

# ***The Anatomy of a Disaster***

*Ed Link, Director*

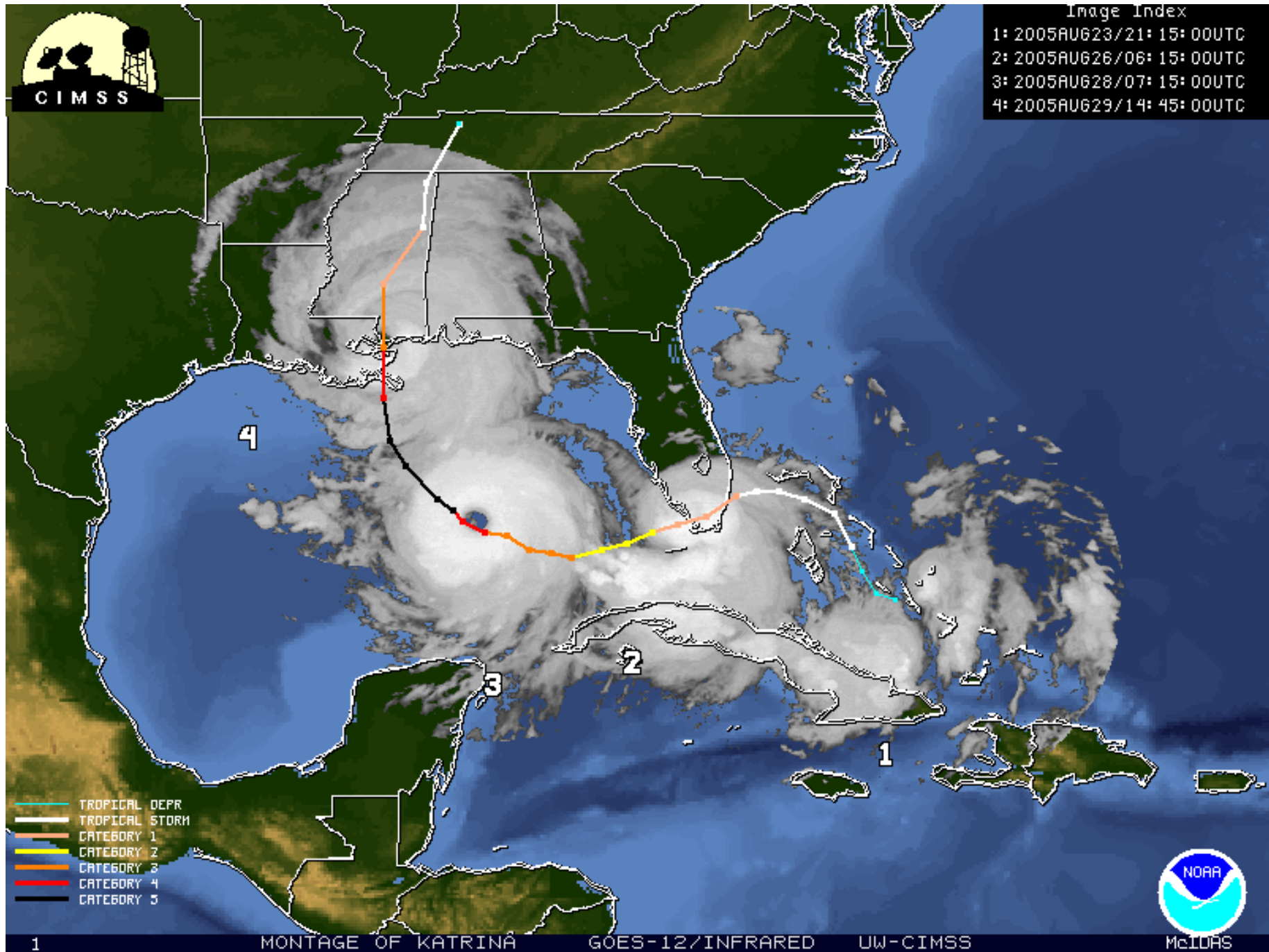
***Interagency Performance Evaluation  
Task Force (IPET)***



<https://ipet.wes.army.mil>



Image Index  
1: 2005AUG23/21: 15: 00UTC  
2: 2005AUG26/06: 15: 00UTC  
3: 2005AUG28/07: 15: 00UTC  
4: 2005AUG29/14: 45: 00UTC



- TROPICAL DEPR
- TROPICAL STORM
- CATEGORY 1
- CATEGORY 2
- CATEGORY 3
- CATEGORY 4
- CATEGORY 5



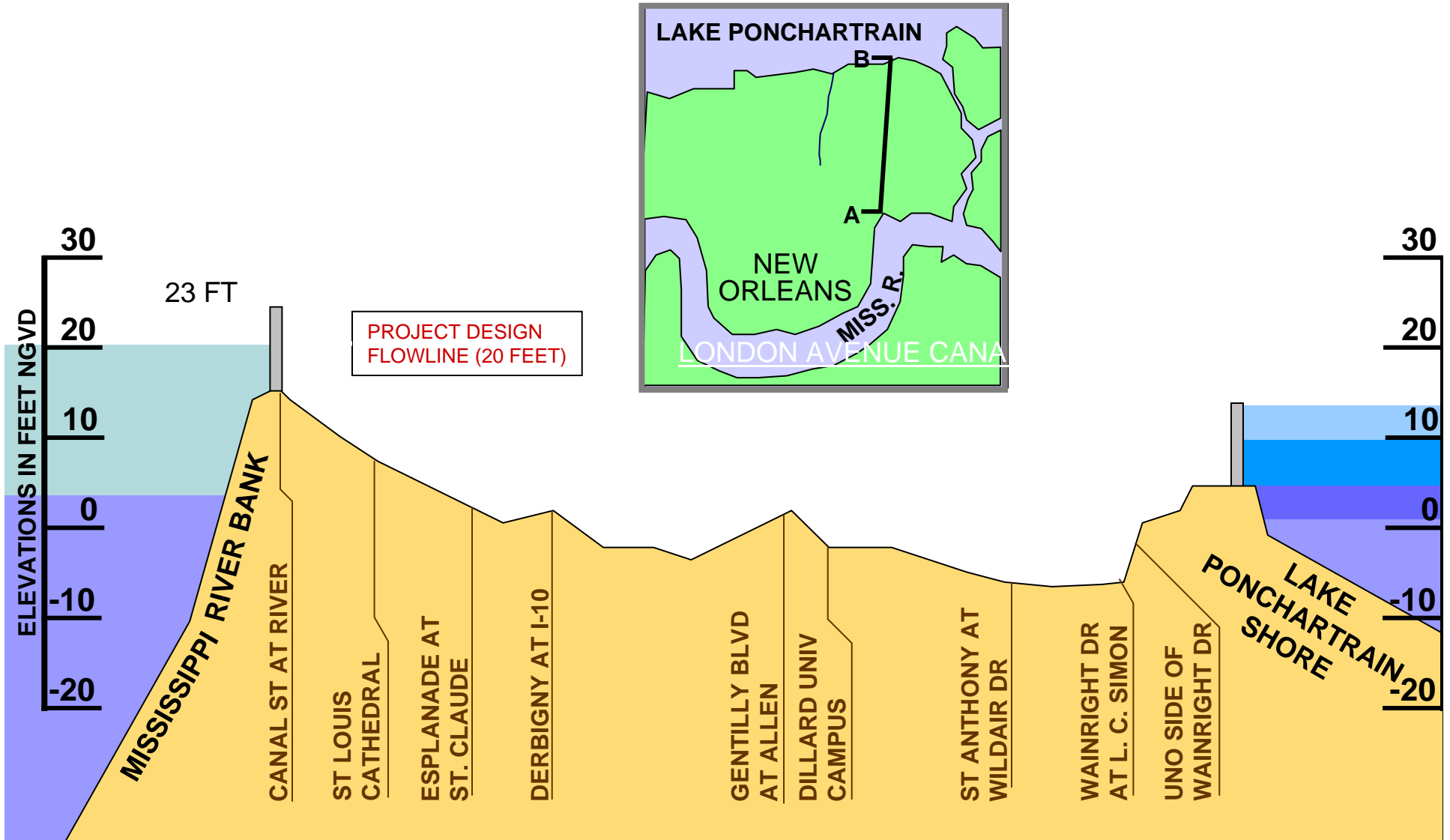
# ***Existing New Orleans Area Hurricane Protection***

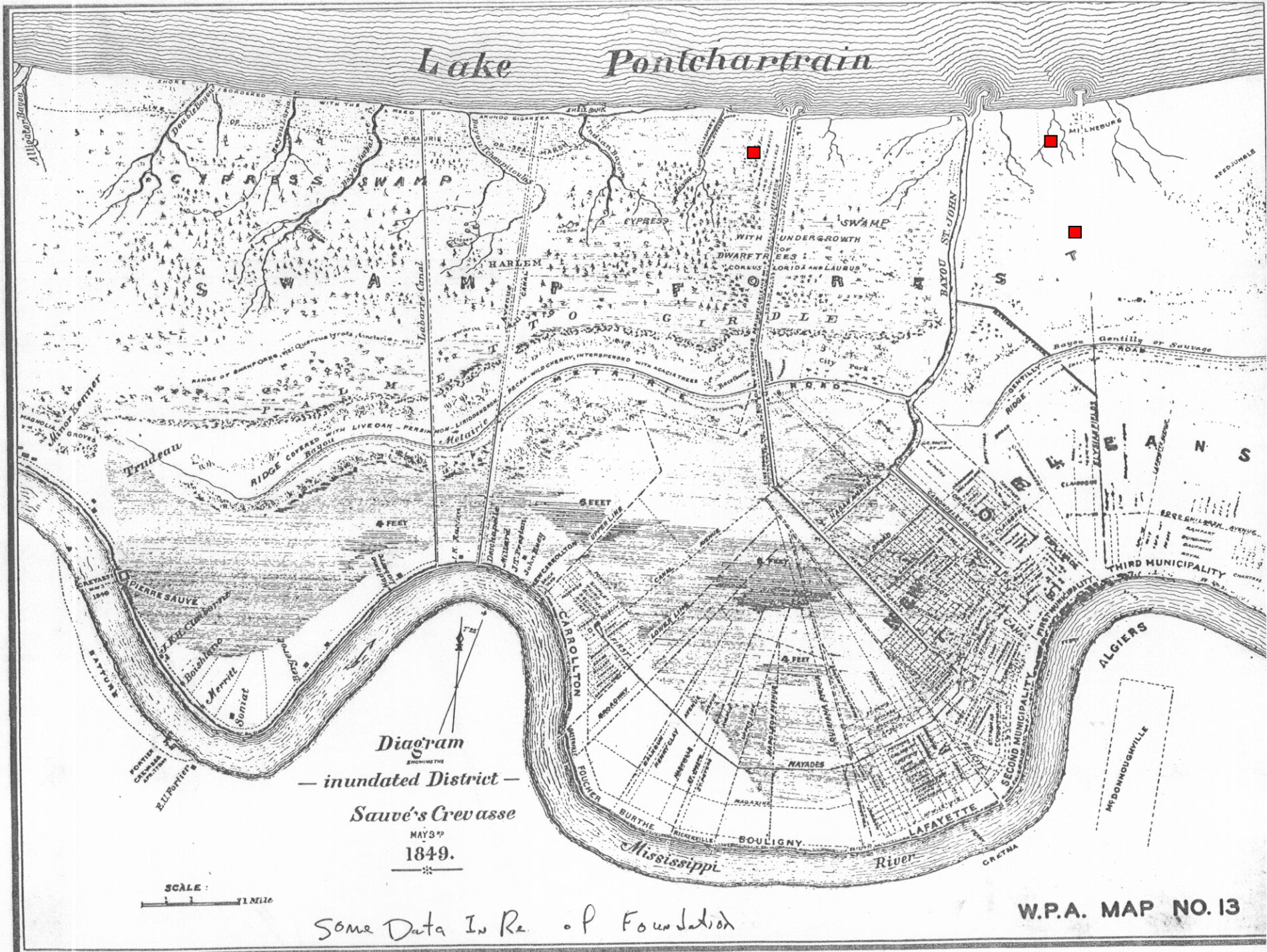


# ***New Orleans Drainage Basins***



# New Orleans Ground Profile





# Lake Pontchartrain

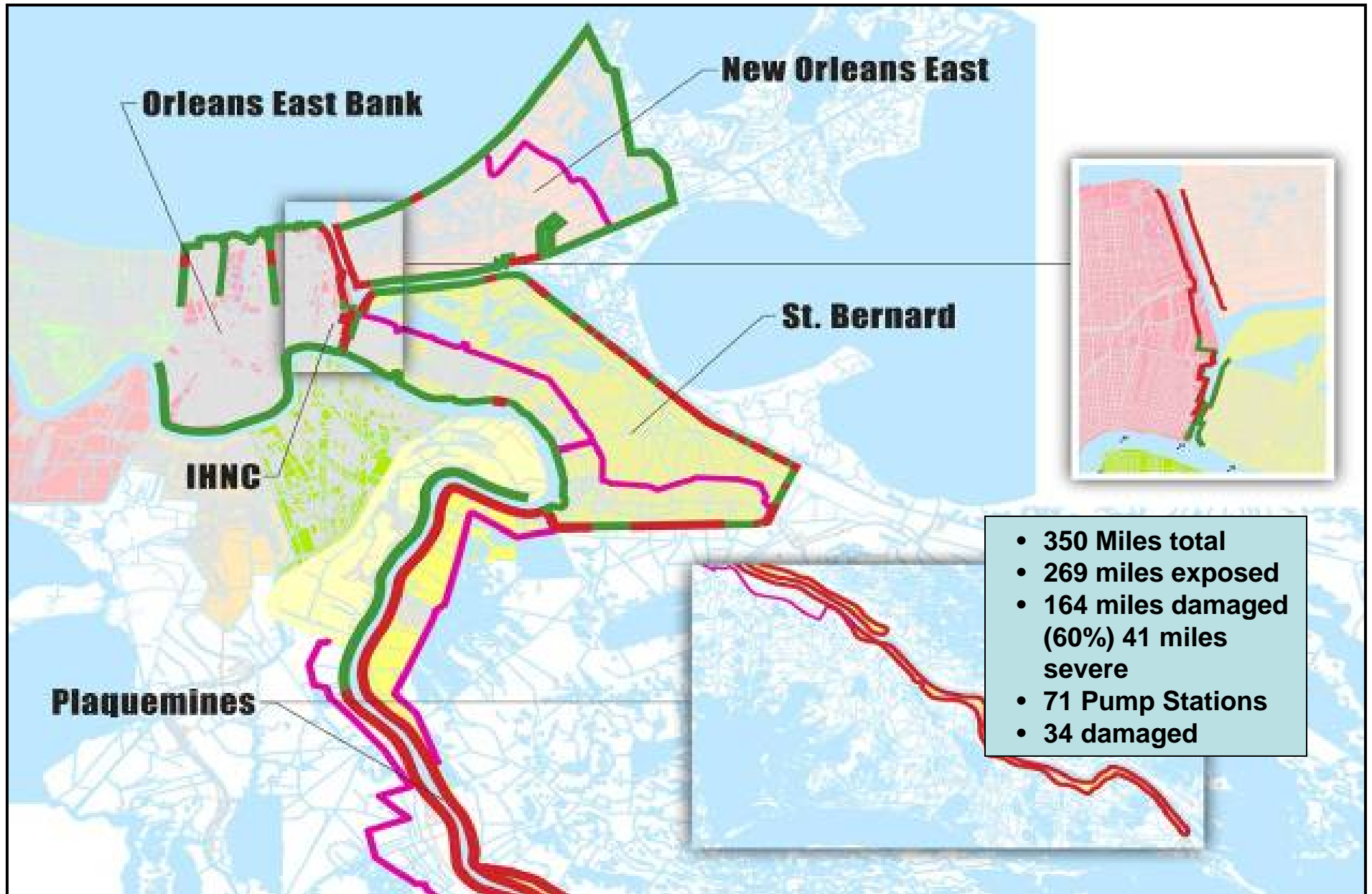
Diagram  
 SHOWING THE  
 — inundated District —  
 Sauvé's Crevasse  
 MAY 3<sup>rd</sup>  
 1849.

SCALE :  
 1 MILE

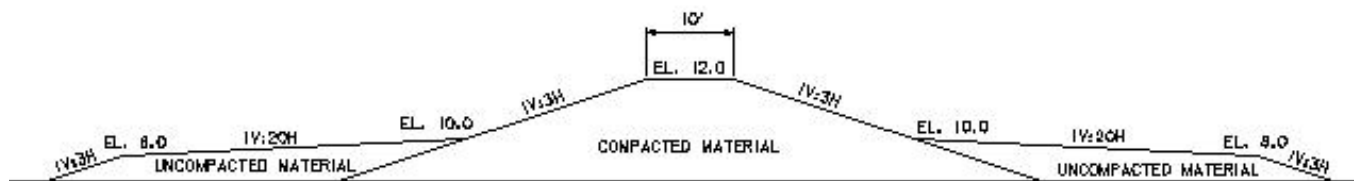
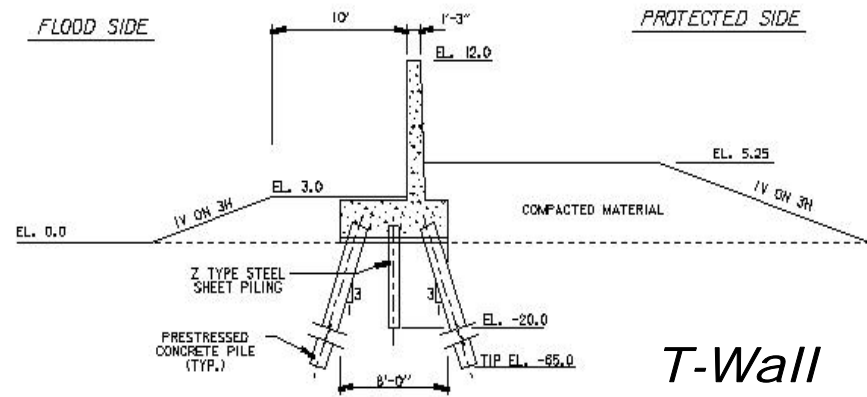
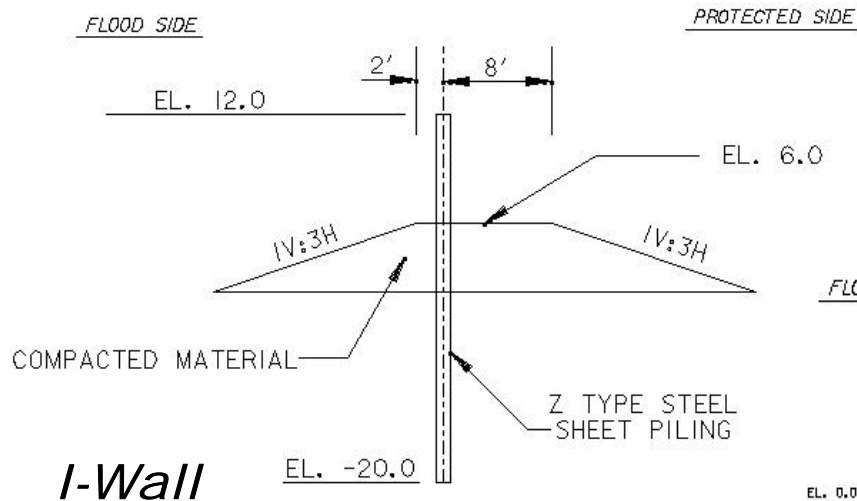
Some Data In Re. of Foundation

W.P.A. MAP NO. 13

# ***Hurricane Protection System Damage***



# The Hurricane Protection System Primary Components



Levee



# ***Levee Overtopping and Scour***



## ***Floodwall overtopping and failure***



# ***Structural Failures of I-Walls / levees along drainage canals***



London Ave Canal – Filmore Breach

SEP 7 2005

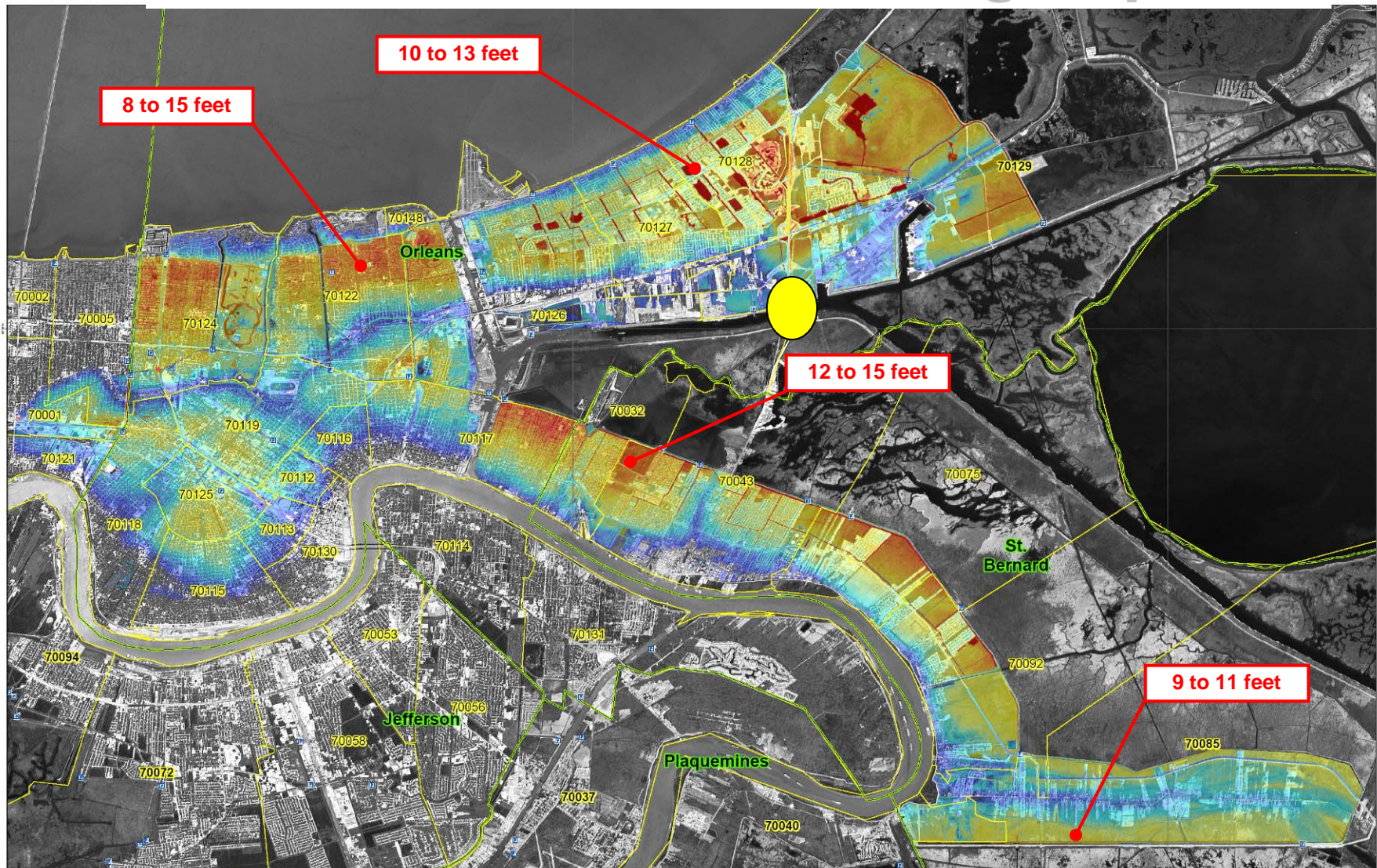
# ***Failure at Transitions***



# ***Overtopping but no failure***



# Katrina Maximum Flooding Depth



datum: North American Datum of 1983  
 Spheroid: Geoidetic Reference System 1980  
 Projection: Geographic  
 Background: SPOT Image  
 Revised: 2005-09-10



1:42,000



**Legend**

- Pumping Stations
  - Zip Code Boundary
  - County Line
- Max Flood Depth  
 High : 12 Ft  
 Low : 0 Ft



# ***Emergency Repairs***



# ***Temporary Surge Barriers***





# ***Un-watering New Orleans***



*53 days  
250 b gallons*

# *Temporary Fixes*



# ***Performance Evaluation is contributing to***

- **Repairs**: to hurricane damaged components by June 1, 2006
- **Restore**: undamaged levees / floodwalls to originally authorized heights by September 1, 2007
- **Complete**: constructed portions of authorized projects by September 2007
- **Higher Levels of Protection**: South Louisiana Hurricane Protection and Restoration Report – preliminary report due June 2006, final December 2007

***<https://ipet.wes.army.mil>***

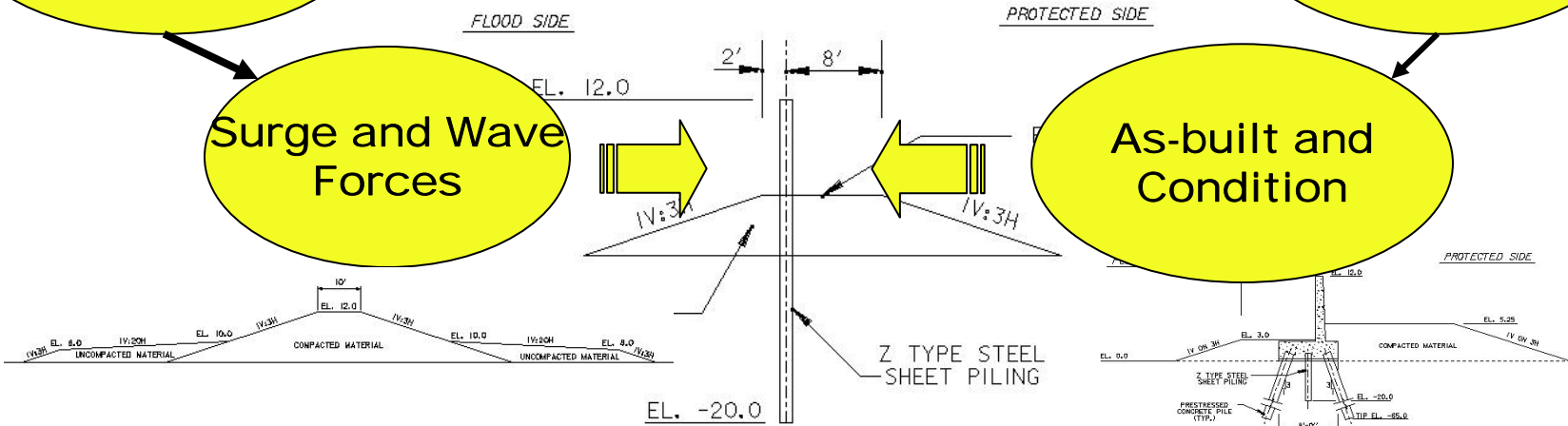
# Performance Evaluation

SPH & Auth Protection

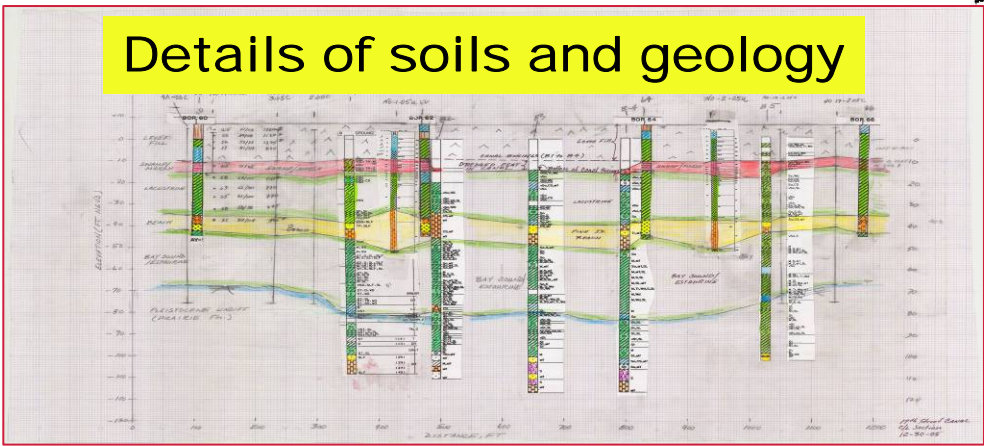
Design & Intent

Surge and Wave Forces

As-built and Condition

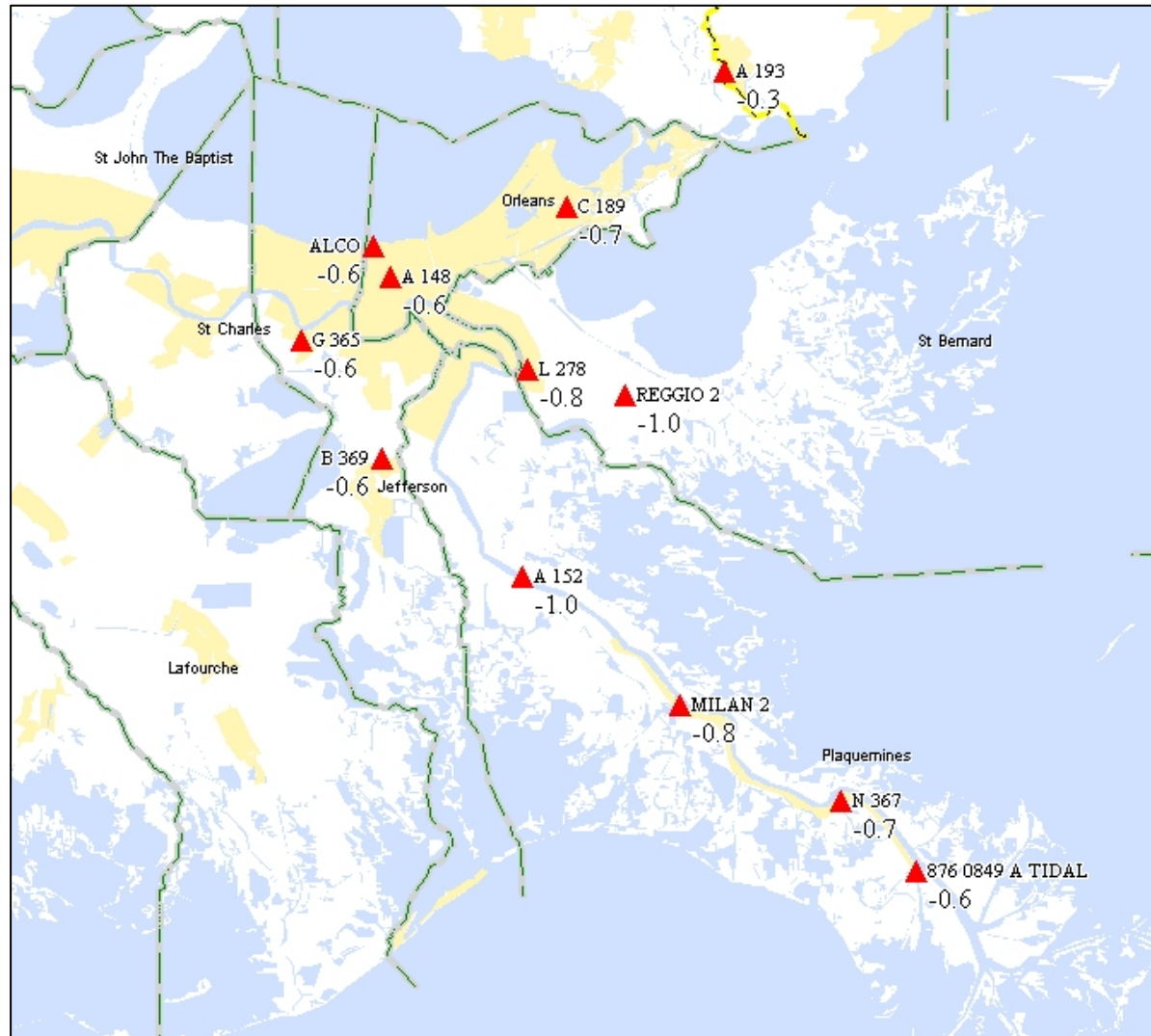


Observed Performance

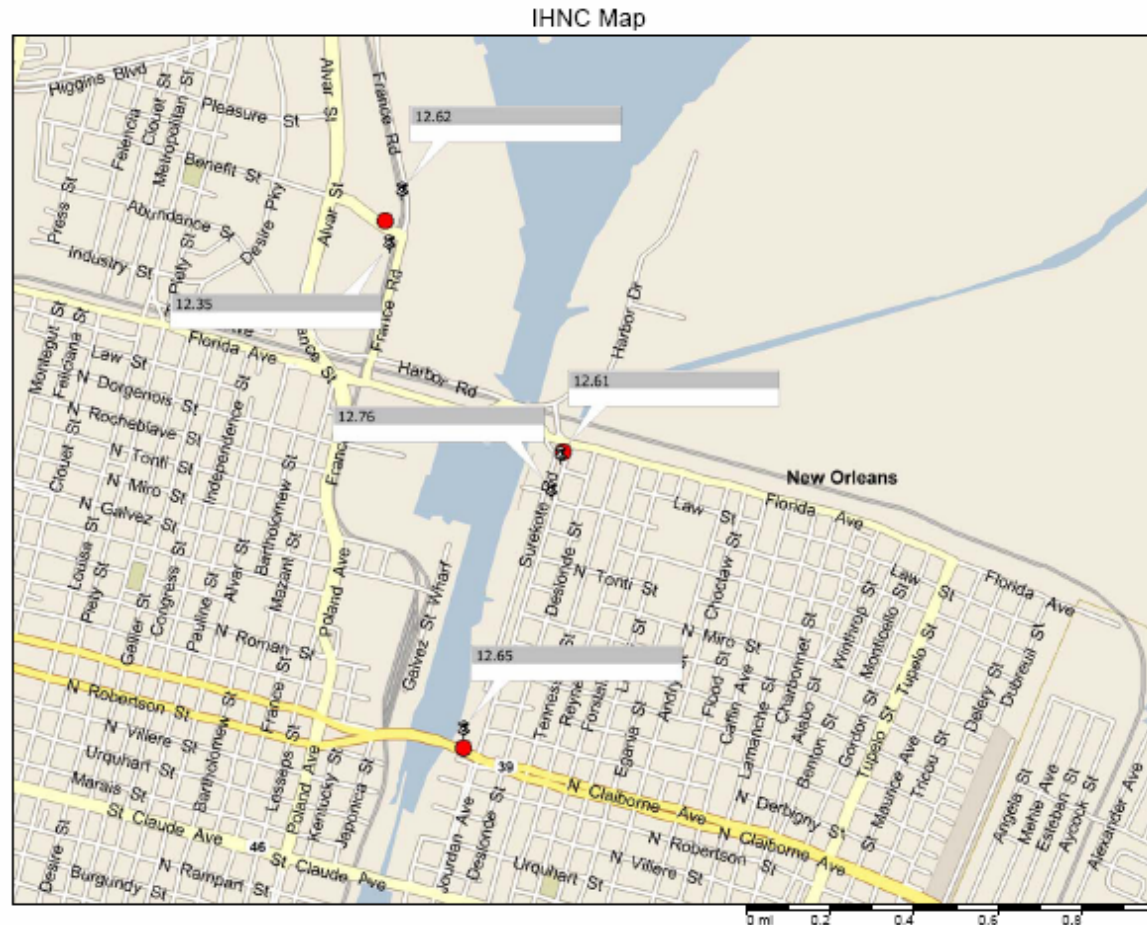


Expected Performance

# ***Elevation Difference between NGVD29 and NAVD88(2004.65), values in feet***

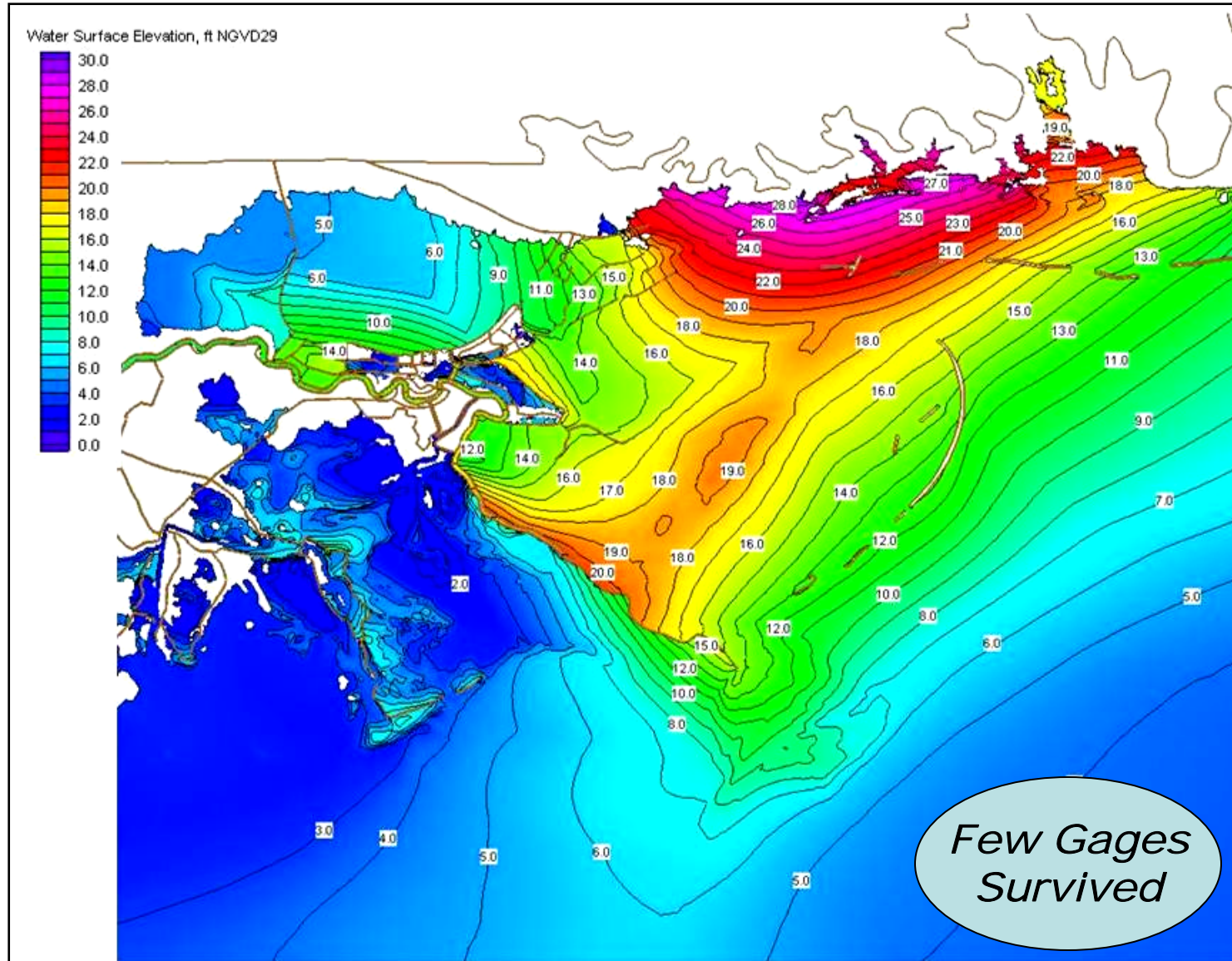


# IHNC Protection losses



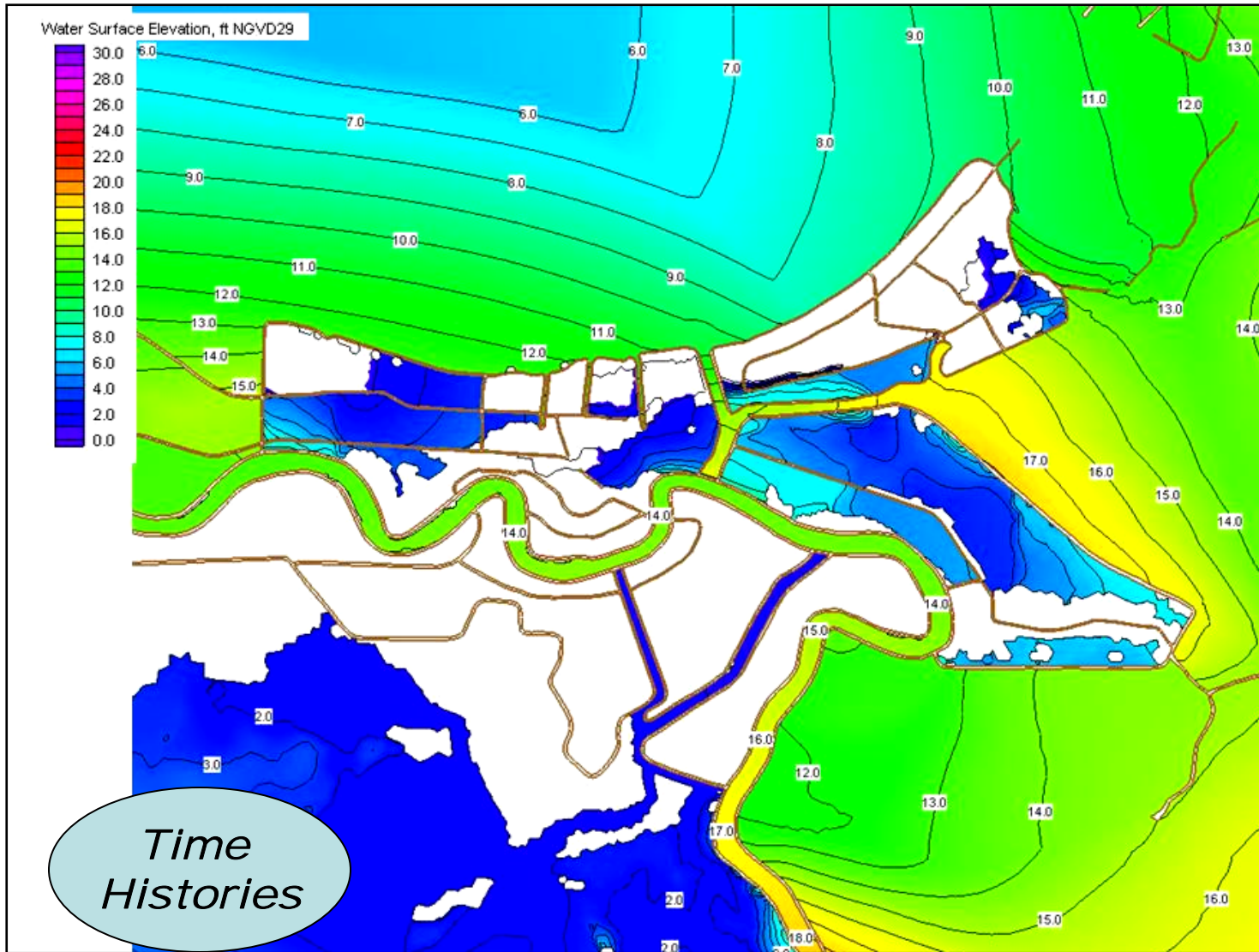
This represents approximately a 2.7 ft loss of protection since the 15.0-ft floodwall was constructed ca 1969.

# Storm Surge Maximums



H\* Winds, ADCIRC, NGVD29

# Max Computed Storm Surge

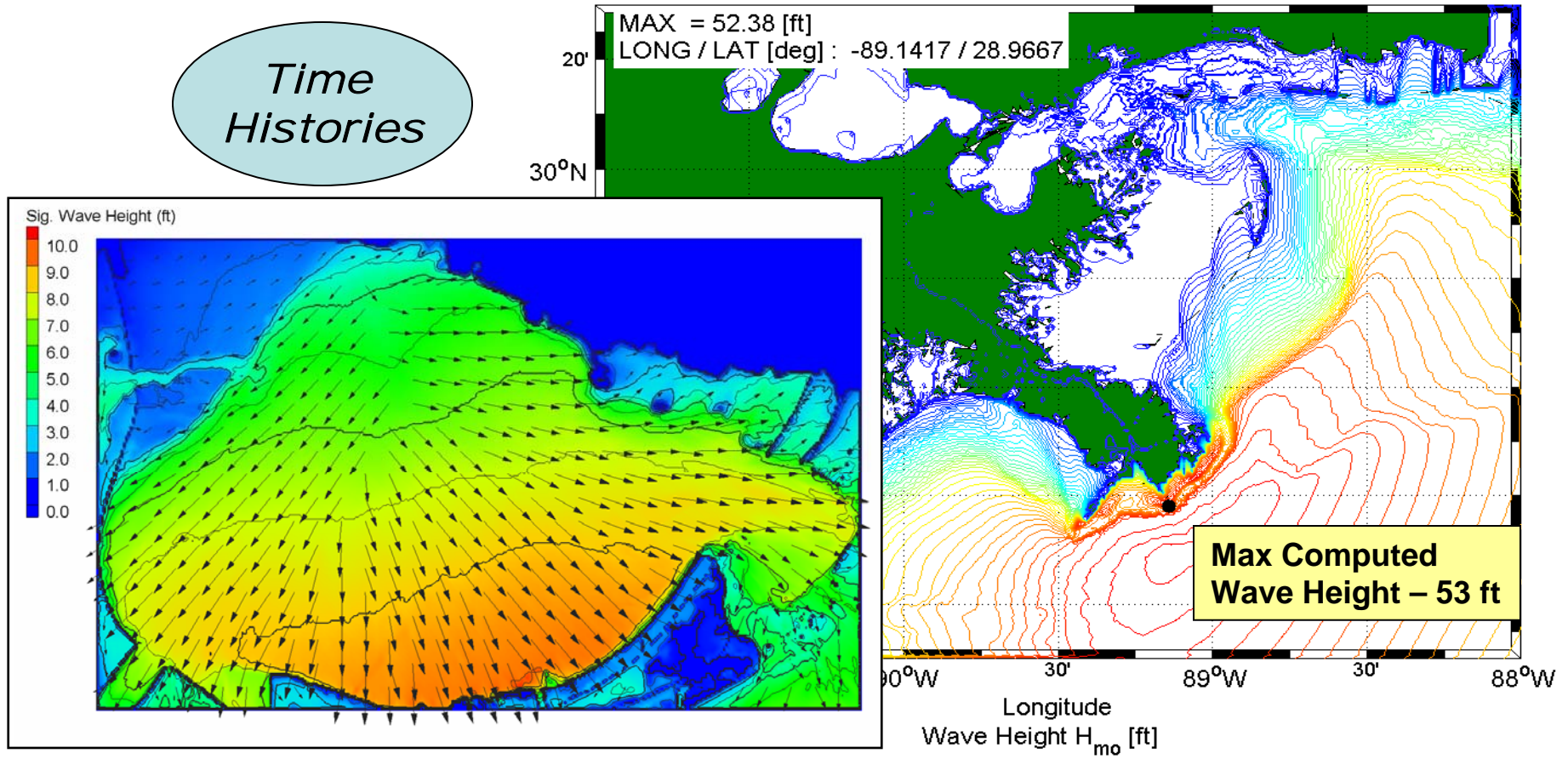


NGVD 29, 0900 CDT, H\* Winds



# Nested Wave Modeling

Time Histories

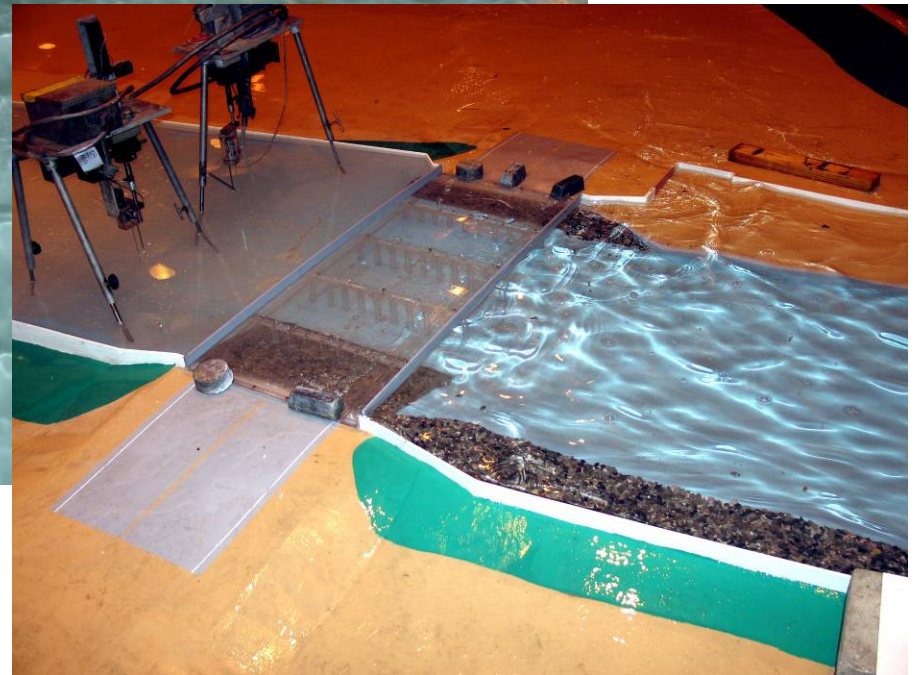


Max Wave Height Map, in feet

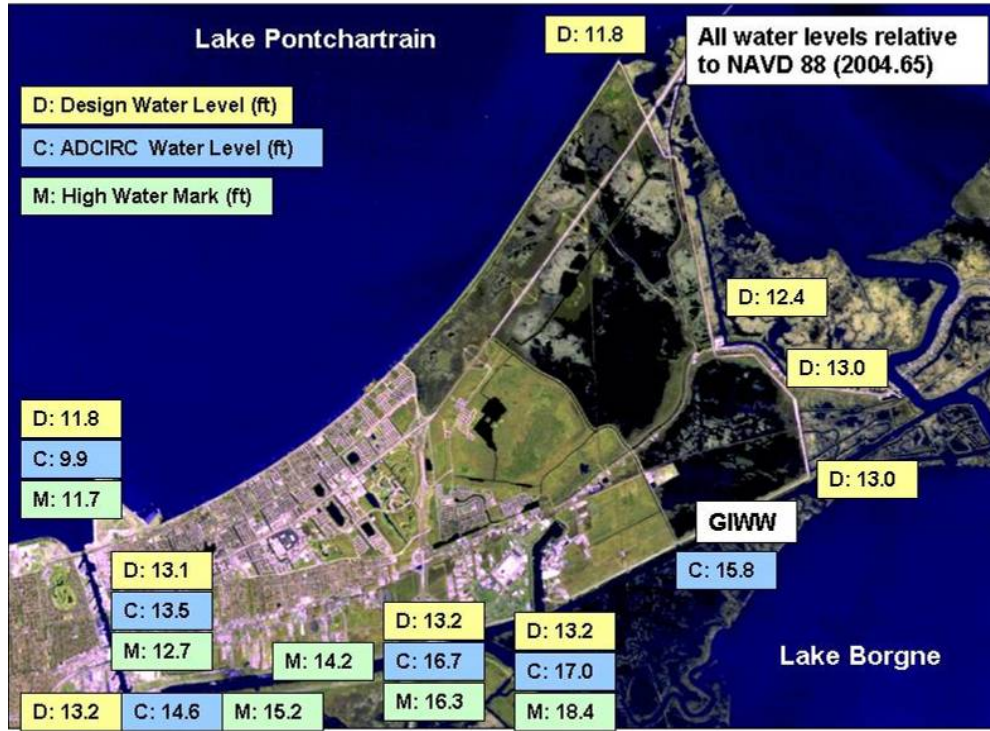
# ***17<sup>th</sup> Street Canal 1:50 scale physical model***



*Wave environment at  
time of breach*



# Katrina vs Design

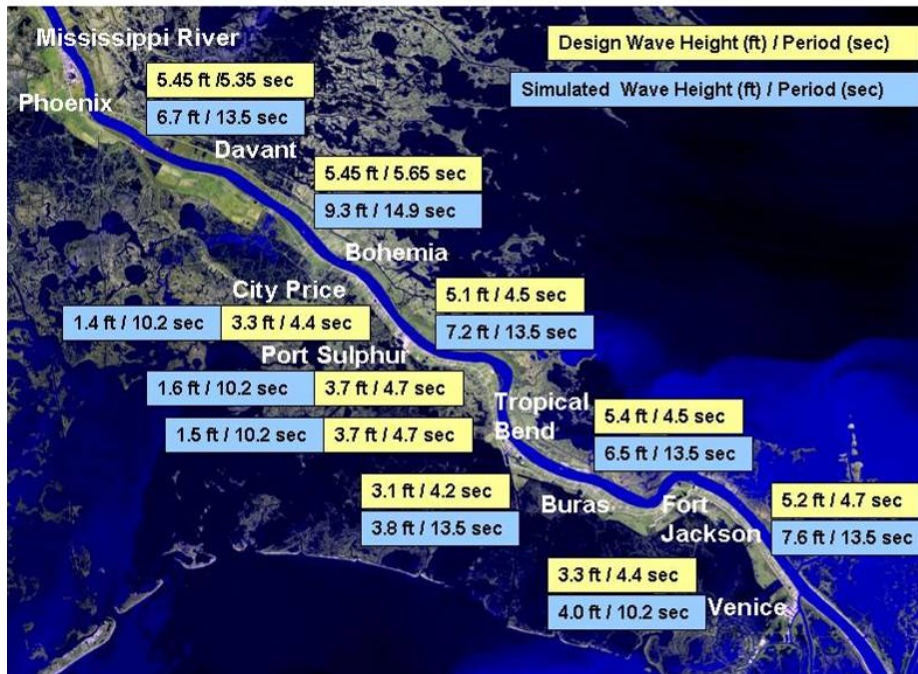


Surge

## Waves

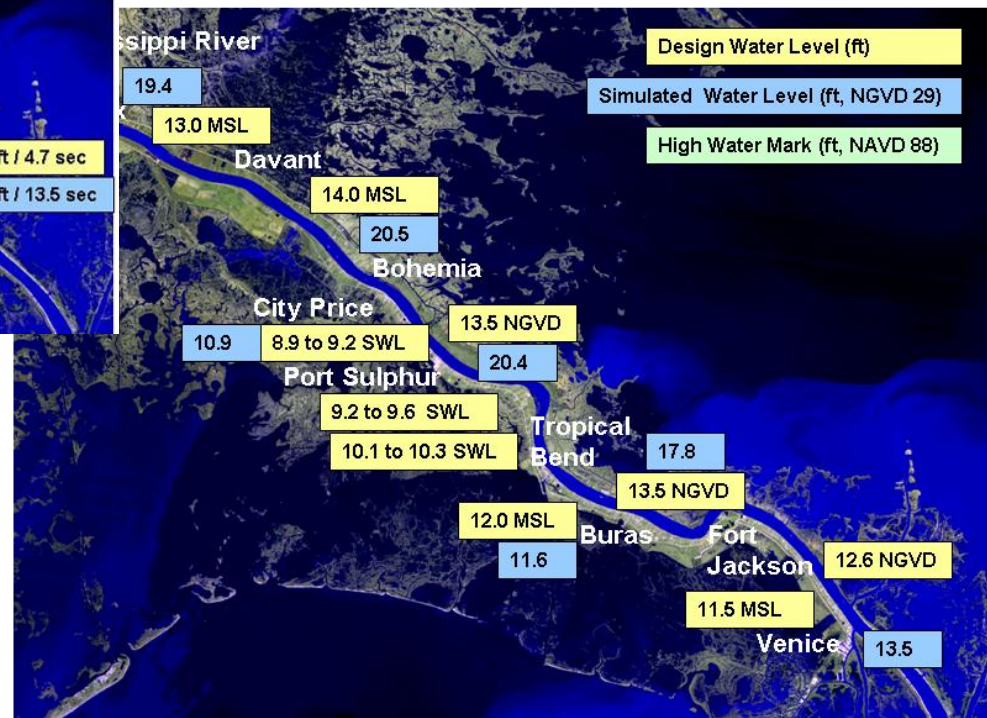


# Katrina vs Design

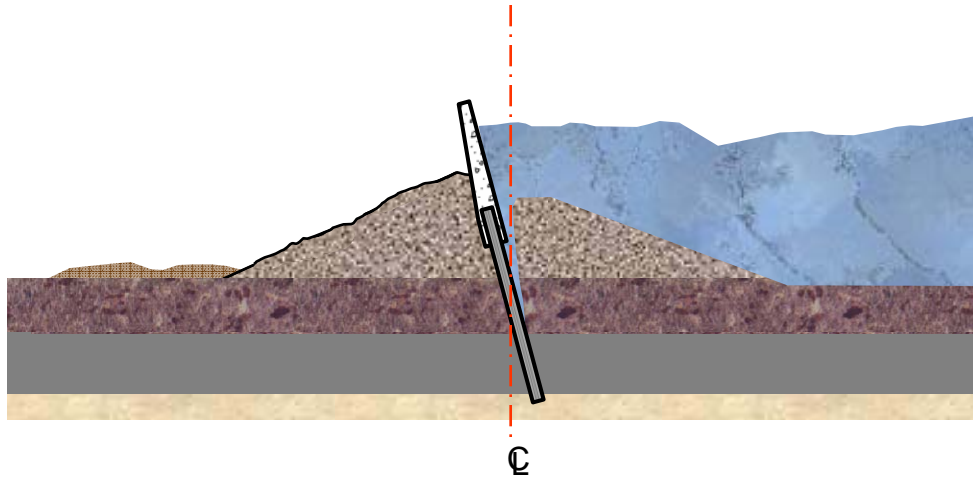


Surge

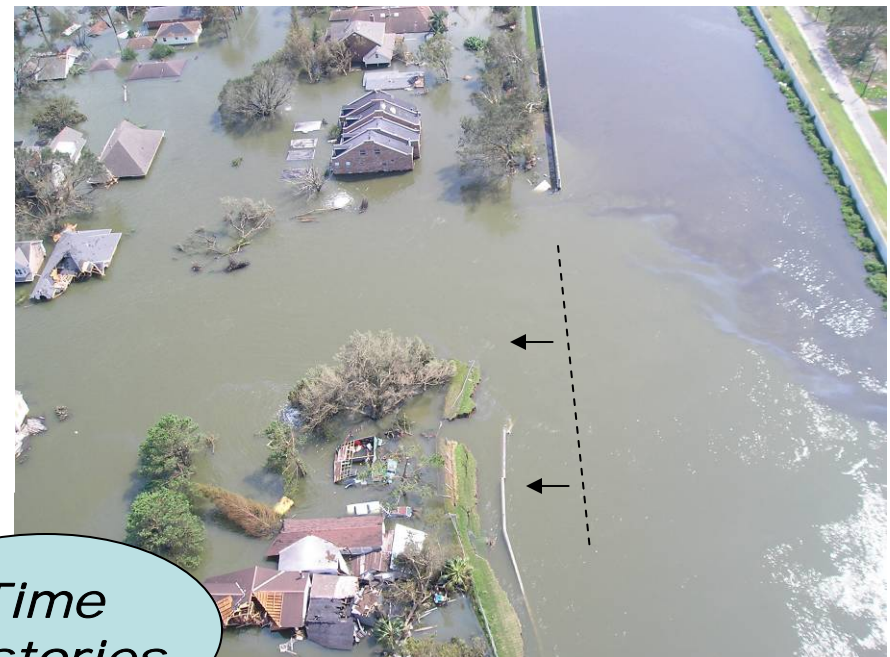
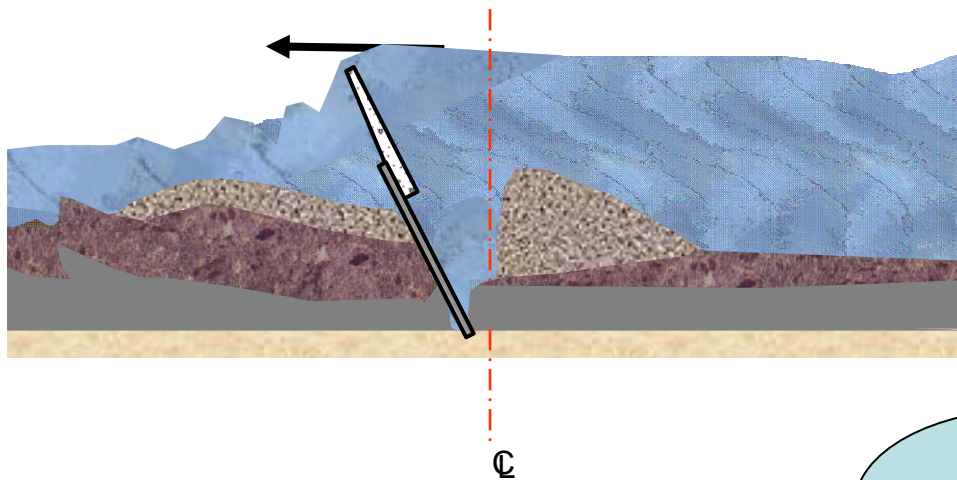
## Waves



# 17th Street Canal Failure Mechanism



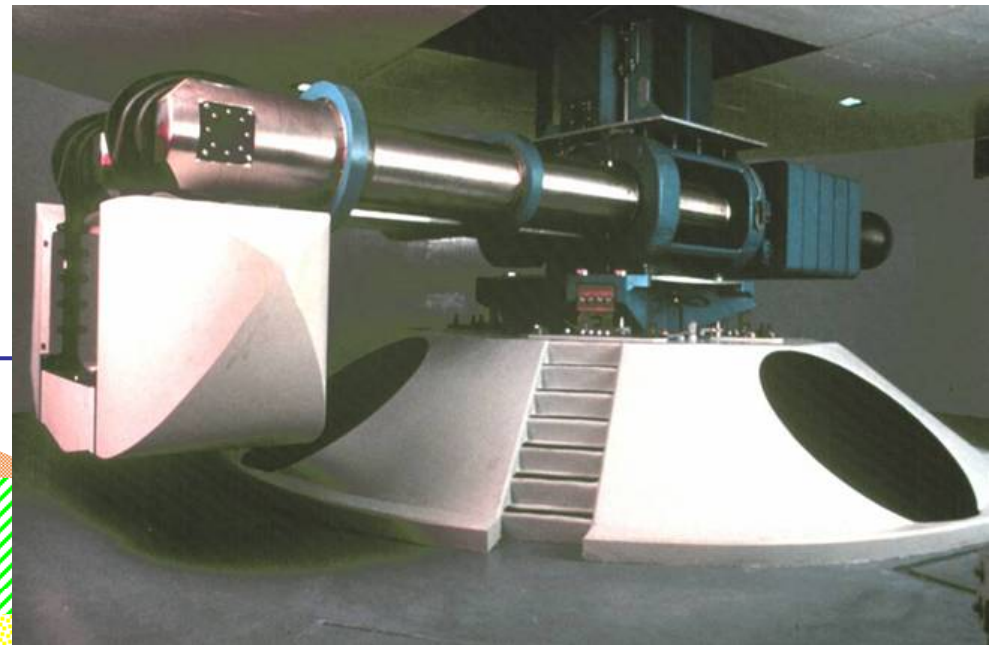
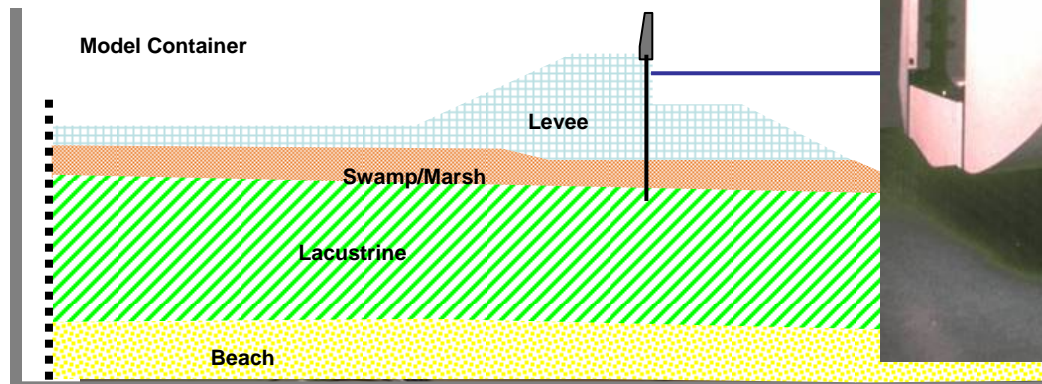
*Apply to Assessment of undamaged reaches*



*Time Histories*

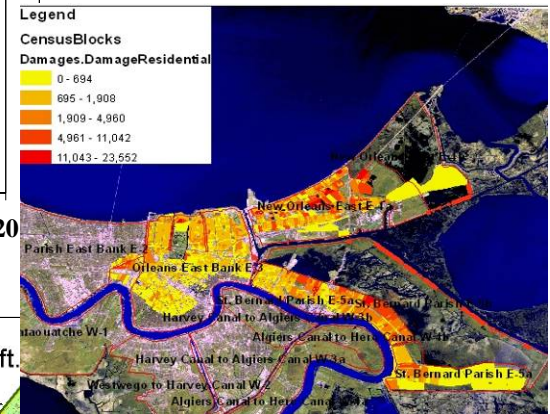
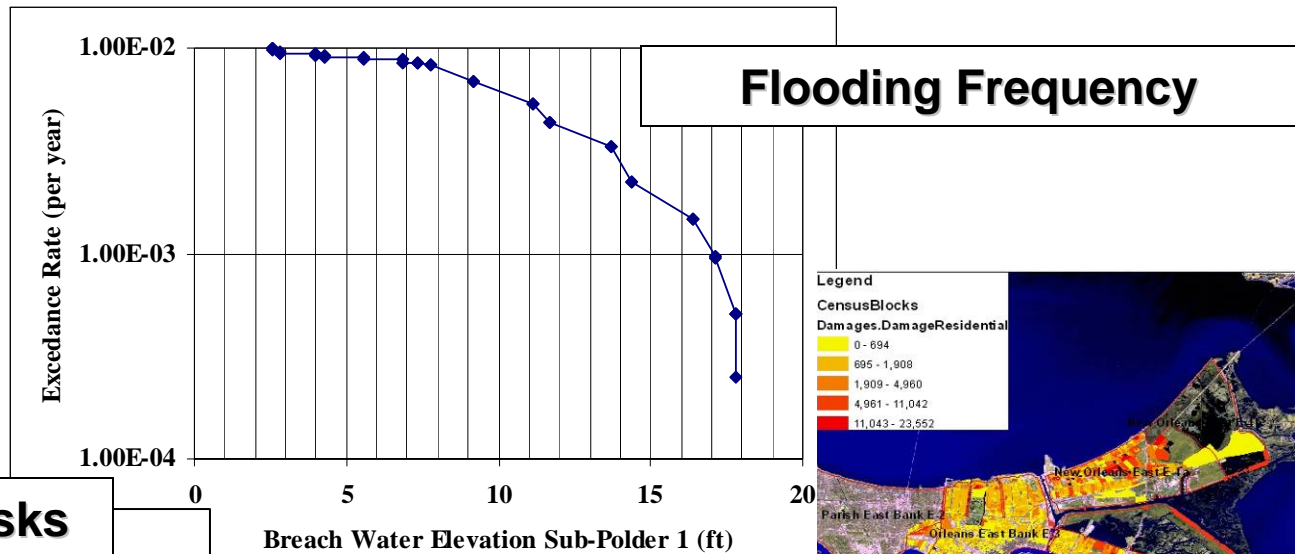
# Centrifuge Validation

*1/50 scale model at 50 g*

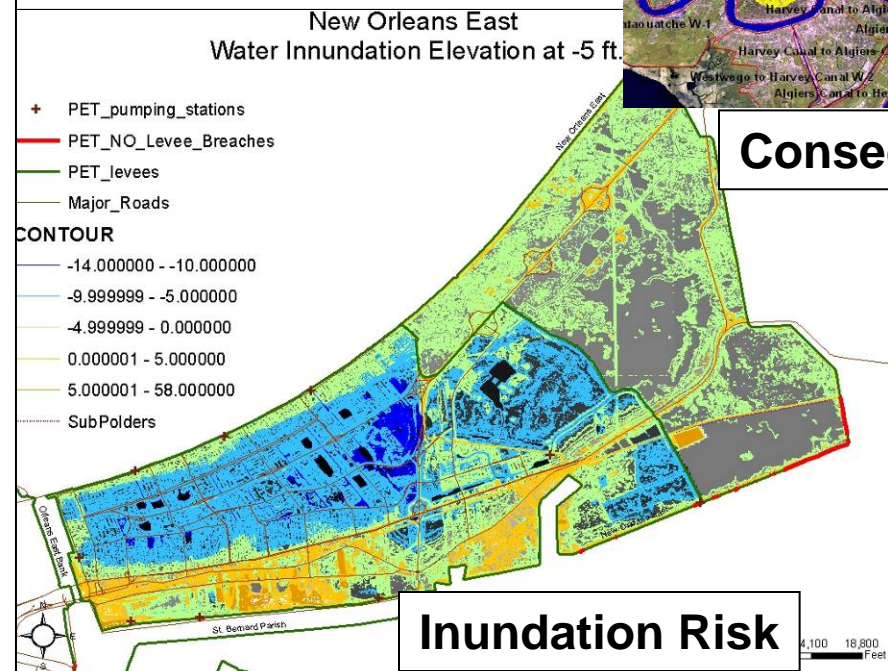
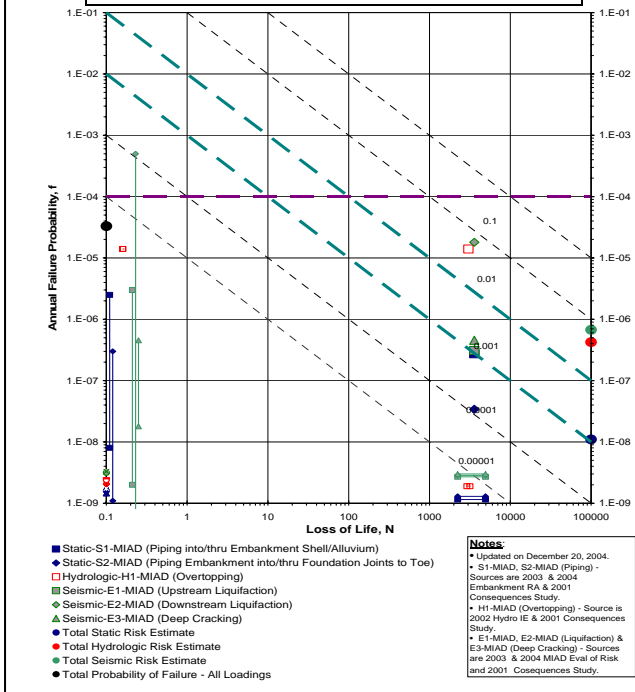


*With RPI  
& Geo Delft*

# Risk and Reliability

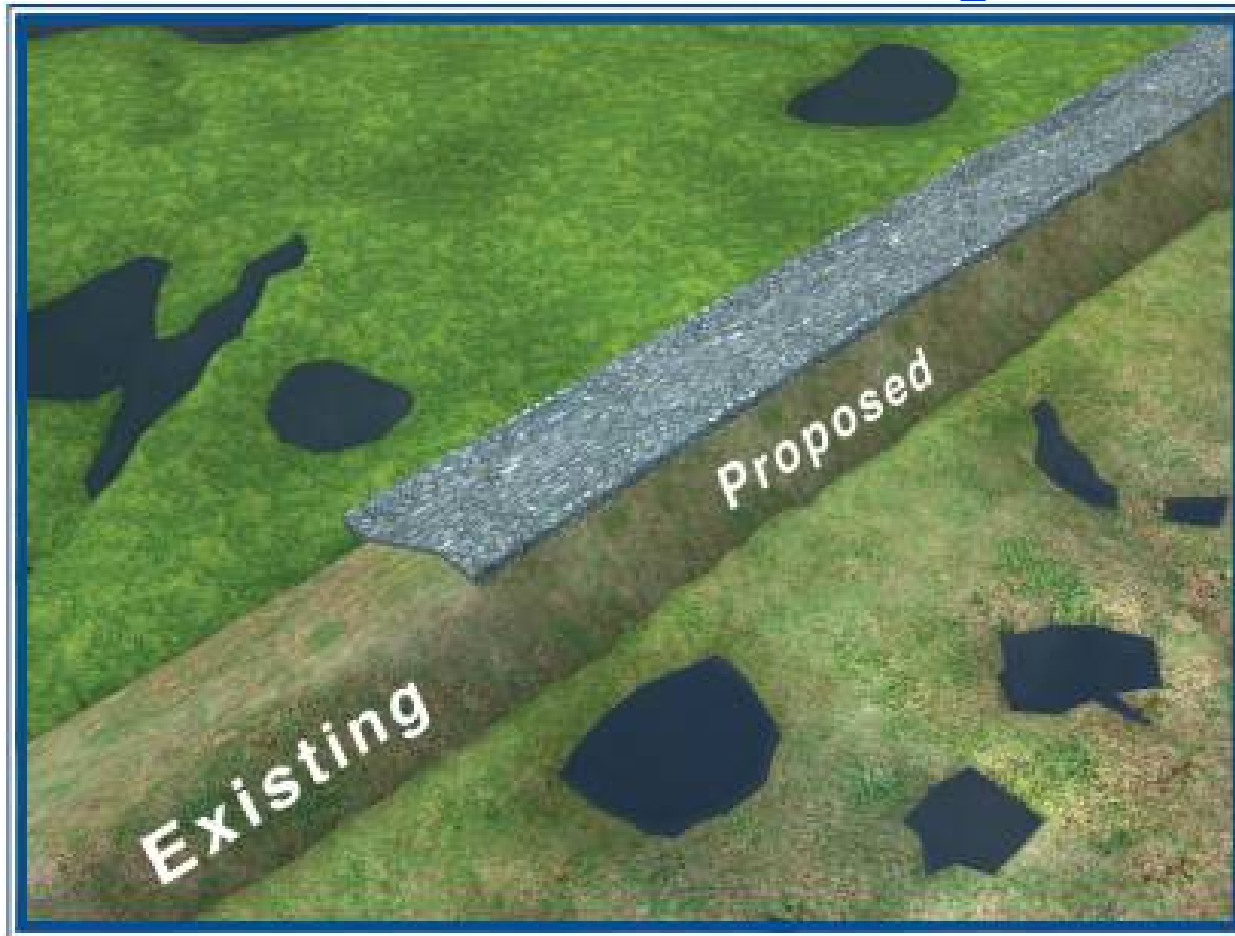


## Component Risks



# ***Southeast Louisiana HPS Improvements***

## **Selective Armoring**

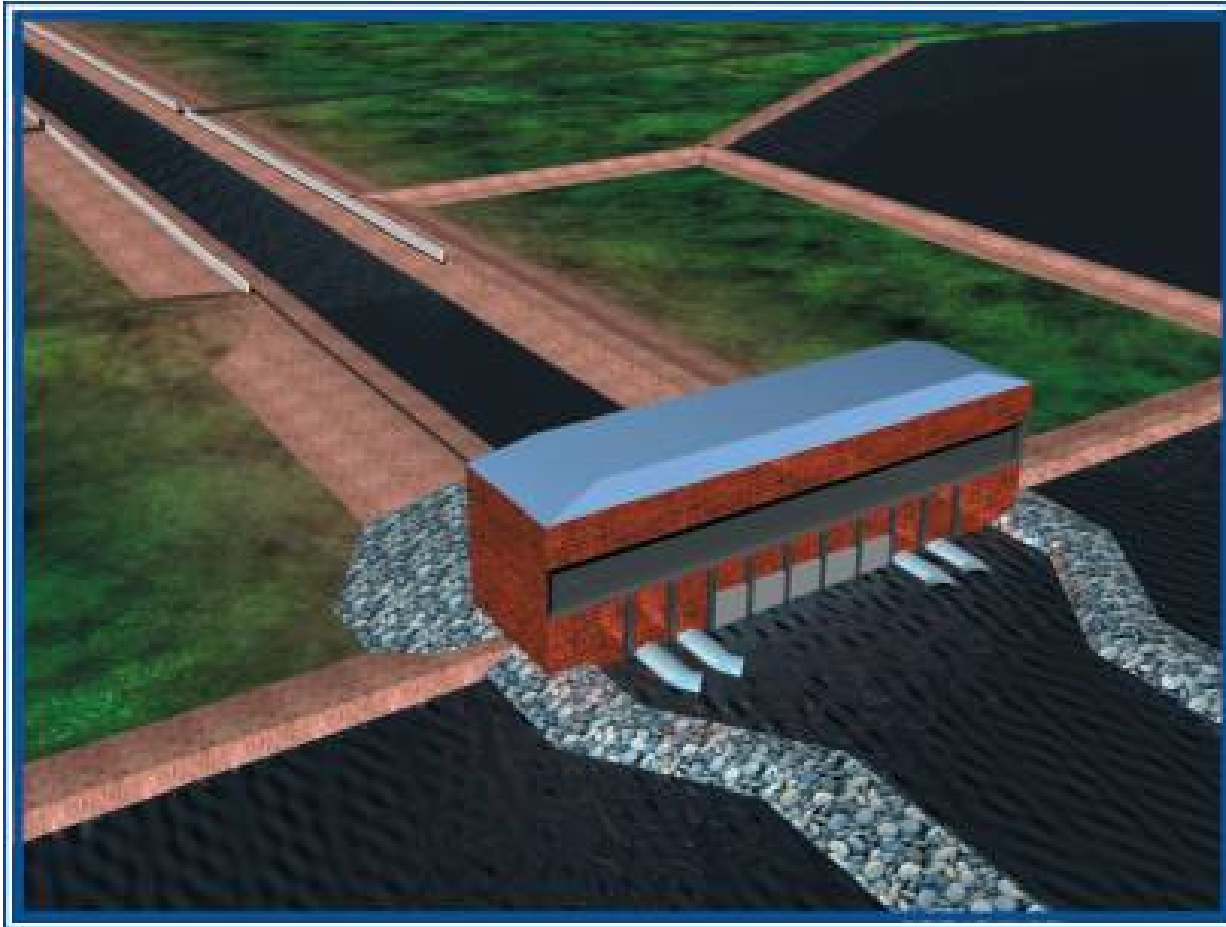


- Levees and floodwalls will be armored at critical points to resist damage from overtopping
- Transitions points between levees, floodwalls, and other structures will also be armored



# ***Southeast Louisiana HPS Improvements***

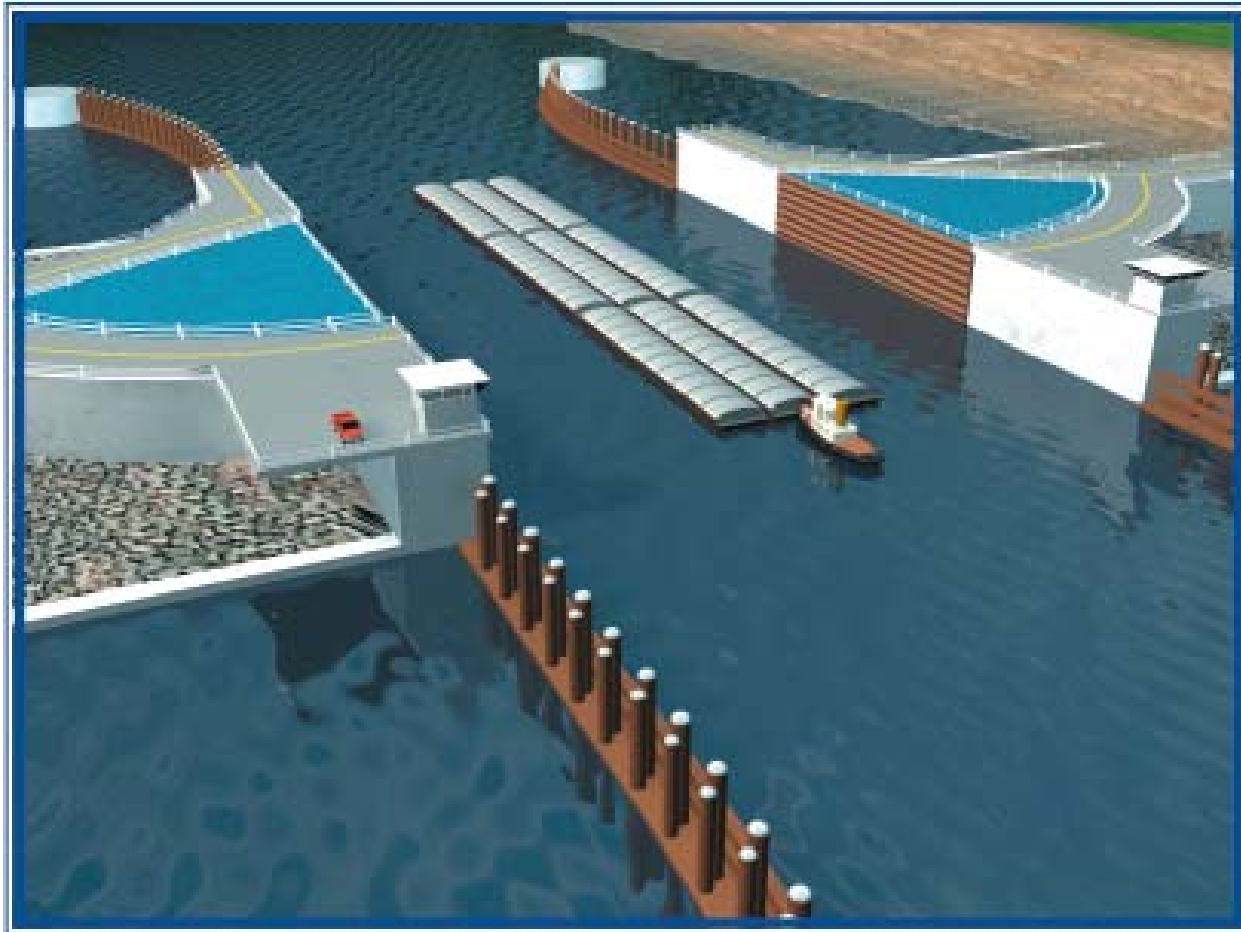
## **Outfall Canal Closures**



- Three locations on Lake Ponchartrain
- Provide New Orleans with rainwater and overtopping drainage
- Prevent storm surge into canals
- Removes 14 miles of floodwalls from primary HPS

# ***Southeast Louisiana HPS Improvements***

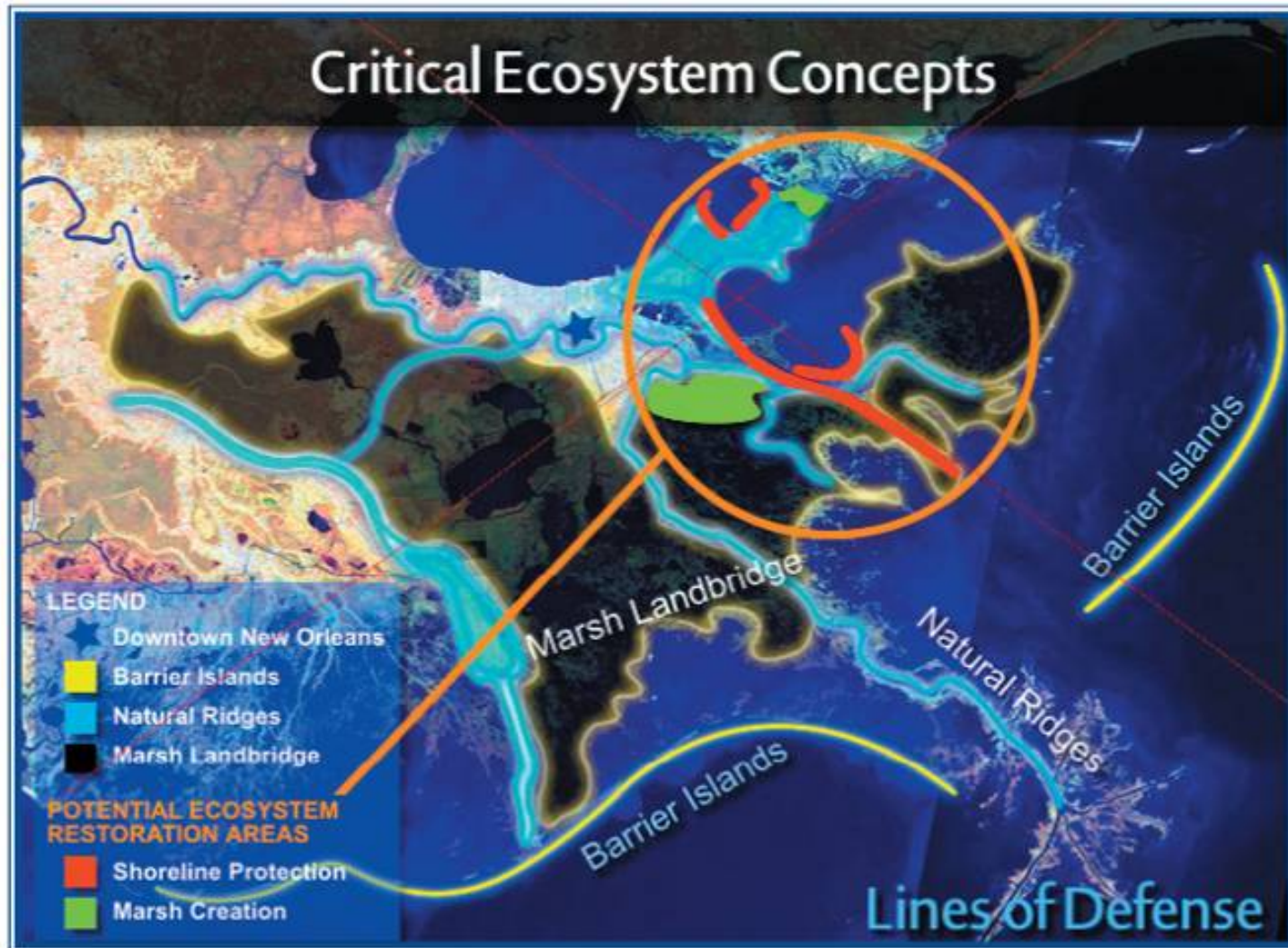
## **Navigable Flood Gates**



- **Two Locations:**
  - **Seabrook**
  - **GIWW/MRGO**
- **Prevents storm surge from Industrial Harbor area**
- **Removes 20 miles of levees and floodwalls from primary HPS**

# ***Southeast Louisiana HPS Improvements***

## **Ecosystem Restoration**



***Was this our wake up call?***



## ***Lessons Learned***

- Resilient Gages are needed
- Question Vertical References & Elevations
- New Analysis Tools 'Rock', but they need quality input
- Looking back is easier than looking forward
- Our practice and policies need continuous renewal
- We suffer from a national complacency about "protection"