appliances will need to be placed into **separate piles** and moved to the curbside for pick-up.
- Consider sharing piles with neighbors.
- Do not set debris against trees or poles. Do not cover up fire hydrants or mail boxes. Doing so makes it harder for cleanup crews to scoop up the items.

For more information:

<http://nepis.epa.gov/Adobe/PDF/P1008EKA.PDF>

General Cleanup

- Be cautious of structural damage and downed power lines. Do not attempt to move structural supports or large pieces of debris.
- DO NOT run power generators indoors. Inhalation of carbon monoxide from the exhaust can cause death. Ensure exhaust is well ventilated.
- DO NOT use open flames indoors.
- Restrict your driving to emergency use only. Road conditions may not be safe until road debris is cleared.

FEMA News Photo



Water

- Listen for instructions regarding public water supply. Use only bottled, boiled or treated water until you know that your water supply is safe.
- You can purify water by boiling for one minute then letting it cool before drinking.

Returning Home

Utility Cleanup

FEMA News Photo



- Check for gas leaks. If you smell or hear gas leaking, leave immediately. DO NOT use the phone or turn on lights in your home. Call the gas company from a neighbor's phone.
- Report any visible damage of power lines to the electric company. Turn off power at main breaker if any electrical equipment or circuits have been exposed to water.
- DO NOT connect generators to your home's electrical circuits. If a generator is on line when electrical service is restored, it can become a major fire hazard. Also, lineworkers working to restore power will be endangered if a generator is hooked up to the home's circuits.
- It is likely that an electric company other than your own will reconnect the lines to your home; however, they can not turn the service back on. Only your electric company can actually turn the power back on to your house.

Sewage Cleanup

- If you suspect water or sewage lines are damaged, do not use your plumbing (toilets, sinks, etc.). Contact the water company or a plumber for repairs.
- A chemical portable commode can be created by the following:
 - ✓ Use 5 gallon buckets with tight lids, lined with heavy duty plastic garbage bags.
 - ✓ Add kitty litter to the bucket as a disinfectant and deodorizer. Keep lids on firmly.
 - ✓ Keep buckets in a cool, dark place. Clean and disinfect buckets immediately.
- Your toilet can also be used by flushing until the bowl has no water. Then, line with heavy duty trash bags and disinfect with chlorine bleach after each use. Remove waste to an outside location.
- If significant sewer outages have occurred, instructions for disposal of human wastes will be announced.
- DO NOT dispose of human waste through your regular trash!

Interior Cleanup

- Disinfect and dry interior buildings and items inside. This will prevent growth of some bacteria, viruses, mold, and mildew that can cause illness.
- Clean walls, floors, and counter tops with soap and water. Disinfect them with a solution of 1 cup of bleach to 5 gallons of water.
- Wash all clothes and linens in hot water. Air dry and spray all unwashable items with disinfectant. Steam clean carpets. Throw away all items touched by water that cannot be disinfected.

Tropical Storm Bill



Figure 1. Photo of Tropical Storm Bill taken from International Space Station by CDR Scott Kelly. Photo Credit NASA.

Tropical Storm Bill made landfall near Matagorda Island on June 16th, 2015. The storm produced gusty winds, minor storm surge flooding at the coast, and bands of heavy rainfall. Rainfall varied greatly across the region with relatively modest amounts around greater Houston, much greater amounts in bands to the southwest and to the east. Heavy rain bands persisted after the storm had tracked well northeast of the area as continued moisture streamed in off the Gulf of Mexico. The most significant flash flooding occurred near El Campo, Edna and Ganado.

Tropical Storm Bill was a good reminder of how quickly a tropical storm or hurricane can develop over the Gulf and make landfall. There were only several hours from the time warnings went out for Tropical Storm Bill to when tropical storm impacts were felt at the coast. The storm was already producing tropical storm force winds before it met the strict definition of a tropical cyclone (well defined closed circulation, thunderstorms clustered around the center). The National Hurricane Center warned of tropical storm-like impacts whether or not the storm became a tropical cyclone. This message was also communicated by the NWS forecast offices and local media. Hurricane Humberto is another example of a quick developer when in September 2007 a disorganized cluster of thunderstorms developed into a land-falling hurricane in less than 24 hours! Needless to say many were caught off guard. Hurricane Humberto was small, making landfall near High Island, TX then tracking toward the north-northeast, just missing more densely populated areas.

Tropical Storm Bill

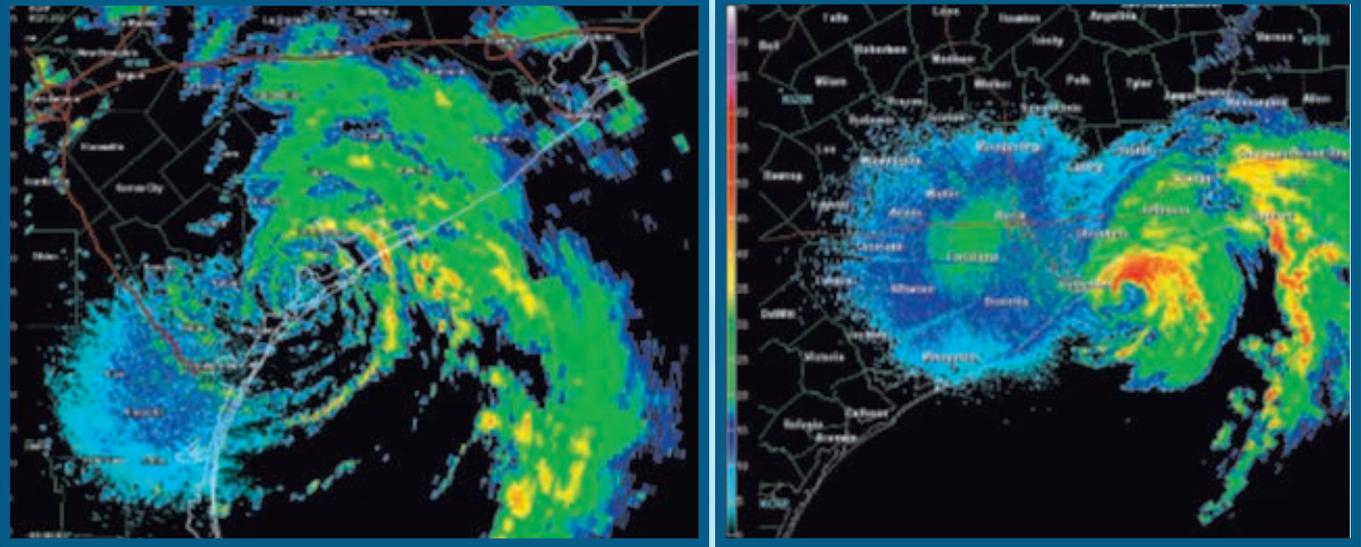


Figure 2. Radar images of TS Bill (left) June 16, 2015, and Hurricane Humberto (right) Sept. 12, 2007

Both Bill and Humberto are the types of storms where the Tropical Weather Outlook can be very useful. In the case of Tropical Storm Bill, the 5-day outlook showed that the disturbance in the Gulf would likely become a tropical storm 44 hours earlier and that it would almost certainly bring impacts whether it was strictly a tropical cyclone or not. This additional lead time may be crucial for last minute preparations. It also demonstrates the need to do pre-season preparations now before you have a storm in the Gulf. This would include making a storm kit and a plan for what you and your family would do if a hurricane was coming.

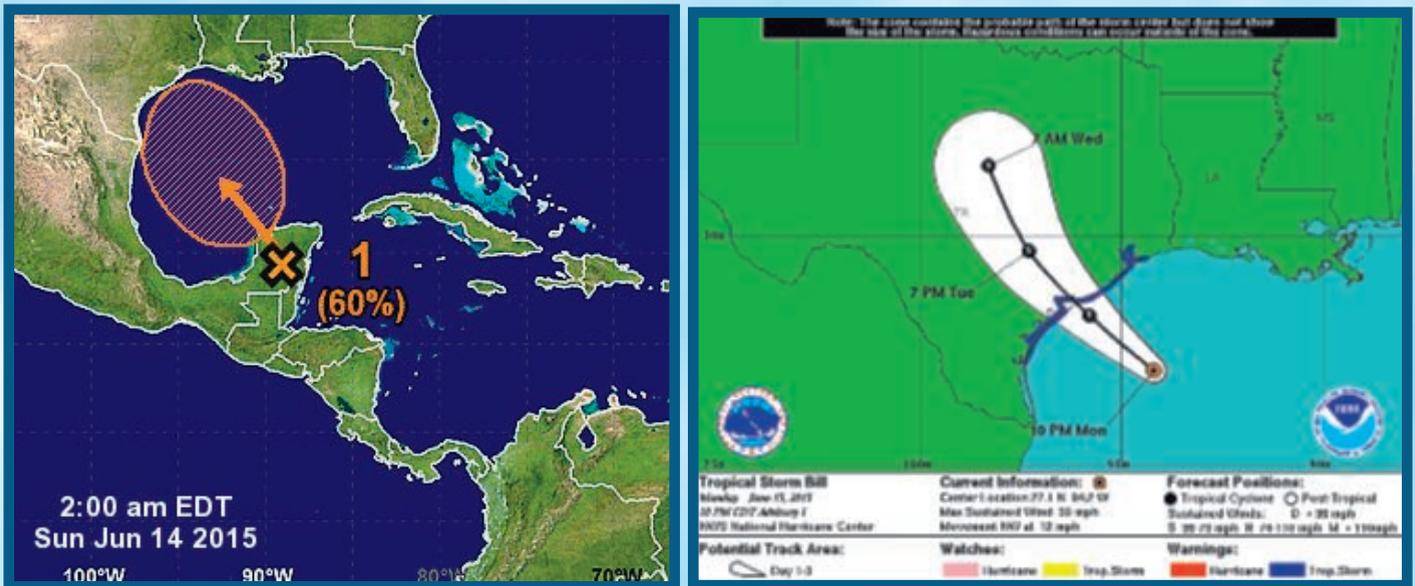


Figure 3. Graphical Tropical Weather Outlook from 7 pm CDT June 13th showing disturbance likely to form into tropical storm. Initial TS Bill advisory from 10 pm CDT June 15th 51 hours later.

Another tropical cyclone affected Southeast Texas as well. Hurricane Patricia formed off the Mexican coast. It intensified extremely rapidly from a 40 mph tropical storm to a 200 mph category 5 hurricane in less than 40 hours! Rapid intensification just before landfall is the worst case scenario and certainly a concern for us here in Coastal Texas. Patricia made landfall as one of the most intense hurricanes on record but fortunately hit a lightly populated area. The remnants of Patricia merged into another system and contributed to rain and gusty winds for the Houston/Galveston region.

Memorial Day Floods

On May 25th 2015 a line of slow moving thunderstorms moved across Southeast Texas. These storms developed within a very moist unstable air mass and were producing measured rain rates of 3 to 4+ inches per hour. As the line reached the greater Houston area it slowed its southeastward progression. By the time the rain finally moved out of the region after 4 am on May 26th, 6 to 11 inches of rain had fallen in a short amount of time, less than 6 hours in many cases. This resulted in widespread flash flooding of roadways and bayous across Harris County, City of Houston and southwest into Fort Bend County. Eight people died as a result of the flooding.

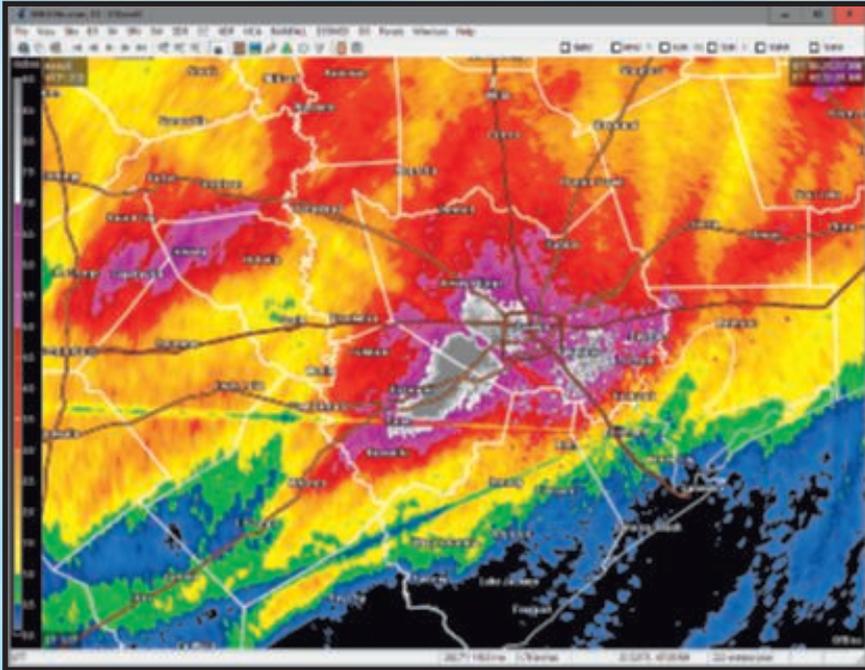
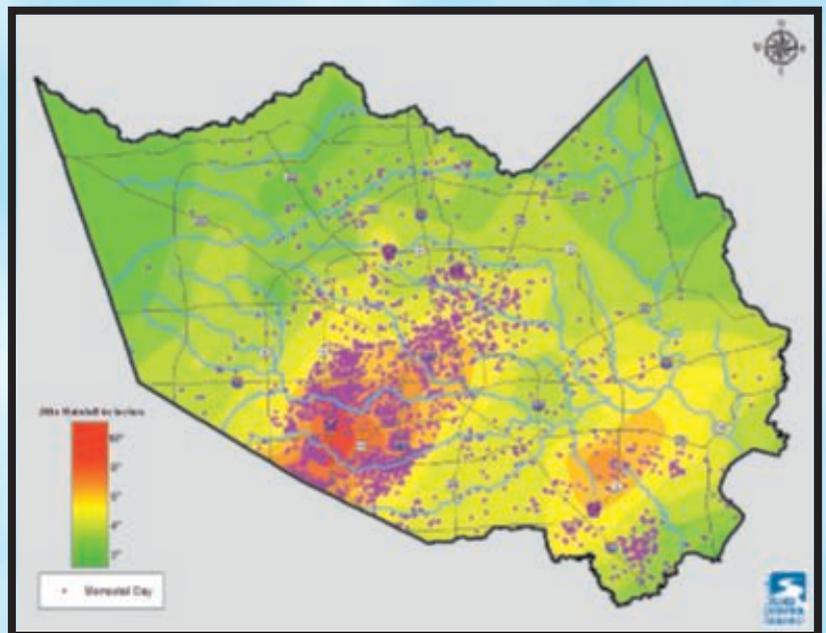


Figure 1. Storm total rainfall as estimated by radar. Areas in white 7 to 11 inches.

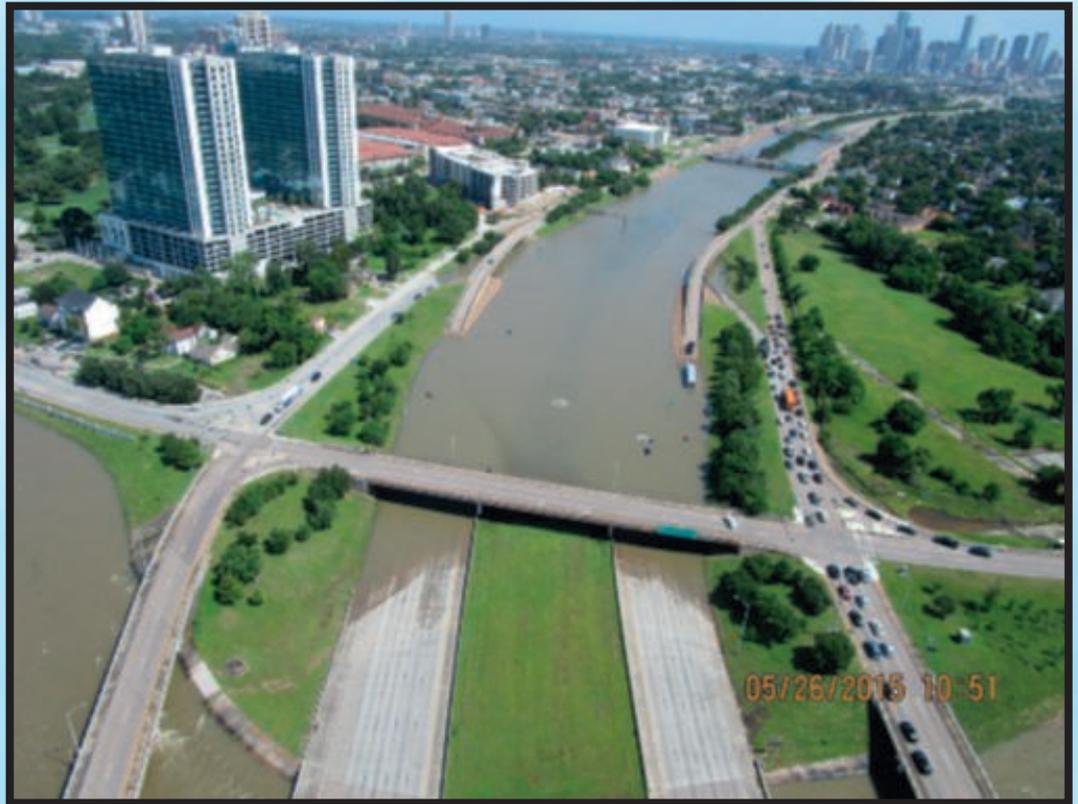
Figure 2. Harris County rainfall and damaged houses heat map (Harris County Flood Control District).



Memorial Day Floods

Although the Memorial Day flood event was not a result of a tropical cyclone, flooding from heavy rain is the greatest threat from tropical storms or hurricanes away from the coast and can impact areas well inland. Tropical Storm Allison in June 2001 produced over 3 feet of rain in some spots with catastrophic flooding across portions of the Houston area. Tropical Storm Claudette in 1979 dumped 43 inches of rain near Alvin, Texas, in just 24-hours, a record that stands today for the greatest 24-hour rainfall in the United States!

The National Weather Service (NWS) issues Flash Flood Warnings for areas where potentially life-threatening flooding is likely imminent or occurring. For the Memorial Day floods NWS Houston/Galveston took one step further and issued a "Flash Flood Emergency" for the first time ever (this option did not exist in 2001 with TS Allison). The Flash Flood Emergency is used when catastrophic flooding, more extreme than the level of previous flash flood events, is confirmed. This might correspond to multiple swift water rescues, water in homes not usually flooded, etc.



**Figure 3. Route 288 near N. Macgregor and Binz looking north.
Courtesy Harris County Flood Control.**

The best way to be safe in flash flood situations is to have a way to get flash flood warnings, to be able to see the warning polygon. Flash Flood (and Tornado) Warnings are carried over the Wireless Emergency Alert (WEA) system which is found on many smartphones. The local news stations also typically have weather apps that carry the warnings. If in a flooded or warned area, the best advice is to stay put, either at home or work, until the heavy rain and floods have passed. The most dangerous place to be in a flash flood situation is on the roads. Statistically about 7 in 10 fatalities from flash flooding occur when people are in their vehicle and inadvertently drive into floodwaters, in some cases swept away. For more flash flood safety tips go to the NWS "Turn Around, Don't Drown" web page at:

<http://www.nws.noaa.gov/os/water/tadd/>

Emergency Management Contacts

AUSTIN

- **County Emergency Management**
979-865-5911

BRAZORIA

- **County Emergency Management**
979-864-1201

www.readybrazoria.us

- **Alvin**
281-388-4363
- **Angleton**
979-849-2383
- **Bailey's Prairie**
979-849-0134
- **Brazoria**
979-798-2489
- **Brookside**
281-997-9777
- **Clute**
979-265-6194
- **Danbury**
979-922-1551
- **Freeport**
979-239-1211
- **Hillcrest Village**
281-748-7149
- **Jones Creek**
979-233-3091
- **Lake Jackson**
979-415-2500
- **Liverpool**
281-581-2342
- **Manvel**
281-489-1212
- **Oyster Creek**
979-233-8481
- **Pearland**
281-997-4650
cityofpearland.com/preparedness

- **Richwood**
979-265-8157
- **Surfside**
979-239-1151
- **Sweeney**
979-548-3321
- **Quintana**
979-233-0848
- **West Columbia**
979-345-5121

BRAZOS

- **County Emergency Management**
979-821-1011
www.bcdem.org
- **Bryan**
979-821-1030
www.bryantx.gov
- **College Station**
979-764-5210
www.csfx.gov/dem

BURLESON

- **County Emergency Management**
979-567-2008

CHAMBERS

- **County Emergency Management**
409-267-2445
www.co.chambers.tx.us

COLORADO

- **County Emergency Management**
979-733-0184

FORT BEND

- **County Emergency Management**
281-342-6185
www.fbcoem.org
- **Arcola**
281-431-0606
- **Beasley**
979-387-2775
- **Fairchild**
979-793-6676
- **Fulshear**
281-346-1796
- **Kendleton**
832-439-1524
- **Meadows Place**
281-983-2900
- **Missouri City**
281-403-8500
www.missouricityready.com
- **Needville**
979-793-4255
- **Orchard**
979-478-6893
- **Pleak**
281-239-8504
- **Richmond**
281-232-6871
- **Rosenberg**
835-595-3700
www.ci.rosenberg.tx.us
- **Simonton**
281-496-0066
- **Stafford**
281-261-3950
- **Sugar Land**
281-275-2853
sugarlandrespondds.com
- **Thompsons**
281-343-9929
- **Weston lakes**
281-533-0907

Emergency Management Contacts

GALVESTON

● **County Emergency Management**
888-384-2000
www.gcoem.org

● **Bayou Vista**
409-935-0449

● **Clear Lake Shores**
281-334-1034
281-334-2799

● **Dickinson**
281-337-4700

● **Friendswood**
281-996-3335

● **Galveston**
409-765-3710
www.cityofgalveston.org

● **Hitchcock**
409-986-5559
www.hitchcockpd.com

● **Jamaica Beach**
409-737-1142
www.ci.jamaicabeach.tx.us

● **Kemah**
281-334-5414

● **La Marque**
409-938-9269
www.cityoflamarque.org

● **League City**
281-554-1000
www.leaguecity.com

● **Santa Fe**
409-925-3092

● **Texas City**
409-643-5840

● **Tiki Island**
409-935-1427

GRIMES

● **County Emergency Management**
936-873-4404

HARRIS

● **County Emergency Management**
713-881-3100
www.readyharris.org

● **Baytown**
281-420-6556
www.oembaytown.org

● **Bellaire**
713-662-8222

● **Deer Park**
281-478-7298
www.deerparktx.gov

● **El Lago**
281-326-5900

● **Galena Park**
713-672-2556

● **Houston**
713-884-4500
www.houstonoem.org

● **Jacinto City**
713-674-8424

● **Humble**
281-446-4928

● **Jersey Village**
713-466-2100

● **Katy**
281-574-8633
281-391-3500
www.cityofkaty.com

● **La Porte**
281-470-0010
www.lpoem.org

● **Morgan's Point**
281-471-2171

● **Nassau Bay**
281-336-6298

● **Pasadena**
713-475-5588

● **Seabrook**
281-291-5700

● **Shoreacres**
281-471-2244

● **South Houston**
713-947-7700

● **Taylor Lake Village**
281-326-2843

● **Tomball**
281-290-1301

● **Webster**
281-332-1826

JACKSON

● **County Emergency Management**
361-782-3398
www.co.jackson.tx.us

● **Edna**
361-782-3122

● **Ganado**
361-771-2800

Emergency Management Contacts

LIBERTY

● **County Emergency Management**
936-334-3219
www.co.liberty.tx.us

● **Cleveland**
281-592-2667

● **Dayton**
936-258-7621

● **Liberty**
936-336-8118

Madison

● **County Emergency Management**
936-348-3810
www.co.madison.tx.us

MATAGORDA

● **County Emergency Management**
979-323-0707
www.co.matagorda.tx.us

MONTGOMERY

● **County Emergency Management**
936-523-3901
www.mctxoem.org

● **Conroe**
936-522-3200

● **Shenandoah**
281-367-8952

POLK

● **County Emergency Management**
936-327-6826
www.oem.polk.tx.us

● **Alabama-Coushatta**
936-563-1100

SAN JACINTO

● **County Emergency Management**
936-653-3395

www.co.san-jacinto.tx.us

WALKER

● **County Emergency Management**
936-435-2418

www.walker.tx.us

WALLER

● **County Emergency Management**
979-826-8282

WASHINGTON

● **County Emergency Management**
979-337-1412

● **Brenham**
979-337-7300

WHARTON

● **County Emergency Management**
979-532-1123

co.wharton.tx.us

● **El Campo**
979-543-5311

● **Wharton**
979-532-3131
www.cityofwharton.com

US Department of Homeland Security

www.ready.gov

Red Cross

www.redcross.org

National - 800-733-2767

Gulf Coast Assistance Line 866-526-8300

FEMA

www.fema.gov

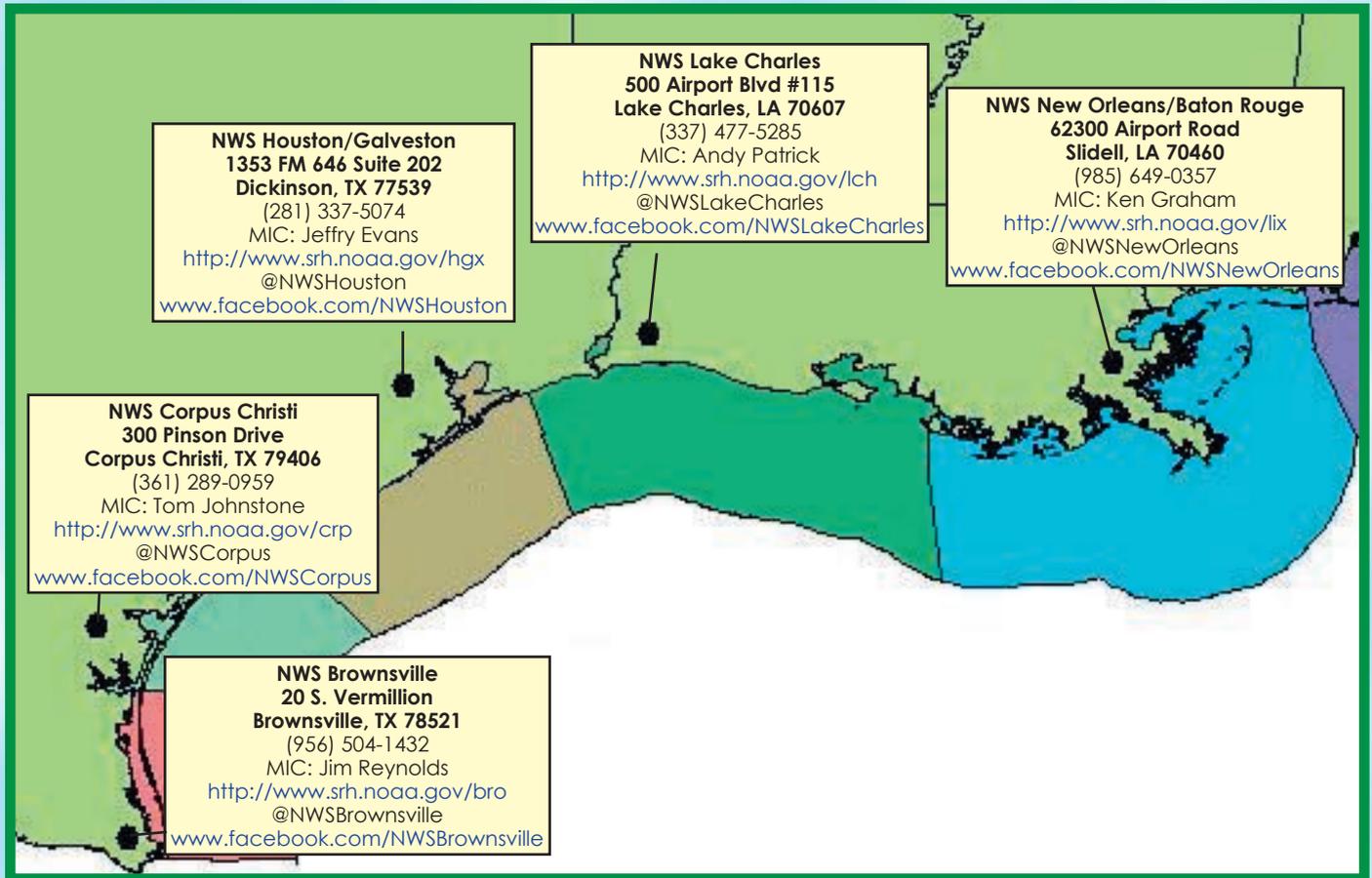
Weather Research Center

www.wxresearch.org

**Community Resource Information:
Do Not Call 911 for Non-Emergencies!**



Regional National Weather Service Offices



American Red Cross

**Whatever comes your way,
you'll know what to do.**

**Red Cross mobile apps
put help in your hand.**



First Aid App



Hurricane App



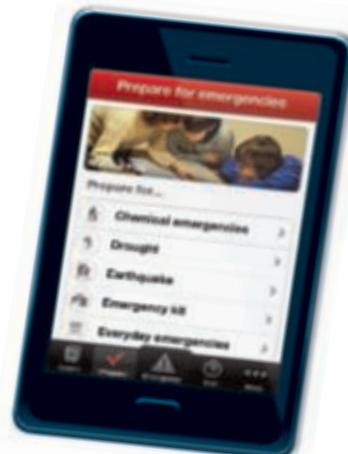
Earthquake App



Wildfire App



Tornado App



Download our free preparedness apps today. Call **REDCROSS from your mobile phone and we'll send you a link to download the apps, or search the iTunes app store or Google Play for American Red Cross.

HURRICANE WORKSHOP **READY** **OR NOT**

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