# Assessment of Flood Risk using the HEC-FDA Model for Coastal Evaluations
# Case Study:
# Southwest Coastal Louisiana


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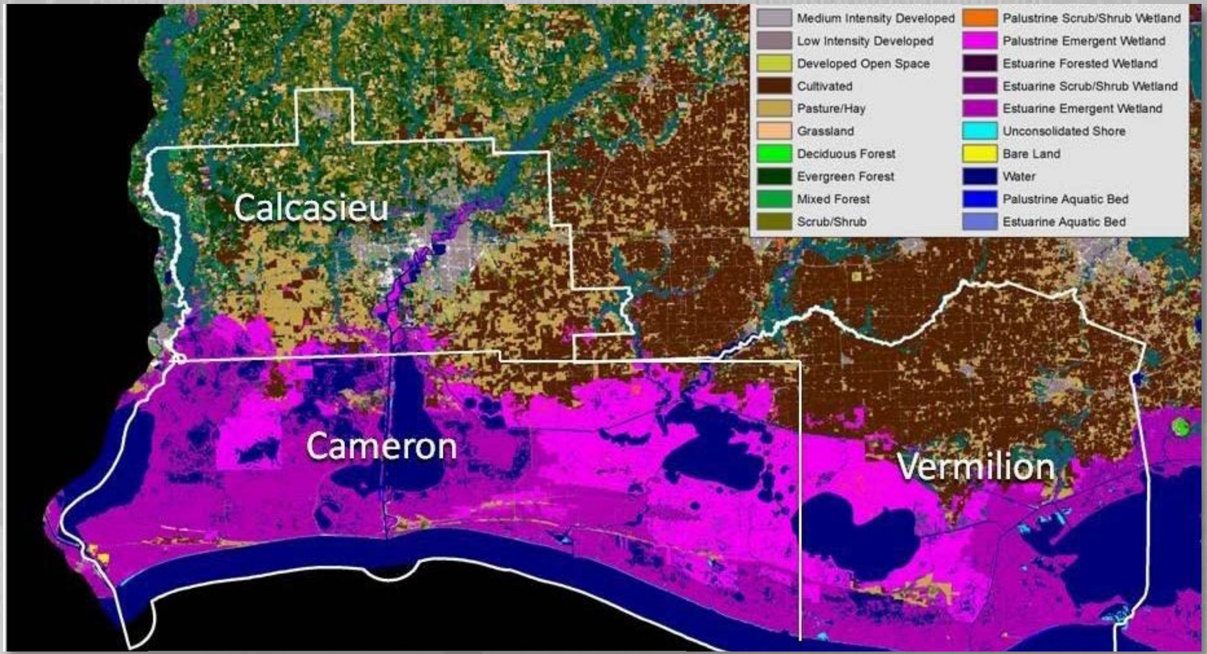
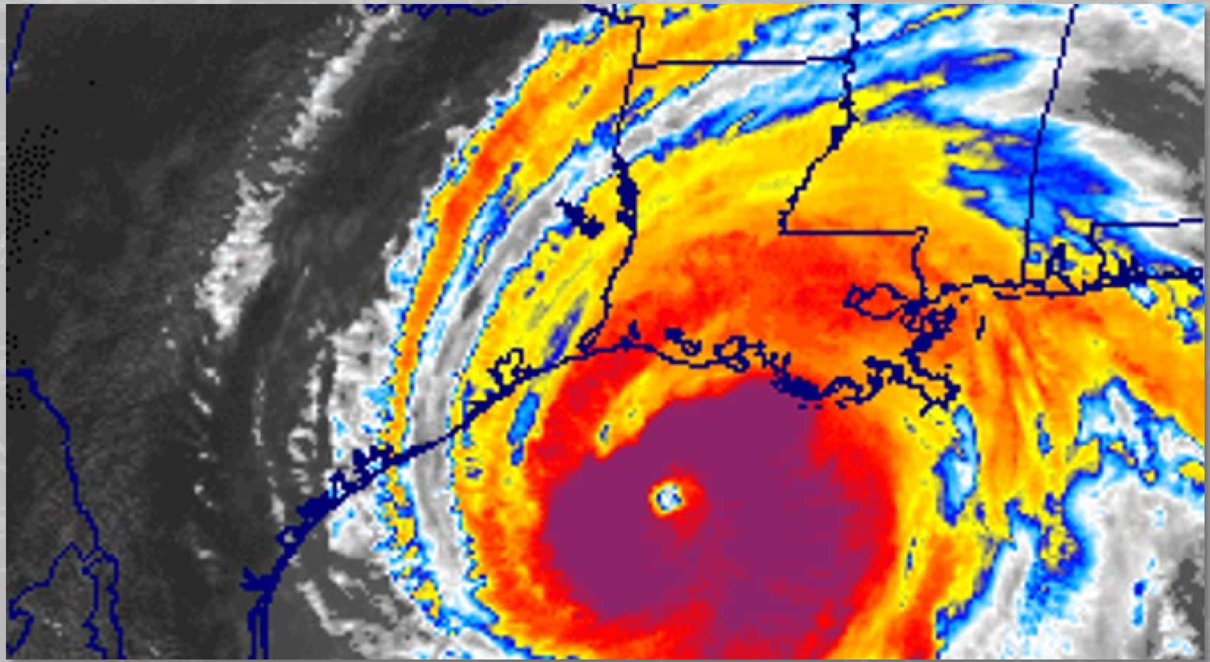
**Mississippi Valley Division**

US Army Corps of Engineers ®

# OVERVIEW OF PRESENTATION

- Southwest Coastal (SWC) Background and Alternatives
  - Study Purpose
  - Location and Characteristics of the Study Area
  - Flood History
  - Proposed Alternatives to Reduce Flood Risk
- Risk Assessment of Southwest Coastal Nonstructural Alternatives
  - Nonstructural Measures Defined
  - Modeling of Nonstructural Measures
  - Southwest Coastal Recommendations and Results
  - Current Status of Project and Nonstructural Evaluations

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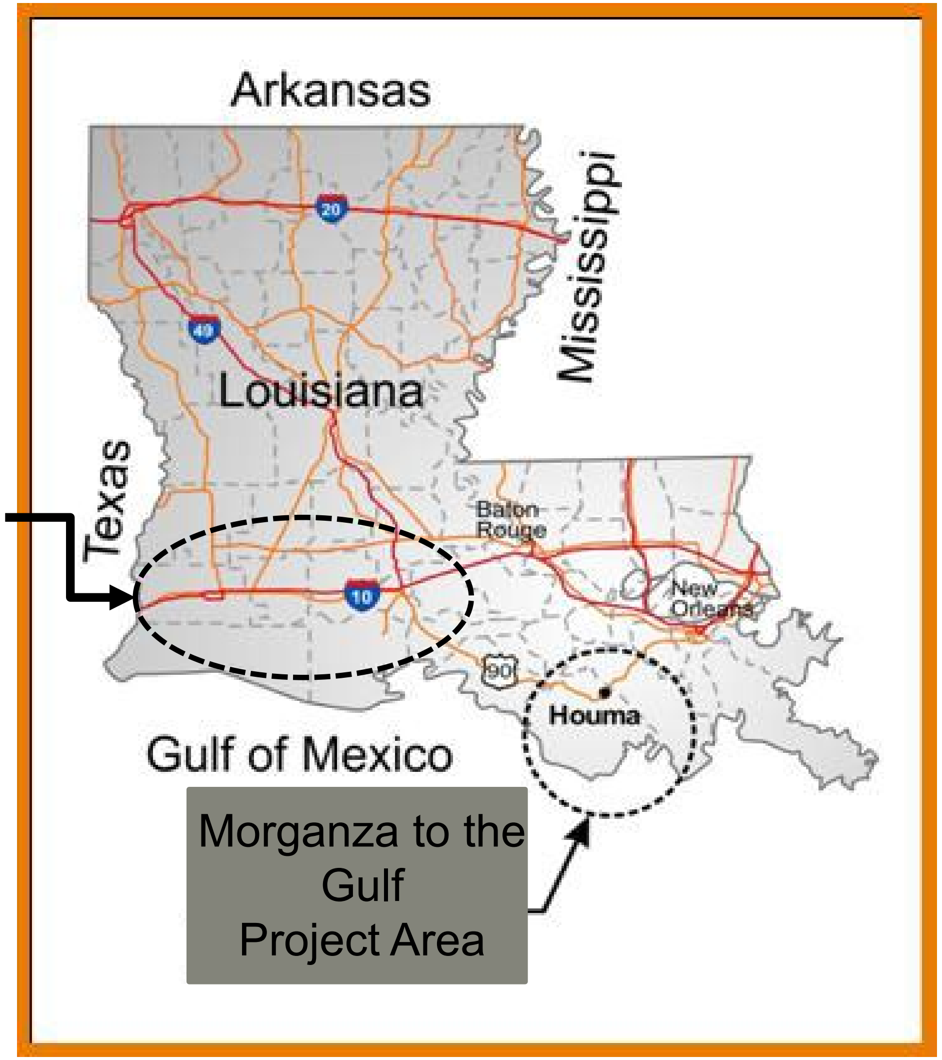
# STUDY PURPOSE

Provide a recommendation for Federal participation in hurricane storm damage risk reduction and environmental restoration features in Cameron, Calcasieu, and Vermilion Parishes located in Southwest Louisiana that would be economically and environmentally justified

# NED and Ecosystem Restoration (NER) Solutions

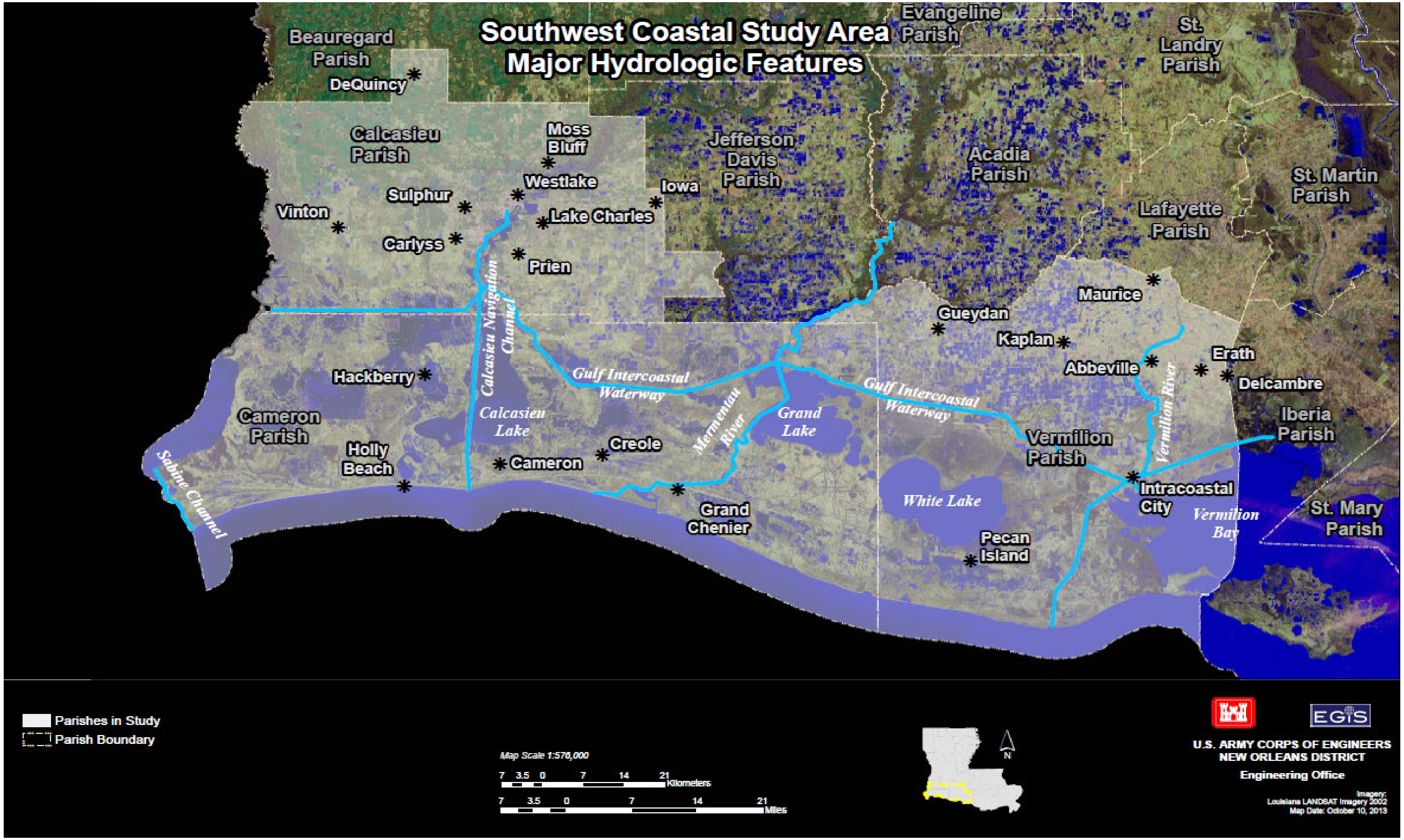
# LOCATION OF THE STUDY AREA

Southwest Coastal
Louisiana
Project Location



U.S. ARMY

# CHARACTERISTICS OF THE STUDY AREA



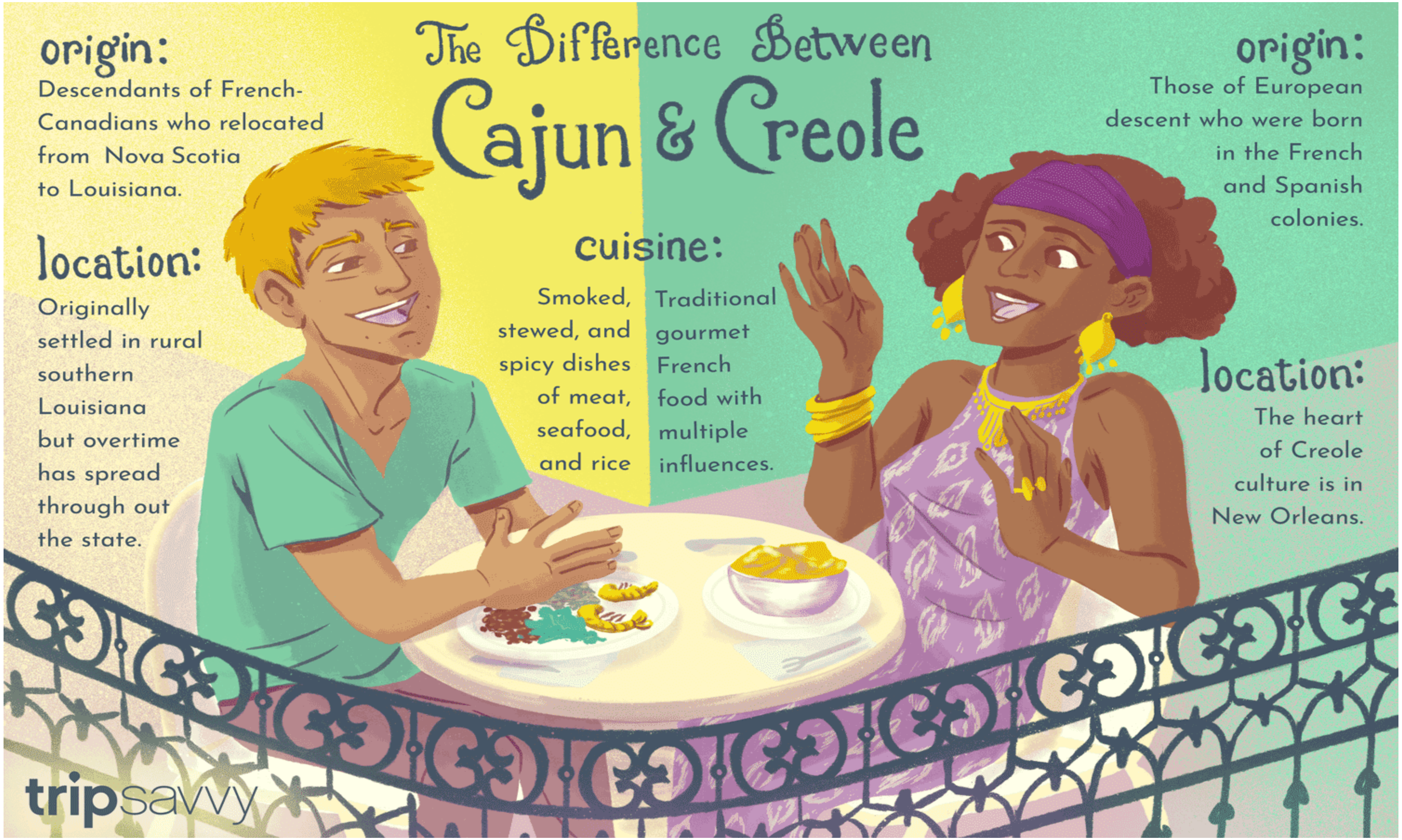
# CAJUN COUNTRY

Vermilion Parish – "The most Cajun Place in the World"

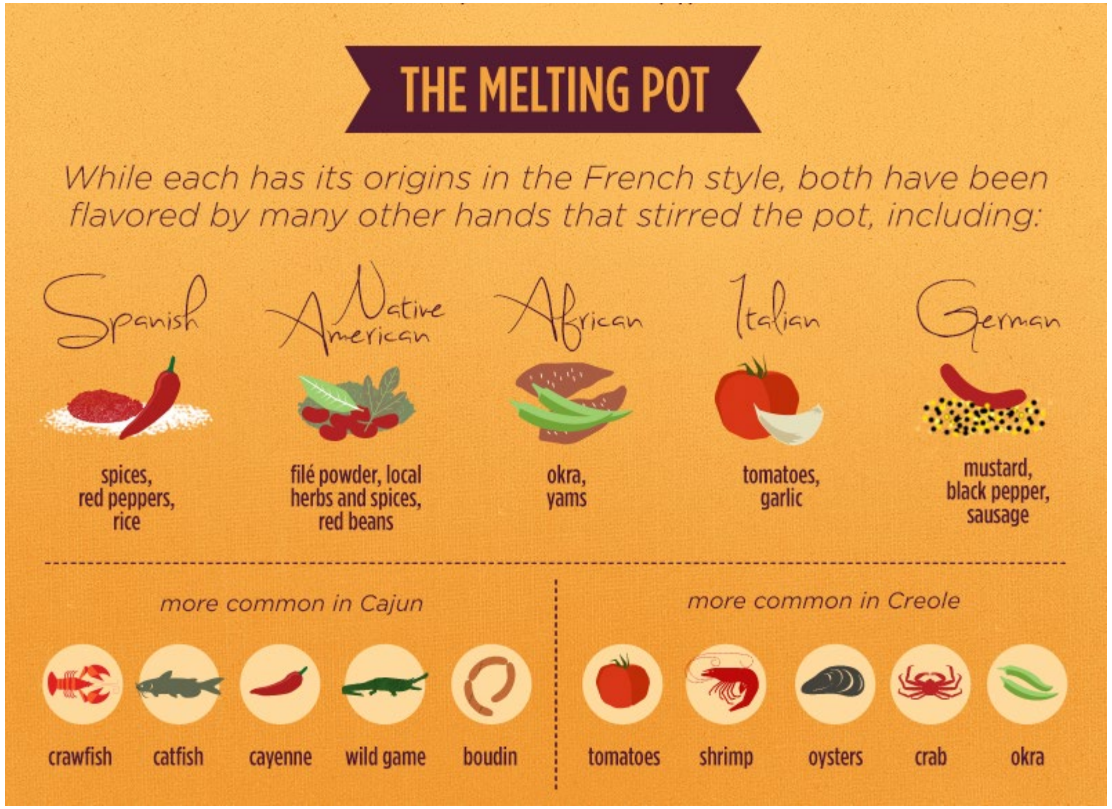
Calcasieu Parish – "quelqueshue" meaning "crying eagle"

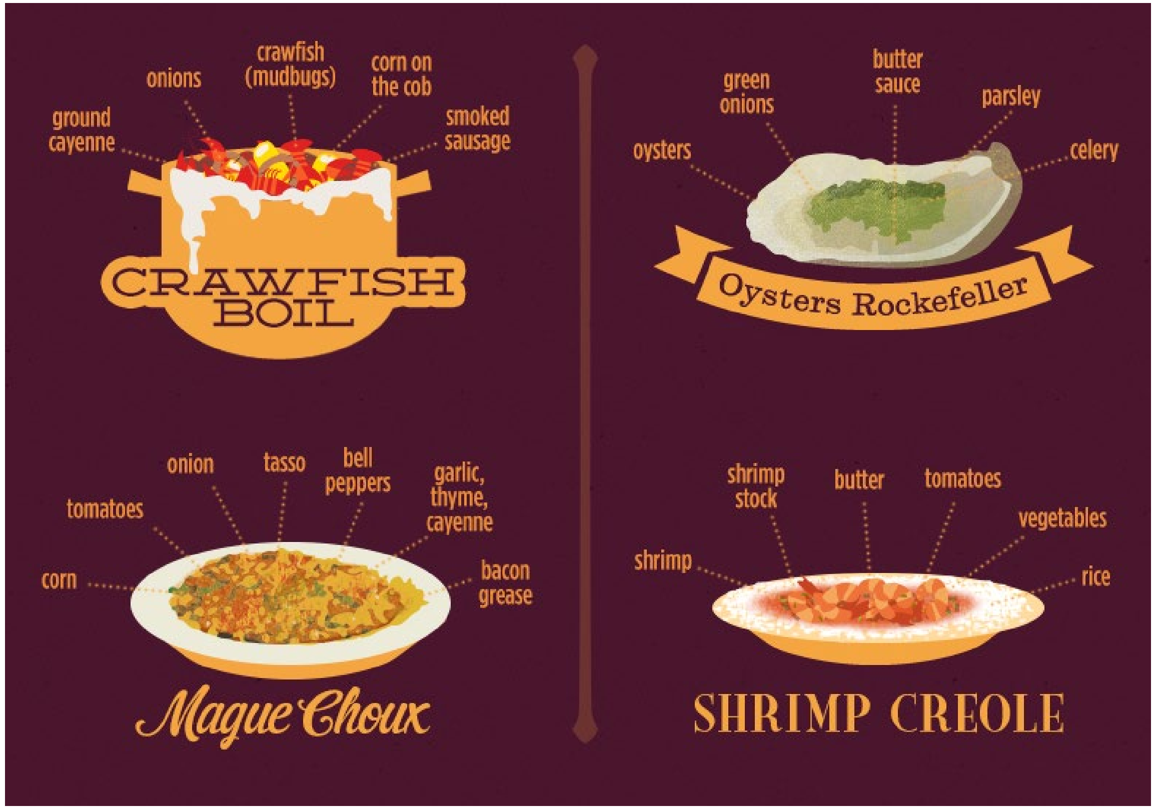
Cameron Parish – part of "no man's land in 1806 due to boundary dispute between US and Spain containing pirates, outlaws, and other nefarious characters

# CAJUN AND CREOLE



# CAJUN VERSUS CREOLE COOKING




# CAJUN TERMS

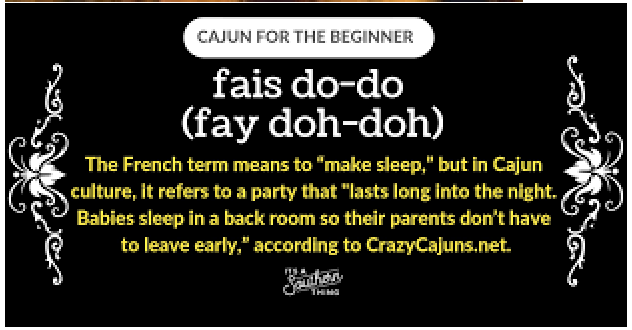
Laissez les bons ton roule – “let the good times roll”


C’est la vie – “that’s life”

Cher – “my sweet”

Bouree – Cajun bridge (card game)

Fais-do-do – Cajun dance party (to make sleep)



# SWC ECONOMIC CHARACTERISTICS

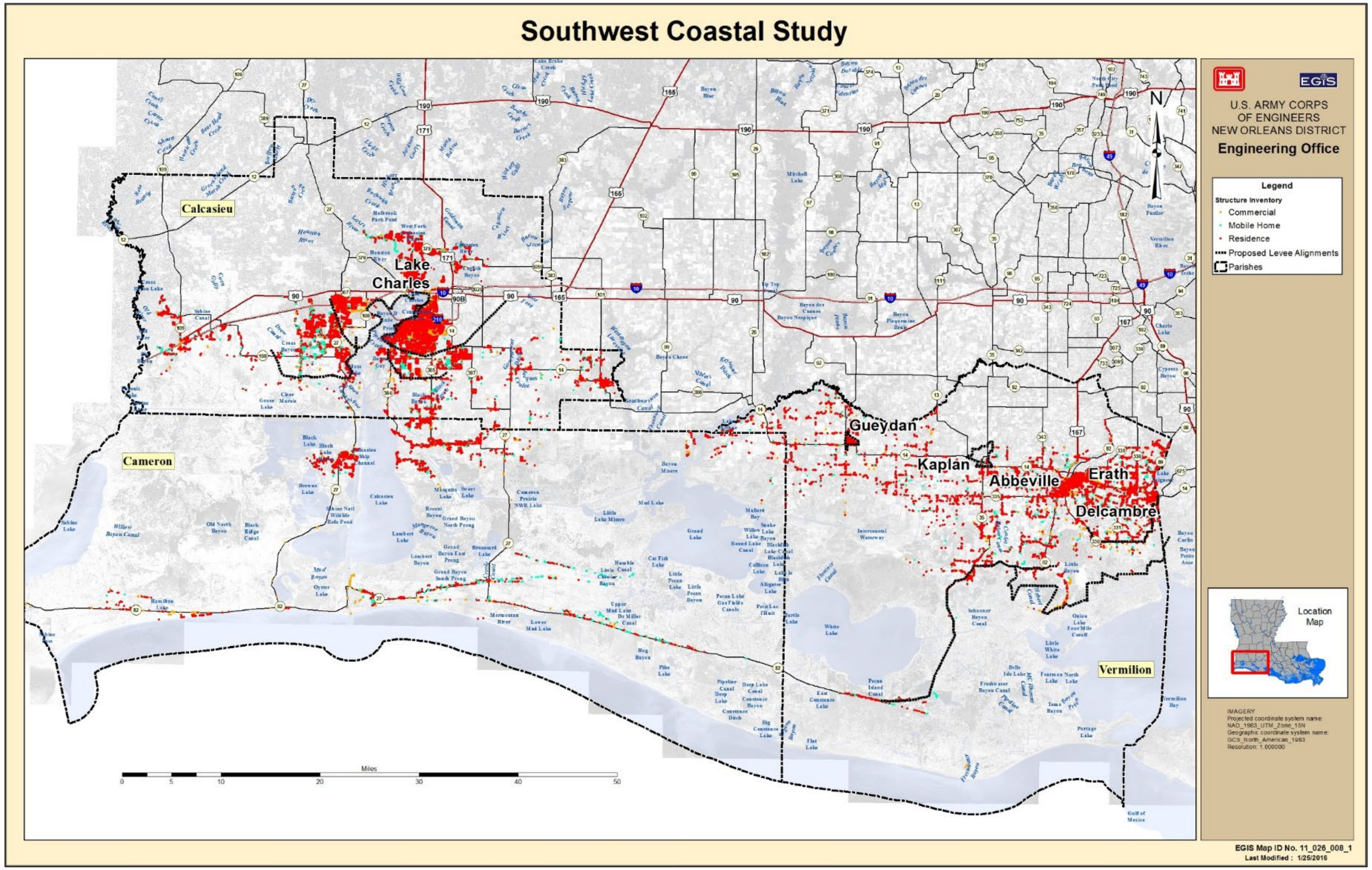
## Study Area Population 2010/2020
–160,000 residents in the inventoried area


## Per Capita Income 2010/2020
–Approximately $40,000 - $50,000

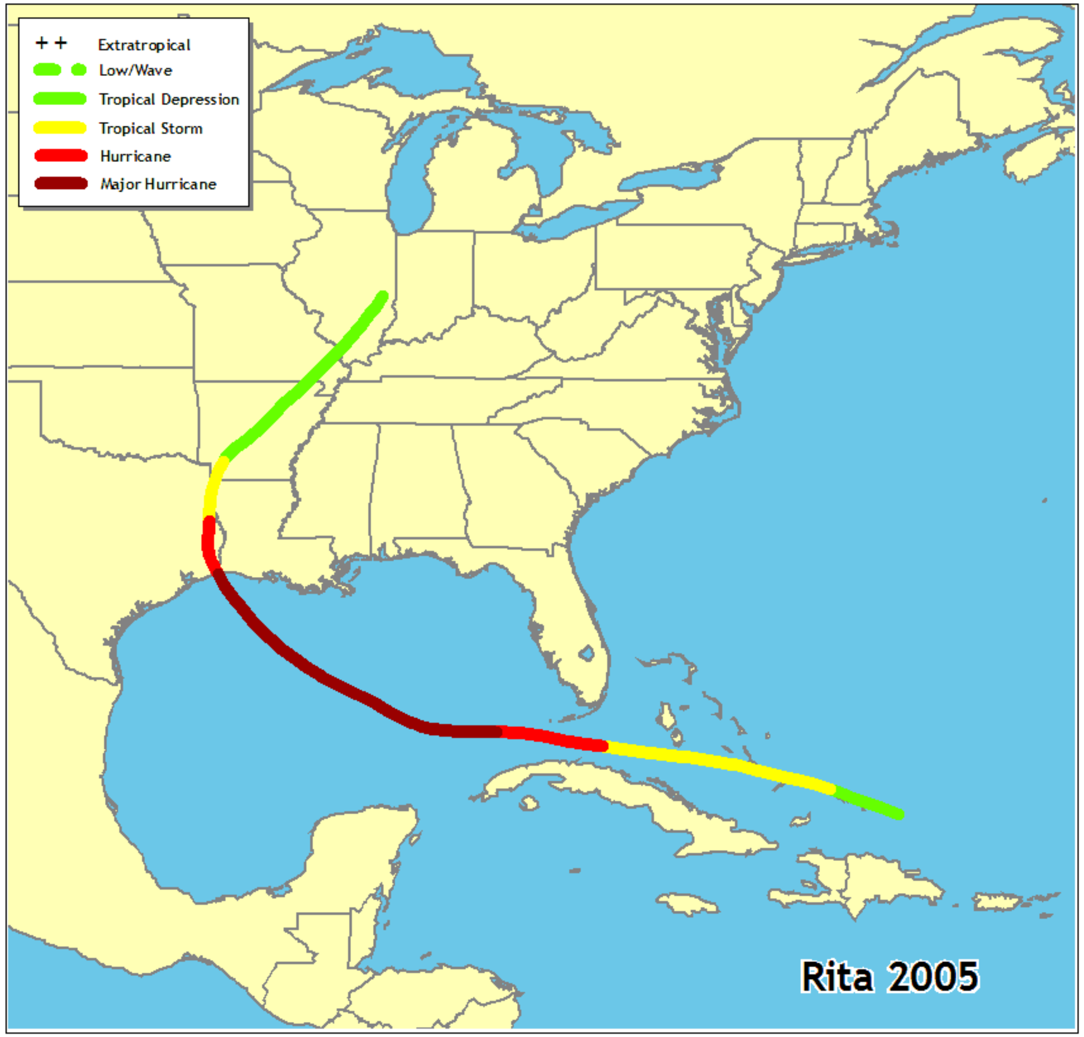
## Employment Drivers
–Energy, Offshore Supply, Fisheries, Agriculture (Rice), Aquaculture, and Cajun Food and Culture

## Structure Inventory
–47,000 Residential
– 5,000 Non-residential

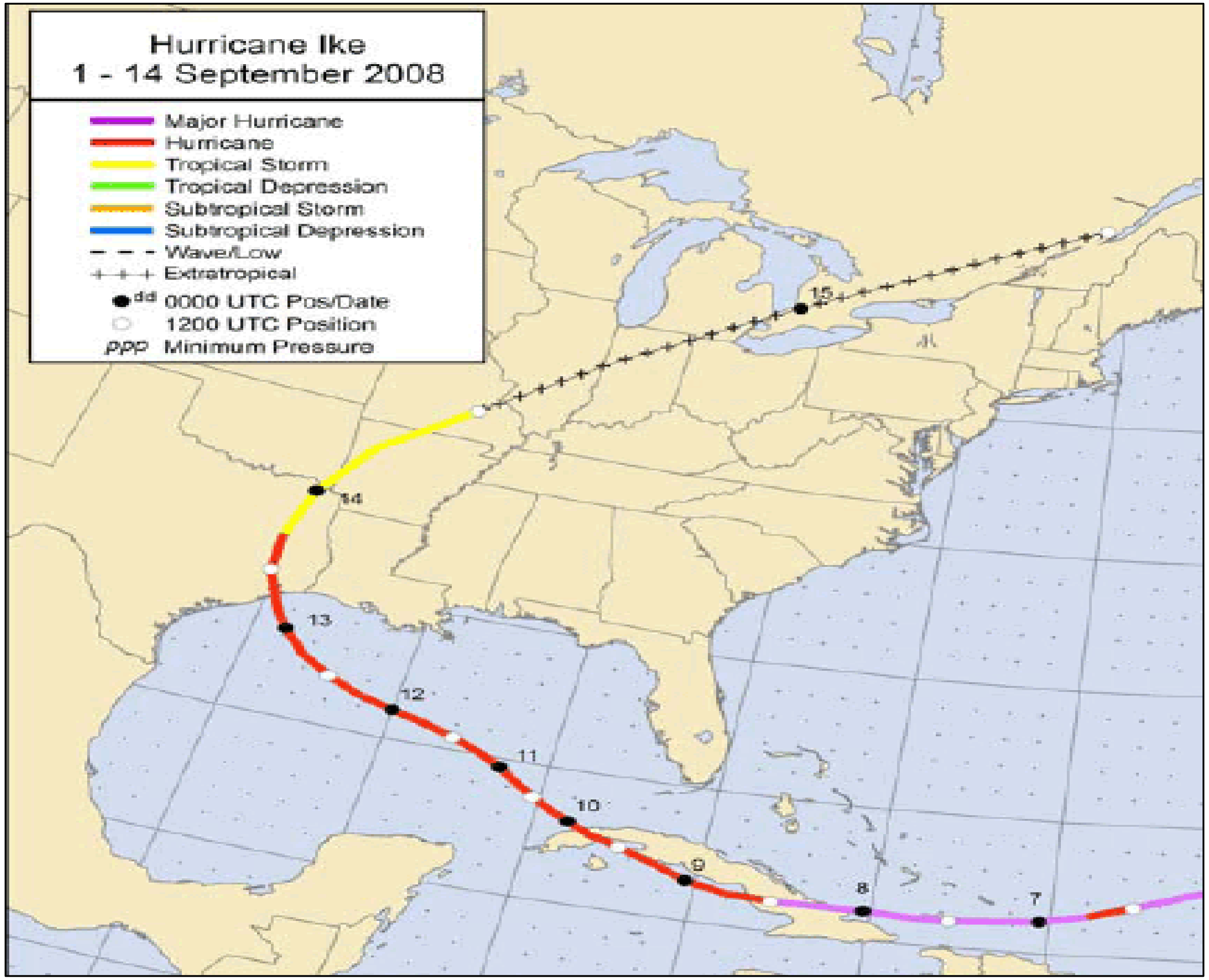
# STRUCTURE INVENTORY – WITHIN 500-YEAR OVERFLOW AREA



# HISTORICAL FLOODING: HURRICANE RITA (2005)

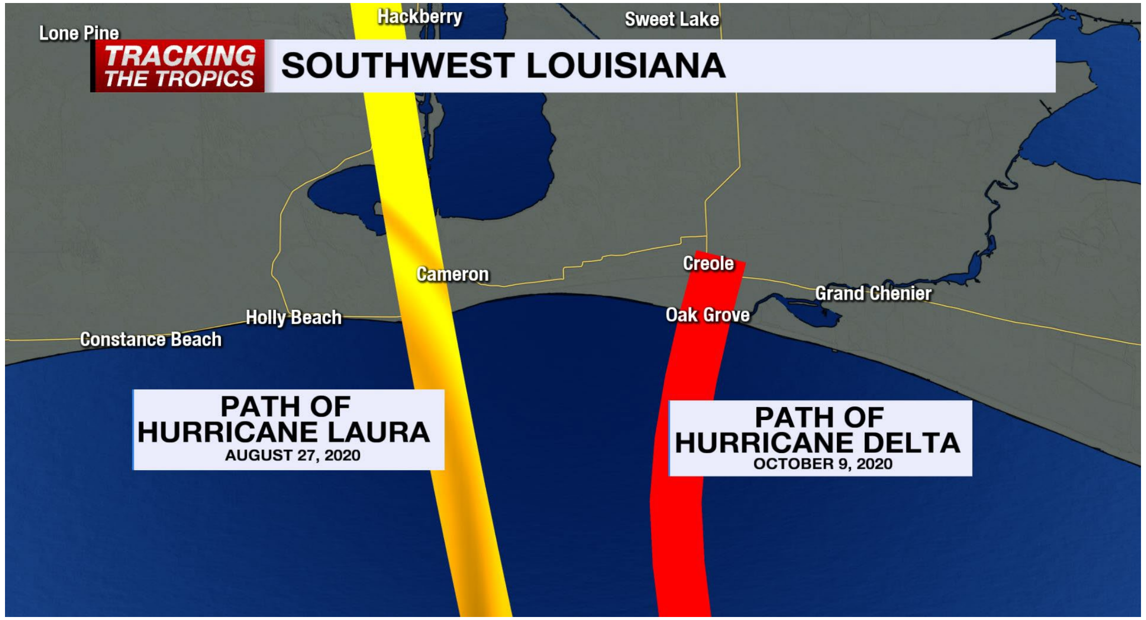


# HISTORICAL FLOODING: HURRICANE IKE (2008)



# HISTORICAL FLOODING: HURRICANES LAURA AND DELTA (2020)


4:50 AM · Oct 8, 2020



# ACTUAL PATH OF HURRICANES LAURA AND DELTA

# HOLLY BEACH, CAMERON PARISH

Pre-Storm

Post-Storm

Hurricane Rita (2005)

Hurricane Ike (2008)

# HOLLY BEACH, CAMERON PARISH 2020

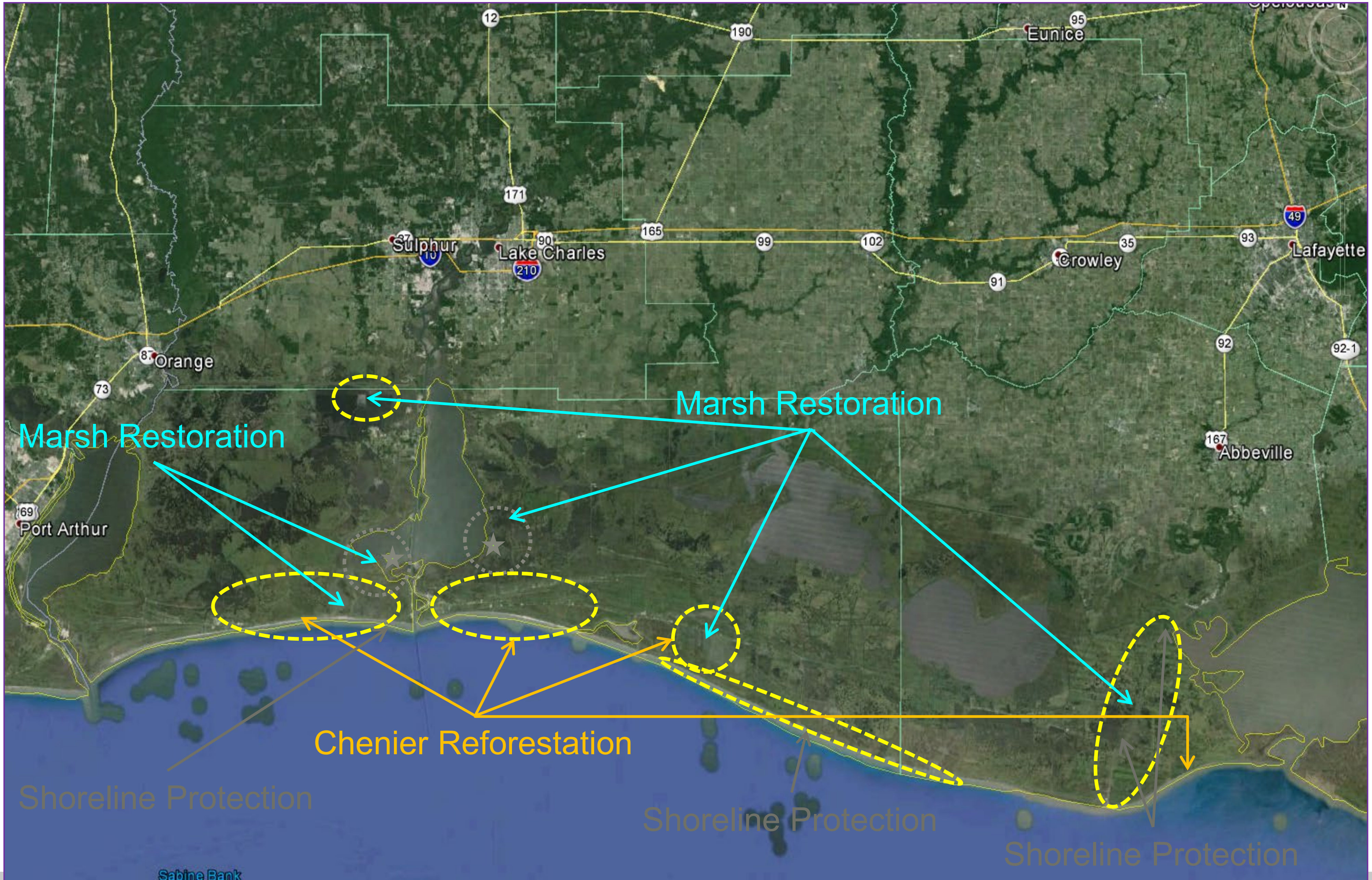
Pre – Hurricane Laura and Delta – August 2020

Post - Hurricane Laura and Delta – October 2020

# FINAL ARRAY OF ALTERNATIVES

0. No Action Plan
1. Lake Charles Eastbank Levee
2. Lake Charles Westbank Sulphur Extended Levee
3. Lake Charles Westbank Sulphur South Levee
4. Delcambre/Erath Levee
5. Abbeville Levee
6. Abbeville to Delcambre Levee
7. Nonstructural Plan (By community)
8. Nonstructural Plan (By floodplain)

# NER FEATURES



# SWC BACKGROUND QUESTIONS

When developing a coastal or riverine flood risk management economics appendix include background information on:

a. Population, income and employment trends
b. Historical flooding information on the study area
c. The study purpose and proposed alternatives
d. All of the above

True or False:
The no action alternative should be eliminated from consideration as structural alternatives are formulated to reduce flood risk.

True or False:
Current policy requires nonstructural alternatives be investigated to reduce flood risk.

# OVERVIEW OF PRESENTATION

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- Risk Assessment of Southwest Coastal Nonstructural Alternatives
  - Risk and Uncertainty Terms and Examples
  - Nonstructural Measures Defined
  - Modeling of Nonstructural Measures
  - Southwest Coastal Recommendations and Results (Updated status of project)

# RISK AND UNCERTAINTY

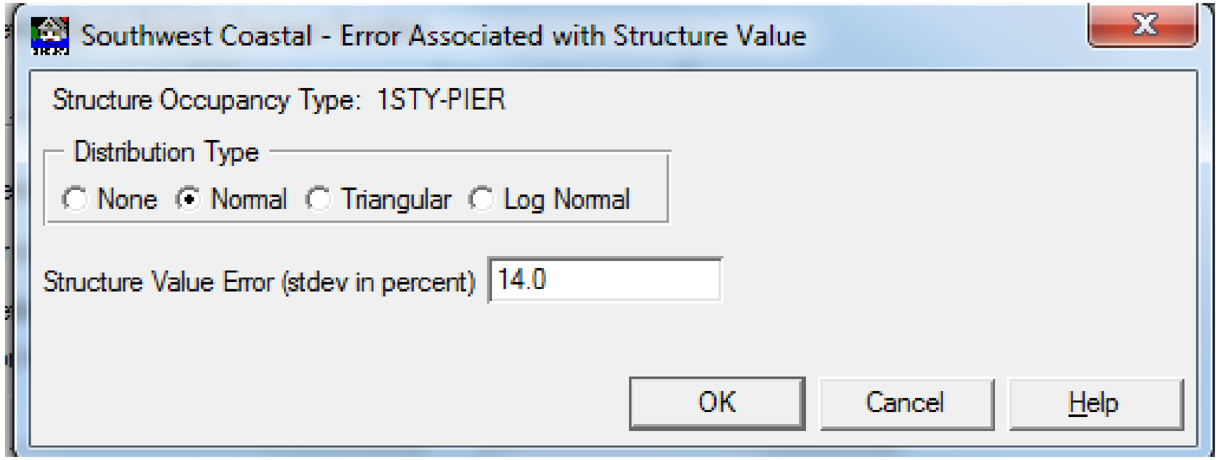
Risk = chance of something happening. It is measured in terms of consequences and likelihood.
Uncertainty = possible errors in the methods used to calculate parameters

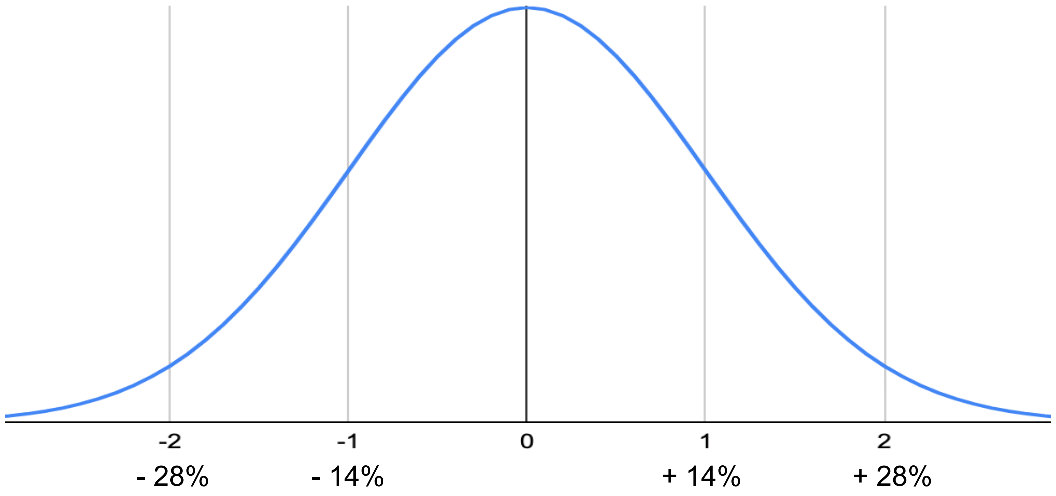
Risk and uncertainty must be quantified.
Traditional method provides single point estimates.
Risk analysis provides a range and probability of occurrence (probability distribution).

Computer models use Monte Carlo Simulation
Hydrologic Engineering Center – Flood Damage Analysis (HEC-FDA) and @Risk (Excel add-on software)

# STRUCTURE VALUE UNCERTAINTY

| RS Means Single-family, 1-story res. | Average | Good | Very Good | Mean Value | Standard Deviation | SD/Mean Value |
|---|---|---|---|---|---|---|
| Depreciated Replacement Cost (Sq Ft) | $67 | $74 | $88 | $76.33 | $10.69 | 14.0% |



# QUESTIONS REGARDING THE STRUCTURE INVENTORY AND UNCERTAINTY

True or False:
The uncertainty surrounding the structure value can be measured using the standard deviation statistic as a percentage of the mean structure value assuming a normal probability distribution.

The value of structures used to calculate flood damages for FRM studies is based on the following:

a. Replacement cost
b. Market value
c. Depreciated replacement cost
d. Value of land

# DEPTH-DAMAGE RELATIONSHIPS

•**Depth-damage relationships** = percentage of the structure or its contents damaged at each increment of flooding above first floor elevation

•**Stage-damage relationships** = total damages to the structures and their contents in a community damaged at each increment of flooding above ground elevation as measured by mean sea level or other datum

•**Site-specific** = depth-damage relationships that are specific to the geographical planning area

•**Generic** = national depth-damage relationships that can be used by Corps Districts throughout the nation. Source: EGM 01-03 (residential no basements) and EGM 04-01 (residential with basements)

DAMAGE FUNCTIONS
FOR SINGLE FAMILY RESIDENTIAL
STRUCTURES WITH BASEMENTS

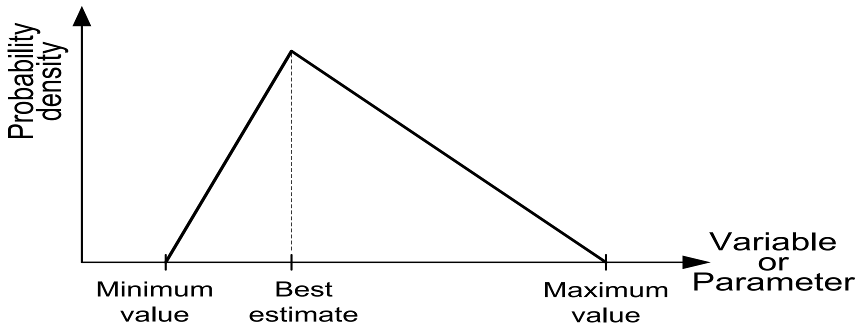
*Structure Depth-Damage*

**Table 1**
**Structure**
**One Story, With Basement**

| Depth | Mean of Damage | Standard Deviation of Damage |
|---|---|---|
| -8 | 0% | 0 |
| -7 | 0.7% | 1.34 |
| -6 | 0.8% | 1.06 |
| -5 | 2.4% | 0.94 |
| -4 | 5.2% | 0.91 |
| -3 | 9.0% | 0.88 |
| -2 | 13.8% | 0.85 |
| -1 | 19.4% | 0.83 |
| 0 | 25.5% | 0.85 |
| 1 | 32.0% | 0.96 |
| 2 | 38.7% | 1.14 |
| 3 | 45.5% | 1.37 |
| 4 | 52.2% | 1.63 |
| 5 | 58.6% | 1.89 |
| 6 | 64.5% | 2.14 |
| 7 | 69.8% | 2.35 |
| 8 | 74.2% | 2.52 |
| 9 | 77.7% | 2.66 |
| 10 | 80.1% | 2.77 |
| 11 | 81.1% | 2.88 |
| 12 | 81.1% | 2.88 |
| 13 | 81.1% | 2.88 |
| 14 | 81.1% | 2.88 |
| 15 | 81.1% | 2.88 |
| 16 | 81.1% | 2.88 |

# DEPTH-DAMAGE RELATIONSHIP UNCERTAINTY

- Triangular Probability Distribution
- Experts provided a minimum; most-likely; and maximum value for the damage percentages at each depth of flooding
- Combined the responses of the experts into one probability distribution



# MOLD DAMAGE

# ??? TEST YOUR KNOWLEDGE ???

What is the probability of a given storm event occurring in any given year?

- 10-year event 1/10 = .10 (10 %)
- 50-year event 1/50 = .02 ( 2 %)
- 100-year event 1/100 = .01 ( 1 %)
- 500-year event 1/500 = .002 ( 0.2 %)

**•Formula: 1 / recurrence event = probability or AEP**

# STAGE-PROBABILITY RELATIONSHIPS (WITHOUT PROJECT)

| SWC North Reach | 0.99 | 0.20 | 0.10 | 0.04 | 0.02 | 0.01 | 0.005 | 0.002 |
|---|---|---|---|---|---|---|---|---|
| 2015 | 2.0 | 2.3 | 2.5 | 2.7 | 3.1 | 3.5 | 4.5 | 5.5 |
| 2025 | 2.5 | 2.8 | 3.0 | 3.2 | 3.6 | 4.0 | 5.0 | 6.0 |
| 2075 | 4.3 | 4.6 | 4.8 | 5.0 | 5.4 | 5.8 | 6.8 | 9.6 |
| | | | | | | | | |
| **SWC South Reach** | **0.99** | **0.20** | **0.10** | **0.04** | **0.02** | **0.01** | **0.005** | **0.002** |
| 2015 | 1.89 | 2.3 | 3.1 | 6.9 | 9.7 | 11.7 | 13.4 | 15.6 |
| 2025 | 2.1 | 3.0 | 3.8 | 7.6 | 10.5 | 12.6 | 14.1 | 16.1 |
| 2075 | 3.4 | 4.7 | 5.5 | 9.2 | 11.9 | 14.0 | 15.8 | 18.2 |
| | | | | | | | | |

# QUESTIONS REGARDING STAGE-PROBABILITY RELATIONSHIPS

What is the approximate ground elevation for the study area reaches?

Why are the stages so much higher for the south reach relative to the north reach?

What could be causing the stages to increase as we move to the future?

How would a structural alternative (such as levee along the coastline) affect the water surface elevations or stage-probability relationships?

How would a nonstructural alternative affect the water surface elevations or stage-probability relationships?

# STAGE-PROBABILITY RELATIONSHIP WITH UNCERTAINTY BANDS

## Stage-Probability Relationships - 50-year Equivalent Record Length

SWCLA 4-23-13 - Exceedance Probability Functions with Uncertainty

File Edit View Help

Plan: Without Stream: SW Coastal

Analysis Year: 2025 Damage Reach: SA-001(1)

Function: Without20251 Use An Existing Function Save

Description: Cancel

Type

Analytical...

Graphical...

Function Statistics...

Plot...

| Exceedance Probability | Stage (ft.) | Confidence Limit Curves Stage (ft.) | | | |
|---|---|---|---|---|---|
| | | -2 SD | -1 SD | +1 SD | +2 SD |
| 0.9990 | 5.08 | 5.08 | 5.07 | 5.10 | 5.11 |
| 0.9900 | 5.09 | 5.08 | 5.08 | 5.10 | 5.11 |
| 0.9500 | 5.38 | 5.23 | 5.31 | 5.45 | 5.52 |
| 0.9000 | 5.53 | 5.33 | 5.43 | 5.64 | 5.74 |
| 0.8000 | 5.72 | 5.55 | 5.63 | 5.80 | 5.89 |
| 0.7000 | 5.85 | 5.70 | 5.77 | 5.93 | 6.01 |
| 0.5000 | 6.07 | 5.93 | 6.00 | 6.15 | 6.22 |
| 0.3000 | 6.30 | 6.12 | 6.21 | 6.38 | 6.47 |
| 0.2000 | 6.43 | 6.05 | 6.24 | 6.62 | 6.81 |
| 0.1000 | 7.03 | 6.23 | 6.63 | 7.43 | 7.83 |
| 0.0400 | 7.83 | 6.69 | 7.26 | 8.40 | 8.97 |

# QUESTIONS REGARDING STAGE-PROBABILITY RELATIONSHIPS WITH UNCERTAINTY

Two standard deviations is approximately the 95 percent level of confidence when using a Normal Probability Distribution. What is the minus or plus stages (in feet) at two standard deviations for the 25-year recurrent event on the previous slide?

a. 6.63 and 7.43 feet

b. 6.69 and 8.97 feet

c. 7.26 and 8.40 feet

d. 5.93 and 6.22 feet

SWCLA 4-23-13 - Exceedance Probability Functions with Uncertainty

File Edit View Help

Plan: Without | Stream: SW Coastal

Analysis Year: 2025 | Damage Reach: SA-001(1)

Function: Without20251 | Use An Existing Function | Save | Cancel

Description:

Type: Analytical... | Graphical... | Function Statistics... | Plot...

| Exceedance Probability | Stage (ft.) | Confidence Limit Curves Stage (ft.) -2 SD | -1 SD | +1 SD | +2 SD |
|---|---|---|---|---|---|
| 0.9990 | 5.08 | 5.08 | 5.07 | 5.10 | 5.11 |
| 0.9900 | 5.09 | 5.08 | 5.08 | 5.10 | 5.11 |
| 0.9500 | 5.38 | 5.23 | 5.31 | 5.45 | 5.52 |
| 0.9000 | 5.53 | 5.33 | 5.43 | 5.64 | 5.74 |
| 0.8000 | 5.72 | 5.55 | 5.63 | 5.80 | 5.89 |
| 0.7000 | 5.85 | 5.70 | 5.77 | 5.93 | 6.01 |
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| 0.0400 | 7.83 | 6.69 | 7.26 | 8.40 | 8.97 |

# DEPTH–DAMAGE AND STAGE–PROBABILITY RELATIONSHIP QUESTIONS

True or False

Zero depth is located at the first-floor elevation of structures in depth-damage relationships.

Which of the following statements is false?

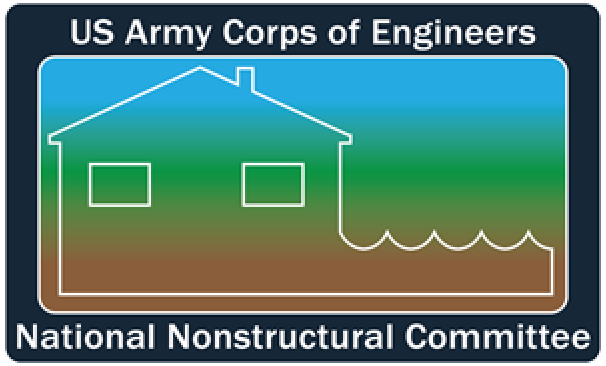
a. The longer the equivalent record length of gage information, then the less uncertainty surrounding water surface elevations
b. Nonstructural measures reduce the stages associated with the various probability events leading to lower with-project damages
c. Relative sea-level rise is a factor that can lead to higher stages associated probability events for future years
d. Risk is measured in terms of consequences and likelihood of occurrence

# WATER RESOURCES DEVELOPMENT ACT (WRDA) 2007

- Best available economic techniques, including risk and uncertainty
- Prioritize public safety
- Environmental justice
- Nonstructural approaches
- Systems approach
- Integrated water resources management

# NONSTRUCTURAL MEASURES DEFINED

Nonstructural measures are permanent or contingent measures applied to a structure and/or its contents that prevent or provide resistance to damage from flooding. Nonstructural measures differ from structural measures in that they focus on reducing the CONSEQUENCES of flooding instead of focusing on reducing the PROBABILITY of flooding.




Changing the CONSEQUENCES not the HAZARD

Typically, only need without project H&H for nonstructural alternatives!

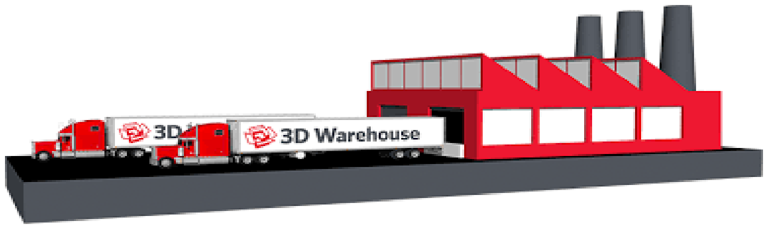
Two types of nonstructural measures: physical (elevation, floodproofing, relocation or acquisition) and nonphysical (evacuation plans, floodplain mapping and warning systems) measures that provide resistance to damage from flooding

# NONSTRUCTURAL MEASURES - SWC

•Elevating residential structures

•Flood proofing non-residential structures

•Localized storm surge risk reduction measures around warehouses (wet flood proofing – water runs through vents near bottom of building). Owner responsible for removing or elevating contents.



# NONSTRUCTURAL PLAN UNIT OF ANALYSIS

**(DEFINING THE COLLECTION OF STRUCTURES INCLUDED IN THE RECOMMENDED PLAN)**

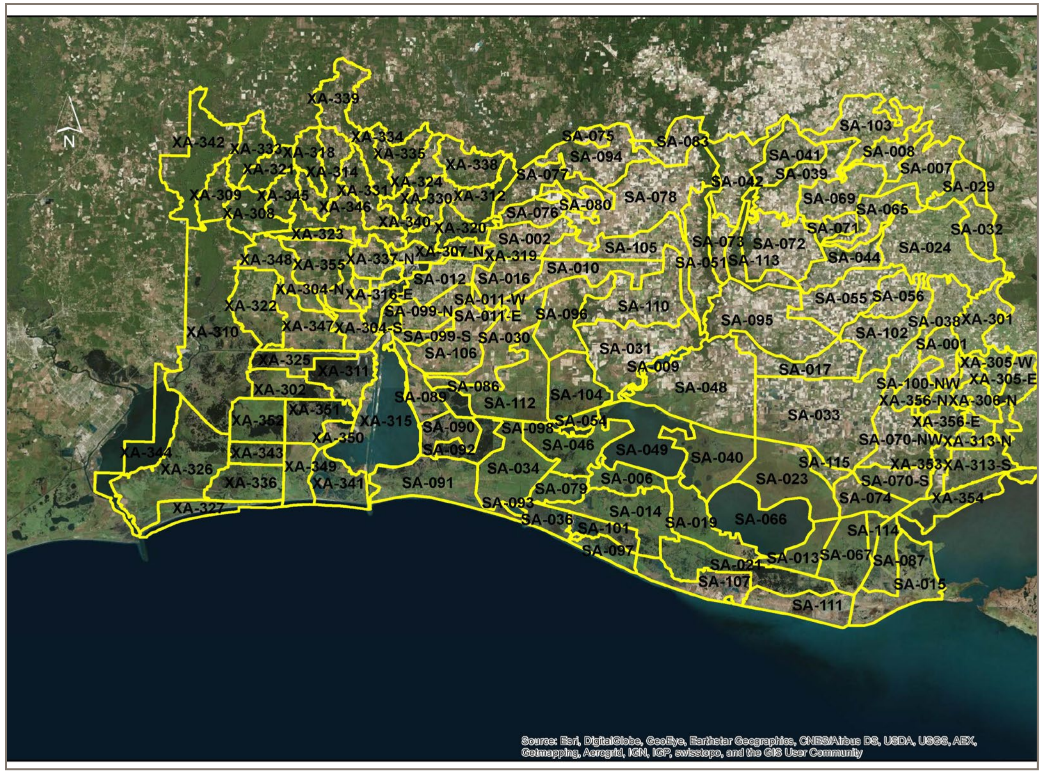
By Reach
- ➢90 Reaches – 63 Occupied – 11 Justified

By Community
- ➢Urban Areas vs. Rural Areas

By Total Study Area
- ➢100-Year Floodplain

By Floodplain
- ➢Tiered Approach within the 100-year Floodplain

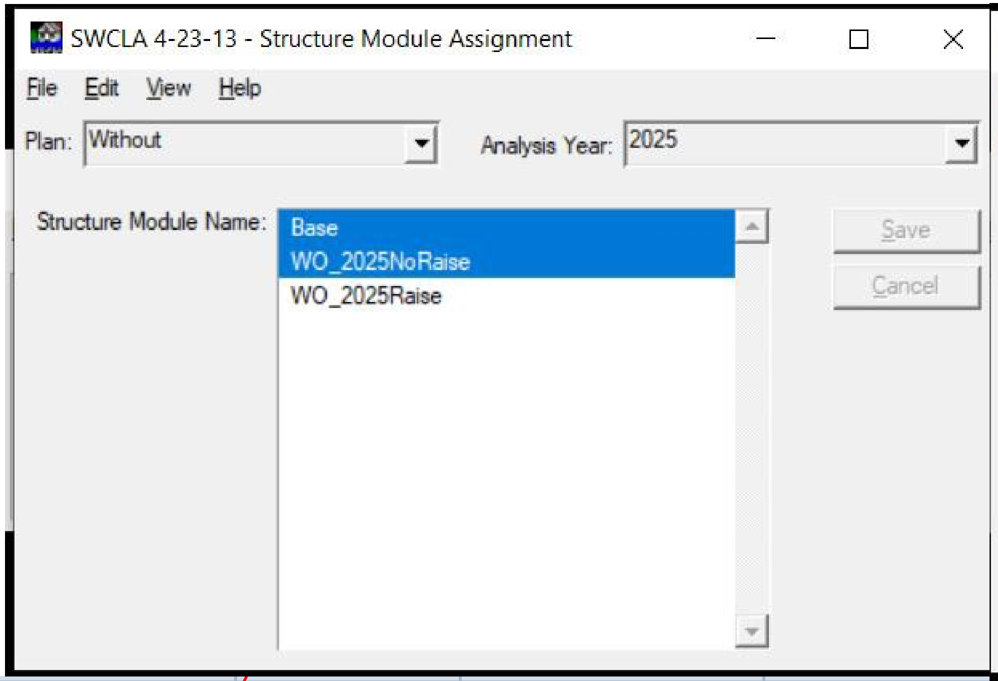
25-Year Floodplain

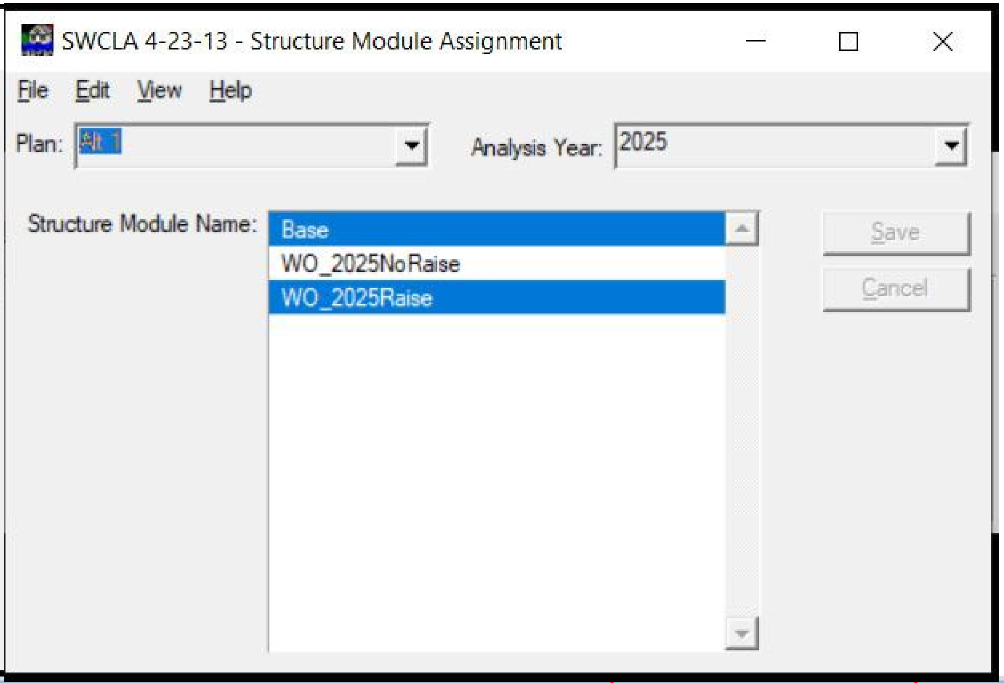


# FLOODPLAIN SUMMARY OF WITHOUT- PROJECT DAMAGES

| | Complete Study Area | Total 100-Year Floodplain | Tier 1 0 to 25 year Floodplain | Tier 2 25 to 50 year Floodplain | Tier 3 50 to 100 year Floodplain |
|---|---|---|---|---|---|
| Equivalent Annual | | | | | |
| Without Project Damages | $ 474,571 | 333,561 | 280,457 | 30,428 | 22,676 |
| Total Number of Structures | 51,857 | 15,667 | 4,952 | 4,216 | 6,499 |
| Residential Structures | 46,860 | 13,934 | 4,219 | 3,811 | 5,904 |
| Non-Residential Structures | 3,432 | 1,003 | 396 | 209 | 398 |
| Warehouses | 1,565 | 730 | 337 | 196 | 197 |

# MODULE ASSIGNMENT – STRUCTURE ELEVATION

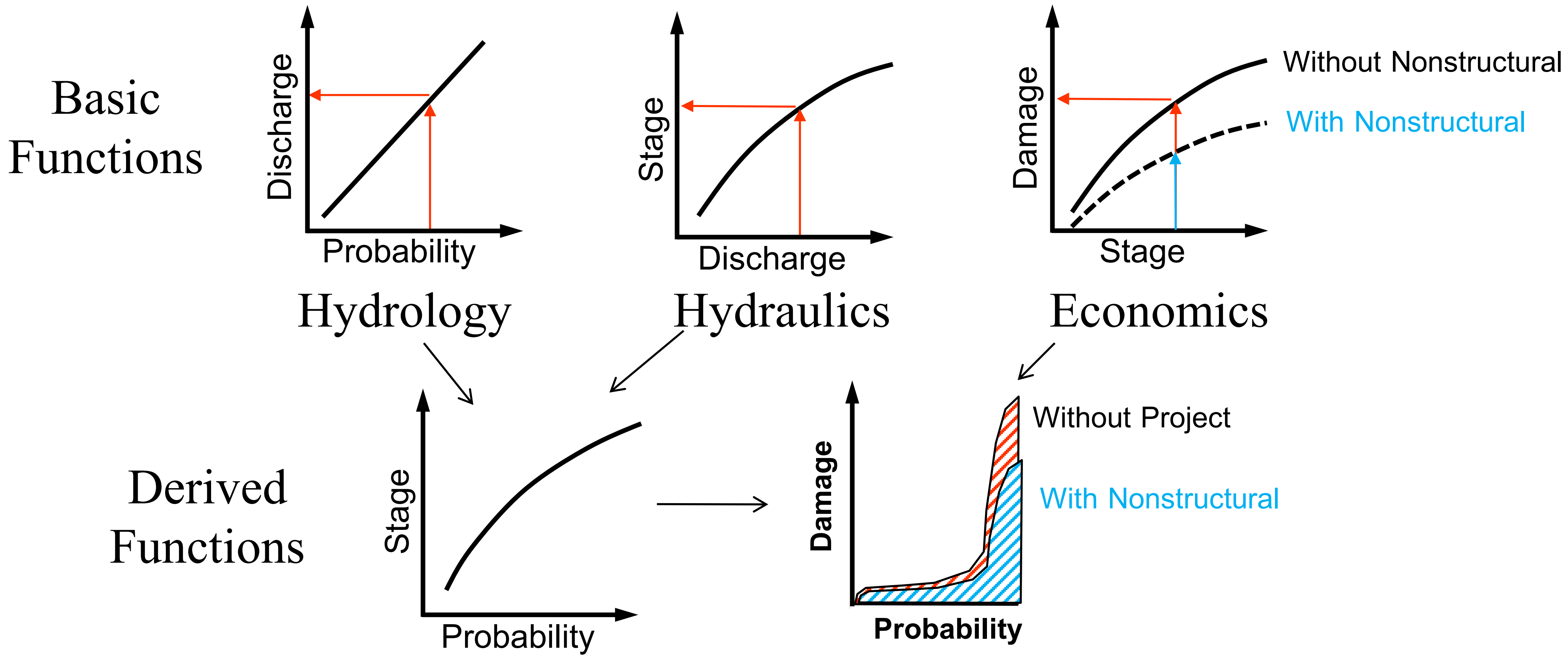



| Struc_Name | Cat_Name | Stream_Name | Occ_Name | Station | Struc_Val | 1F_Stage | Mod_Name |
|---|---|---|---|---|---|---|---|
| 110901 | RES | SW Coastal | 1STY-PIER | 283 | 99.81 | 8.36 | WO_2025NoRaise |
| 110901R | RES | SW Coastal | 1STY-PIER | 283 | 99.81 | 12.4 | WO_2025Raise |

# CALCULATING EXPECTED ANNUAL DAMAGES (NONSTRUCTURAL MEASURES)

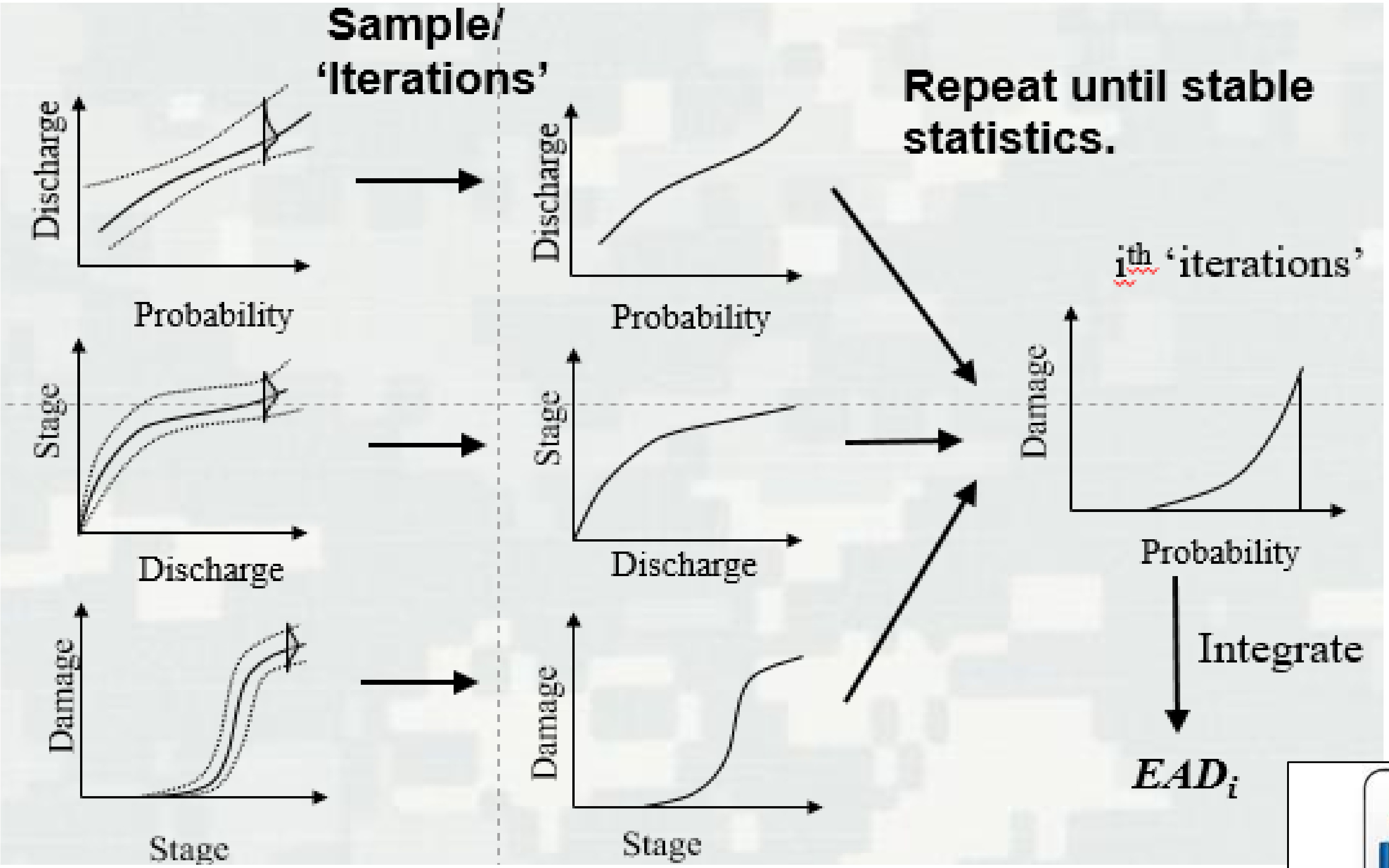
## Derived Probability-Damage Relationship



# NED BENEFIT CALCULATION

Without Project Damages - With Project Alternative Damages = NED Benefits

# CALCULATING EAD USING MONTE CARLO SIMULATIONS




# DISPLAY RESULTS FOR PLAN NOT INDIVIDUAL STRUCTURES

## PLANNING BULLETIN

US Army Corps of Engineers®

No. PB 2019-03 Issuing Office: CECW-P Issued: 13 December 2018

**Subject:** Further Clarification of Existing Policy for USACE Participation in Nonstructural Flood Risk Management and Coastal Storm Risk Management Measures

**Applicability**: Guidance

AfterNonstructural
Equivalent Annual Damage Reduced and Distributed by Plans
(Damage in $1,000's)

Discount Rate: 2.875
Analysis Period: 50 Years
Version 1.4.2, July 2017; Less Simple Method (0.010)

| Plan Name | Plan Description | Equivalent Annual Damage: Total Without Project | Equivalent Annual Damage: Total With Project | Equivalent Annual Damage: Damage Reduced | Probability Damage Reduced Exceeds Indicated Values: .75 | Probability Damage Reduced Exceeds Indicated Values: .50 | Probability Damage Reduced Exceeds Indicated Values: .25 |
|---|---|---|---|---|---|---|---|
| Without | No Action | 72.62 | 72.62 | 0.00 | 0.00 | 0.00 | 0.00 |
| With | Nonstructural | 72.62 | 9.50 | 63.13 | 38.94 | 59.46 | 83.33 |

***** - Computations have not been completed.
\+ - Something has changed and computations need to be redone.

# COST PER SQUARE FOOT OF ELEVATING RESIDENTIAL STRUCTURES

## (FY 2015 PRICE LEVELS)

| | 1STY-SLAB | | | 2STY-SLAB | | | 1STY-PIER | | | 2STY-PIER | | | MOBHOM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ft. Raised | Min | Most Likely | Max | Min | Most Likely | Max | Min | Most Likely | Max | Min | Most Likely | Max | Min | Most Likely | Max |
| 1 | 66 | 74 | 82 | 74 | 82 | 90 | 57 | 65 | 73 | 64 | 72 | 80 | 32 | 36 | 40 |
| 2 | 66 | 74 | 82 | 74 | 82 | 90 | 57 | 65 | 73 | 64 | 72 | 80 | 32 | 36 | 40 |
| 3 | 67 | 75 | 83 | 75 | 83 | 91 | 60 | 68 | 76 | 67 | 75 | 83 | 32 | 36 | 40 |
| 4 | 70 | 78 | 86 | 80 | 88 | 96 | 60 | 68 | 76 | 67 | 75 | 83 | 32 | 36 | 40 |
| 5 | 70 | 78 | 86 | 80 | 88 | 96 | 60 | 68 | 76 | 67 | 75 | 83 | 40 | 44 | 48 |
| 6 | 71 | 79 | 87 | 82 | 90 | 98 | 61 | 69 | 77 | 68 | 76 | 84 | 40 | 44 | 48 |
| 7 | 71 | 79 | 87 | 82 | 90 | 98 | 61 | 69 | 77 | 68 | 76 | 84 | 40 | 44 | 48 |
| 8 | 74 | 82 | 90 | 85 | 93 | 101 | 63 | 71 | 79 | 70 | 78 | 86 | 40 | 44 | 48 |
| 9 | 74 | 82 | 90 | 85 | 93 | 101 | 63 | 71 | 79 | 70 | 78 | 86 | 40 | 44 | 48 |
| 10 | 74 | 82 | 90 | 85 | 93 | 101 | 63 | 71 | 79 | 70 | 78 | 86 | 40 | 44 | 48 |
| 11 | 74 | 82 | 90 | 85 | 93 | 101 | 63 | 71 | 79 | 70 | 78 | 86 | 40 | 44 | 48 |
| 12 | 74 | 82 | 90 | 85 | 93 | 101 | 63 | 71 | 79 | 70 | 78 | 86 | 40 | 44 | 48 |
| 13 | 77 | 85 | 93 | 90 | 98 | 106 | 64 | 72 | 80 | 71 | 79 | 87 | 40 | 44 | 48 |

# NET BENEFIT CALCULATION

Total Benefits - Total Costs = **Net Benefits**

Total Benefits ÷ Total Costs = **B/C Ratio**

# RECOMMENDED PLAN

- Is focused on the properties exposed to the highest flood risk in the study area as defined by the 25-year floodplain.

- Reduces risk for 3,961 total structures
  - 3,462 residential
  - 342 non-residential
  - 157 warehouses

- Estimated first cost of ~$908M (FY15 price level)

- Benefit-to-Cost ratio of 5.6:1

- Average annual net benefits of ~$167M (FY15 price level)

# UPDATED STATUS OF SOUTHWEST COASTAL

- Engineering and Design Phase (PED phase is on-going)

- Infrastructure Investment and Jobs Act (IIJA - $125 million to jumpstart the project)

- Economic Update (conducted 5 years after authorization to determine if still economically feasible)

# CONSIDERATIONS FOR GROUPING STRUCTURES

1. Hydraulic Characteristics
   - Left bank / right bank
   - Source of flooding
   - Frequency of flooding
   - Timing of flooding (arrival, duration)
   - Physics of flooding (depths, velocities, d x v)
   - Hydrologic influences (ice flow, debris laden, erosion)

2. Structure Characteristics
   - First floor elevation
   - Common land use, structure type, construction method/category, age
   - Density of development
   - Historic areas or neighborhoods
   - Shared infrastructure (physical)
   - Shared critical infrastructure (buildings)

3. Community Characteristics
   - Shared demographics
   - Shared socioeconomics
   - Shared cultural values
   - Political jurisdictions

4. Life Risk Characteristics
   - Population age (over/under 65)
   - Available evacuation routes
   - Accessibility to public transportation
   - Physics of flooding (depths, velocities, d x v)
   - Structural attributes (story height, wall type, attic access)

5. Other Characteristics
   - Common flood consequences (e.g., % damage)
   - Potential for reuse of evacuated floodplain for ecosystem restoration or recreation

# NONSTRUCTURAL QUESTIONS

What feature of the HEC-FDA model is used to manipulate the structure records to provide damage and benefit results?

a. Price indexing
b. Modules
c. Monte Carlo simulation
d. Content-to-Structure Value ratios (CSVRs)

True or False:
Nonstructural measures do not change the hazard, only the consequences of a flood event.

# ECONOMIC RESULTS QUESTIONS

True or False:
Total benefits minus total costs equals net benefits.

True or False:
If the benefit to cost ratio equals 1.0 or greater, then the project costs exceed the project benefits.

# HURRICANE IDA – CATEGORY 4 – 29 AUGUST 2021




# MAJOR COMPONENTS OF THE HSDRRS

# WUZZLES NONSTRUCTURAL

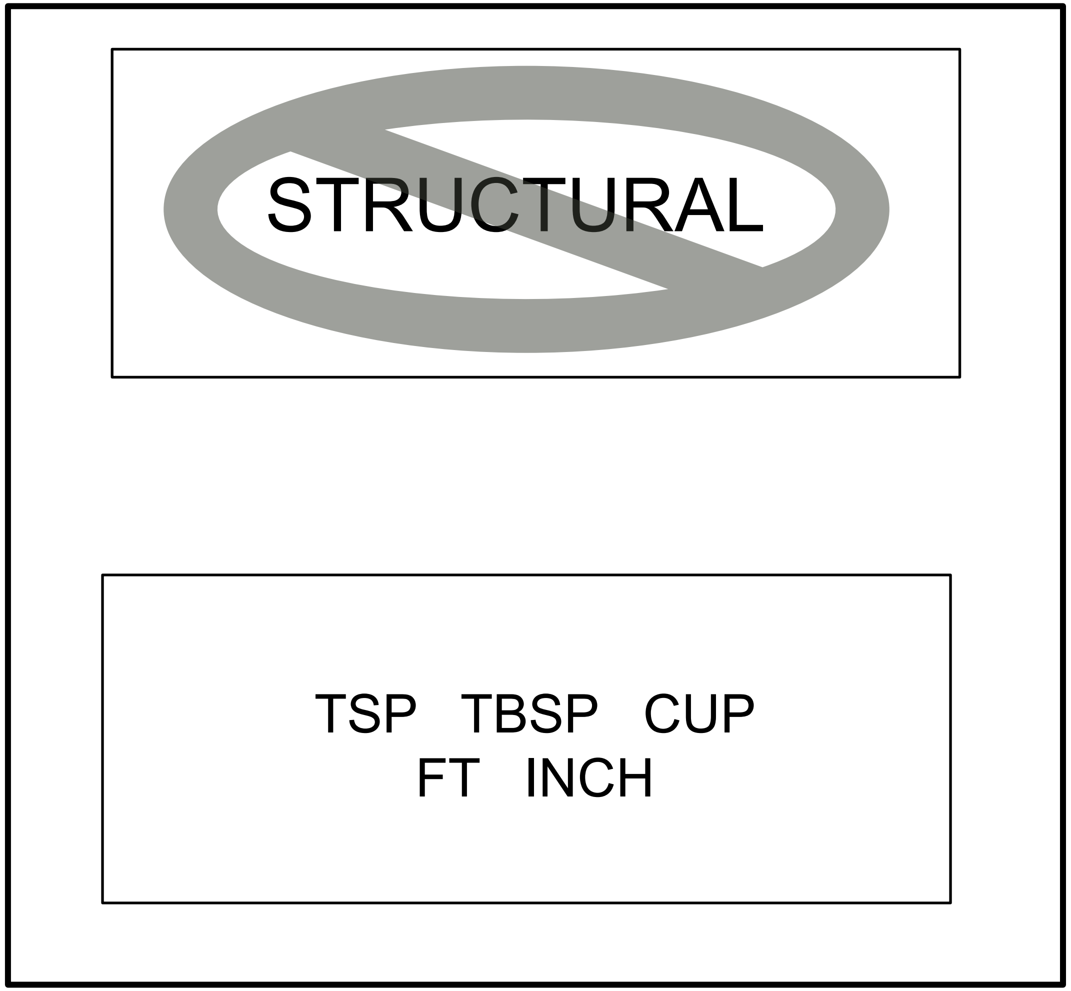
Nonstructural Wuzzles – is a riddle that uses words, letters and/or graphics to create a disguised word, phase or saying.

Example, NOON GOOD = GOOD AFTERNOON

# WUZZLES

| | |
|---|---|
| NOON | GOOD |

# NONSTRUCTURAL WUZZLES

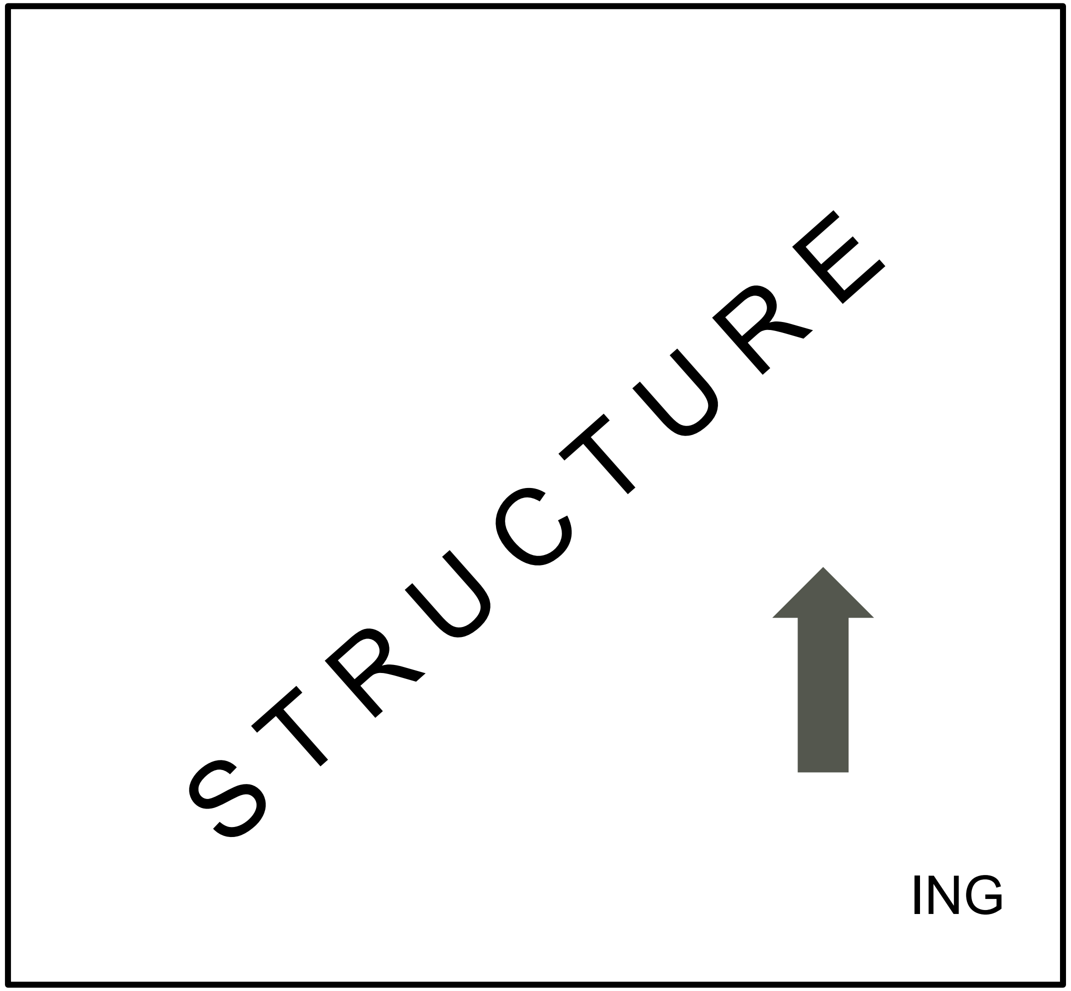


# NONSTRUCTURAL WUZZLES

BUY

________ ________ ________ ________ ________ ________

# NONSTRUCTURAL WUZZLES

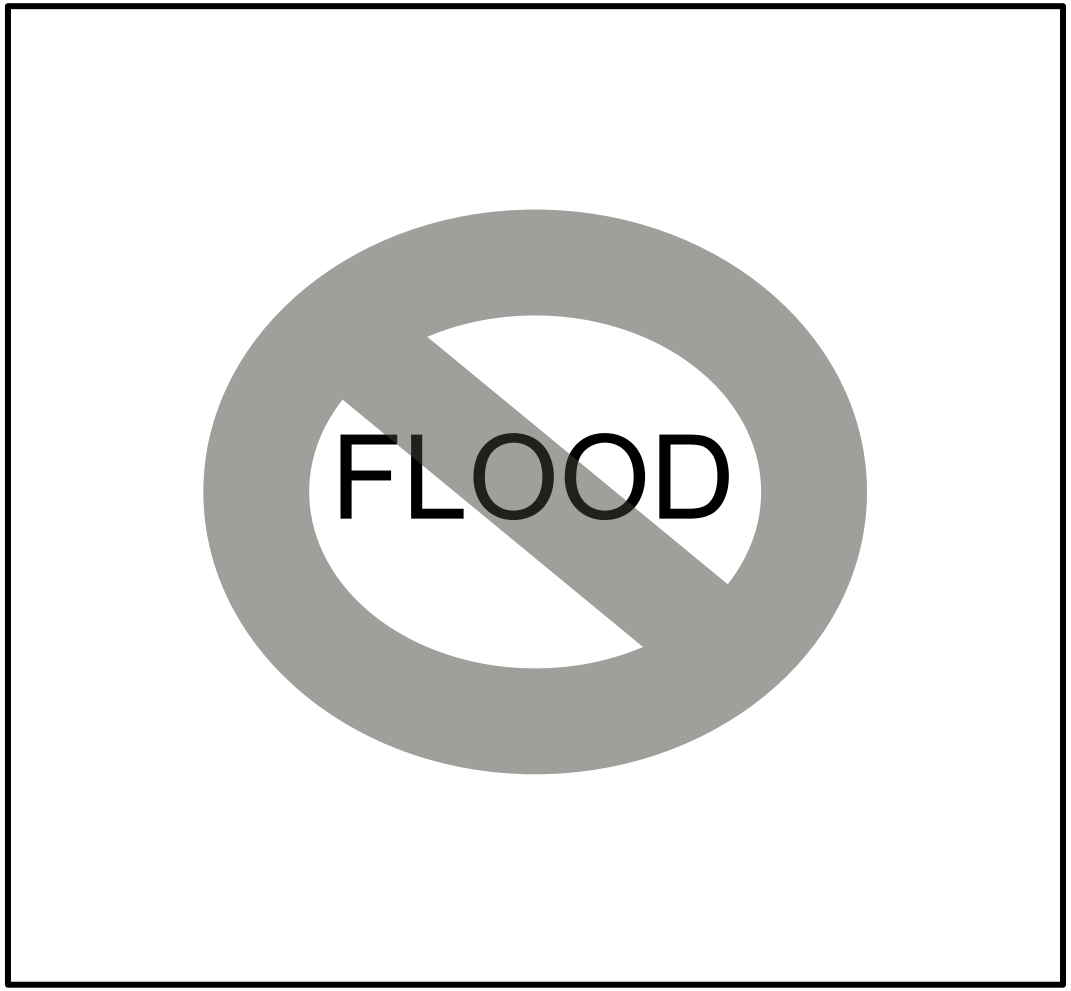


# NONSTRUCTURAL WUZZLES

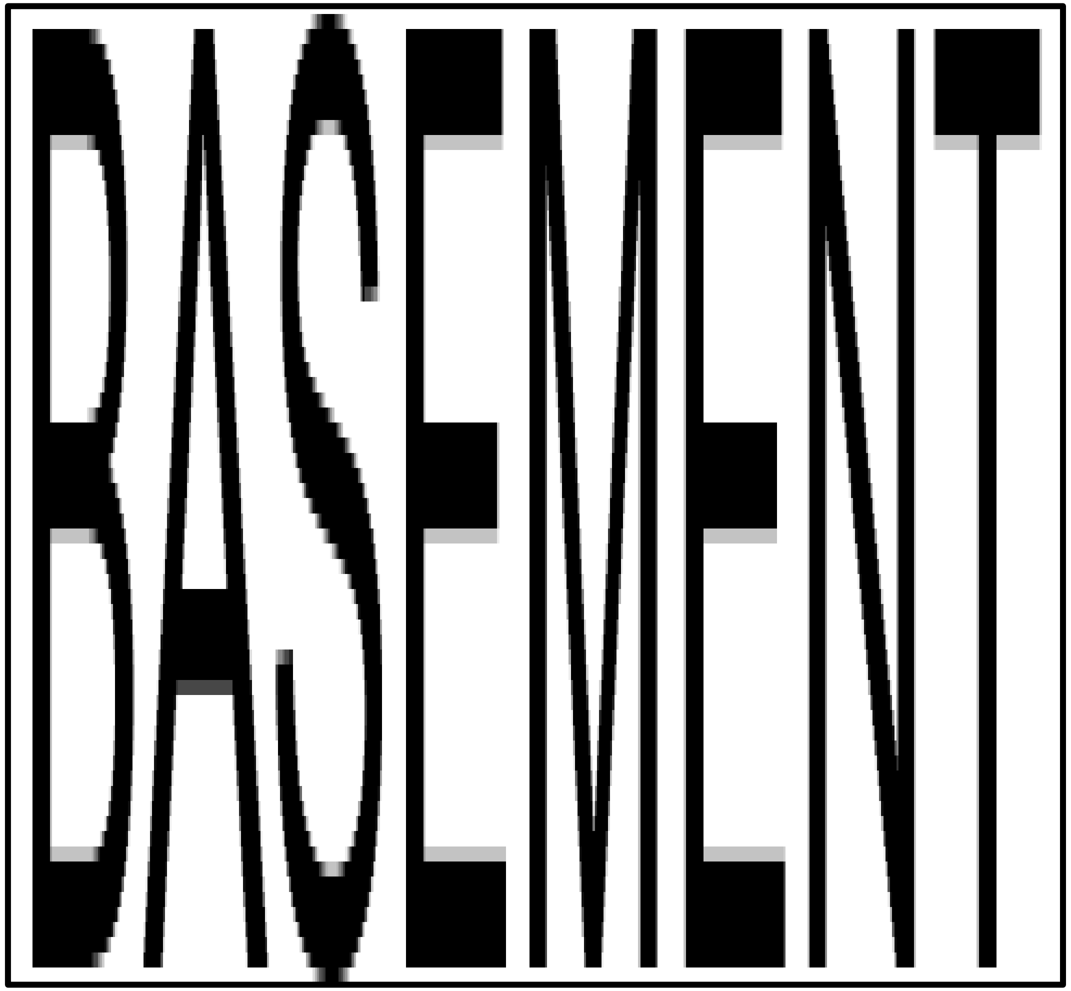
LOCATION

LOCATION

# NONSTRUCTURAL WUZZLES



# NONSTRUCTURAL WUZZLES



# QUESTIONS