OVERVIEW OF THE STATE'S COASTAL MASTER PLAN AND ITS IMPORTANCE TO NEW ORLEANS

Karim Belhadjali, Coastal Protection and Restoration Authority

Coastal Protection and Restoration Authority

Single state entity with authority to articulate a clear statement of priorities to achieve comprehensive coastal protection for Louisiana.

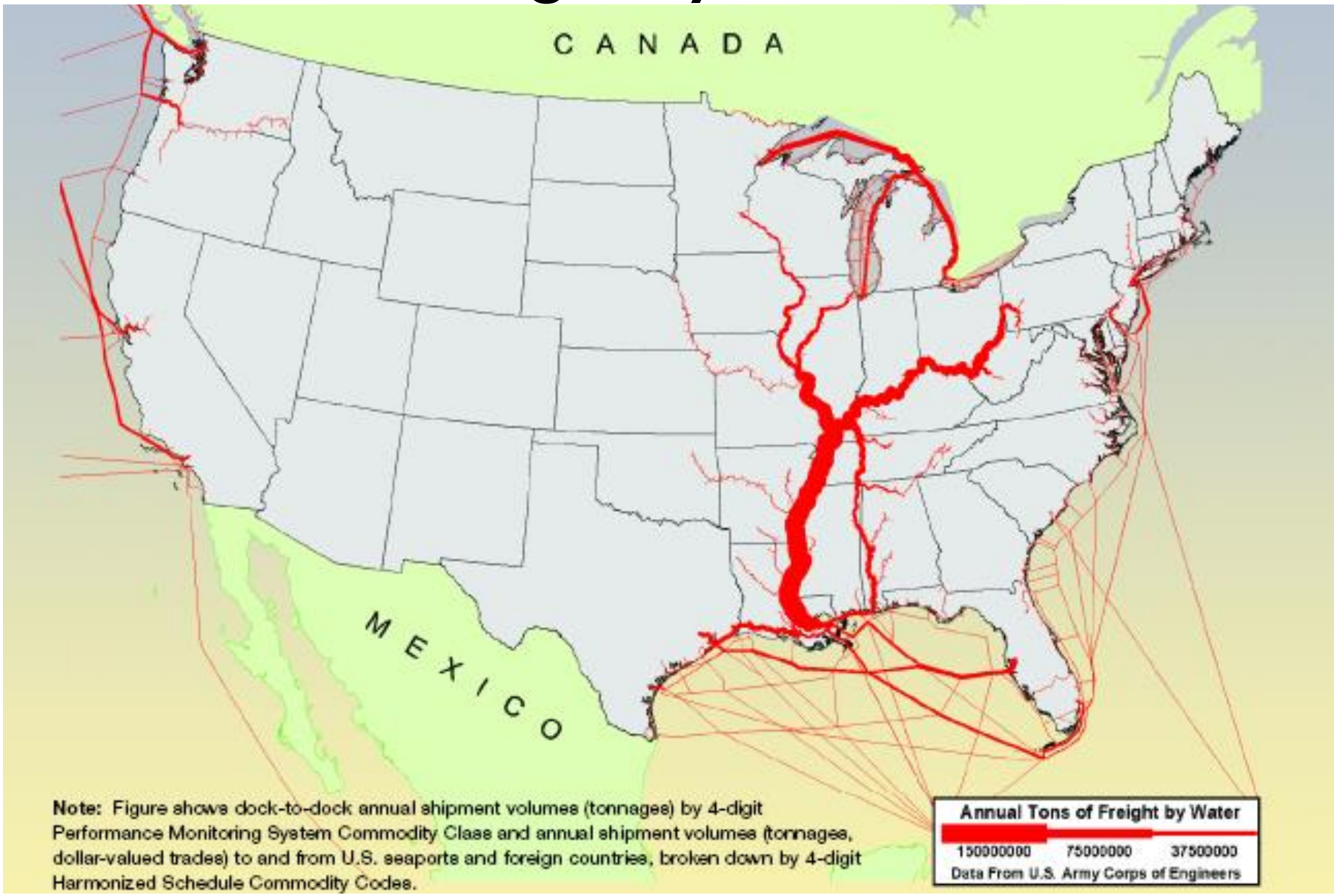
Mandate is to develop, implement, and enforce a comprehensive coastal protection and restoration Master Plan.

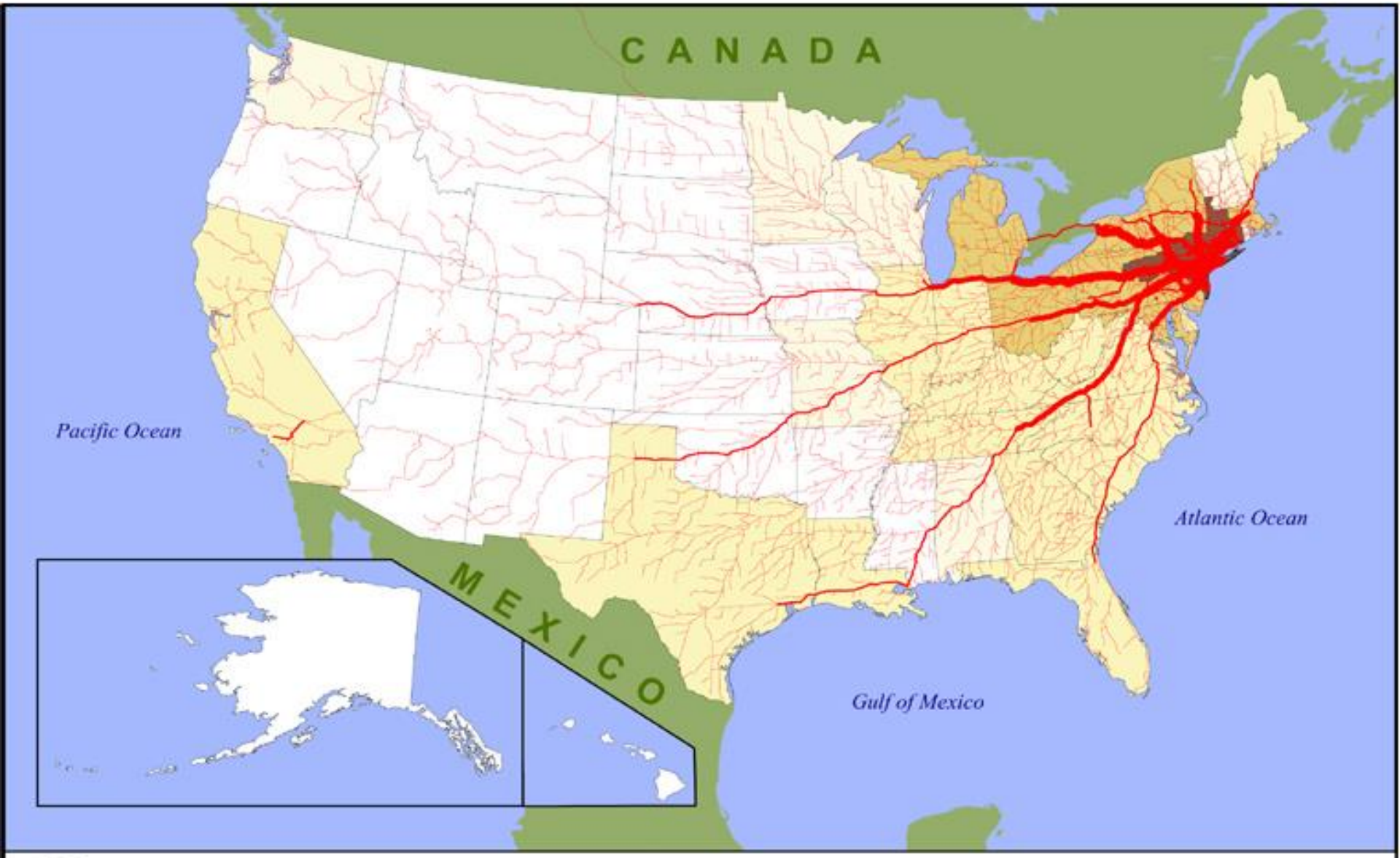
Louisiana's National Role

Ports - Cargo

- **Top tonnage port in the nation**
- **Five of the top 15 tonnage ports in the US**
- **One of the largest cargo port complexes in the world**
- **19 percent of all domestic waterborne commerce**
- **Over 30 states depend upon Louisiana's ports for imports and exports…..**

Annual Tons of Freight by Water





U.S. Department of Transportation
Federal Highway Administration
Office of Freight Management and Operations
Freight Analysis Framework

Total Combined Truck Flows
(1998)

NEW YORK

Network Flows
(Tons)
- 0 - 2,000,000
- 2,000,000 - 5,000,000
- 5,000,000 - 10,000,000
- 10,000,000 - 25,000,000
- More Than 25,000,000

BEA to State Flows
(Tons)
- 0 - 1,000,000
- 1,000,000 - 3,000,000
- 3,000,000 - 9,000,000
- More Than 9,000,000

U.S. Department of Transportation
Federal Highway Administration
Office of Freight Management and Operations
Freight Analysis Framework

Total Combined Truck Flows
(1998)

LOS ANGELES

Network Flows
(Tons)
- 0 - 2,000,000
- 2,000,000 - 5,000,000
- 5,000,000 - 10,000,000
- 10,000,000 - 25,000,000
- More Than 25,000,000

BEA to State Flows
(Tons)
- 0 - 1,000,000
- 1,000,000 - 3,000,000
- 3,000,000 - 9,000,000
- More Than 9,000,000

U.S. Department of Transportation
Federal Highway Administration
Office of Freight Management and Operations
Freight Analysis Framework

Total Combined Truck Flows
(1998)

HOUSTON

Network Flows
(Tons)
- 0 - 2,000,000
- 2,000,000 - 5,000,000
- 5,000,000 - 10,000,000
- 10,000,000 - 25,000,000
- More Than 25,000,000

BEA to State Flows
(Tons)
- 0 - 1,000,000
- 1,000,000 - 3,000,000
- 3,000,000 - 9,000,000
- More Than 9,000,000

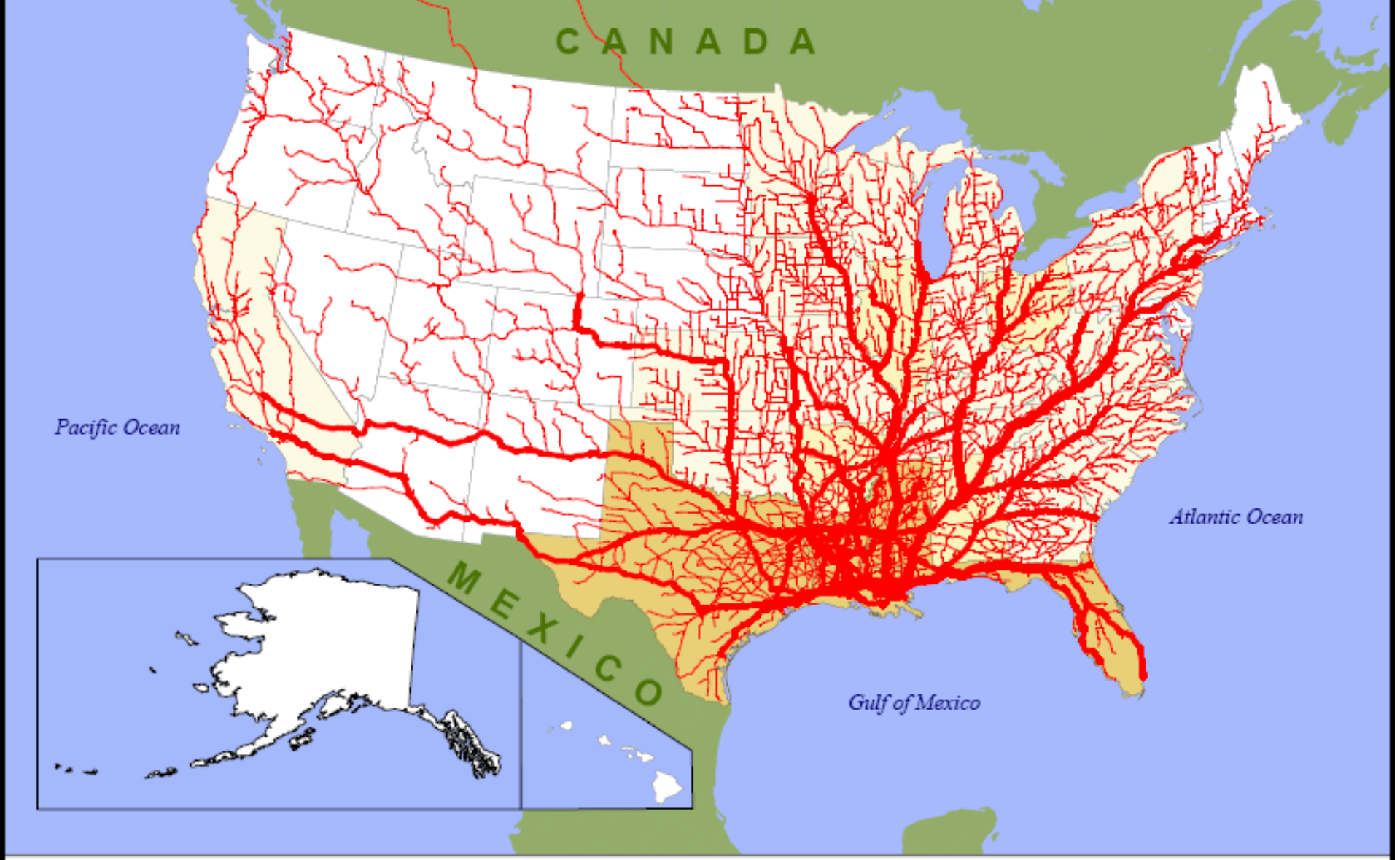
U.S. Department of Transportation
Federal Highway Administration
Office of Freight Management and Operations
Freight Analysis Framework

Total Combined Truck Flows
(1998)

NEW ORLEANS

Network Flows
(Tons)
- 0 - 2,000,000
- 2,000,000 - 5,000,000
- 5,000,000 - 10,000,000
- 10,000,000 - 25,000,000
- More Than 25,000,000

BEA to State Flows
(Tons)
- 0 - 1,000,000
- 1,000,000 - 3,000,000
- 3,000,000 - 9,000,000
- More Than 9,000,000



U.S. Department of Transportation
Federal Highway Administration
Office of Freight Management and Operations
Freight Analysis Framework

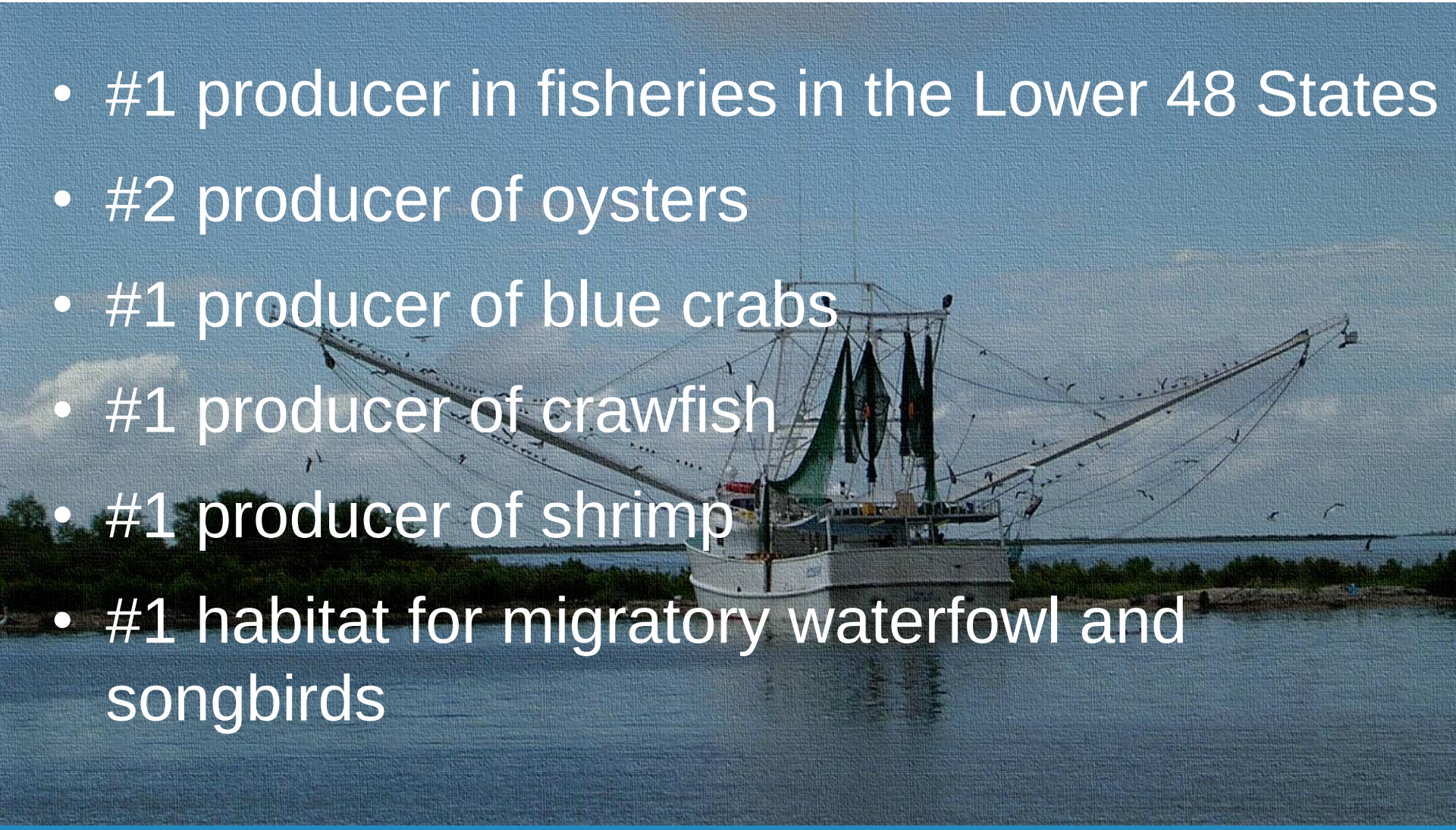
Total Combined Truck Flows
(1998)

LOUISIANA

Network Flows
(Tons)
- 0 - 500,000
- 500,000 - 1,000,000
- 1,000,000 - 10,000,000
- 10,000,000 - 50,000,000
- More Than 50,000,000

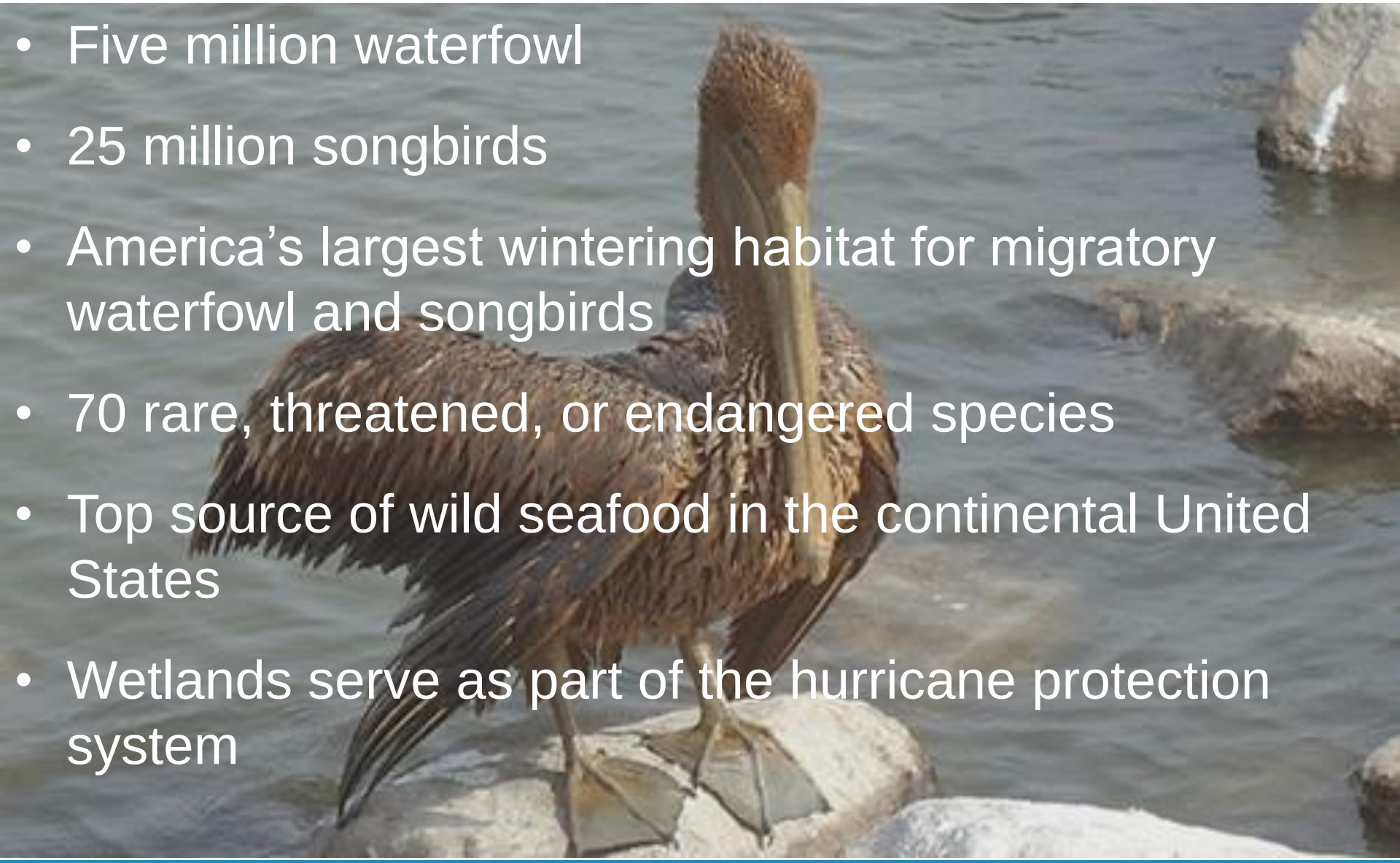
State to State Flows
(Tons)
- 0 - 1,000,000
- 1,000,000 - 5,000,000
- 5,000,000 - 10,000,000
- More Than 10,000,000

Seafood and Wildlife



- #1 producer in fisheries in the Lower 48 States
- #2 producer of oysters
- #1 producer of blue crabs
- #1 producer of crawfish
- #1 producer of shrimp
- #1 habitat for migratory waterfowl and songbirds

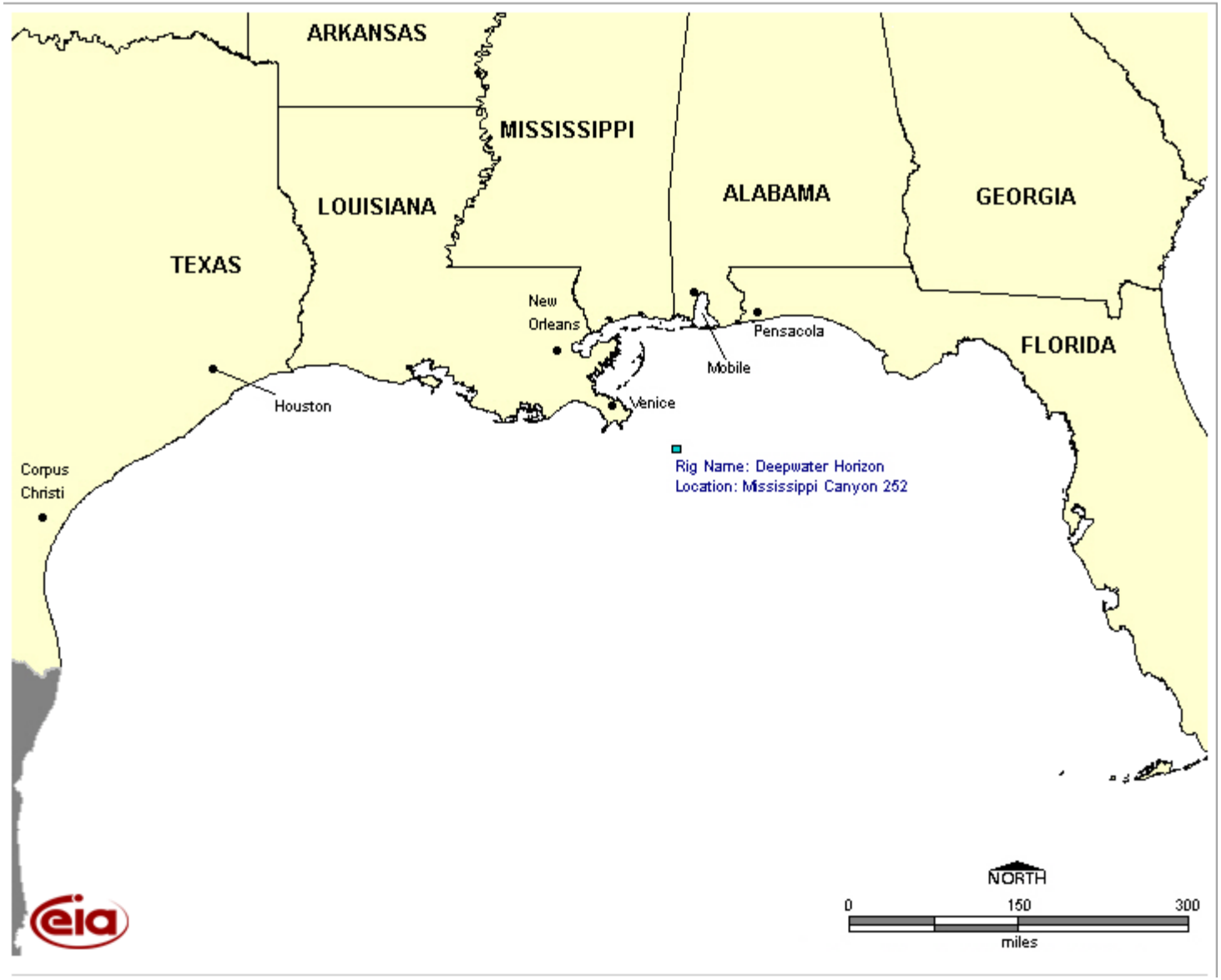
Ecosystem Services



- Five million waterfowl
- 25 million songbirds
- America's largest wintering habitat for migratory waterfowl and songbirds
- 70 rare, threatened, or endangered species
- Top source of wild seafood in the continental United States
- Wetlands serve as part of the hurricane protection system

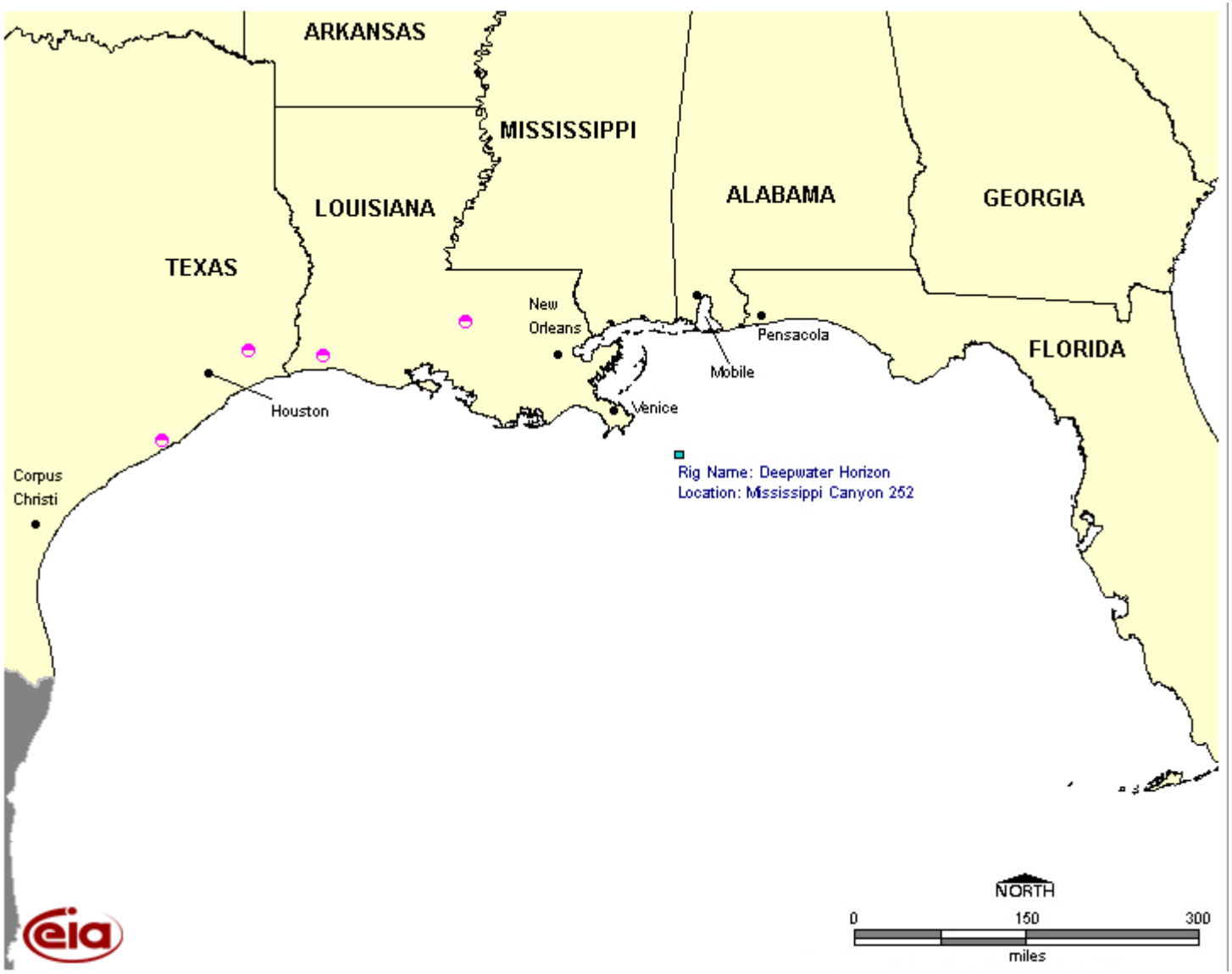
Gulf of Mexico-Energy

Deepwater Horizon Well Site



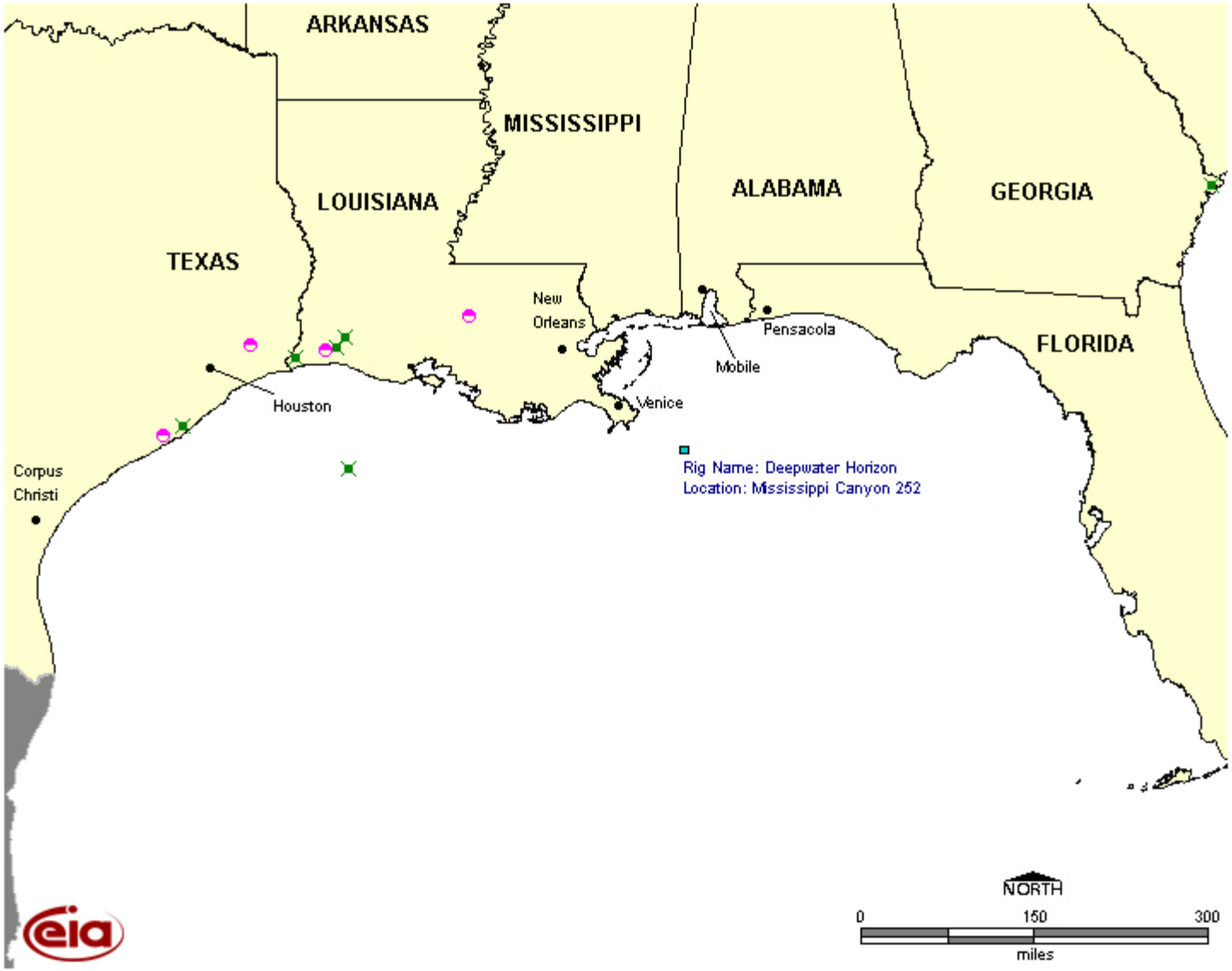
Strategic Petroleum Reserves

[Pink]



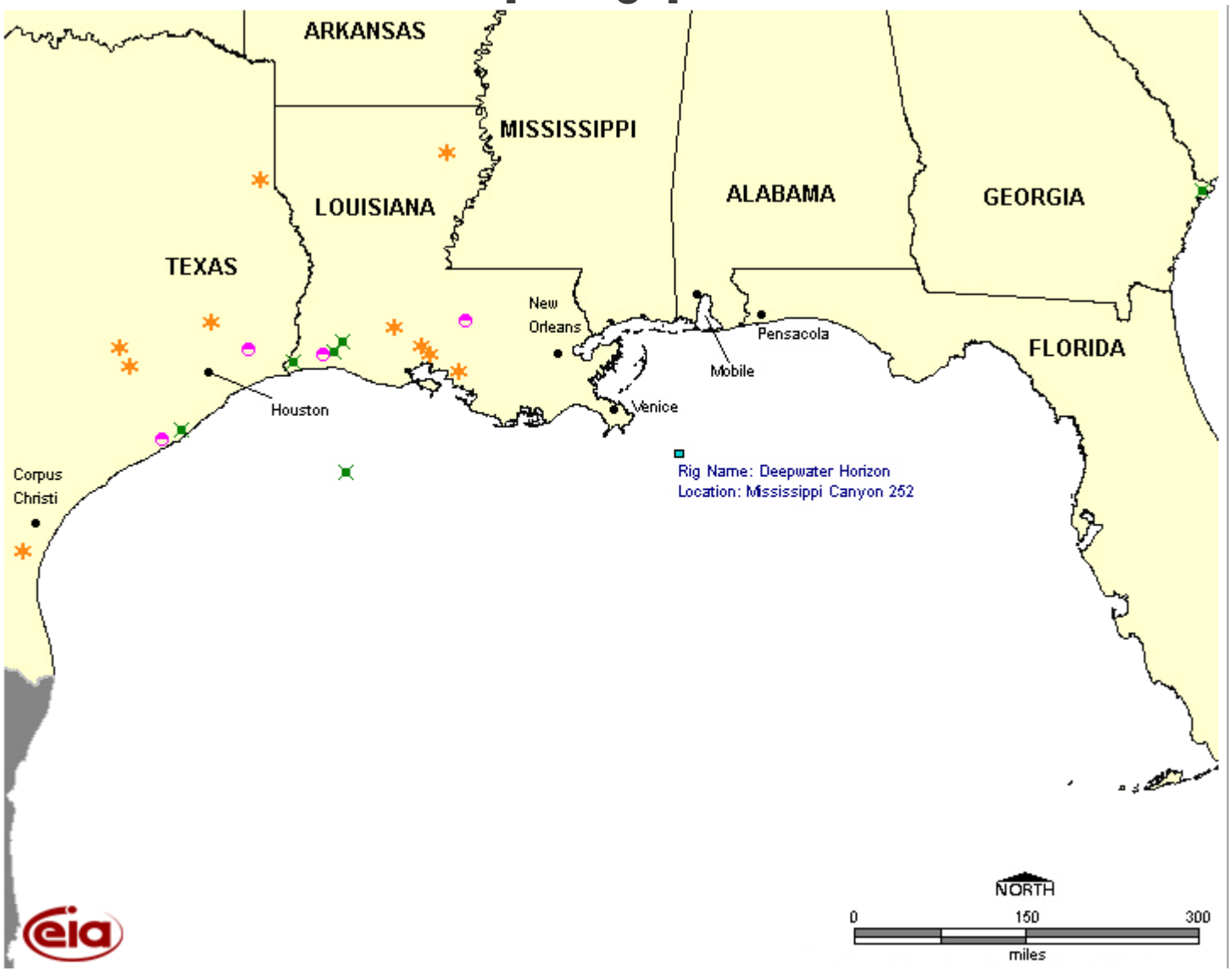
LNG Terminals

[Green]



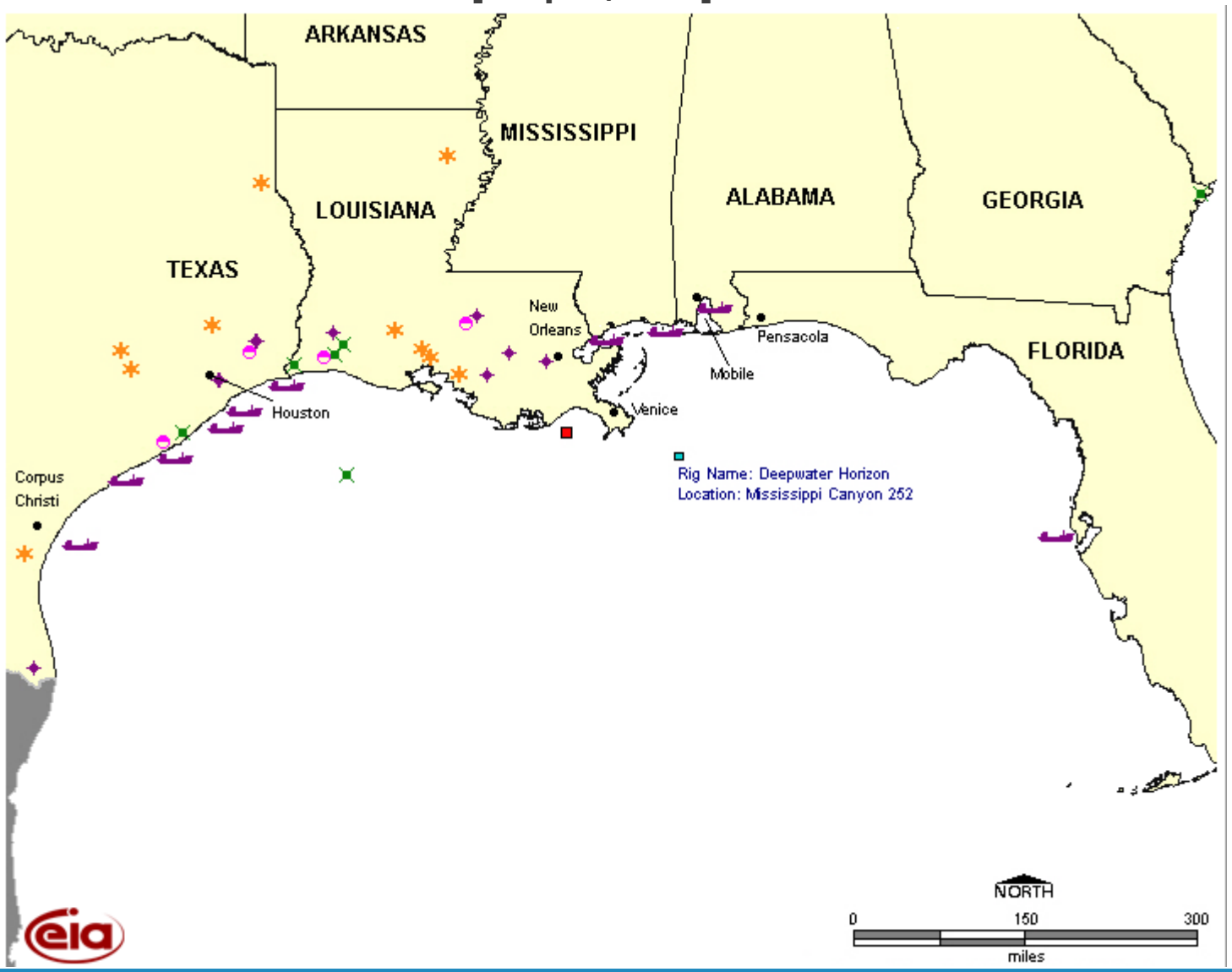
Natural Gas Market Center Hubs

[Orange]



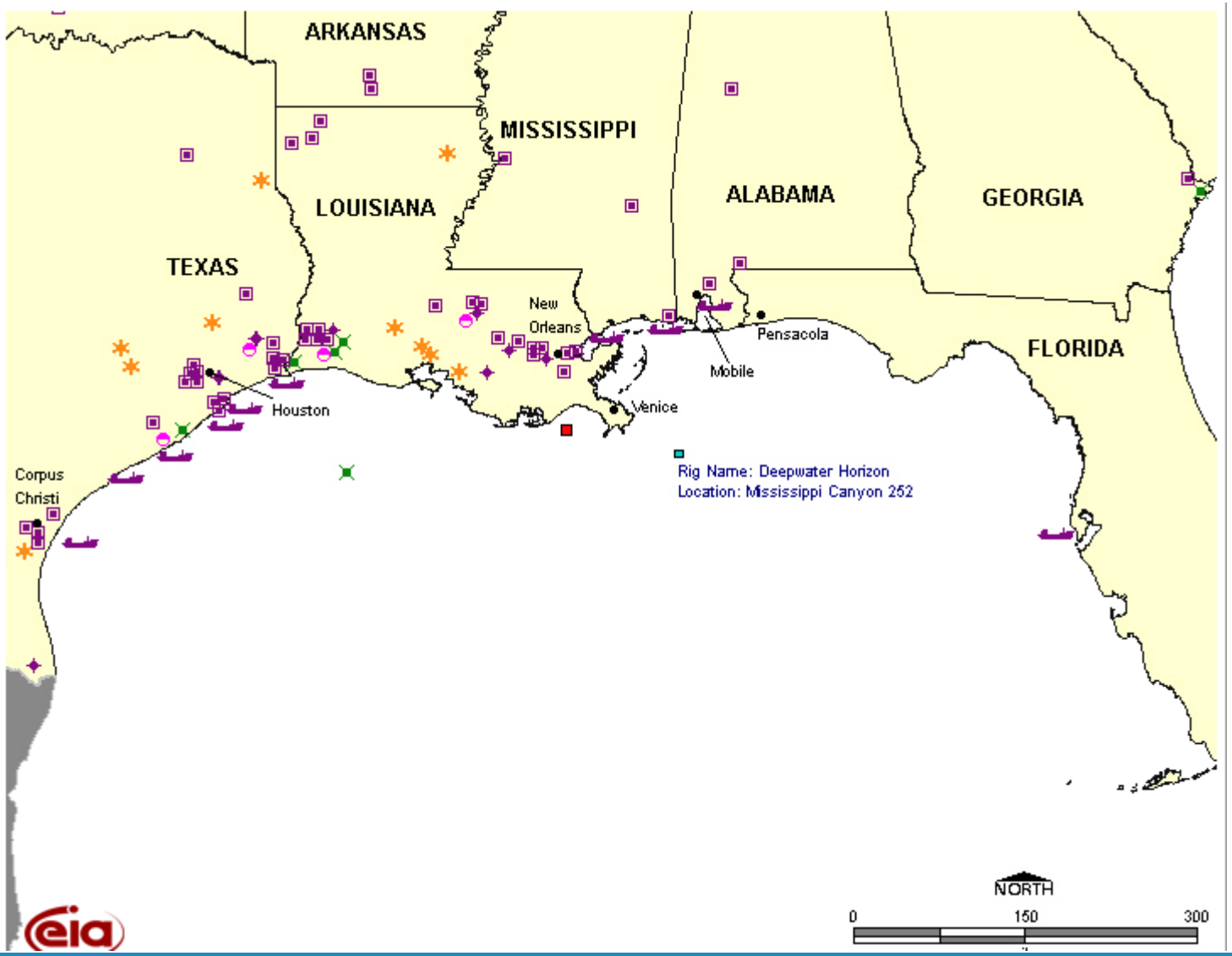
Oil Import Sites/Seaports

[Purple/Red]



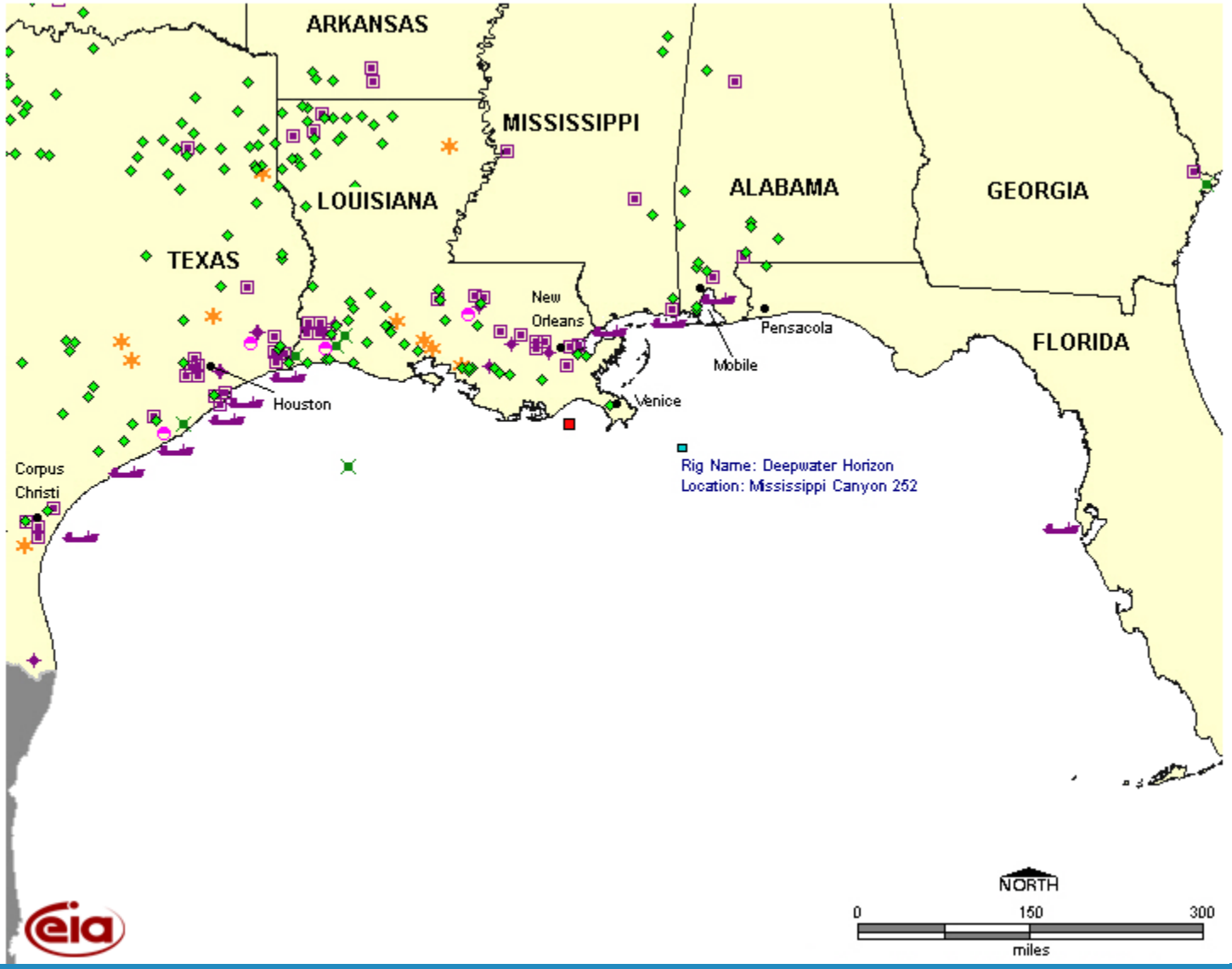
Petroleum Refineries

[Purple Squares]



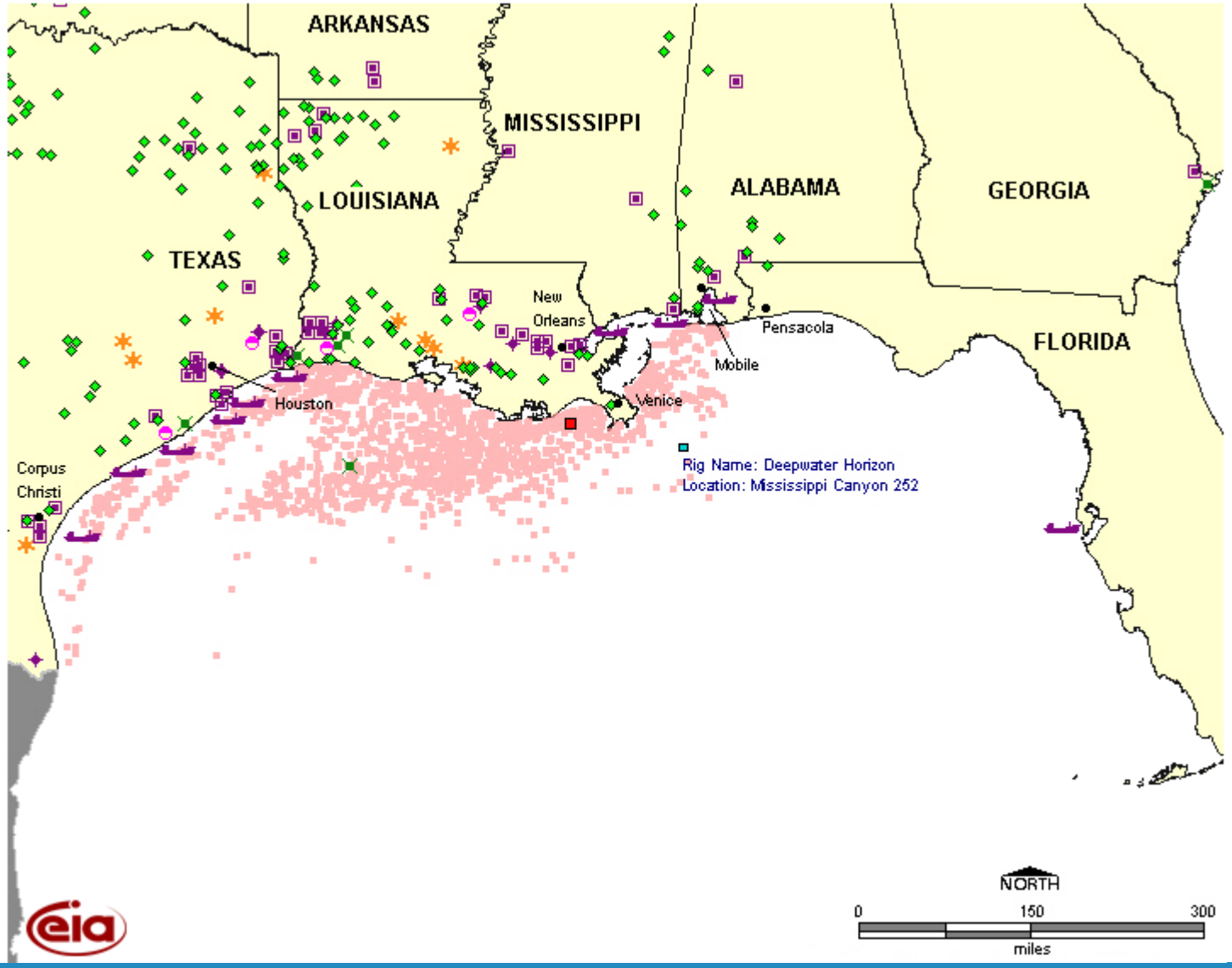
Natural Gas Processing Facilities

[Green Diamonds]

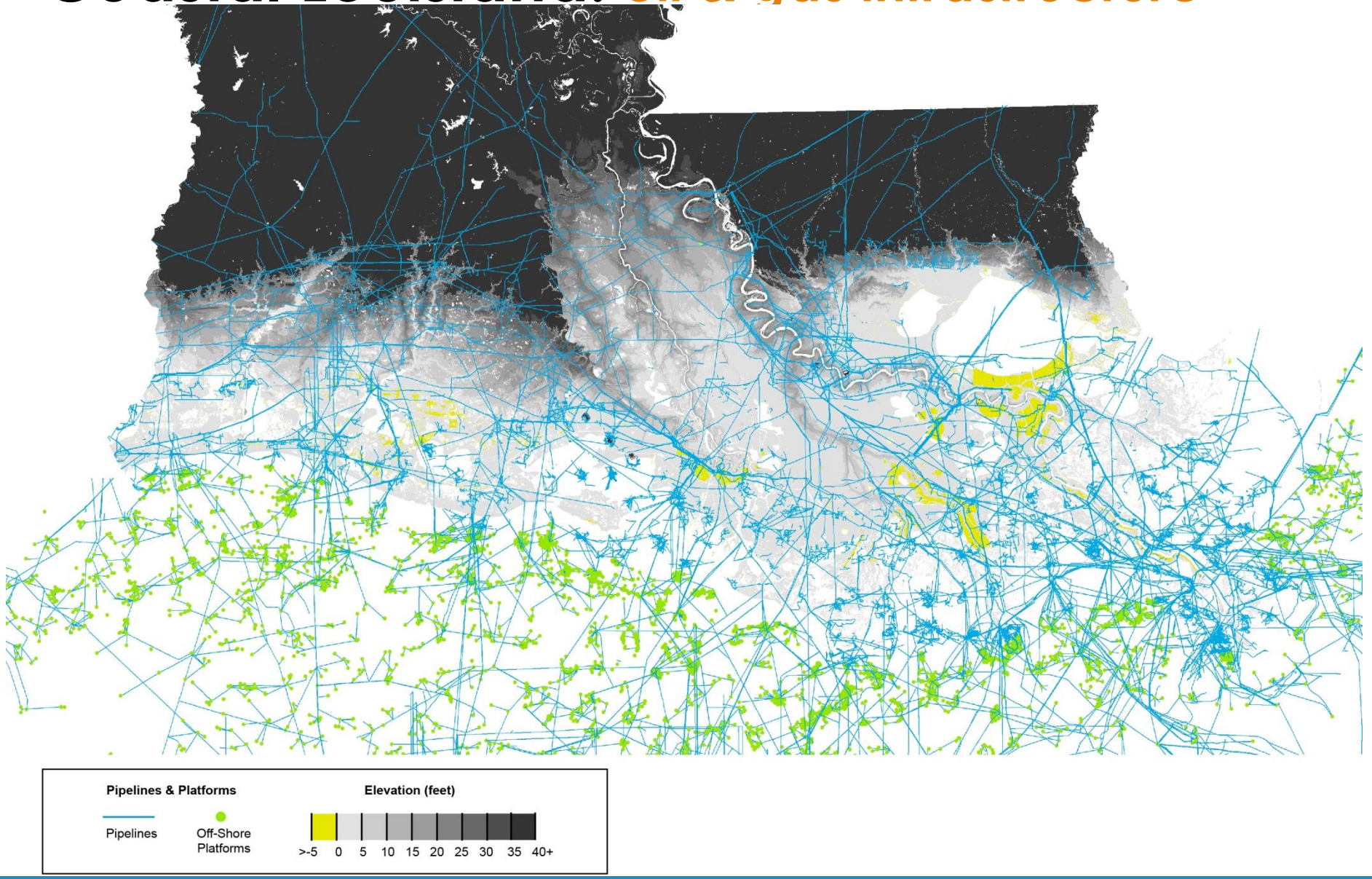


Active Offshore Oil/Gas Platforms

[Pink]



Coastal Louisiana: *oil & gas infrastructure*

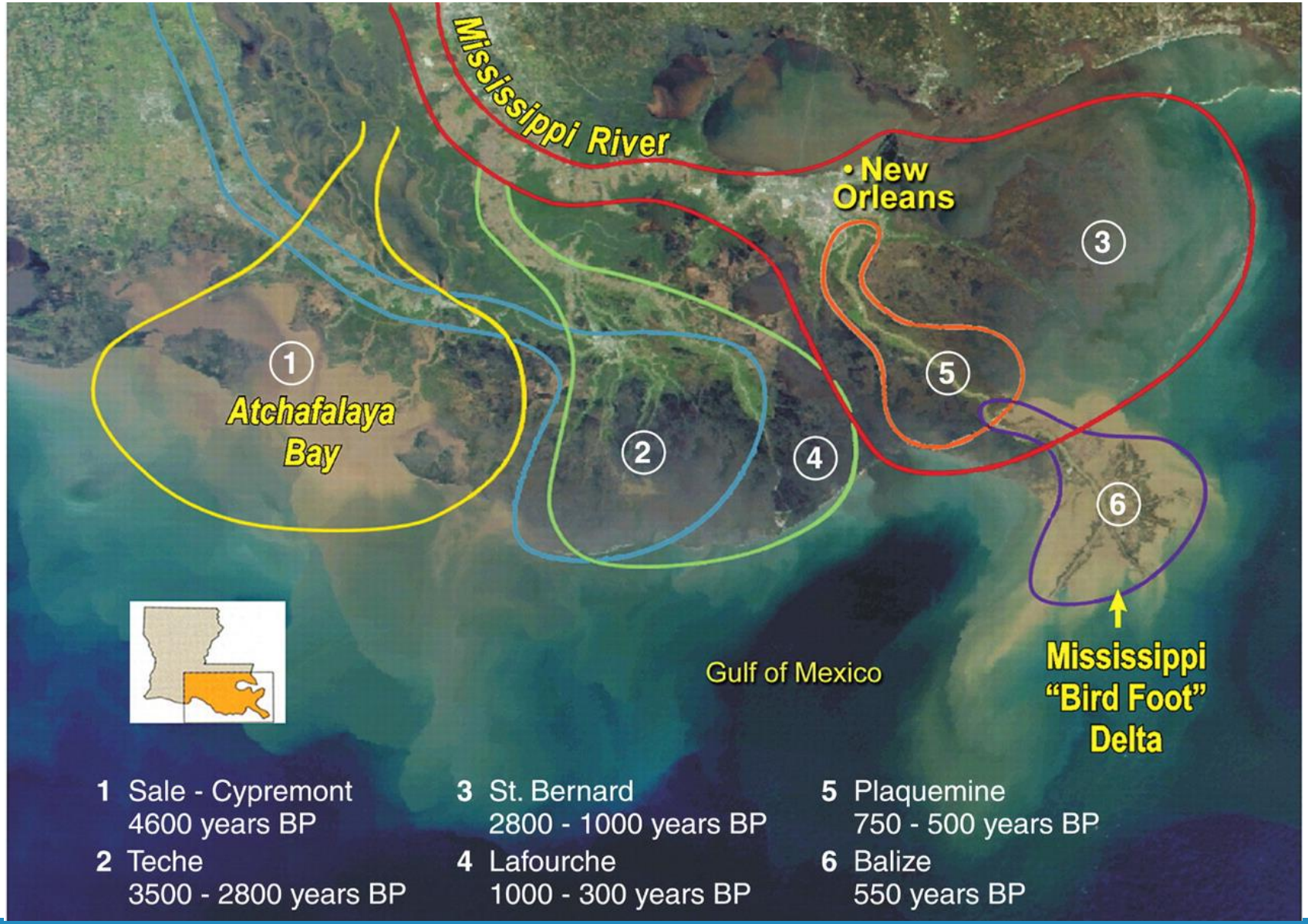


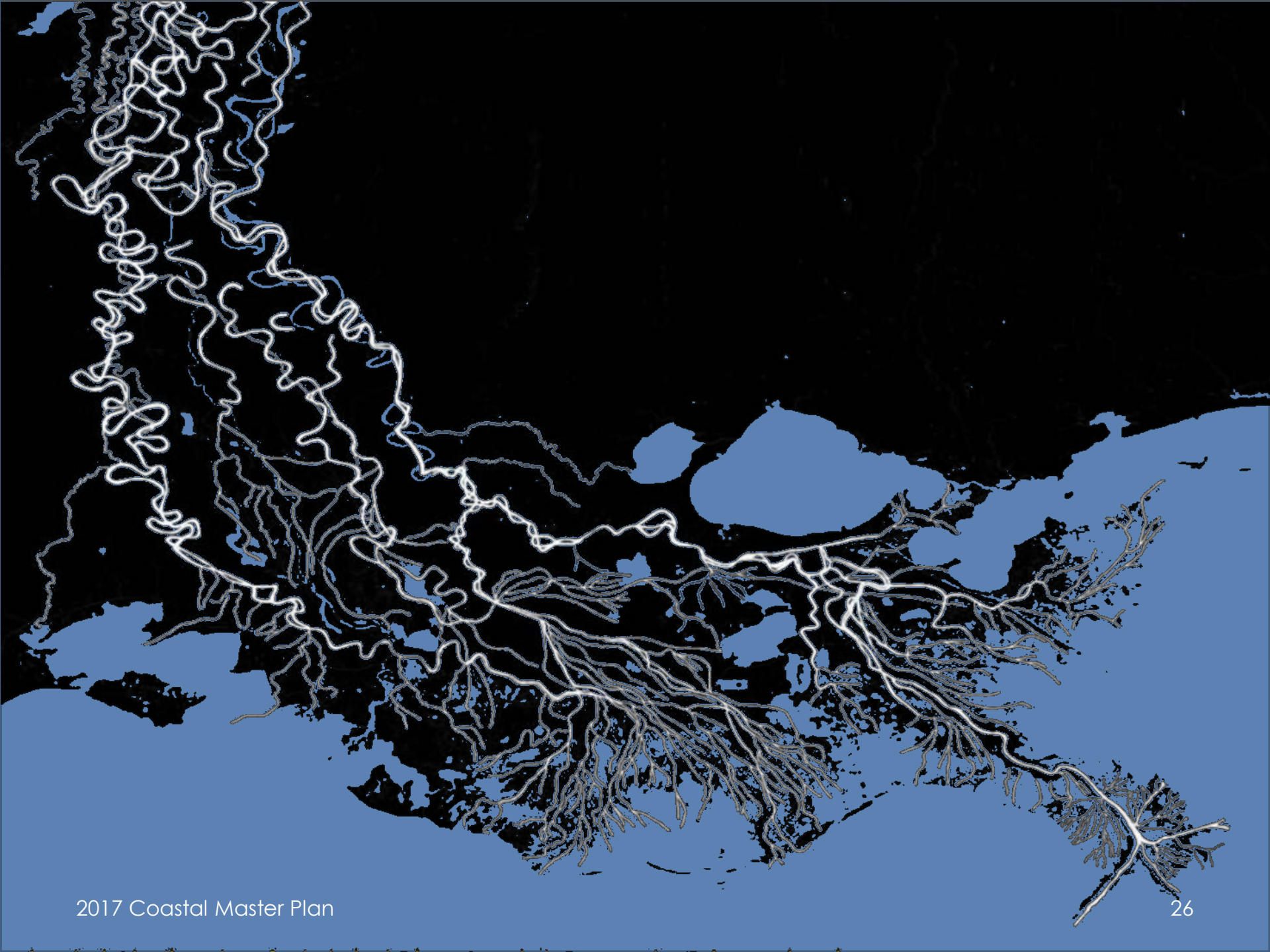
Sustainable?
Our Coastal Crisis

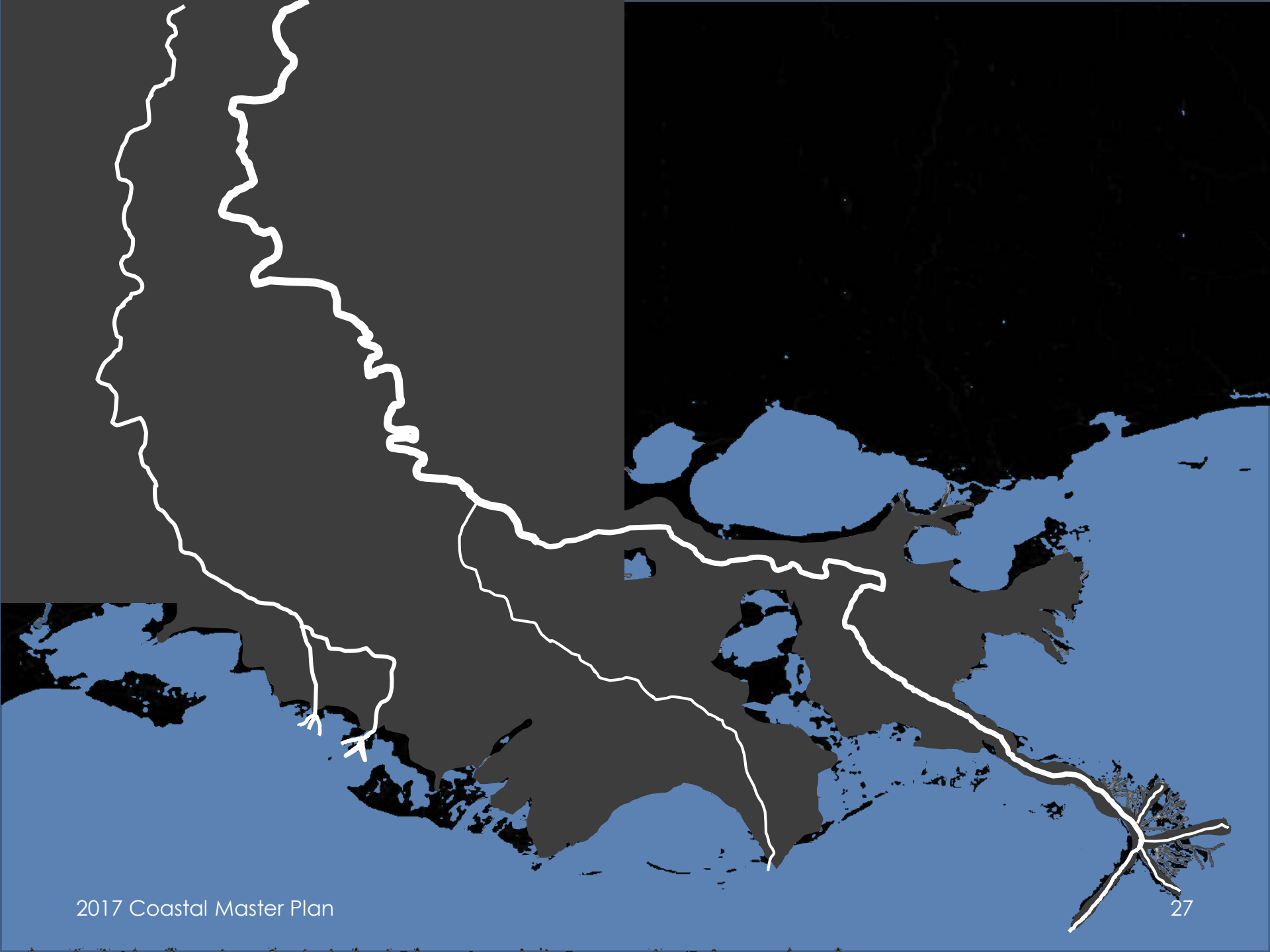
Mississippi River Watershed

- Two-thirds of the continental United States
- 42% of the contiguous land mass of North America

Mississippi River and Tributaries

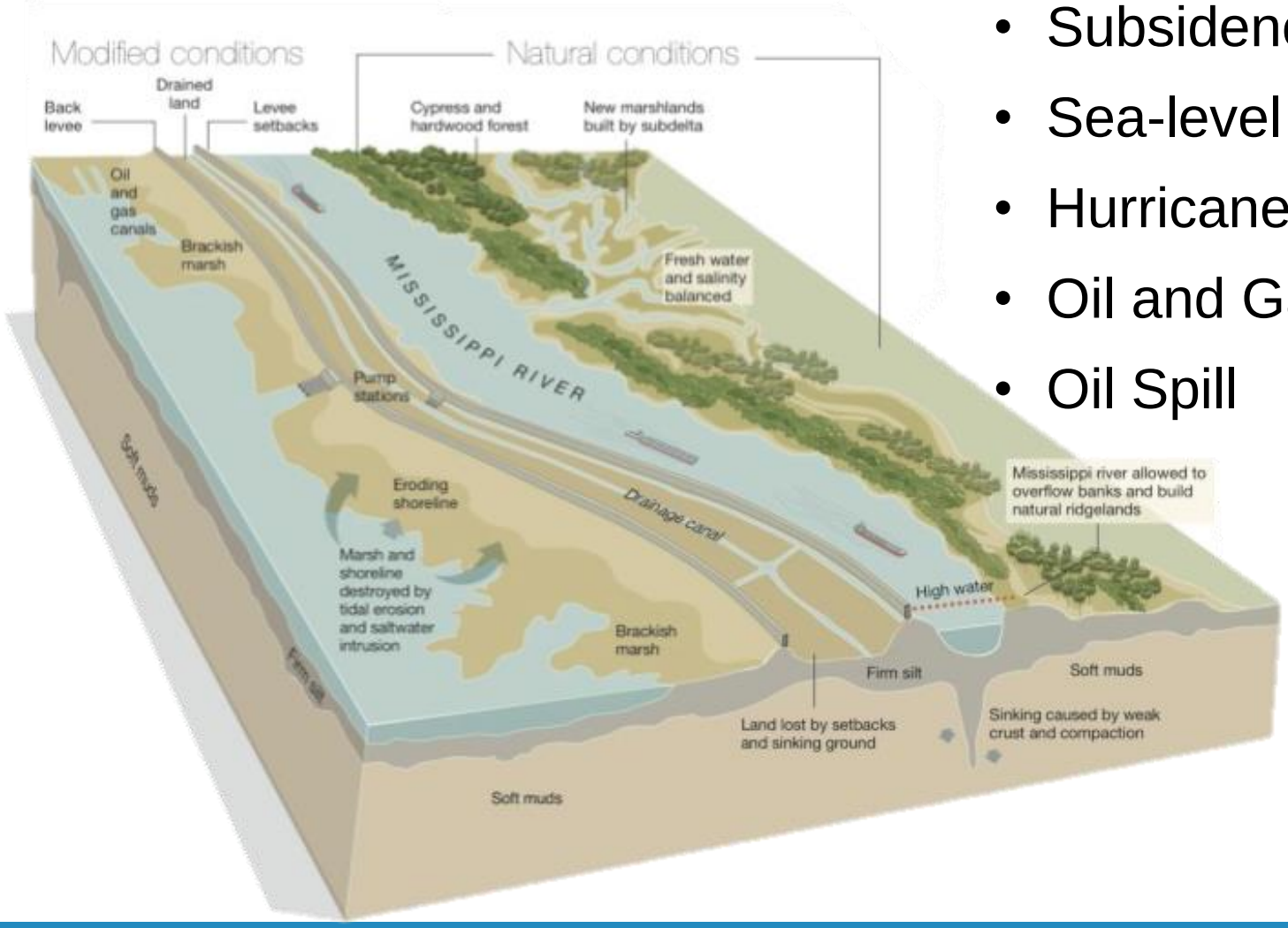






Main Causes of Land Loss

- Levees/Dams
- Subsidence
- Sea-level Rise
- Hurricanes
- Oil and Gas Infrastructure
- Oil Spill

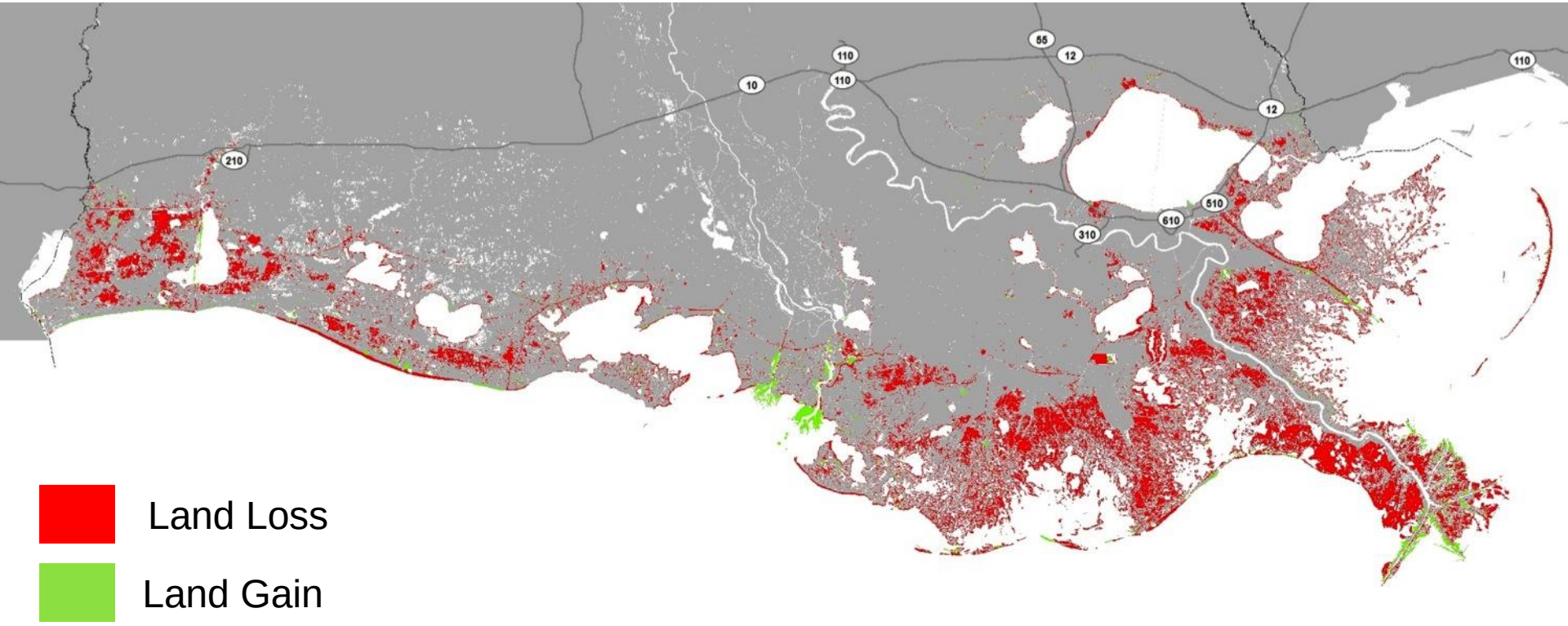


Louisiana is Experiencing a Coastal Crisis

1,883 square miles lost since the 1930s (4,877 sq. km)

Currently losing over **16** square miles per year (41 sq. km)

Land Area Change in Coastal LA 1932 – 2010 SURVEY THE SCENE

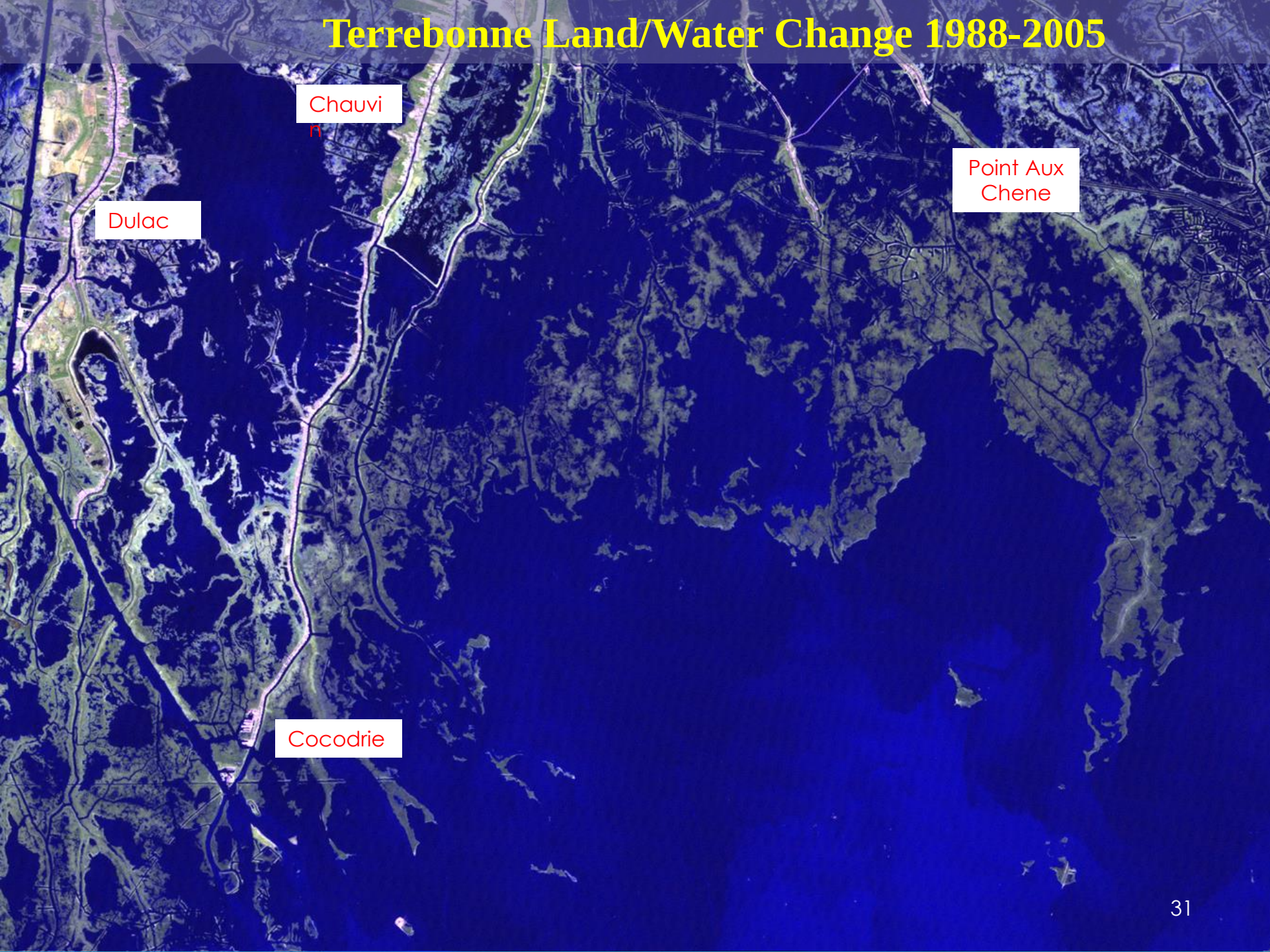


Historic Land-Water Change from 1932-2010

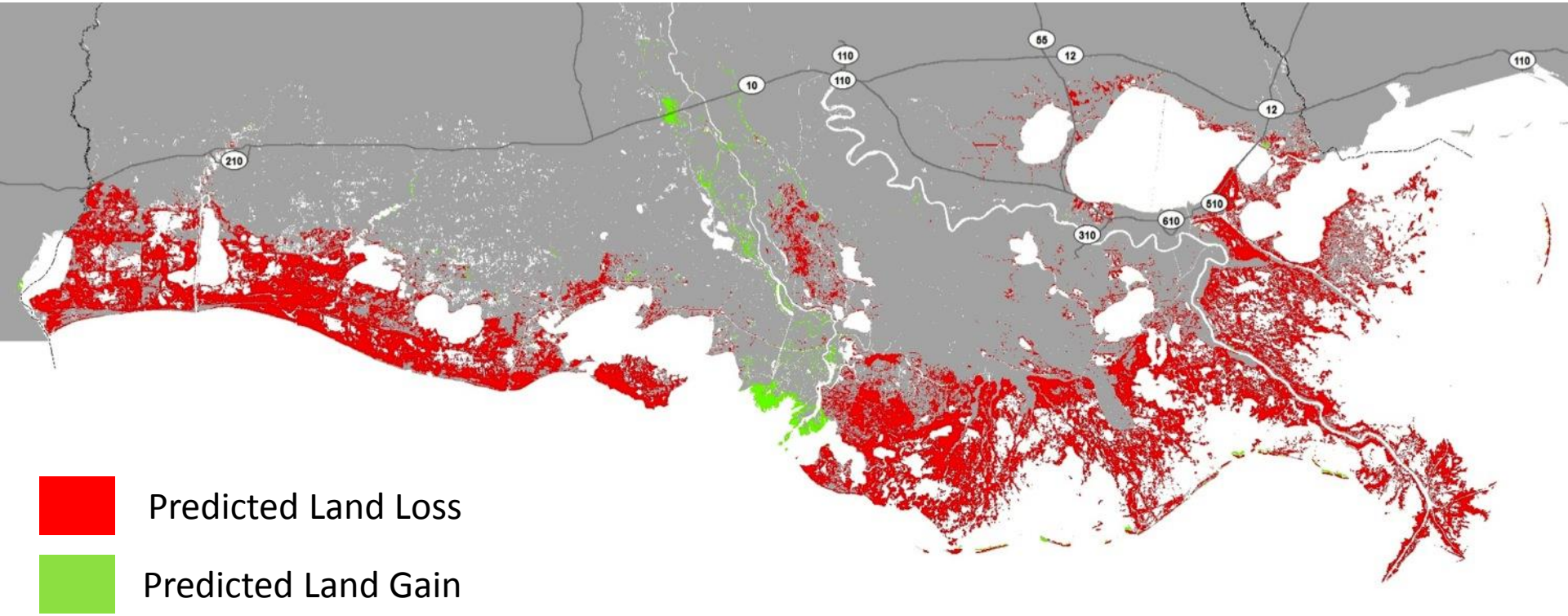
Approx. 1,900 sq. mi. (492,100 ha.)

Couvillion et al (USGS), 2011

Terrebonne Land/Water Change 1988-2005



HOW BAD IS IT – Future Without Action

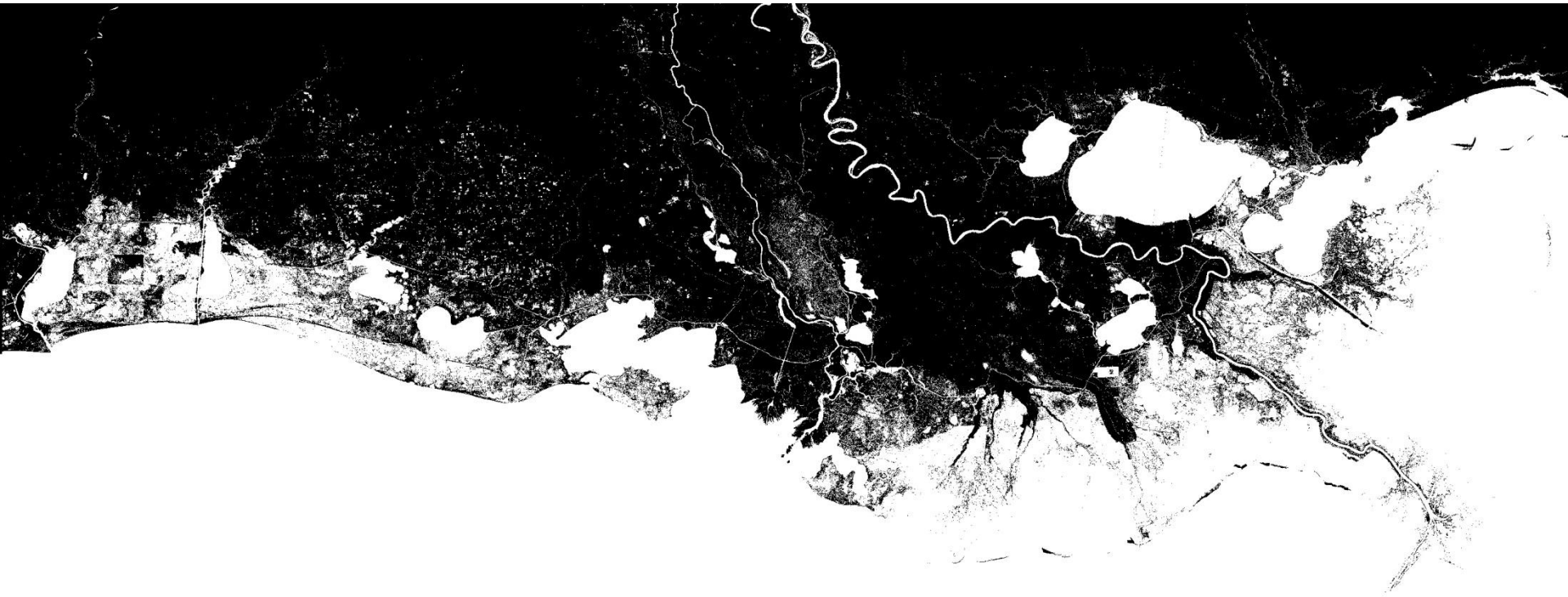


More Extreme- Potential to lose an additional 1,765 square miles (4,571 sq. km) of land over the next 50 years.

Utilized 0.45 m of sea level rise over 50 years, Subsidence rates 0 to 25 mm per year

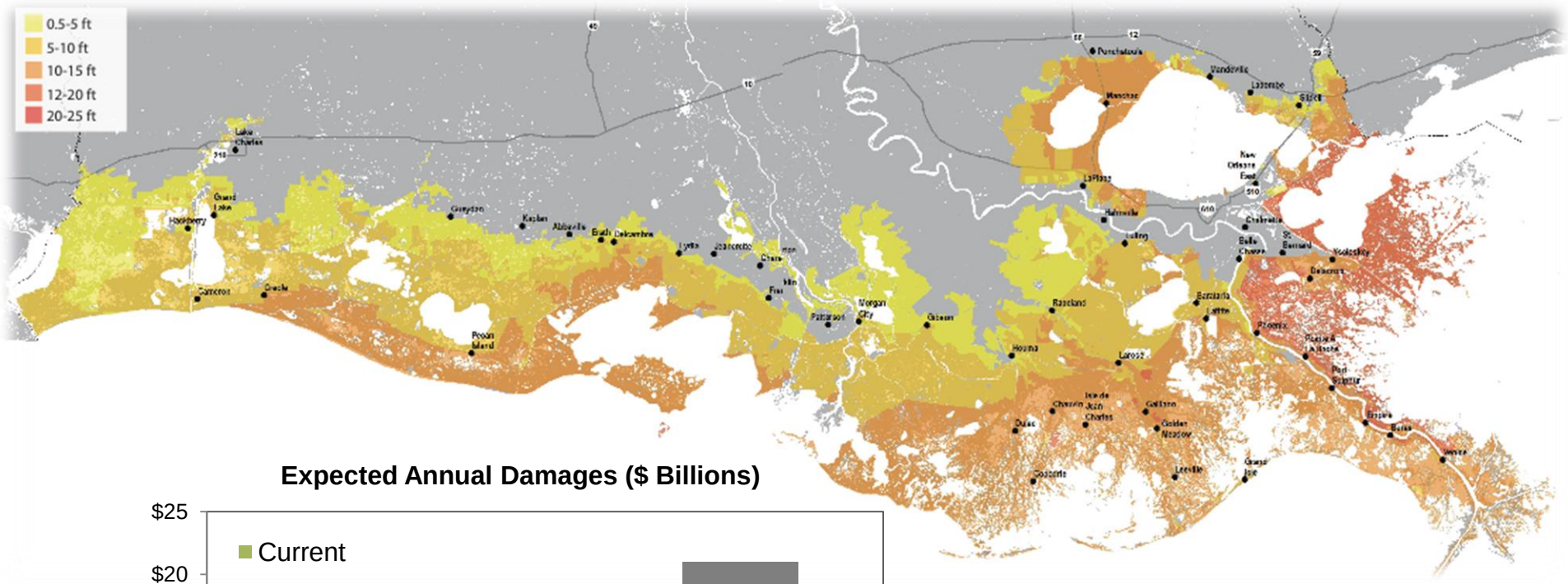
Our Coastal Crisis Will Continue

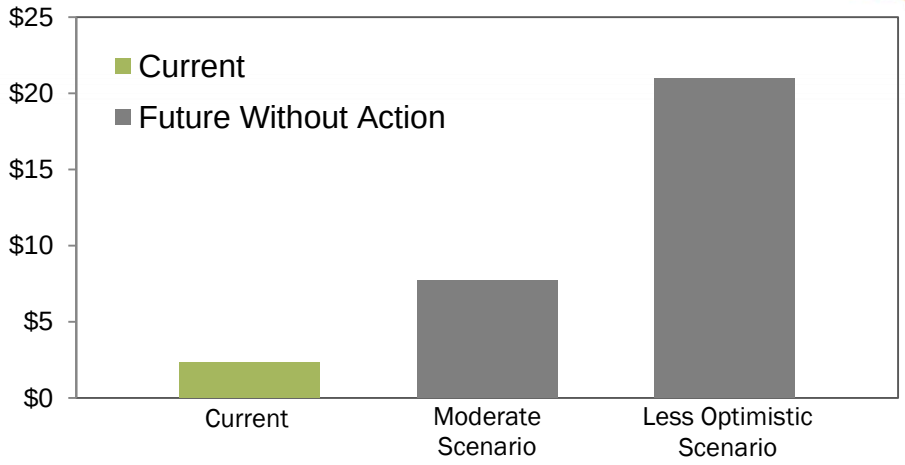
Current 2020 2030 2040 2050 2060



With No Action Over the Next 50 Years

Increasing Vulnerability to Livelihoods





Could experience **10x** more damages than today


1905
LEEVILLE CEMETERY
On June 8, 1905, during the yellow fever epidemic, three Leeville residents:
Joseph C. Picciola, Camille Rebstock
and Adrien Lefort
purchased this plot of land from the Martin Family for the Leeville Cemetery Co. for $95. It became a large cemetery, but with each hurricane, graves were demolished and washed away. On September 2, 1905
Joseph C. Picciola
died of yellow fever and was buried where his tomb still stands.

Responding to the Crisis

2005 • Hurricanes Katrina and Rita

• **CPRA Board Established**

2007 • Original **Master Plan Developed**

2008 • Hurricanes Gustav and Ike

2009 • **CPRA Implementation Office Established**

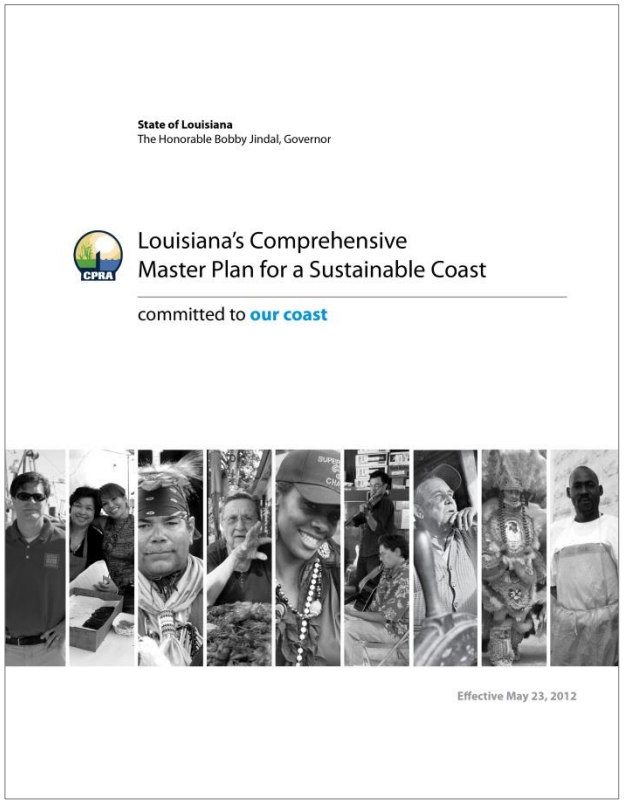
2010 • Deepwater Horizon Oil Spill

2011 • Mississippi River High Water Event

2012 • **Master Plan Updated**

Louisiana's Coastal Master Plan

Coastal Master Plan



Guiding document of CPRA and our efforts to protect and restore the Louisiana coast.

Revised every 5 years.

Timeline of Coastal Planning in Louisiana

1927

Flood Control in the Mississippi Valley in its Relation to Louisiana Fisheries (Dept. of Conservation)

1928

Louisiana Wet Lands and the Value of Their Wild Life and Fishery Resources (Dept. of Conservation)

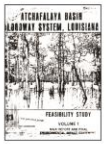
1973

Environmental Atlas and Multi-Use Management Plan for South-Central Louisiana (LSU)

1981

Report on Special Projects for Coastal Louisiana (Committee of Natural Resources)

1982



Atchafalaya Basin Floodway System, Louisiana (USACE)

1987

Saving Louisiana's Coastal Wetlands: The Need for a Long-Term Plan of Action (EPA)

1993

A Long-Term Plan for Louisiana's Coastal Wetlands (LDNR)

1993

The Louisiana Coastal Wetlands Restoration Plan (CWPPRA)

1994

A Long-Term, Comprehensive Management Plan for Coastal Louisiana (LSU)

An Environmental-Economic Blueprint for Restoring the Louisiana Coastal Zone: The State Plan

1995

Lake Pontchartrain Basin Foundation Comprehensive Management Plan-Phase III (LPBF)

The State of Louisiana's Policy for Coastal Restoration Activities

1996

The Estuary Compact: Barataria-Terrebonne National Estuary Program (LPBF)

1997

Louisiana Coastal Wetlands Conservation Plan

1998

Coast 2050: Toward a Sustainable Coastal Louisiana (Wetlands Conservation & Restoration Authority)

2000

Mississippi River Sediment, Nutrient, and Freshwater Distribution Study (CWPPRA)

2002

Saving Coastal Louisiana: Recommendations for Implementing an Expanded Coastal Restoration Program

2004

Ecosystem Restoration Study (LCA)

2006

A New Framework for Planning the Future of Coastal Louisiana After the Hurricanes of 2005

The Multiple Lines of Defense Strategy to Sustain Coastal Louisiana (LPBF)

Envisioning the Future of the Gulf Coast (America's WETLAND)

Drawing Coastal Louisiana's New Map: Addressing Land Loss in Coastal Louisiana

Mississippi River Gulf Outlet (MRGO) Channel Restoration and Mitigation Plan and Addendum (LDNR & EPA)

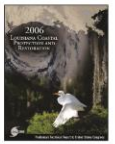
2007

Louisiana's Comprehensive Master Plan for a Sustainable Coast (CPRA)

Comprehensive Recommendations Supporting the Use of the Multiple Lines of Defense Strategy to Sustain Coastal Louisiana

Louisiana Speaks Regional Plan (Louisiana Recovery Authority)

2009



Louisiana Coastal Protection and Restoration (LACPR)

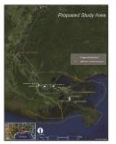
2010

Louisiana Coastal Area, Louisiana Ecosystem Restoration (CPRA, USACE)

2012

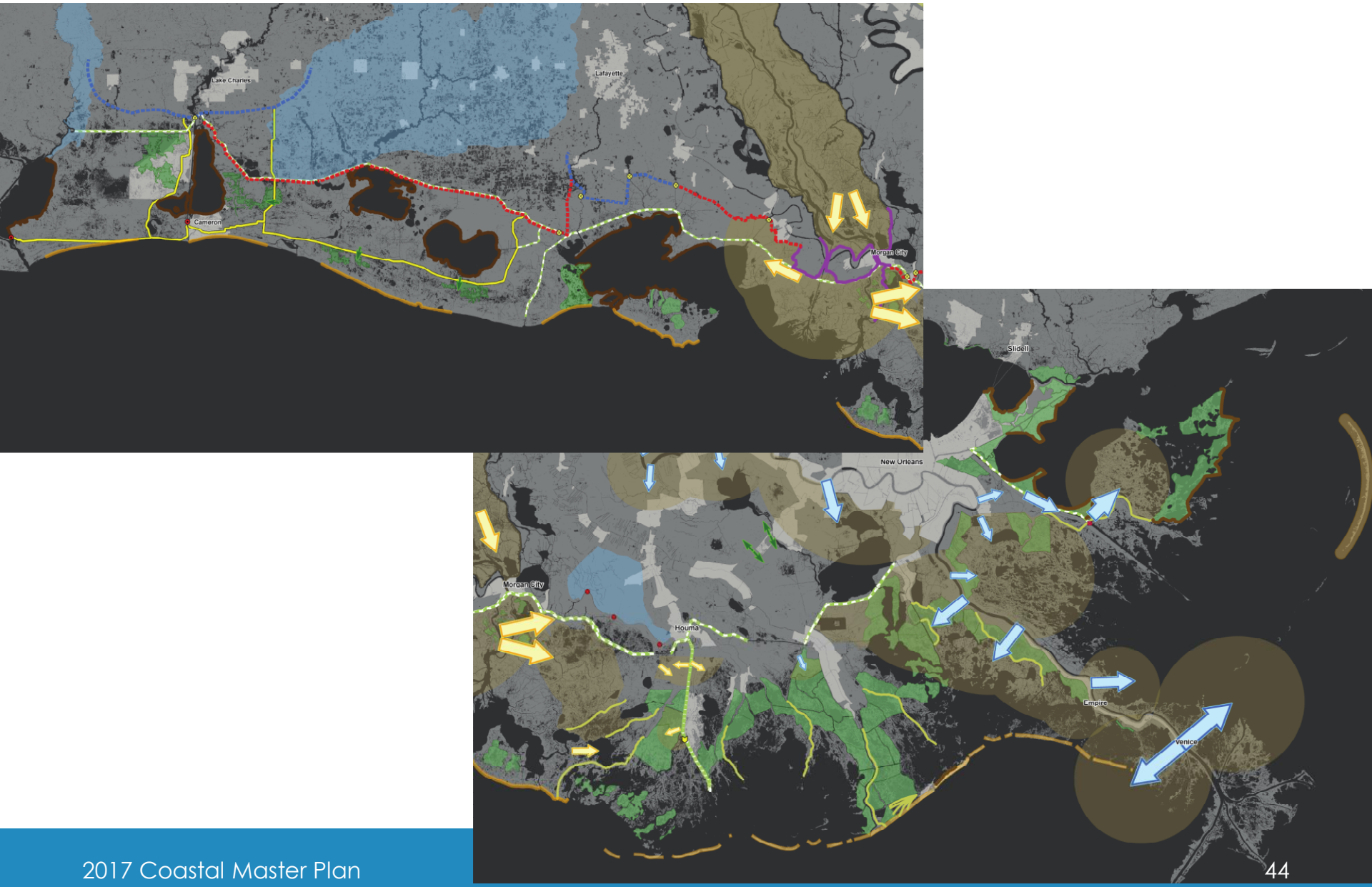
Louisiana's Comprehensive Master Plan for a Sustainable Coast (CPRA)

2014



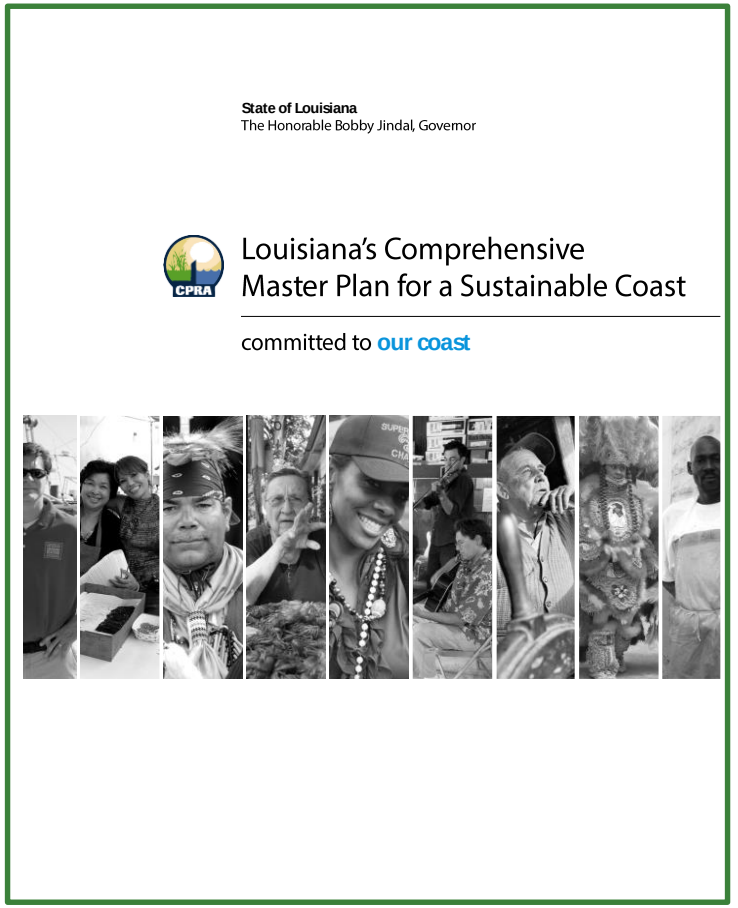
Mississippi River Hydrodynamic and Delta Management Study (LCA)

Building on the 2007 Master Plan



2012 Coastal Master Plan

- Built on world class science and engineering
- Evaluated hundreds of existing project concepts
- Incorporated extensive public input and review
- Resource constrained
  - **Funding**, water, sediment
- Identified investments that will pay off, not just for us, but for our children and grandchildren



Master Plan Objectives

Flood Protection

Reduce economic losses from storm-based flooding

Natural Processes

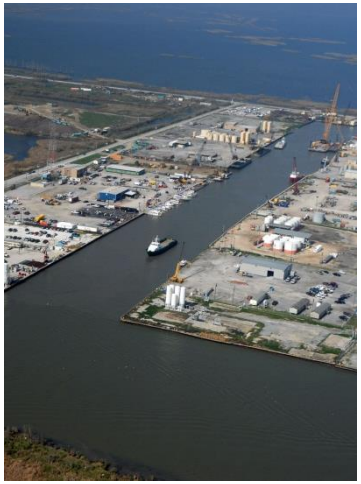
Promote a sustainable ecosystem by harnessing the processes of the natural system

Coastal Habitats

Provide habitats suitable to support an array of commercial and recreational activities coast wide

Cultural Heritage

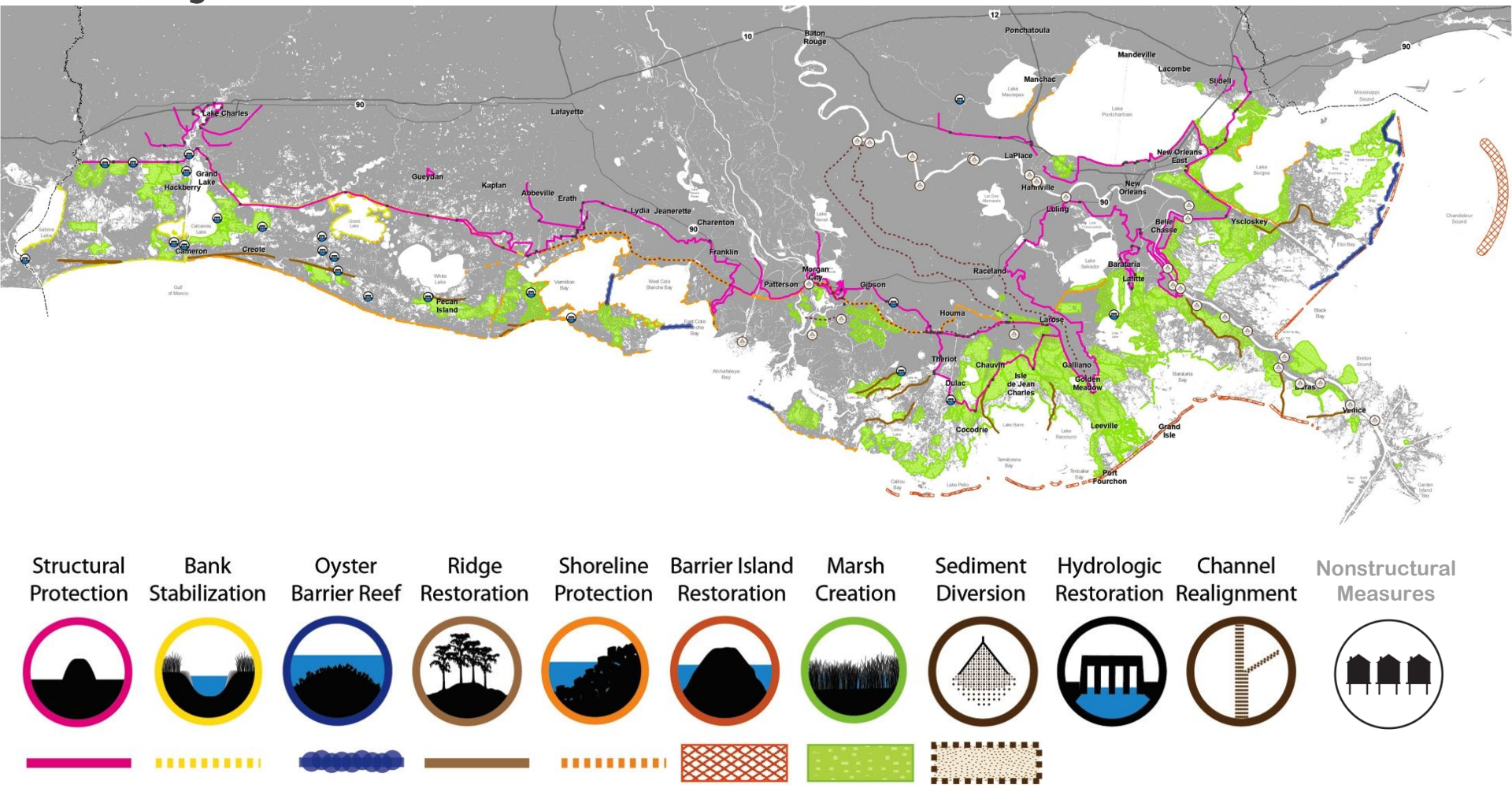
Sustain Louisiana's unique heritage and culture



Working Coast

Support regionally and nationally important businesses and industries

Evaluation of Hundreds of Existing Projects



Nearly 400 Projects Evaluated Across the Coast

Restoration Projects

Barrier Island Restoration

Hydrologic Restoration

Marsh Creation

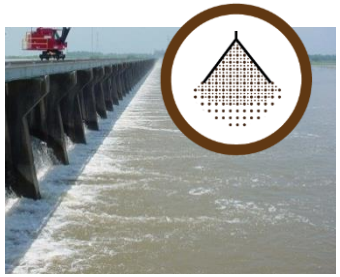
Oyster Barrier Reefs

Ridge Restoration

Shoreline Protection

Bank Stabilization

Channel Realignment



Sediment Diversion

Protection Projects:
Structural Protection Projects

Earthen Levee

Concrete Wall

Floodgate

Pumps

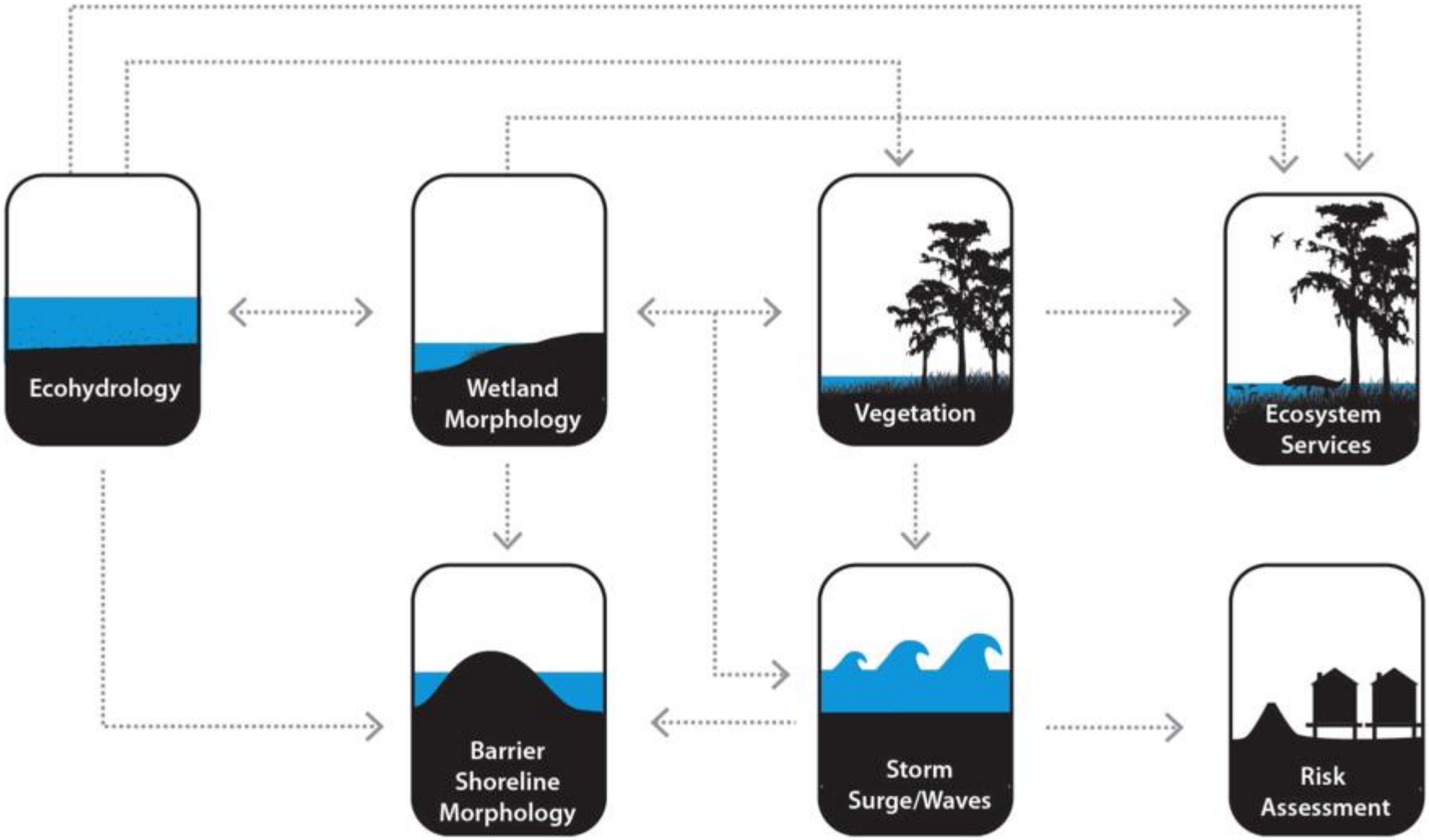
Protection Projects: *Nonstructural Protection Projects*

Elevated Housing

Floodproofing

Voluntary Acquisition

Using New Tools, Breaking New Ground



Coastal Louisiana Risk Assessment (CLARA) Model Estimates Economic Damage from Coastal Flooding

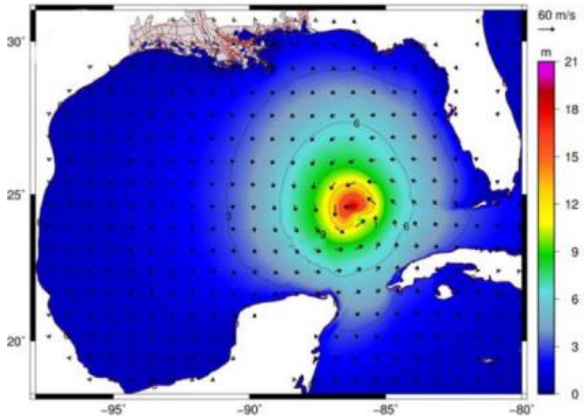
Estimates flood depths across the coast

Determines direct economic damage

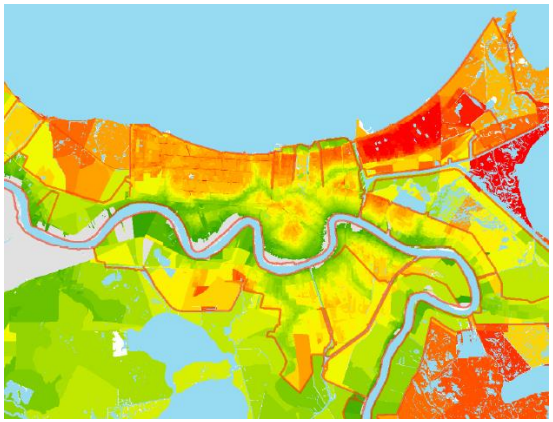
- **Builds on post-Katrina flood modeling efforts**
  - LACPR
  - IPET Risk and Reliability
  - FEMA HAZUS-MH
- **Provides balanced resolution for future risk estimates**
  - Estimates damage reduction from many structural and nonstructural options
  - Considers many scenarios

CLARA Proceeds in Three Calculation Steps

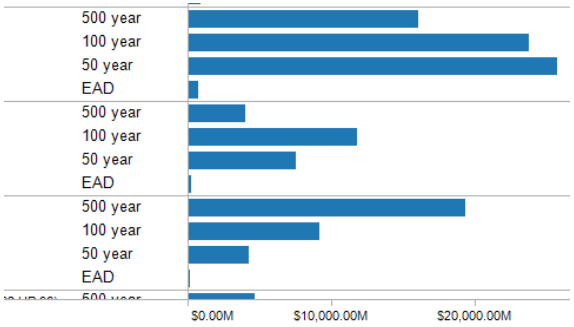
Statistical
Pre-Processing Module



Flood Depth Module



Economic Module

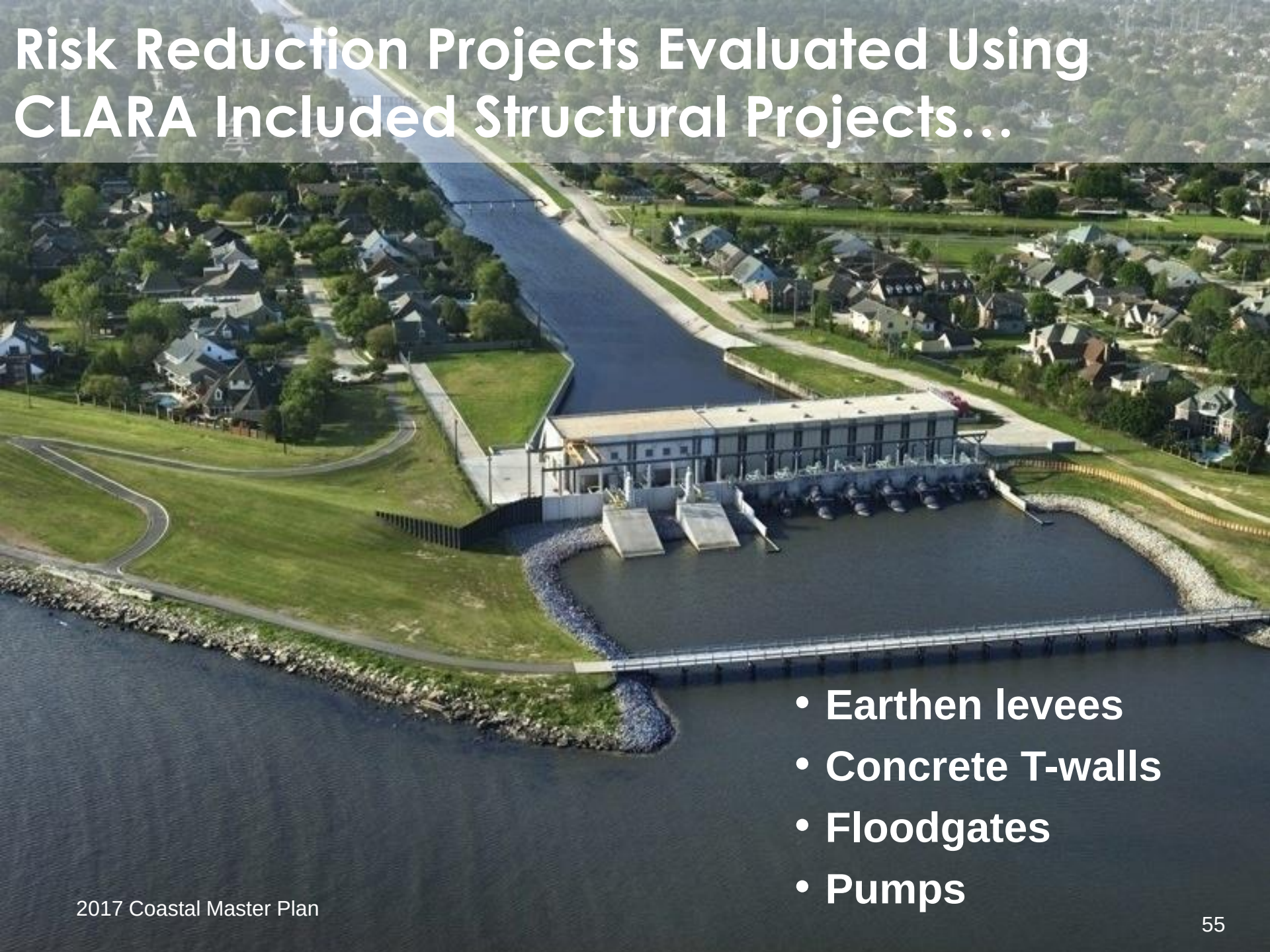


Damage Dollars

Damage is estimated for the following types of assets:

- single-family residences
- manufactured homes
- small multifamily residences (e.g., duplex, triplex)
- large multifamily residences (e.g., apartment building, condominium)
- commercial properties
- industrial
- public facilities
- transport infrastructure (e.g., roads, bridges, rail)
- vehicles
- agriculture structures and properties
- agricultural crops

Risk Reduction Projects Evaluated Using CLARA Included Structural Projects…



- **Earthen levees**
- **Concrete T-walls**
- **Floodgates**
- **Pumps**

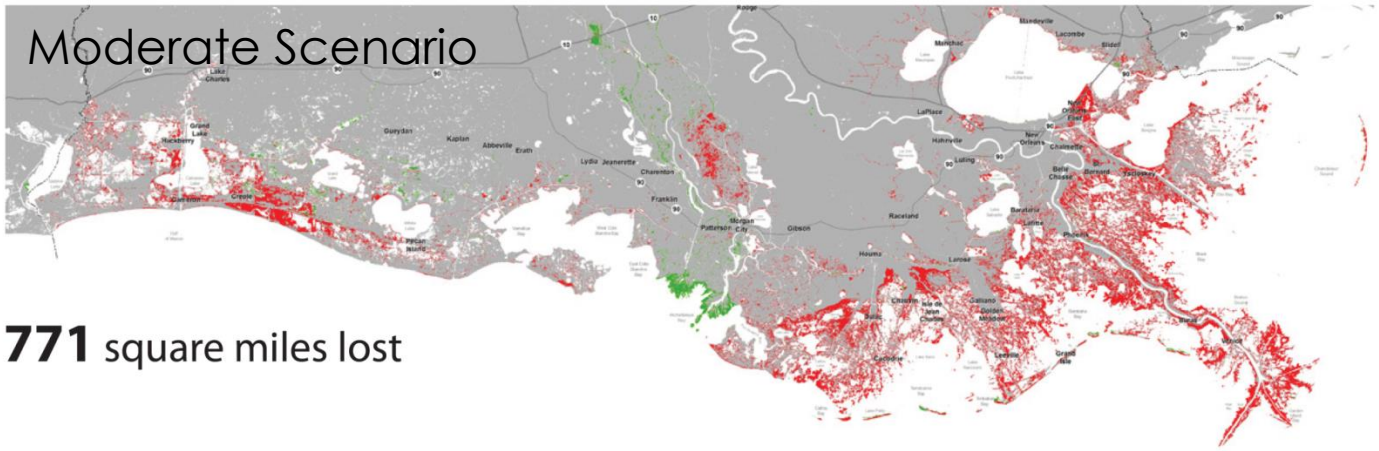
…and Non-Structural Projects

- Elevation
- Floodproofing
- Voluntary acquisition

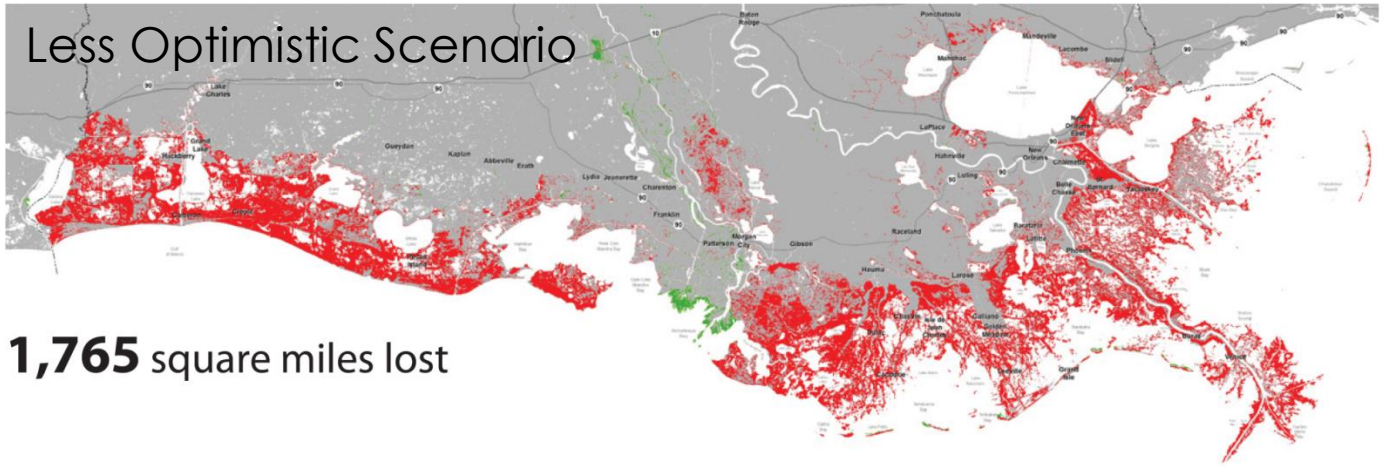
Predictive Models Team

Predictive Model	Lead
Ecohydrology	Ehab Meselhe, PhD, PE, ULL + 9 members
Vegetation	Jenneke Visser, PhD, ULL + 8 members
Wetland Morphology	Greg Steyer, PhD, USGS + 6 members
Barrier Island Morphology	Mark Kulp, PhD, UNO + 6 members
Ecosystem Services	Andy Nyman, PhD, LSU + 8 members
Storm Surge	Joe Suhayda, PhD, Arcadis + 3 members
Storm Damage/Risk	Jordan Fischbach, PhD, RAND + 7 members
Data Integration	Craig Conzelmann and USGS team
Uncertainty Analysis	Emad Habib, PhD, ULL
Technical Advisor	Denise Reed, PhD, UNO

Future Scenarios



771 square miles lost



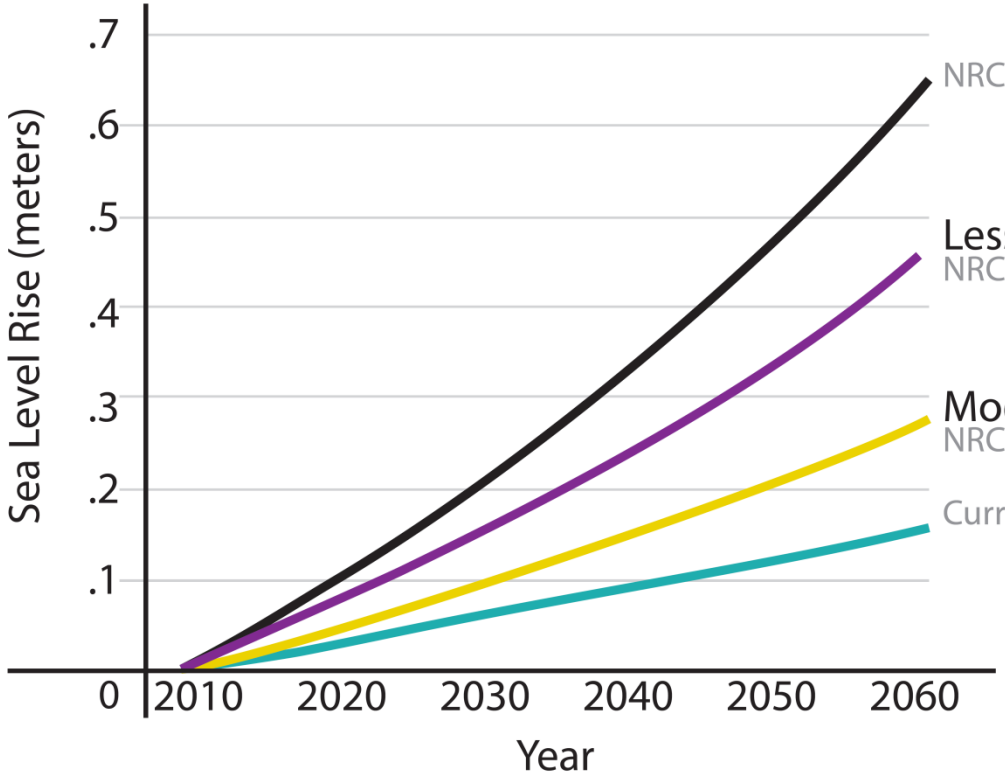
1,765 square miles lost

Factors Accounted for by Our Scenarios

- Sea Level Rise
- Subsidence
- Storm Intensity
- Storm Frequency
- River Discharge / Sediment Load
- River Nutrient Concentration
- Rainfall
- Evapotranspiration
- Marsh Collapse Threshold

Variation in Sea Level Rise (Eustatic)

Estimates of Sea Level Rise over Next 50 Years

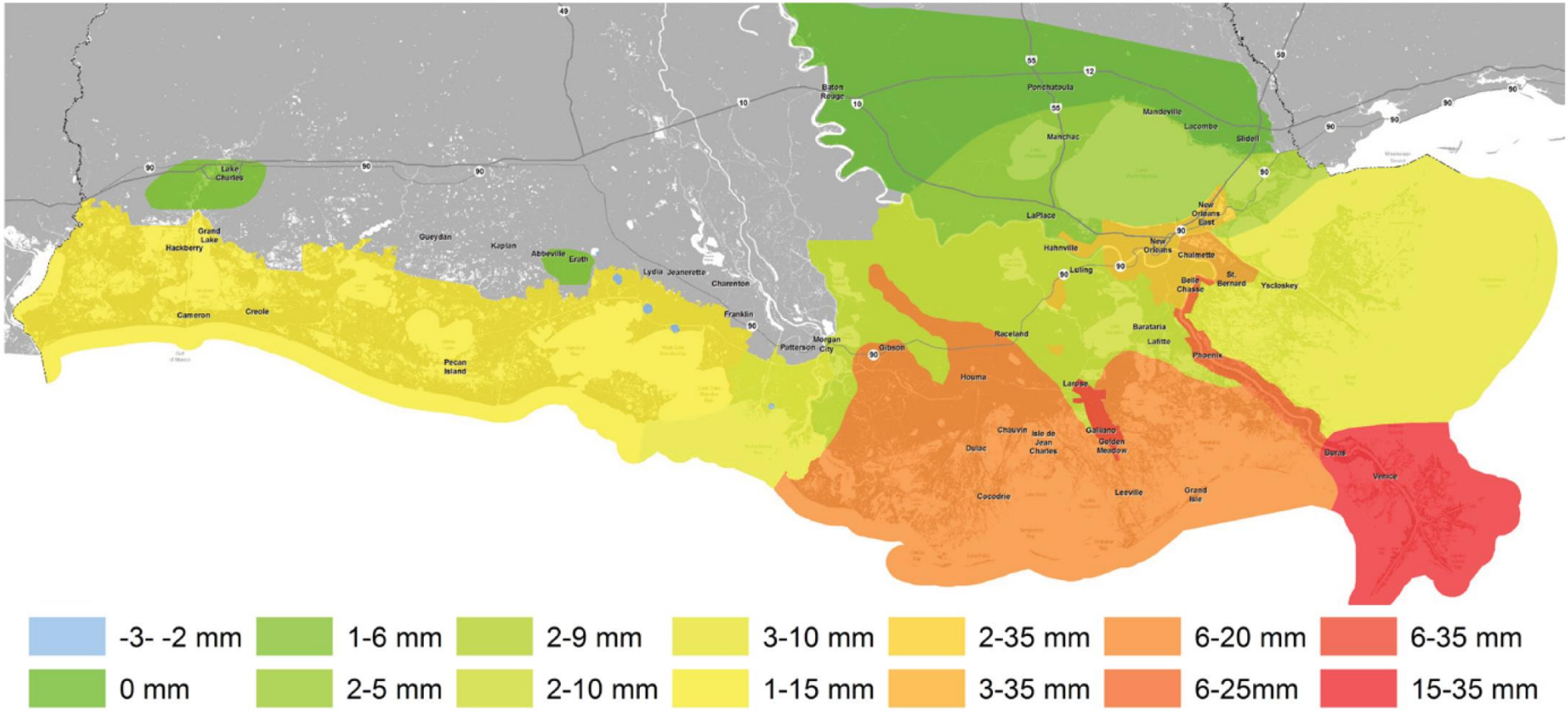


0.45 m over 50

0.27 m over 50

On-going analysis is incorporating new research and evaluating a scenario of 0.78 m over 50 years

Variation in Subsidence Rates



Subsidence Advisory Panel Members: Louis Britsch, PhD, PG, USACE-MVN; Roy Dokka, PhD, LSU; Joseph Dunbar, PG, USACE-ERDC; Mark Kulp, PhD, UNO; Michael Stephen, PhD, PG, CEC; Kyle Straub, PhD, Tulane; Torbjorn Tornqvist, PhD, Tulane

The Analytical Challenge

- Complex coastal environment
  - Wetlands, bays, barriers/Rural, urban, industry
- Planning horizon
  - 50 years – need to consider change over time
- Multiple future scenarios
- Projects
  - 210 restoration projects
  - 34 Structural protection projects
  - 112 Non-structural protection projects
- Diverse community needs, competing stakeholder preferences

There is No Optimal Solution – Tough Decisions Must Be Made

- Risk reduction
- Use of river diversions
- Near term benefits

- Restoration
- Maintenance of current salinity gradients
- Long term sustainability

The Planning Tool Is a Computer-Based Decision Support Tool

1. Compares and ranks individual projects

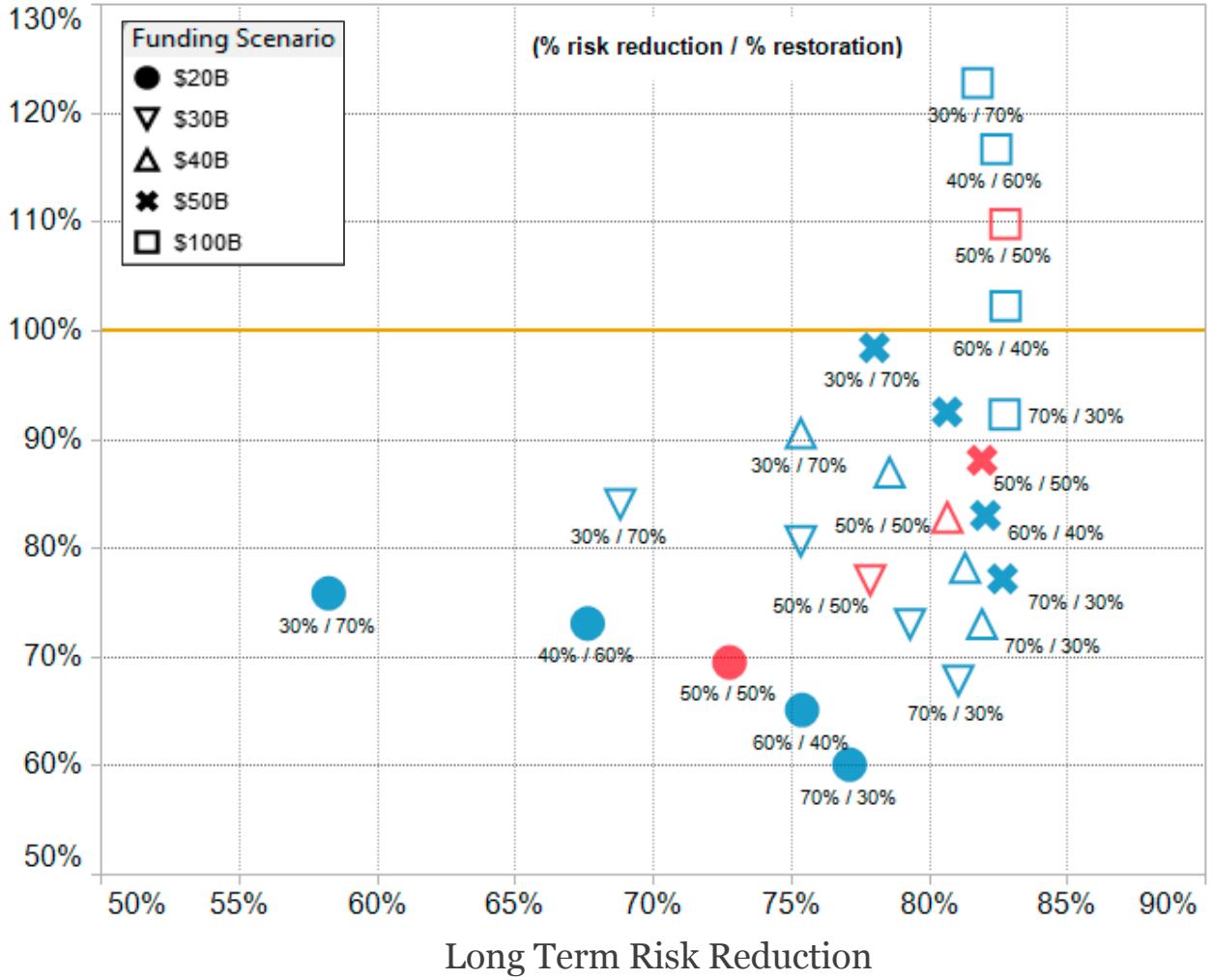
2. Develops different combinations of projects for comprehensive strategy

3. Uses interactive visualizations to display tradeoffs and support decision making

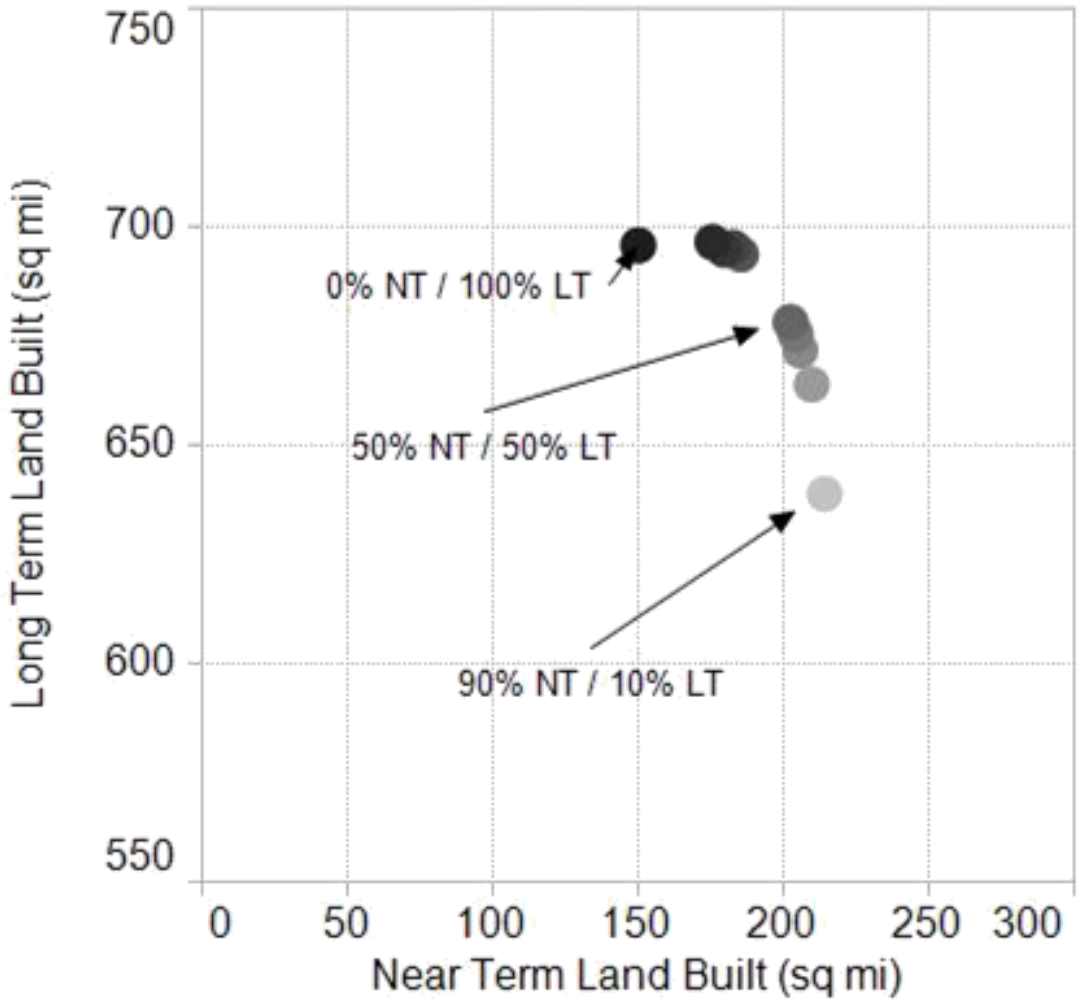
Key Decision Points

- Flood Risk Reduction and Land Building as Decision Drivers
- Funding Allocation – $50 Billion, 50/50 split
- Near Term and Long Term Benefits – 50/50 split
- Selecting Projects for an Uncertain Future
- Use of Decision Criteria and Ecosystem Services
- Land Building Experiments

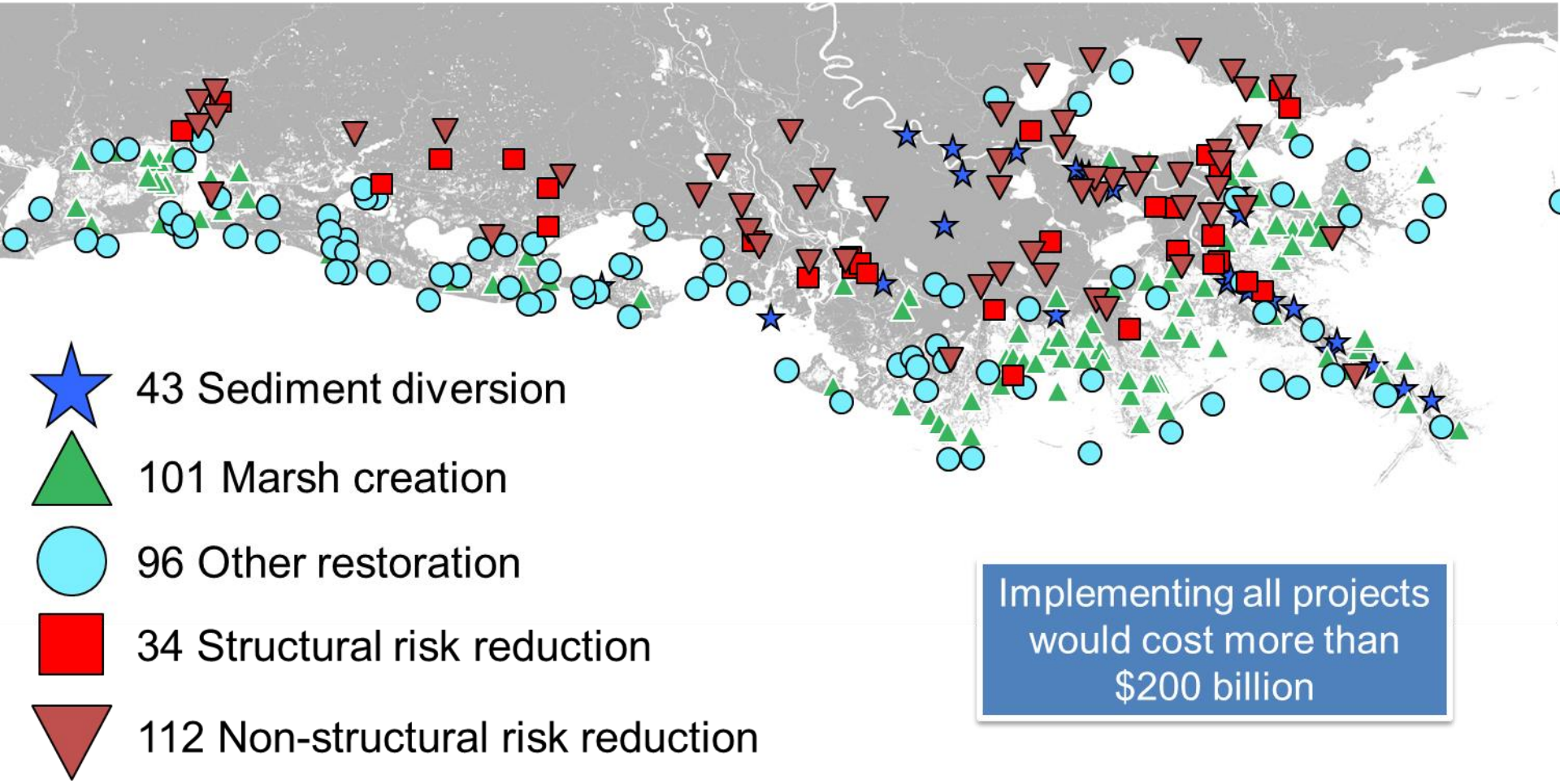
Explored Funding Scenarios and Allocation Between Risk Reduction and Restoration Projects



Evaluated Balance Between Near Term and Long Term Benefits



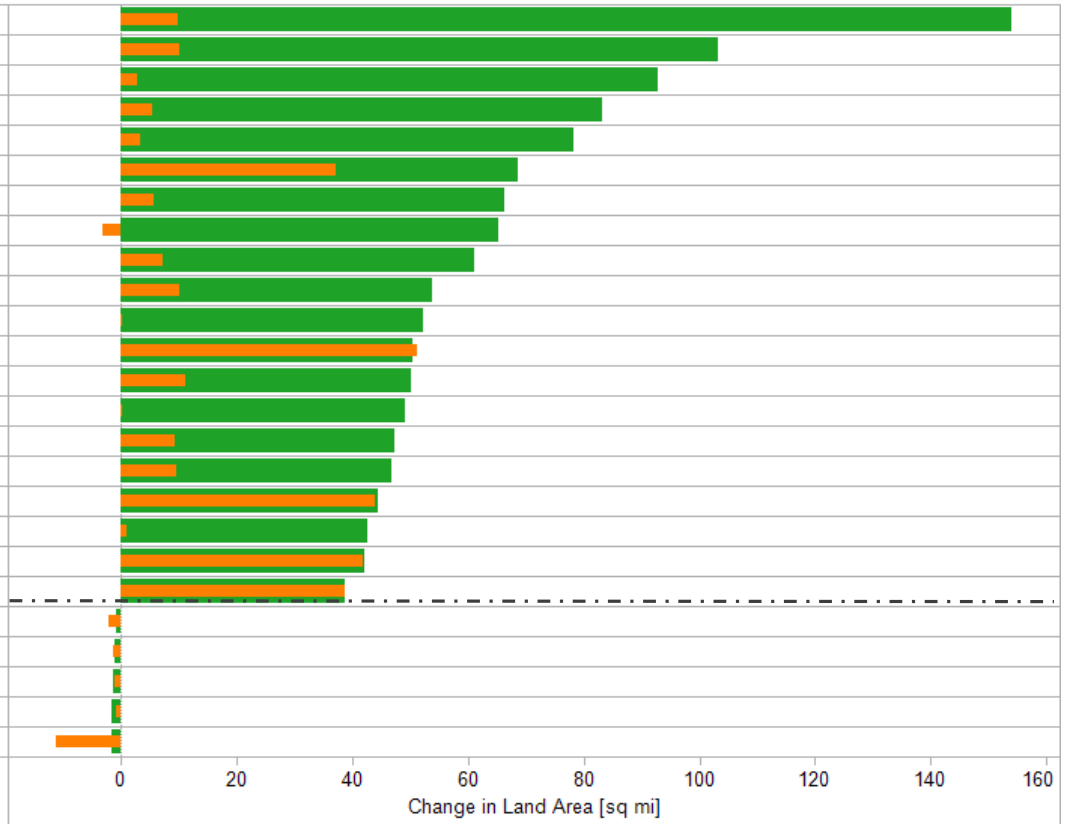
Planning Tool Evaluates Hundreds of Restoration and Risk Reduction Projects



Planning Tool Compares Individual Projects

Near and Long Term Land

Project Name	Project Type
Pass a Loutre Channel Realignment with Up River Diversions	Channel re-alignment
Pontchartrain-Barataria Multi-Diversion Plan	Diversion
Up River Reallocation (80/20)	Channel re-alignment
Up River Reallocation (90/10)	Channel re-alignment
Up River Reallocation (50/50)	Channel re-alignment
Mid-Barataria Diversion (250,000 cfs- 2nd Increment)	Diversion
Upper Breton Diversion (250,000 cfs)	Diversion
Down River Reallocation (10/90)	Channel re-alignment
Hermitage Diversion (250,000 cfs Seasonally Operated)	Diversion
Mid-Barataria Diversion (250,000 cfs)	Diversion
Biloxi Marsh Creation	Marsh Creation
Lower Barataria Marsh Creation	Marsh Creation
Mid-Barataria Diversion (50,000 cfs- 1st Increment)	Diversion
Golden Meadow-Montegut Marsh Creation	Marsh Creation
West Pointe a la Hache Diversion (250,000 cfs)	Diversion
Up River Reallocation (10/90)	Channel re-alignment
Dulac-Cocodrie Marsh Creation	Marsh Creation
Down River Reallocation (50/50)	Channel re-alignment
Large-Scale Barataria Marsh Creation	Marsh Creation
North Terrebonne Bay Marsh Creation	Marsh Creation
East Maurepas Diversion (5,000 cfs)	Diversion
Bonnet Carre Diversion (5,000 cfs)	Diversion
Humble Canal Hydrologic Restoration	Hydrologic Restoration
Mermentau River Hydrologic Restoration	Hydrologic Restoration
Central Wetlands Diversion (50,000 cfs)	Diversion



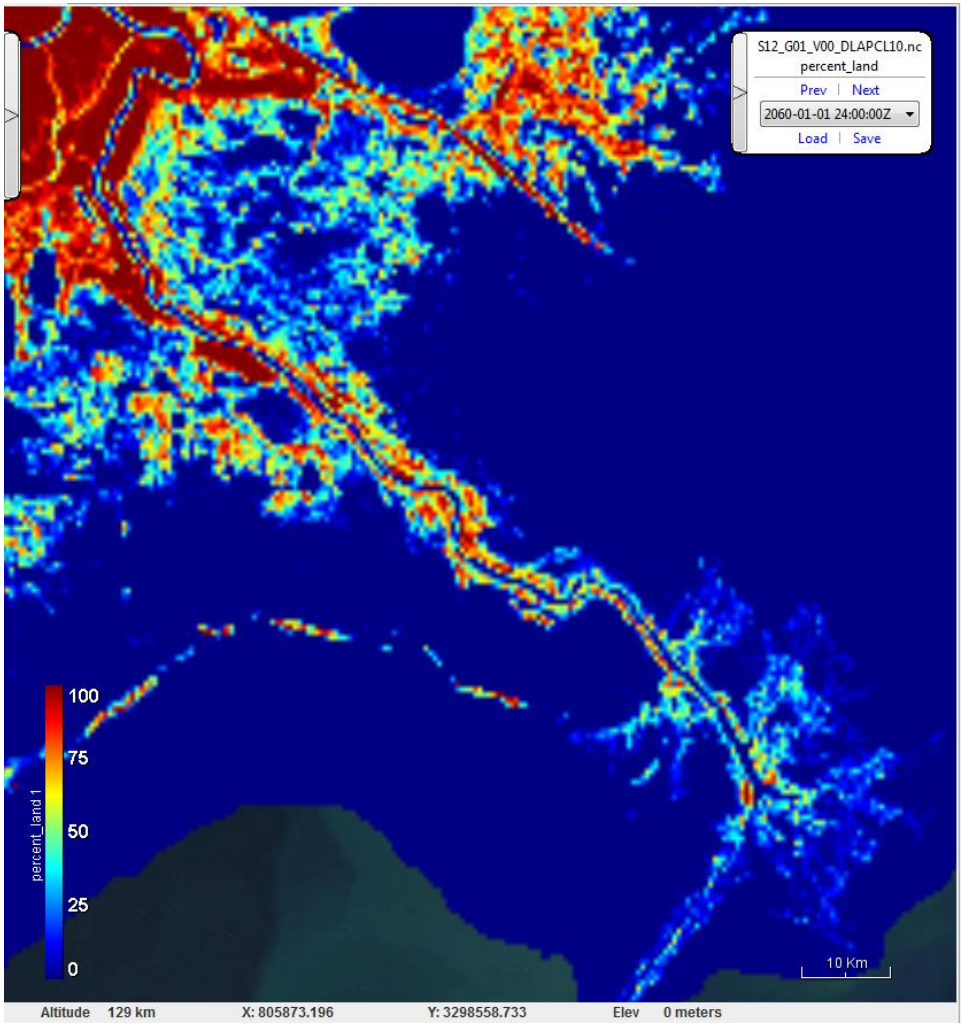
Near Term Land (Year 20)

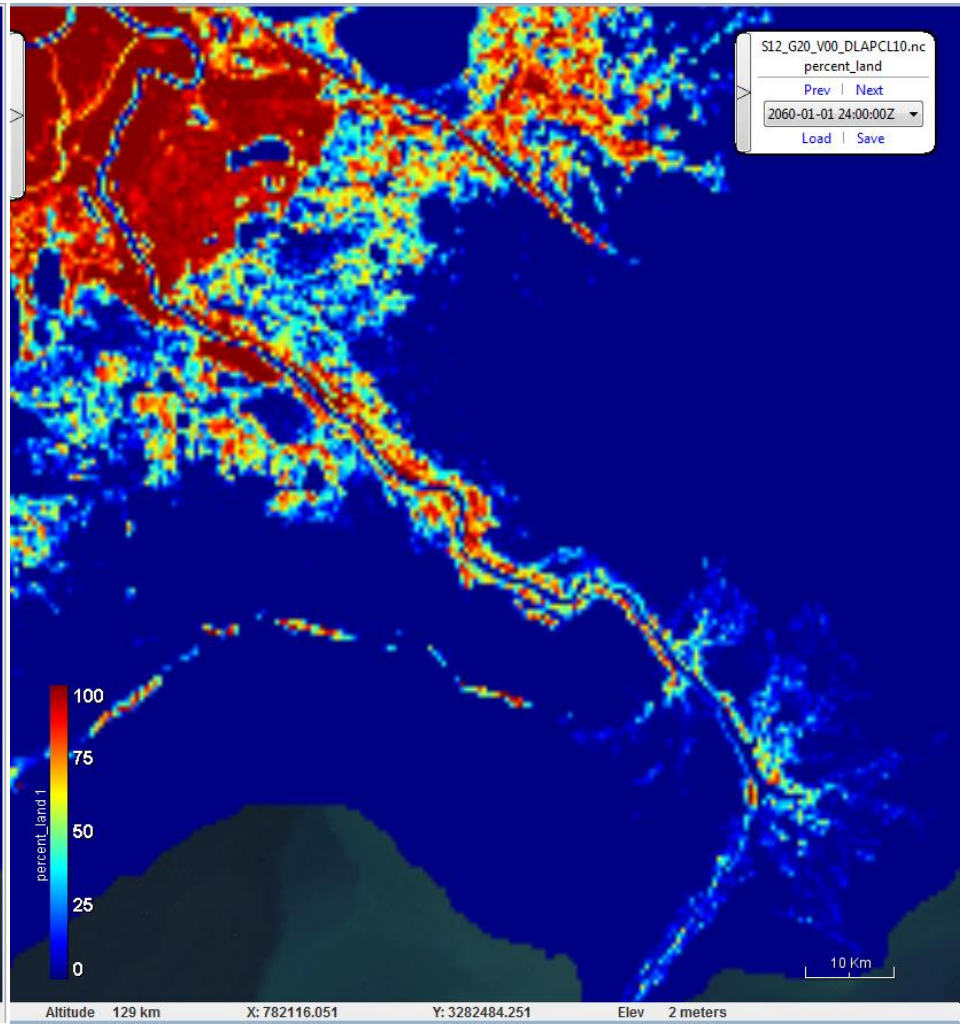
Long Term Land (Year 50)

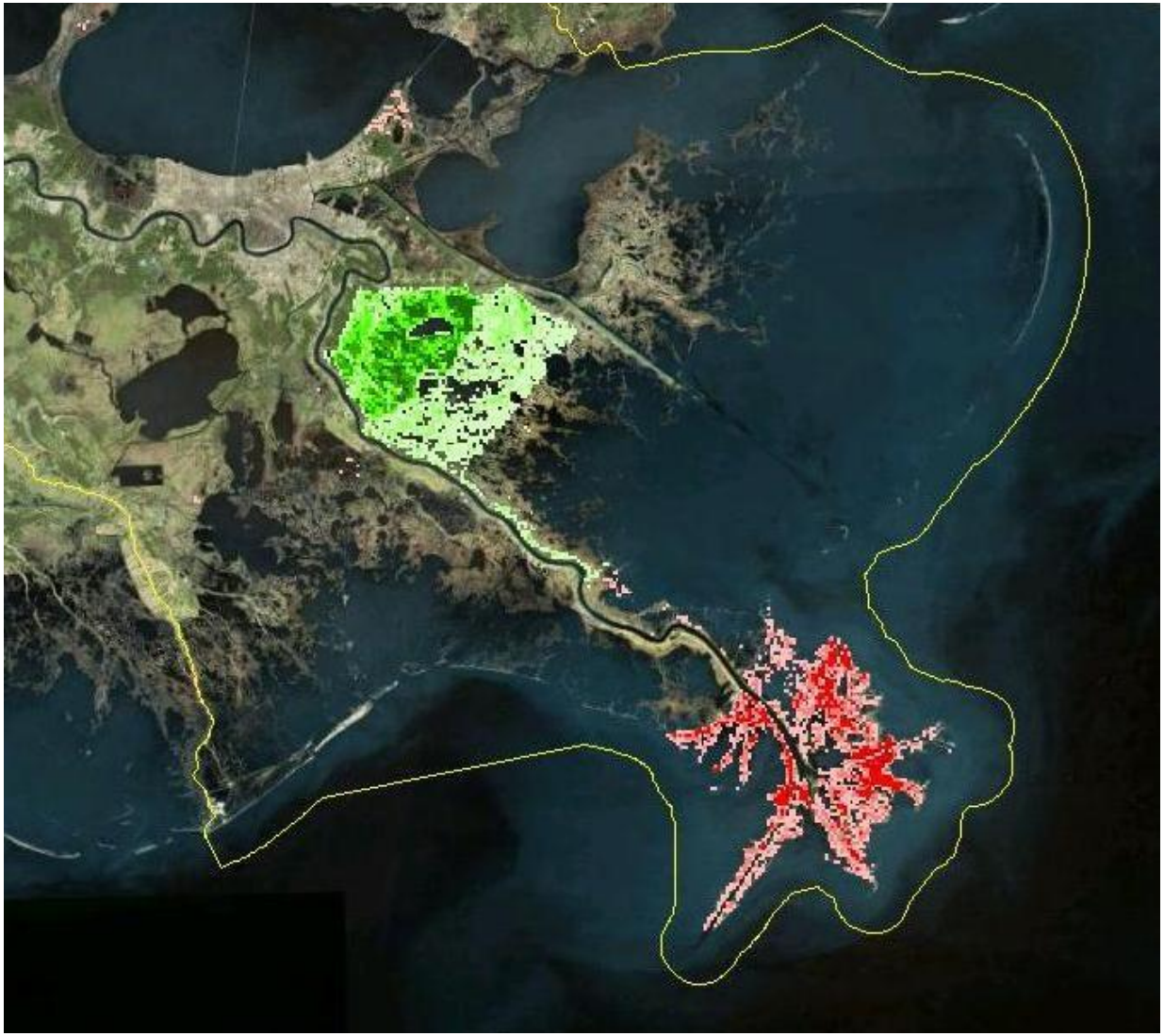
Group 20	001.DI.17	Diversion	Caernarvon Diversion: 250,000 cfs capacity (70% Mississippi/30% Atchafalaya)

10 times average discharge of Göta River (575 m^3/s)

Operation at capacity when Mississippi River exceeds 900,000 cfs; operation at 50,000 for flows from 900,000 cfs to 600,000 cfs; operation at 8% of river flow for river flows from 600,000 cfs down to 200,000 cfs, no operation below 200,000 cfs

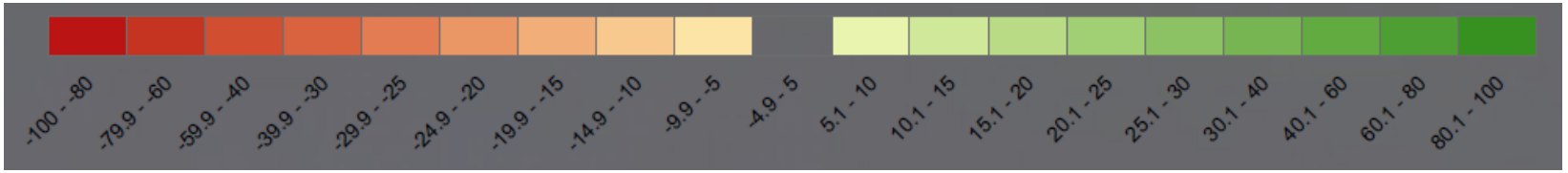

S12_G01_V00_DLAPCL10.nc
percent_land
Prev | Next
2060-01-01 24:00:00Z
Load | Save
100
75
50
25
0
percent_land 1
10 Km
Altitude 129 km
X: 805873.196
Y: 3298558.733
Elev 0 meters


S12_G20_V00_DLAPCL10.nc
percent_land
Prev | Next
2060-01-01 24:00:00Z
Load | Save
100
75
50
25
0
percent_land 1
10 Km
Altitude 129 km
X: 782116.051
Y: 3282484.251
Elev 2 meters



Year 50 Change in Percent Land Compared to FWOA

Scenario B

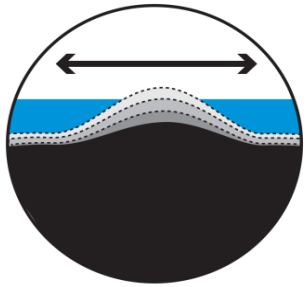


Grounded in Science

Risk Reduction

Expected Annual Damages

Restoration



Land Area

Decision Criteria and Ecosystem Services

- Distribution of flood risk across socioeconomic groups
- Flood protection of historic properties
- Flood protection of strategic assets
- Operation and maintenance costs
- Sustainability
- Support for navigation
- Use of natural processes
- Support for cultural heritage
- Support for oil & gas

- Oyster
- Shrimp
- Freshwater Availability
- Alligator
- Waterfowl
- Saltwater Fisheries
- Freshwater Fisheries
- Carbon Sequestration
- Nitrogen Removal
- Agriculture/Aquaculture
- Other Coastal Wildlife
- Nature-Based Tourism

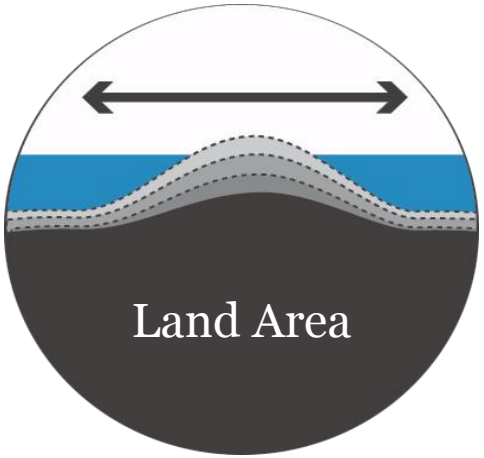
Planning Tool Assembles Different Project Combinations to Meet Louisiana's Objectives

- Uses constrained mixed integer program to select combinations of projects that maximize land building and risk reduction

Objective Function:

Let d_j represent the weight for decision criterion j.

$$Max\ [d_1(\text{Alternative Near-term Reduction in EAD}) + d_2(\text{Alternative Long-term Reduction in EAD}) + d_3(\text{Alternative Near-term Coast wide Land Area}) + d_4(\text{Alternative Long-term Coast wide Land Area})]$$



Planning Tool Assembles Different Project Combinations to Meet Louisiana's Objectives

- Choices are constrained by funding, available sediment, and river flow

$$\sum_{p_e} \sum_i \left(\text{Cost}_{p_e,i,t} \times x_{p_e,i}\right) \leq \text{Restoration Funding}_t, \quad \text{for all values of t } (\forall\, t)$$

$$\sum_{p_r} \sum_i \left(\text{Cost}_{p_r,i,t} \times x_{p_r,i}\right) \leq \text{Risk Reduction Funding}_t, \quad \forall\, t$$

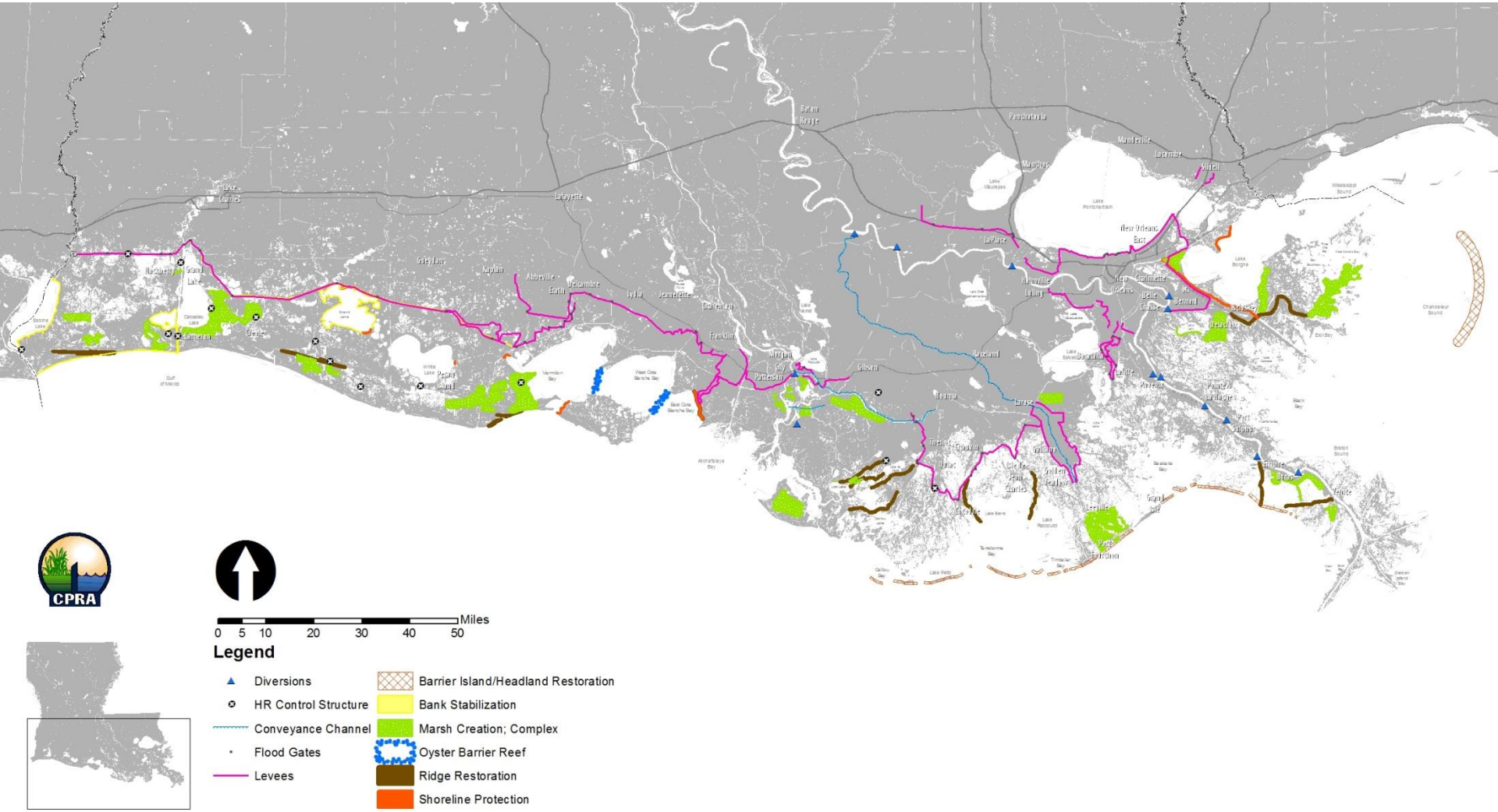
$$\sum_{p_e} \sum_i \left(\text{Sediment Required}_{p_e,i,t,s} \times x_{p_e,i}\right) \leq \text{Sediment Available}_{t,s}, \quad \forall\, t, s$$

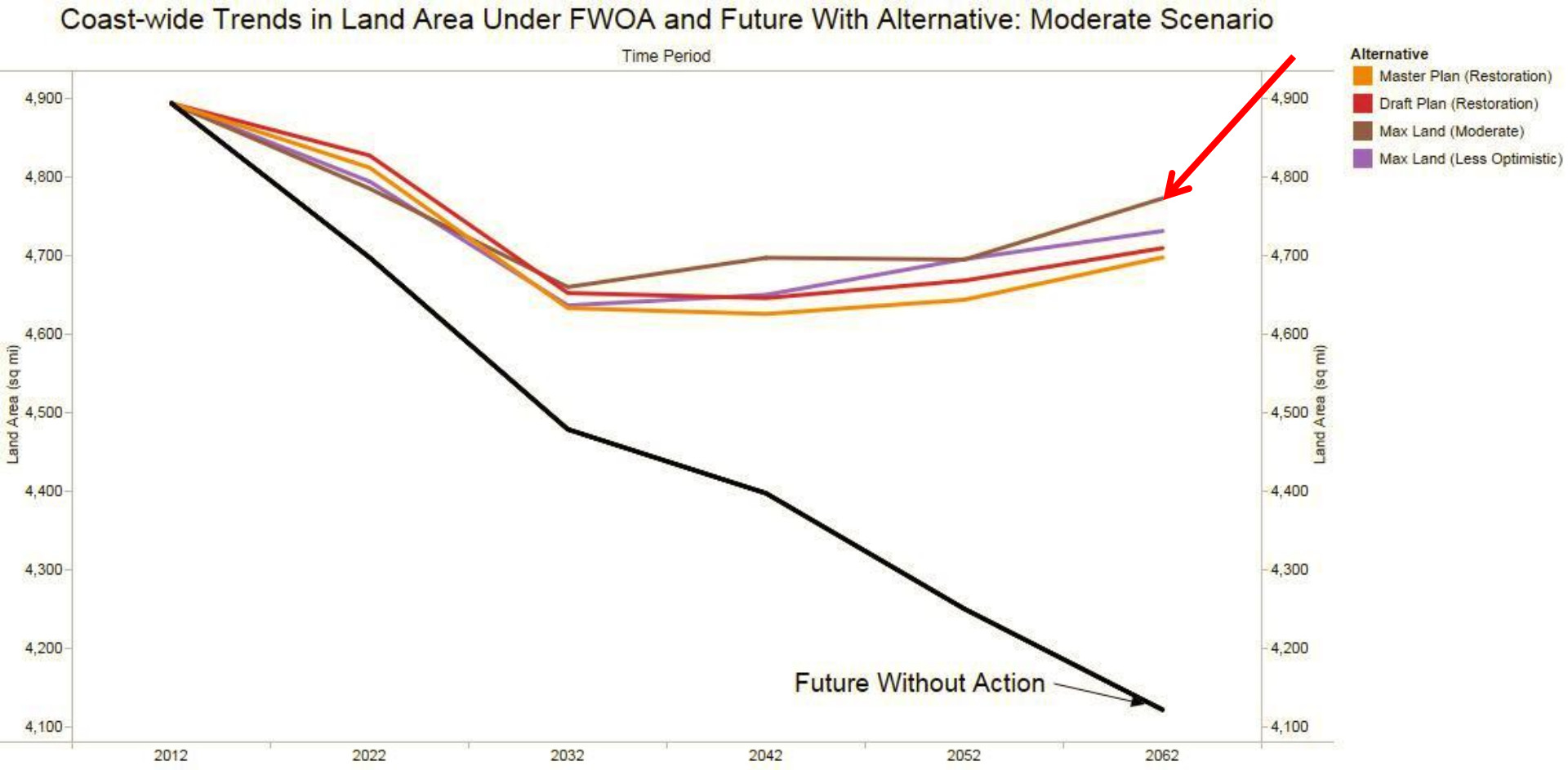
$$\sum_{p_e} \sum_i \left(\text{River Flow Diverted}_{p_e,i,z} \times x_{p_e,i}\right) \leq \text{River Flow}_z, \quad \forall\, z$$

$$\sum_{p_e} \sum_i \left(\text{River Reach Indicator}_{p_e,k} \times x_{p_e,i}\right) \leq \text{Allowable Number of Diversions}_k, \quad \forall\, k$$

Louisiana's 2012 Coastal Master Plan

Max Land/Max Risk Alternative




Coast-wide Trends in Land Area Under FWOA and Future With Alternative: Moderate Scenario
Time Period
Land Area (sq mi)
4,900
4,800
4,700
4,600
4,500
4,400
4,300
4,200
4,100
2012
2022
2032
2042
2052
2062
Alternative
Master Plan (Restoration)
Draft Plan (Restoration)
Max Land (Moderate)
Max Land (Less Optimistic)
Future Without Action

Planning Tool Assembles Different Project Combinations to Meet Louisiana's Objectives

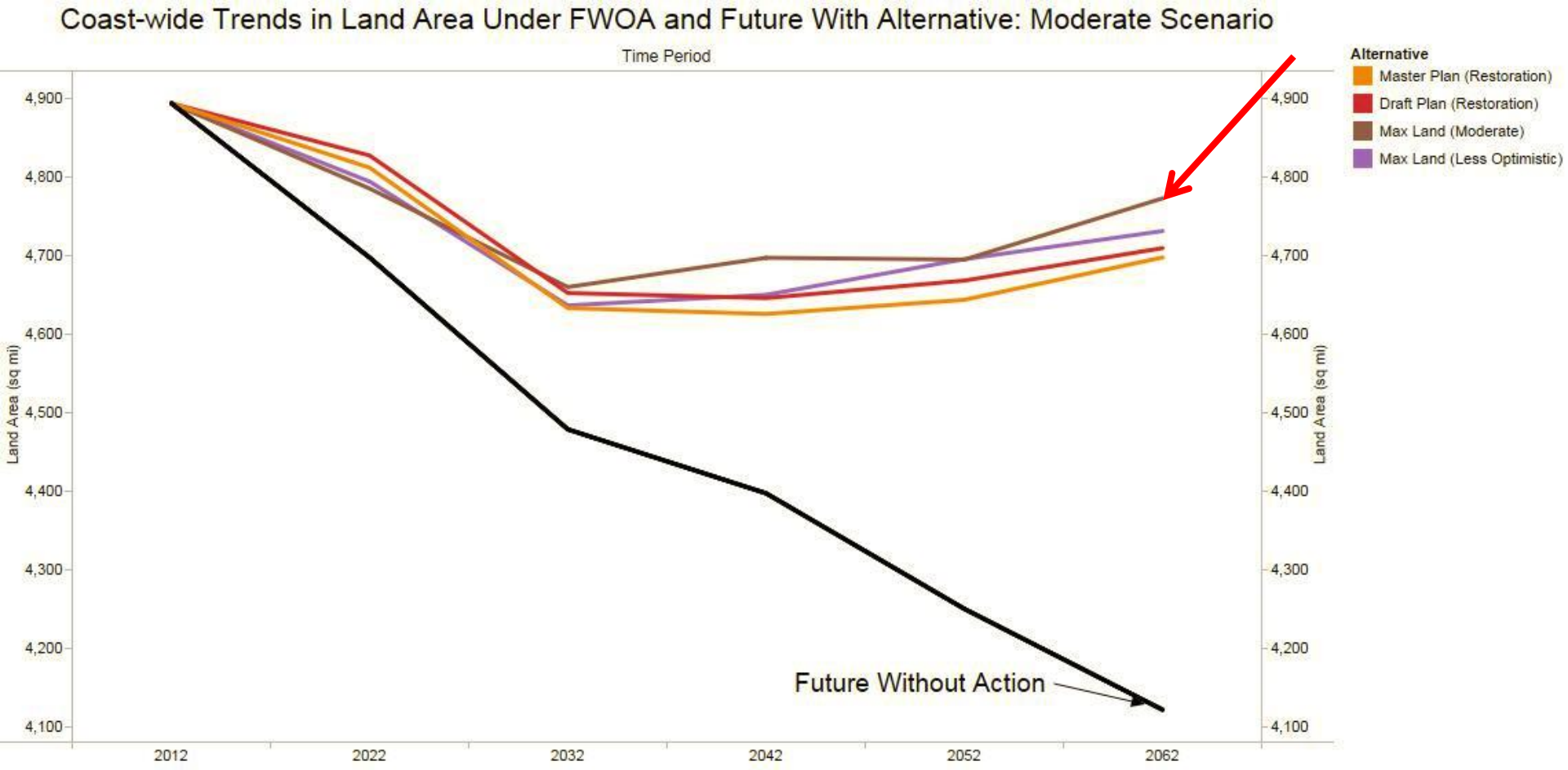
- Combinations balance ecosystem health, navigation, and other coastal interests

Coastal habitats

$$\sum_p \sum_i \left(\text{Metric}_{p,i} \times x_{p,i}\right) \geq \text{Performance Threshold}$$

Decision Criteria

$$\sum_p \sum_i \left(\text{Decision Criterion Score}_{p,i} \times x_{p,i}\right) \geq \text{Performance Threshold}$$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Future Without Action

Science and Engineering Board

Ecosystem Science / Coastal Ecology

- William Dennison, PhD, University of Maryland
- Edward Houde, PhD, University of Maryland
- Katherine Ewel, PhD, University of Florida

Engineering

- Robert Dalrymple, PhD, PE, Johns Hopkins University
- Jos Dijkman, MsC, PE, Dijkman Delft

Geosciences

- Charles Groat, PhD, University of Texas at Austin

Social Science and Risk

- Greg Baecher, PhD, PE, University of Maryland
- Philip Berke, PhD, University of North Carolina – Chapel Hill

Climate Change

- Virginia Burkett, PhD, U.S. Geological Survey

Environmental/Natural Resource Economics

- Edward Barbier, PhD, University of Wyoming

Technical Advisory Committees

Predictive Models

- Steve Ashby, PhD, USACE Eng. Res. Dev. Center
- John Callaway, PhD, University of San Francisco
- Fred Sklar, PhD, South Florida Water Mgmt. District
- Si Simenstad, MS, University of Washington

Planning Tool

- John Boland, PhD, PE, John Hopkins
- Ben Hobbs, PhD, John Hopkins
- Len Shabman, PhD, Virginia Tech

Cultural Heritage

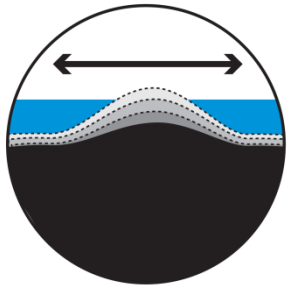
- Don Davis, PhD, Louisiana State University
- Maida Owens, LA Dept. of Culture, Recreation, and Tourism
- Carl Brasseaux, PhD, University of Louisiana Lafayette

Grounded in Science

Risk Reduction

Expected Annual Damages

Restoration



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- Nitrogen Removal
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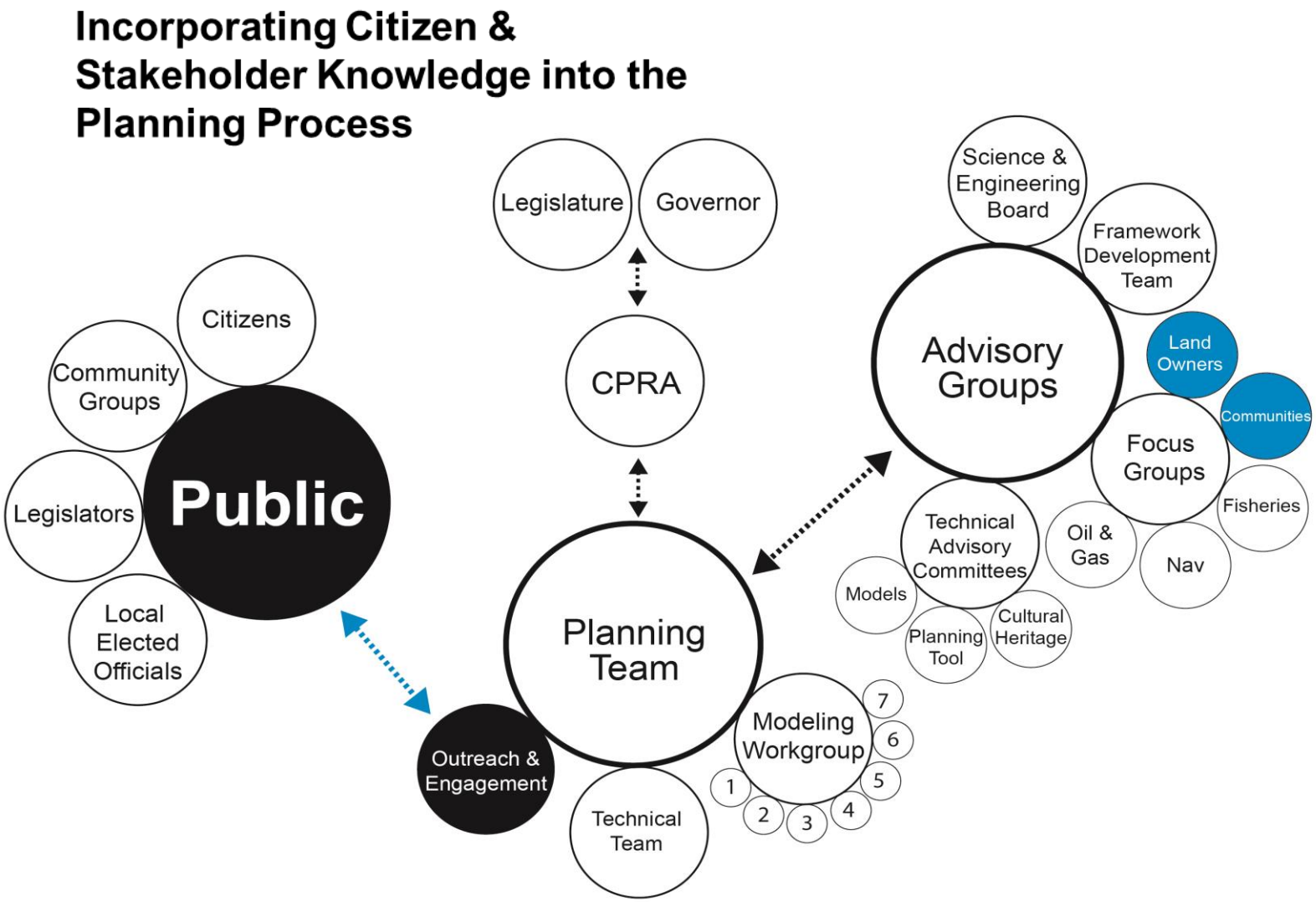
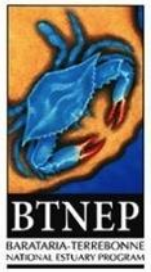
- Other Coastal Wildlife
- Nature-Based Tourism

Responsive to the Needs of Our Coastal Communities

Outreach and Engagement Groups



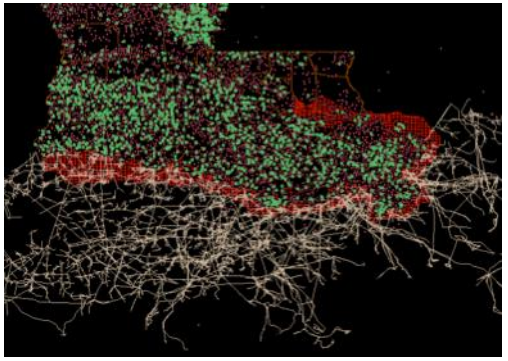
Framework Development Team

Over 30 Federal, State, NGO, Academic, Community, and Industry Organizations

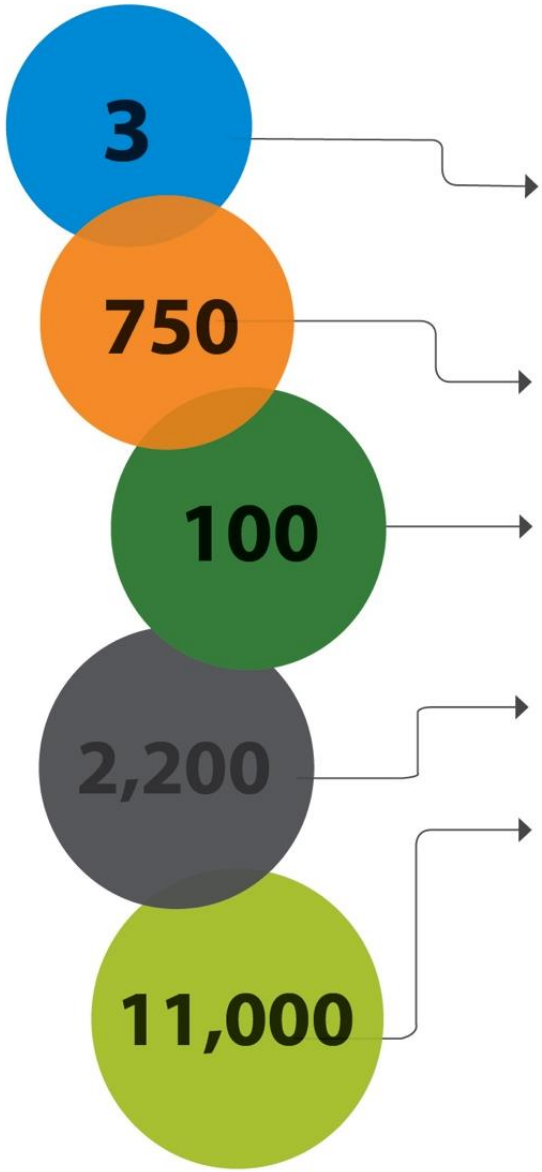
Focus Groups

- Key industries are impacted by land loss and large scale protection and restoration efforts
- Created three focus groups:
  - Navigation
  - Fisheries
  - Oil and Gas
- Expanding membership to:
  - Landowners
  - Community groups



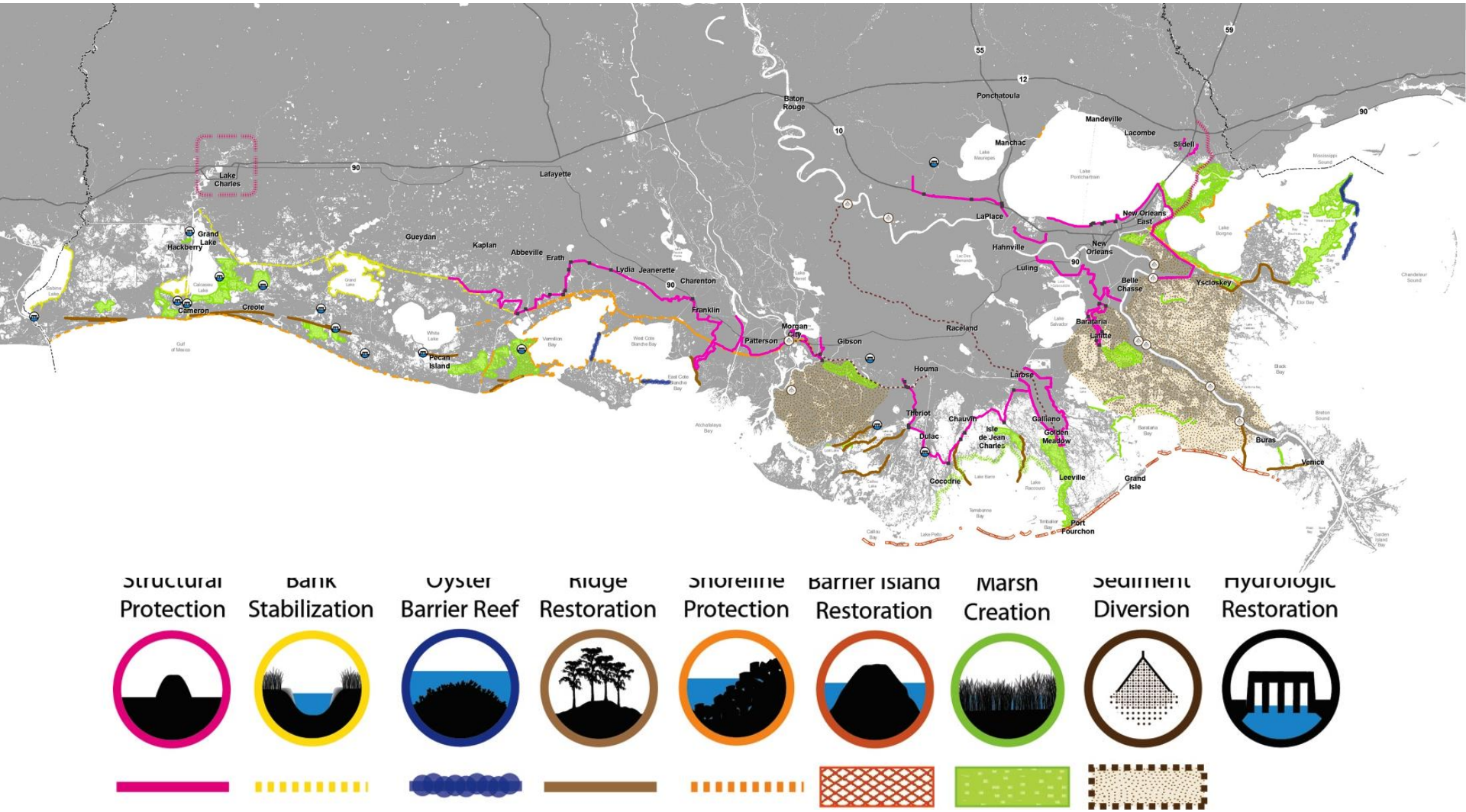
Extensive Public Outreach and Review

Extensive Public Outreach and Review

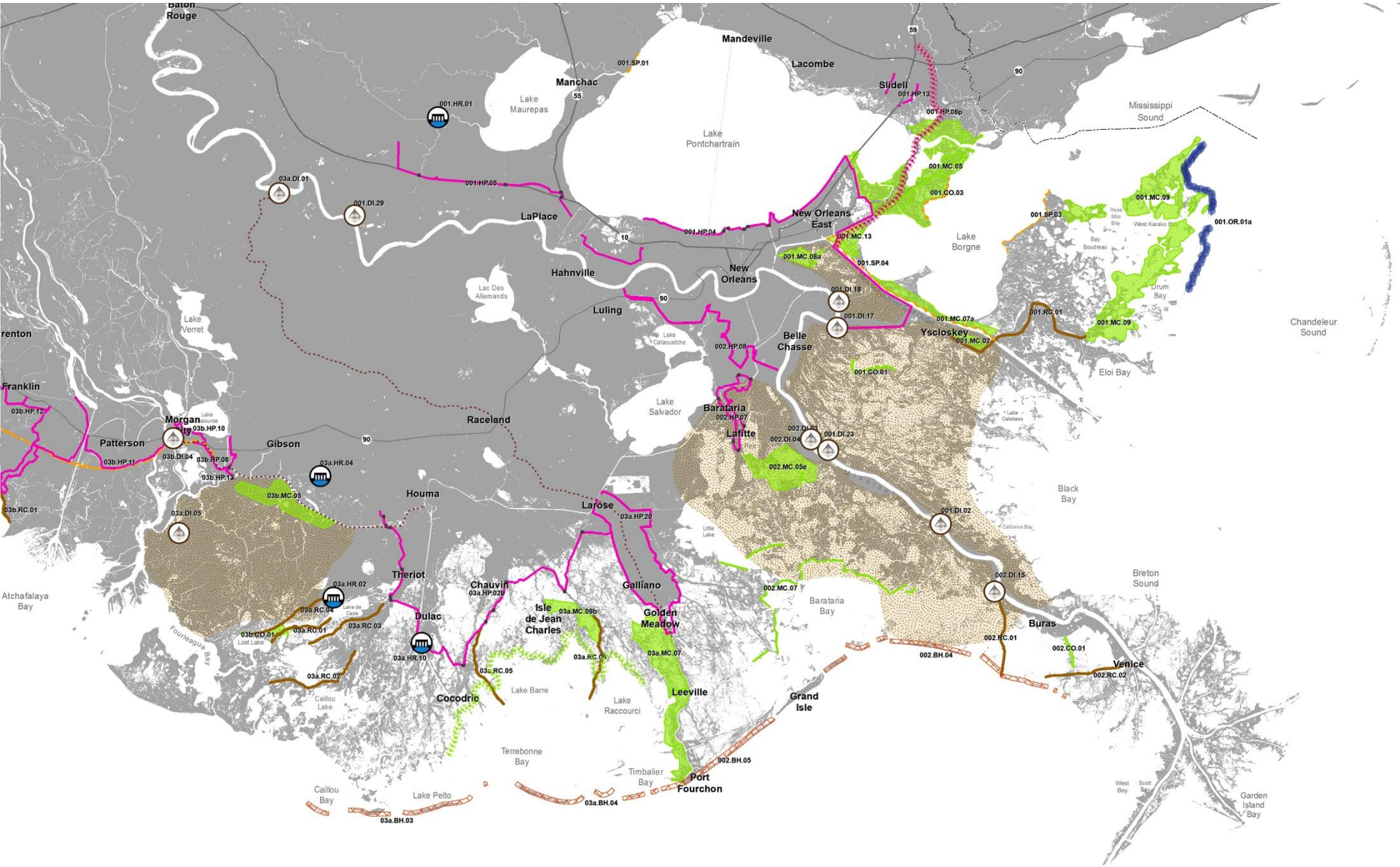


- **3** Open house and public hearings held to receive feedback on draft plan: New Orleans, Houma, and Lake Charles
- **750** Attendees at the public hearings
- **100** Public comments received on draft plan at public meetings
- **2,200** Public comments received on draft plan
- **11,000** People visited the plan website during the public comment period

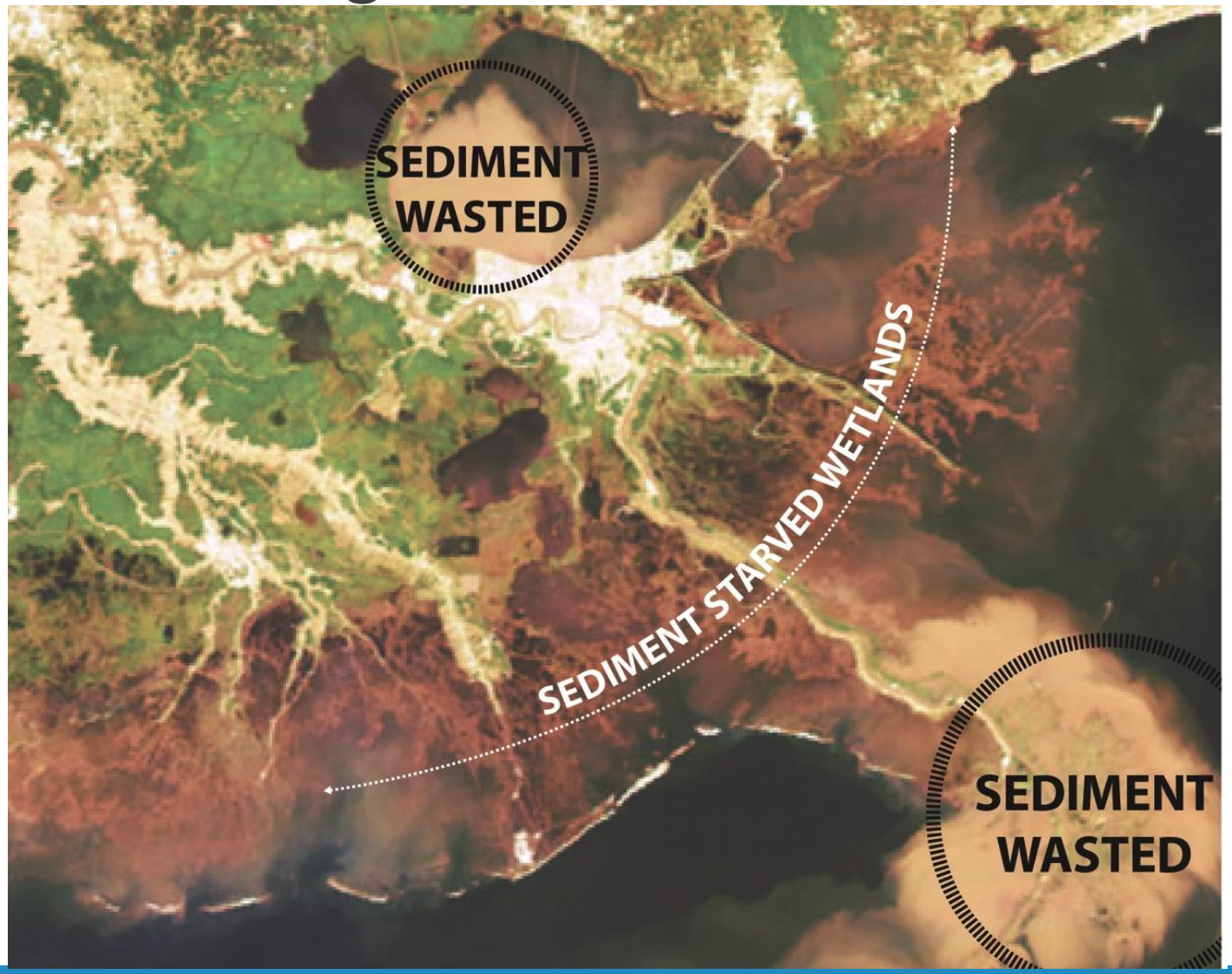
Louisiana's 2012 Comprehensive Master Plan for a Sustainable Coast



A Closer Look: Southeast Coast



Keystone of the 2012 Master Plan: Reconnecting the River



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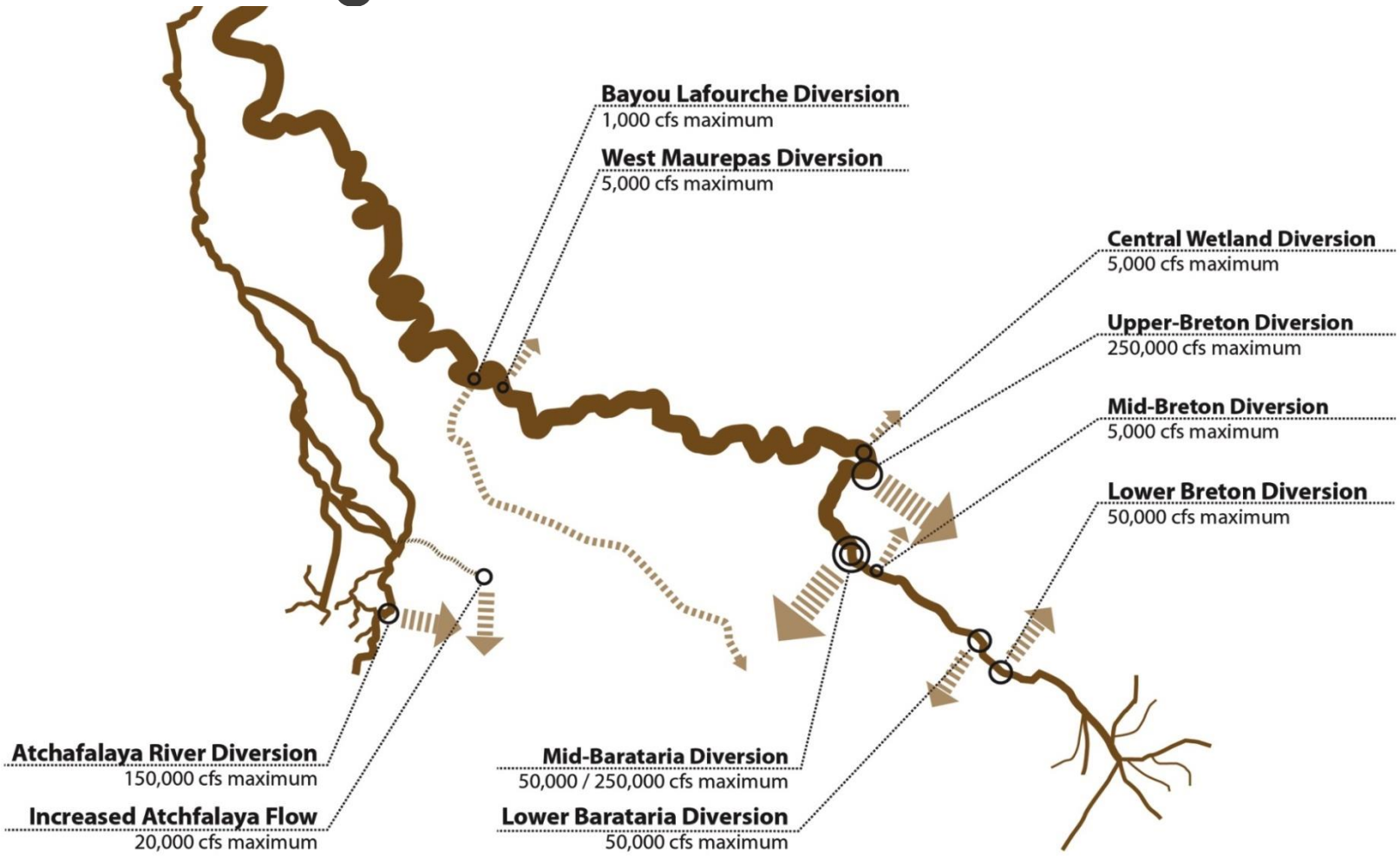
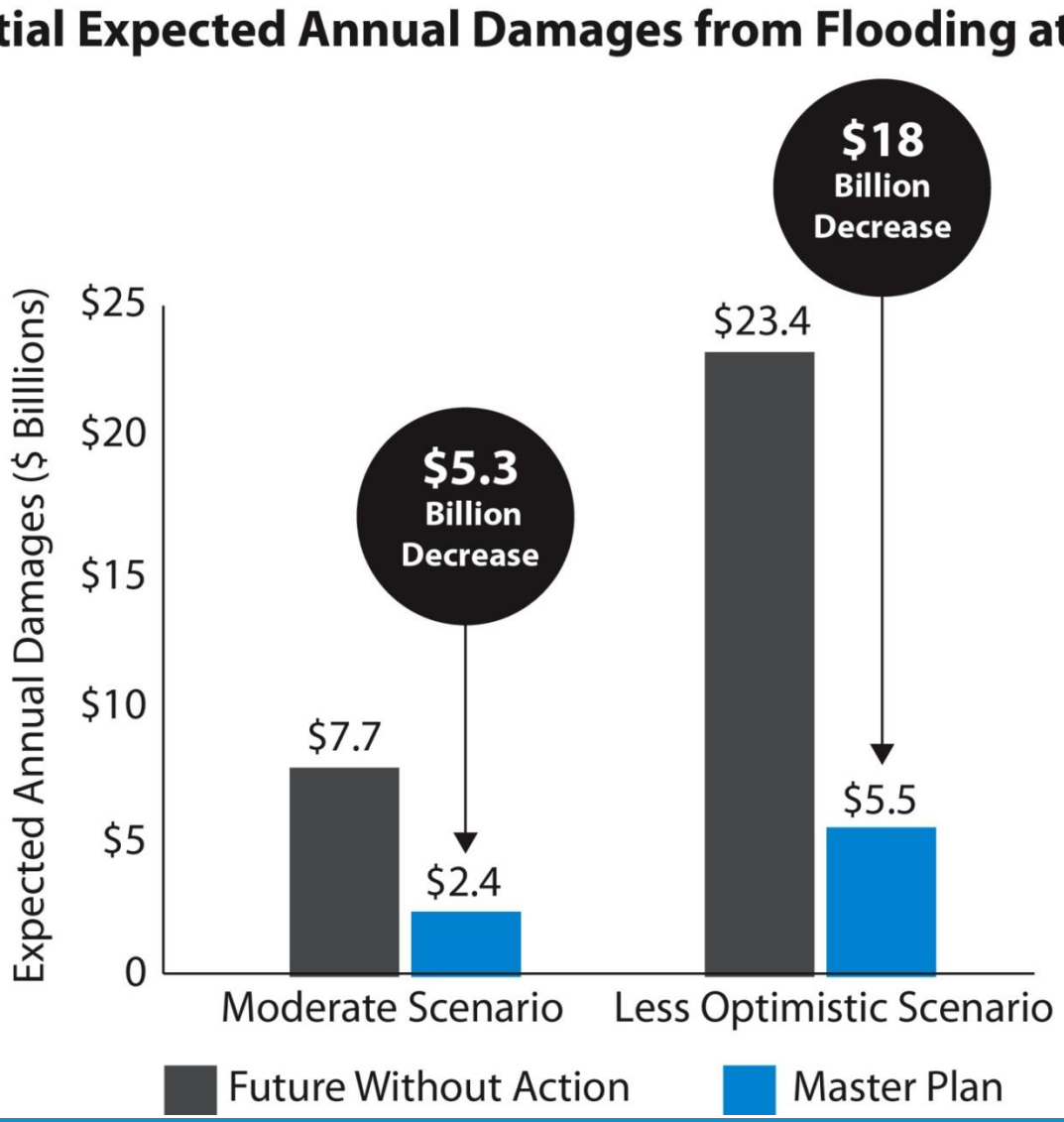


The projects in the plan would use up to 50% of the Mississippi River's peak flow for sediment diversions, in addition to using water and sediment from the Atchafalaya River.

What the Master Plan Delivers



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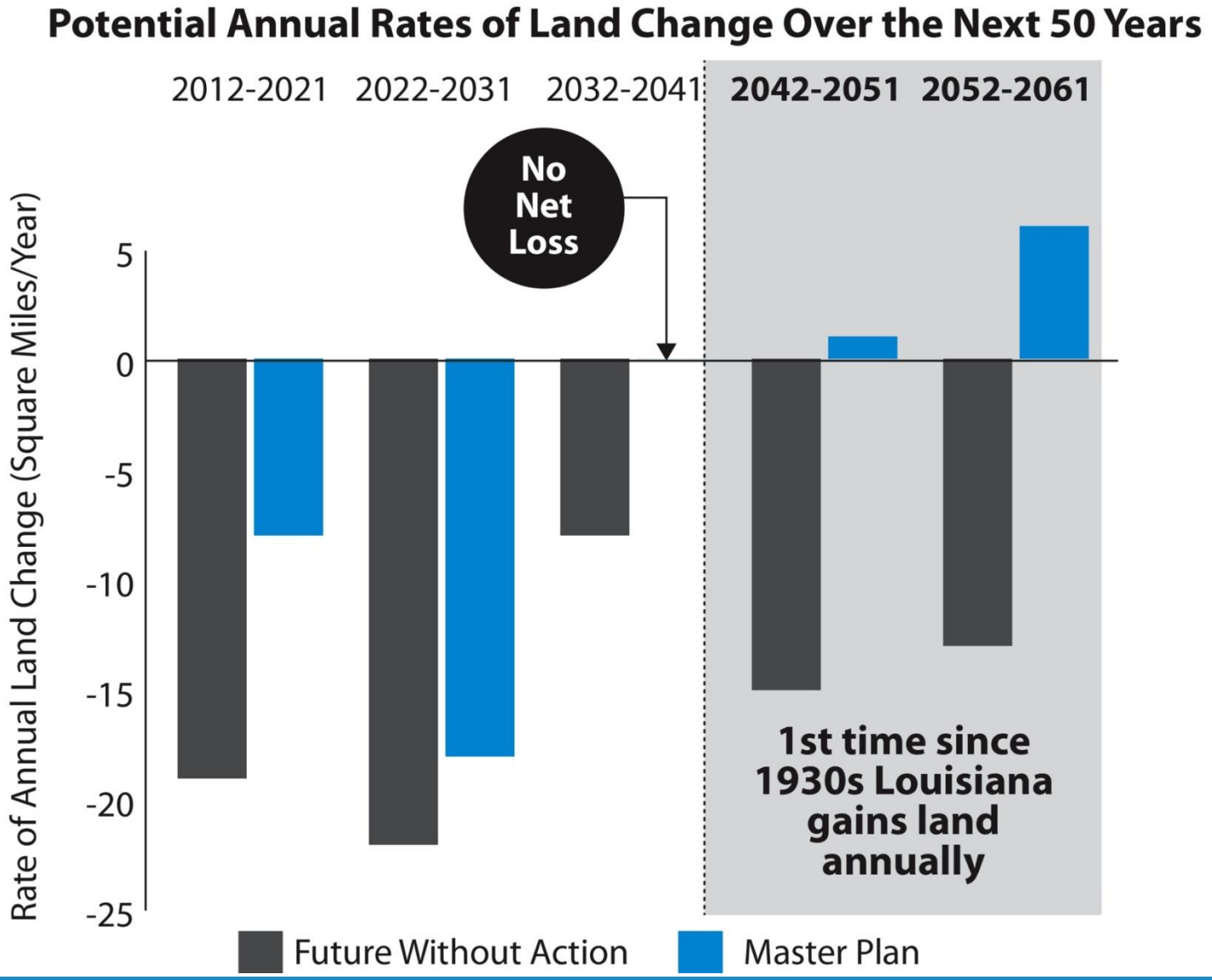

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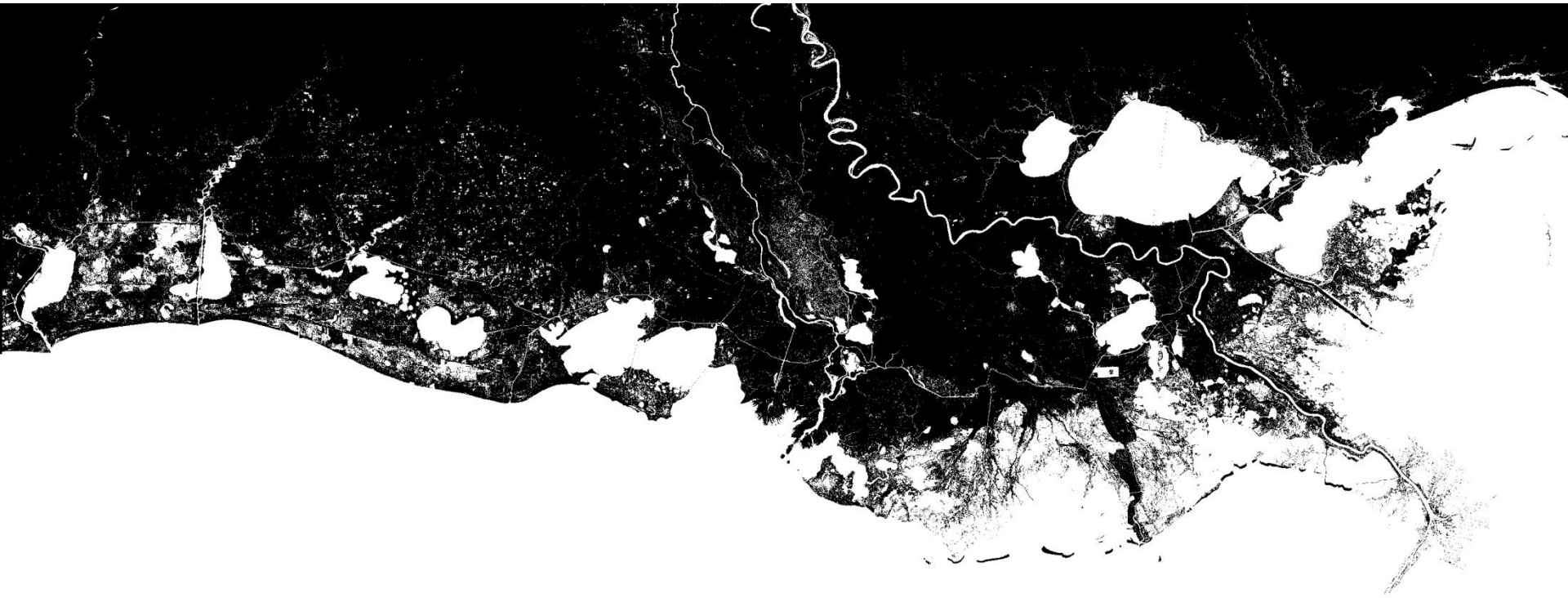


2061: Future Without Action

2061: Future With Master Plan

Implementing the Plan

Since 2007, we have

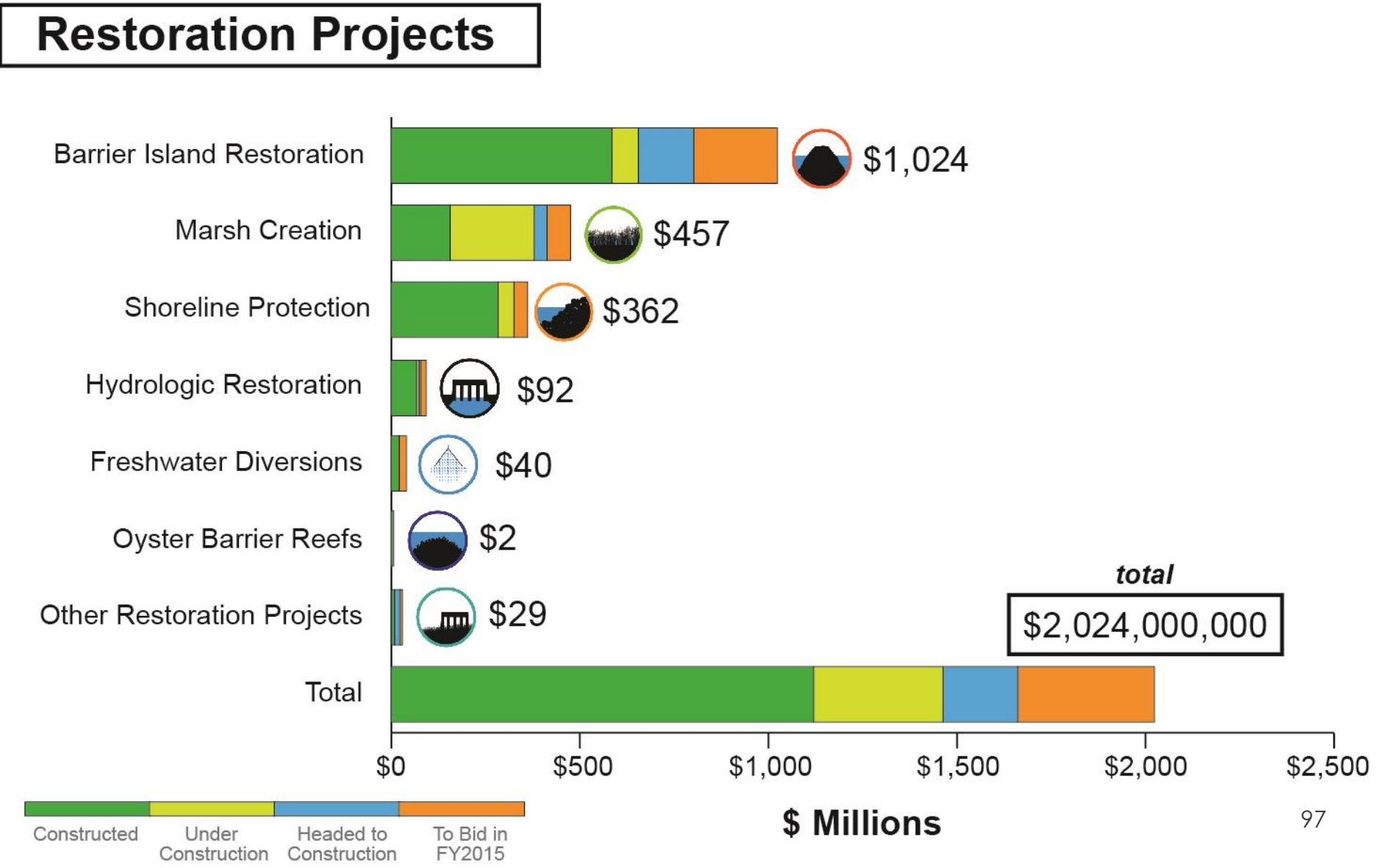
26,000+ acres of land benefitted
250+ miles of levee improved
45 miles of barrier islands constructed
95.4 million cubic yards of fill placed

$18B secured for restoration and protection projects



Progress on the Ground

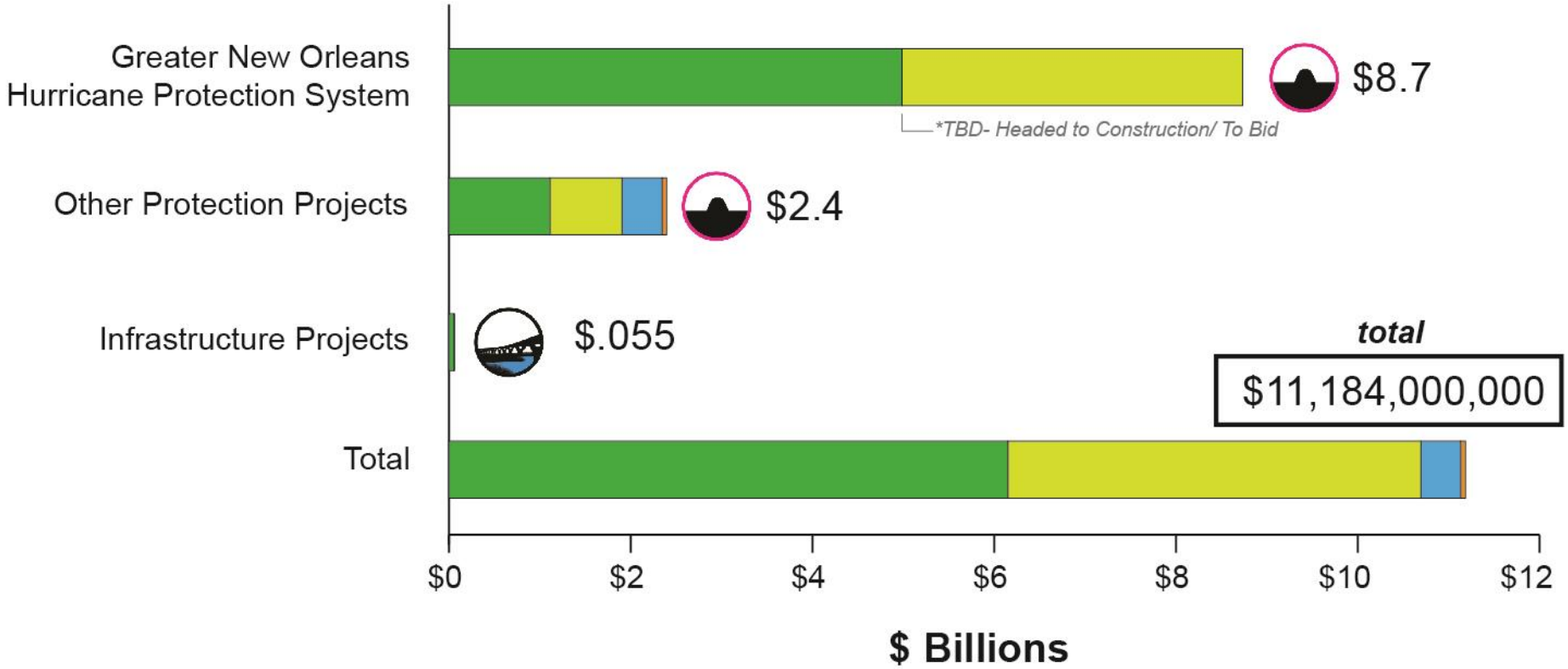
Projects 2007-present



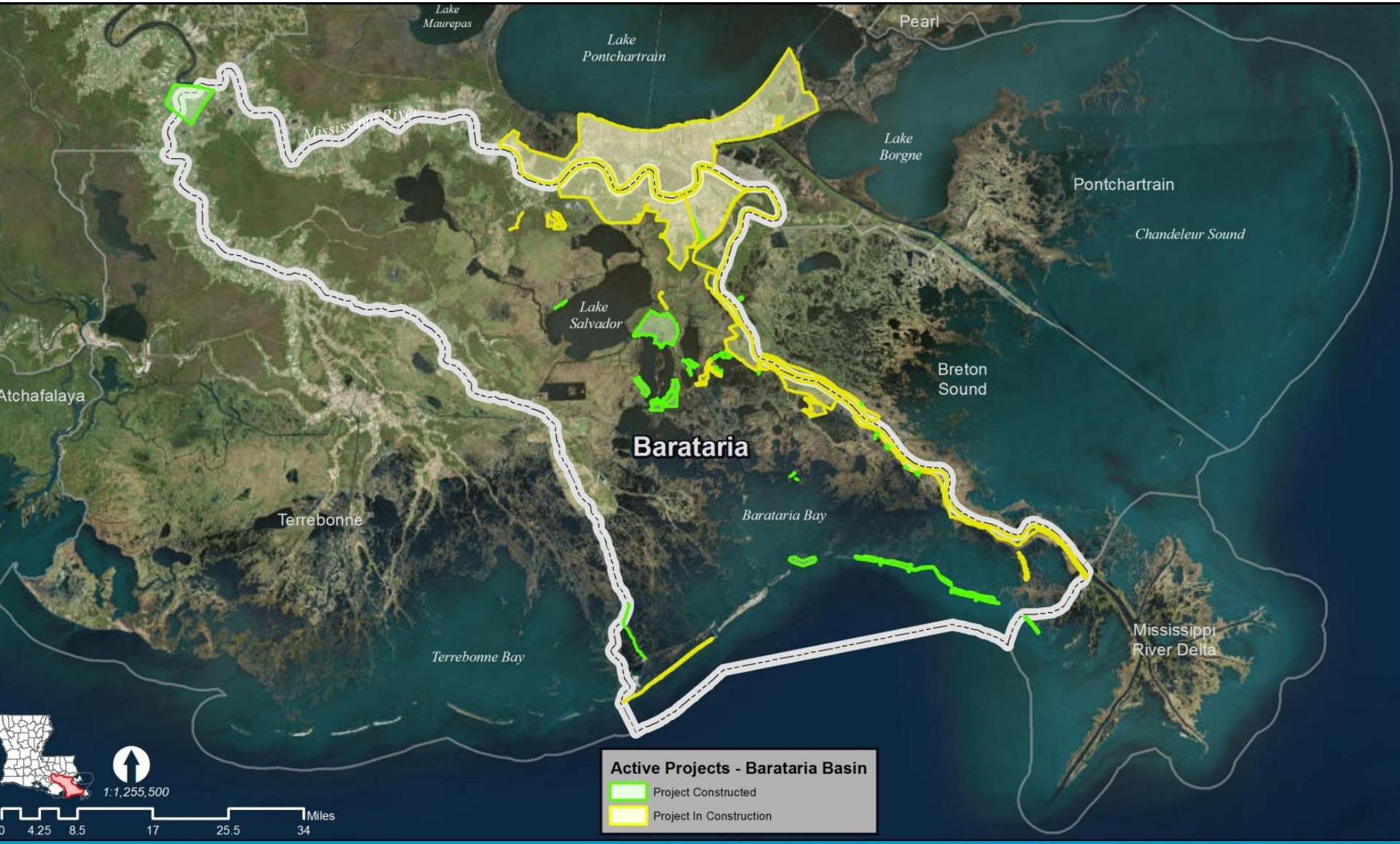
Progress on the Ground

Projects 2007-present

Protection Projects



Restoring Barataria Basin



BEFORE AND AFTER

Chaland Headland

Sept 2008

Oct 2014

BEFORE AND AFTER

Shell Island East

May 2013

Dec 2013

BEFORE AND AFTER

Scofield Island

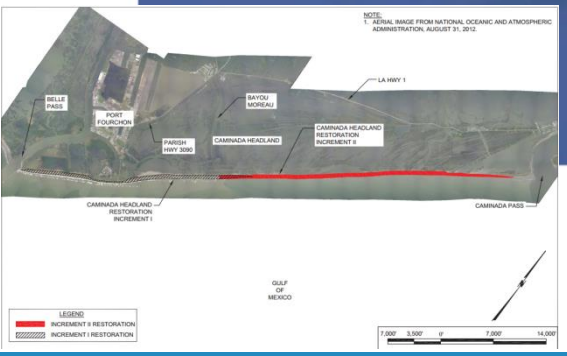
Nov 2012

Dec 2014

Caminada Headland Beach and Dune Restoration – Increment I January 2014

Caminada

Caminada Headland Beach and Dune Restoration INCR 2



Status: Headed to Construction

Estimated Project Cost: $147M

Long Distance Sediment Pipeline & Bayou Dupont June 2014

Long Distance Sediment Pipeline & Bayou Dupont January 2015

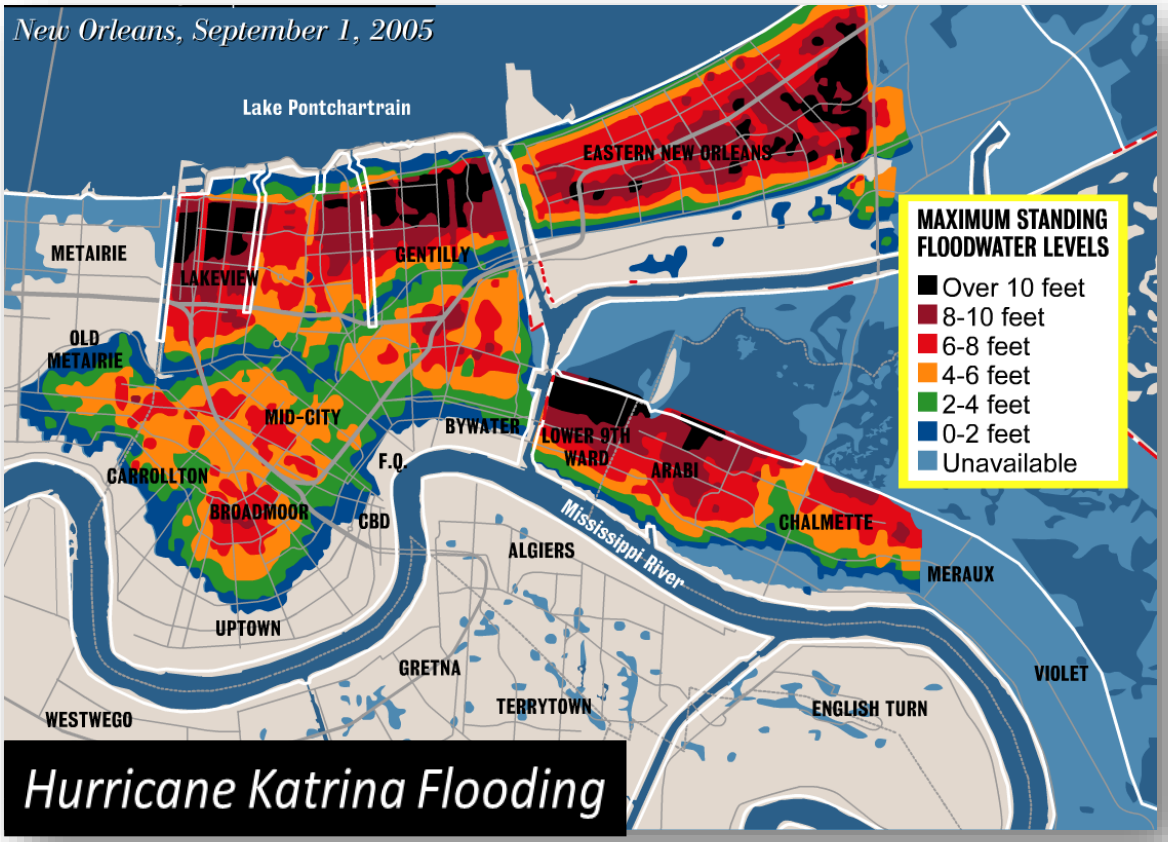
2017 Coastal Master Plan

Biloxi Marsh
January 2014

Flood Protection

Major Components

- Levees
- Floodwalls
- Pump Stations
- Sector Gates & Barge Gates
- Locks

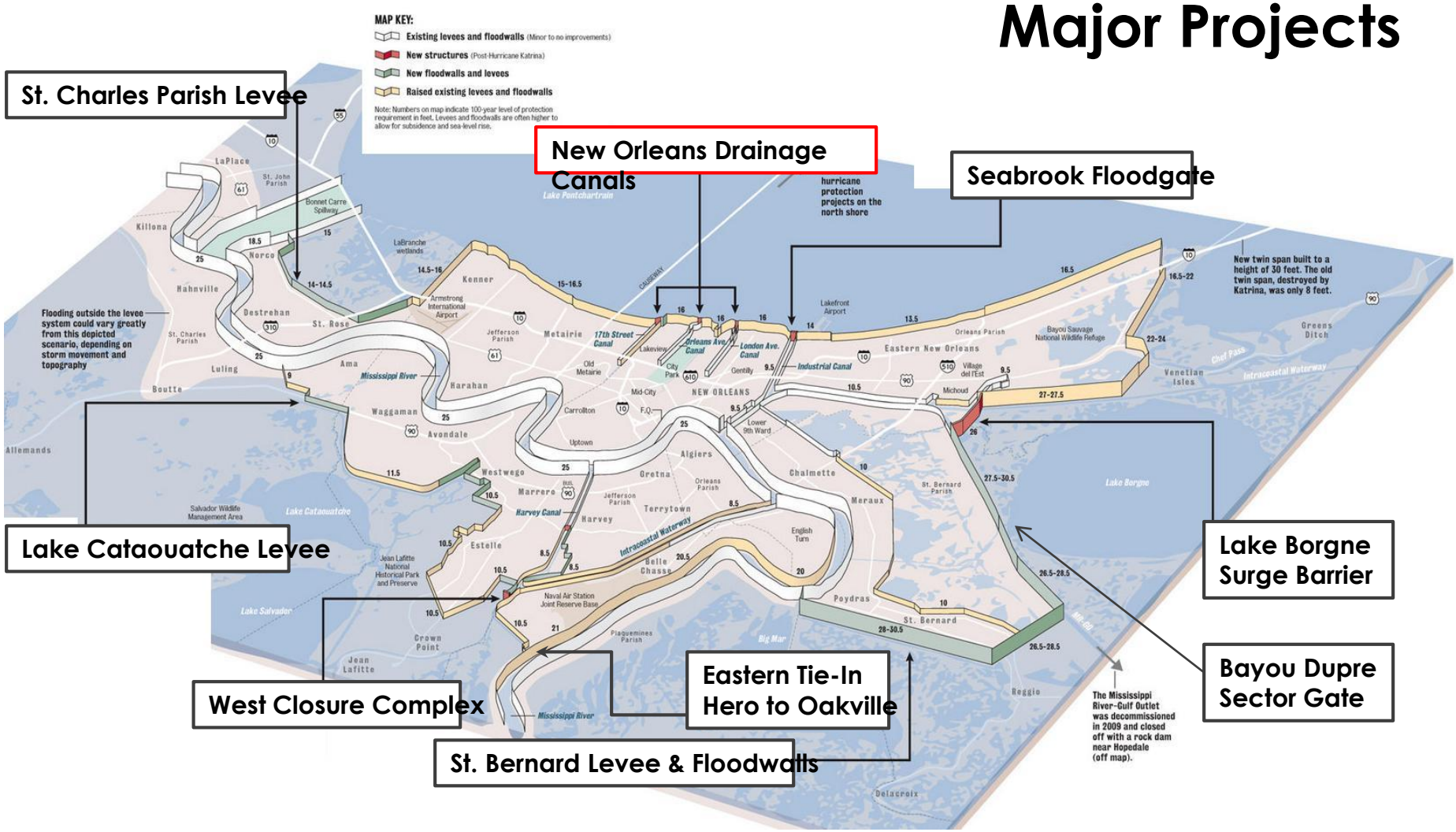


Role of CPRA

- Design and Review
- Construction Oversight & Review
- Levee Inspections
- Emergency Response Teams

Flood Protection

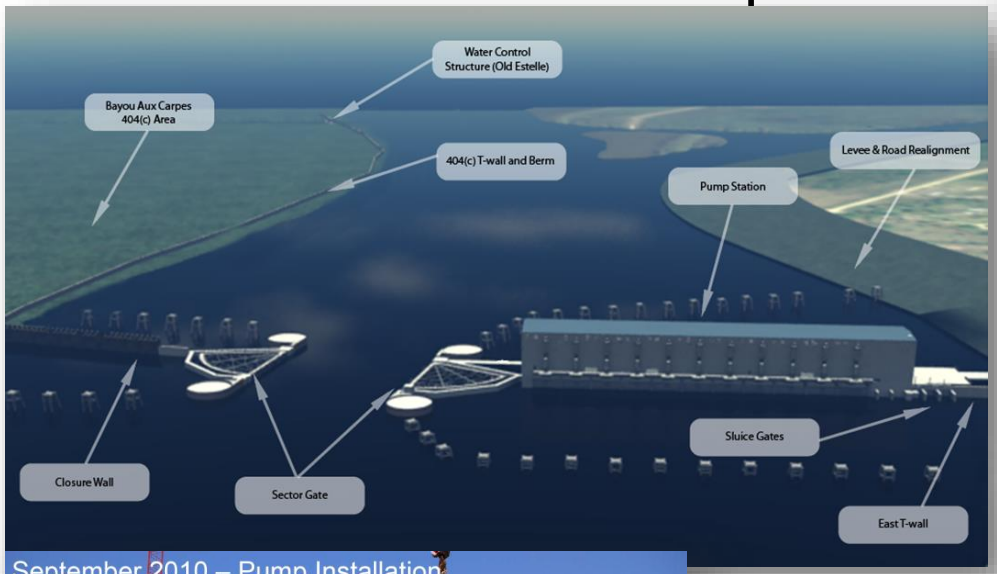
Major Projects

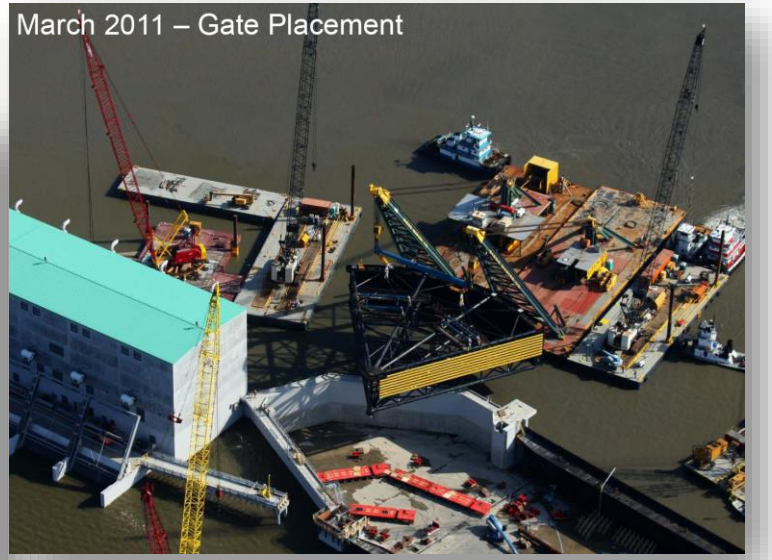


Flood Protection

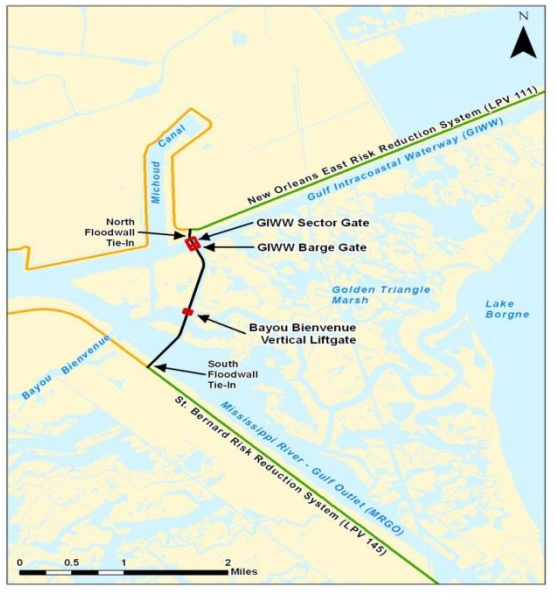
Flood Protection

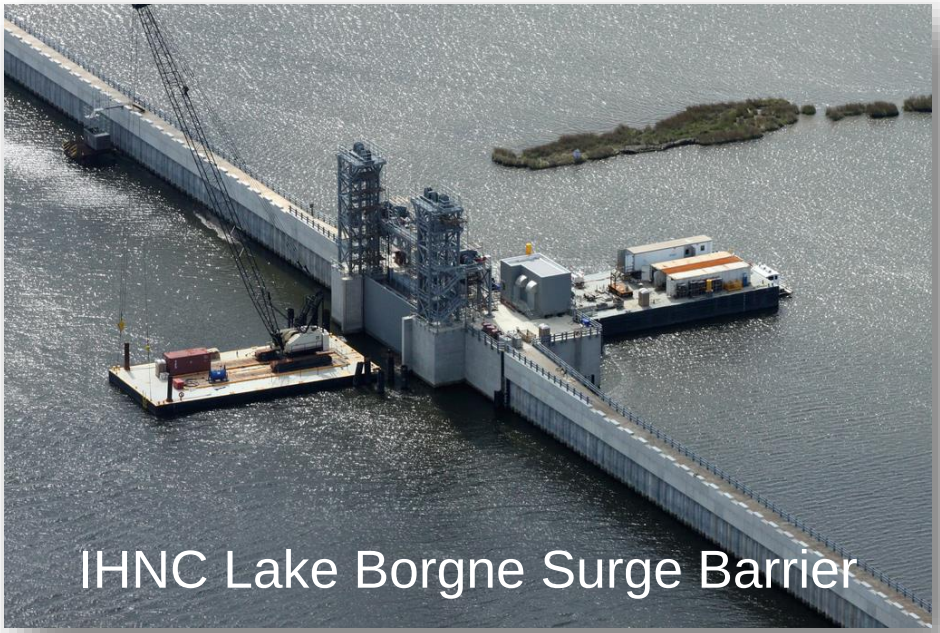
GIWW West Closure Complex





Flood Protection

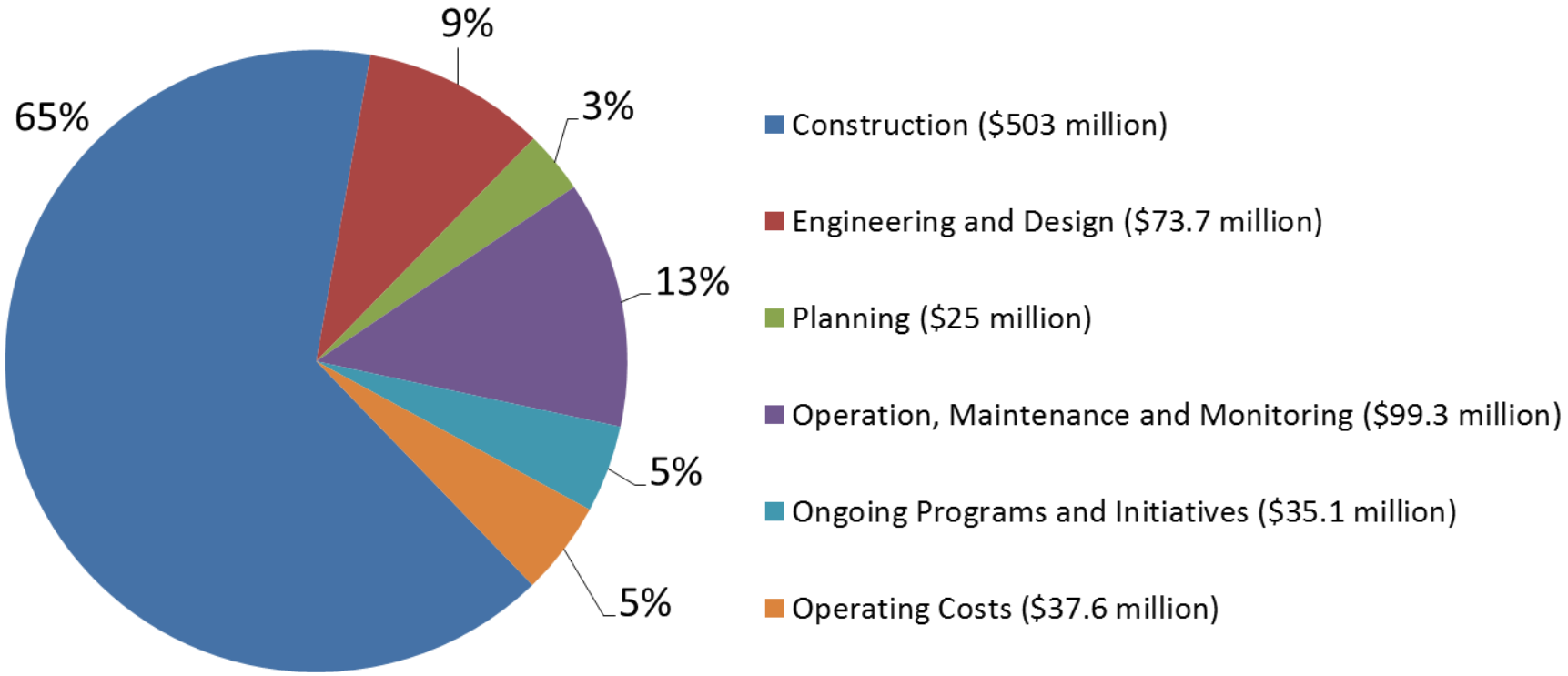




IHNC Lake Borgne Surge Barrier

Projected FY16 Expenditures

By Project Phase



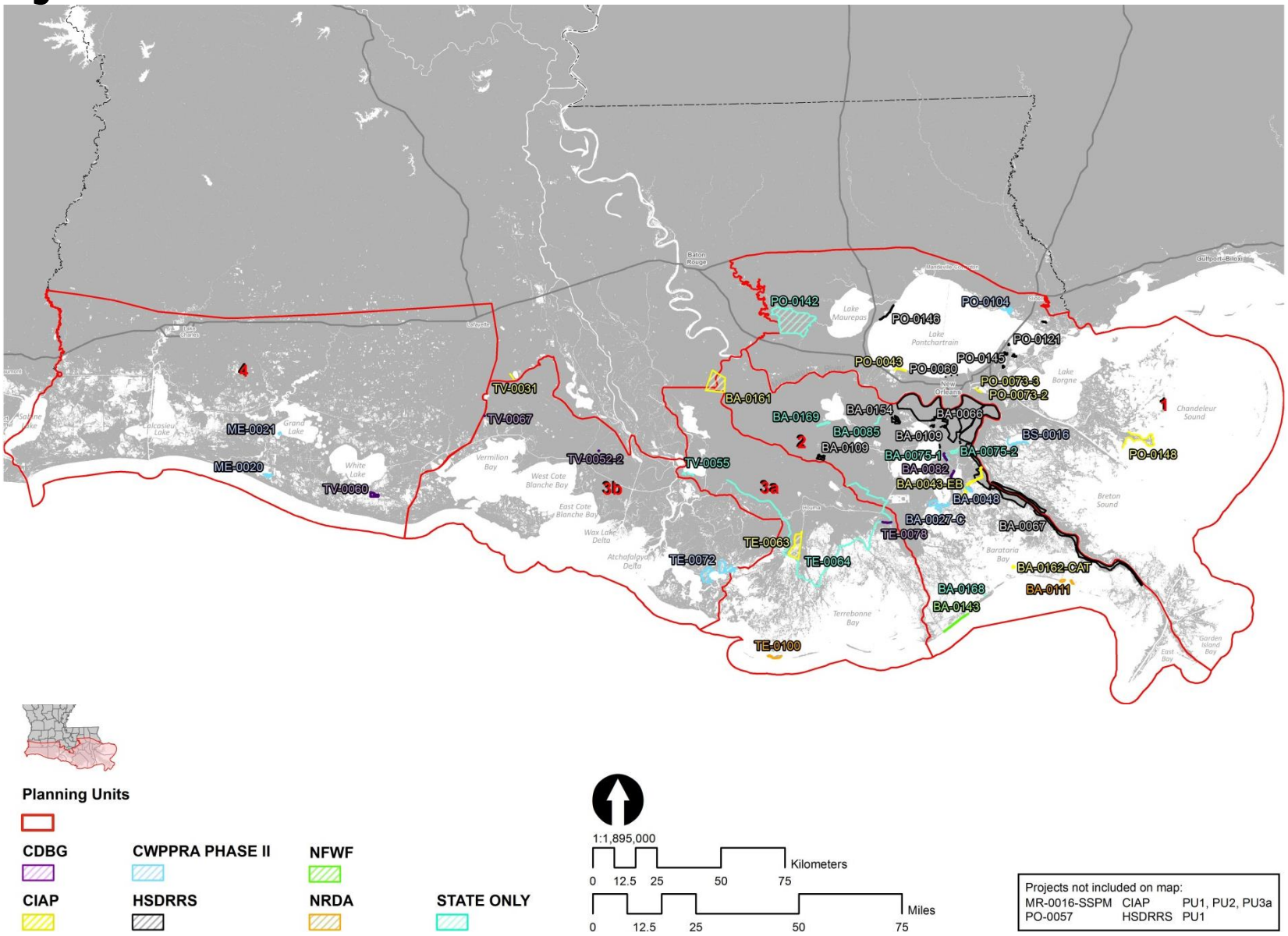
Construction includes Beneficial Use ($4 million)

OM&M includes BIMP ($361,000), Repair/Rehabilitation of Projects ($1.1 million), Marine Debris Removal ($1.6 million), and Isaac Beach and Dune Recovery ($45.8 million)

Ongoing Programs includes Project Support ($4.1 million)

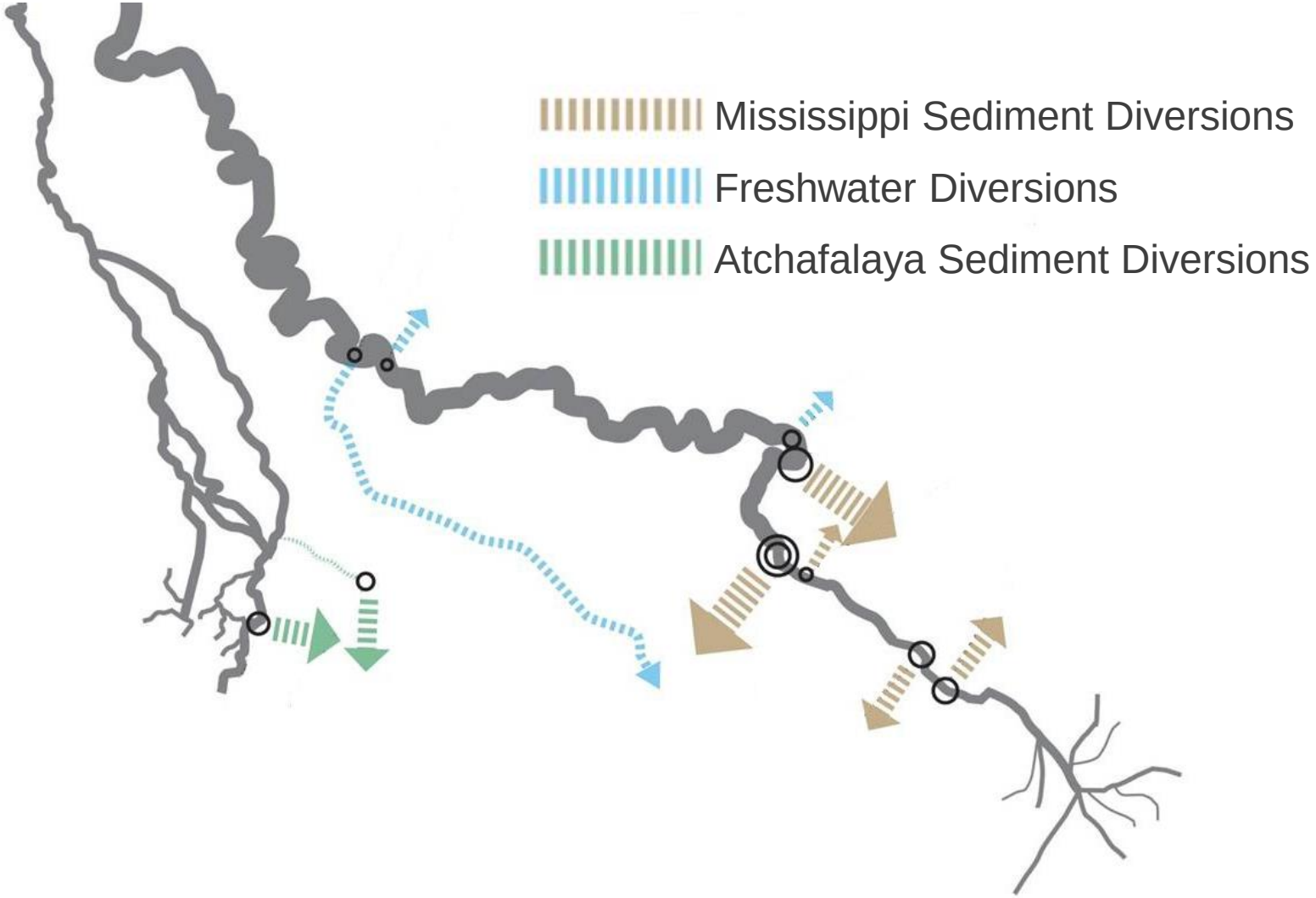
Total Expenditures
$773 Million

Projects Scheduled for Construction in FY16



2012 Coastal Master Plan

Freshwater and Sediment Diversions

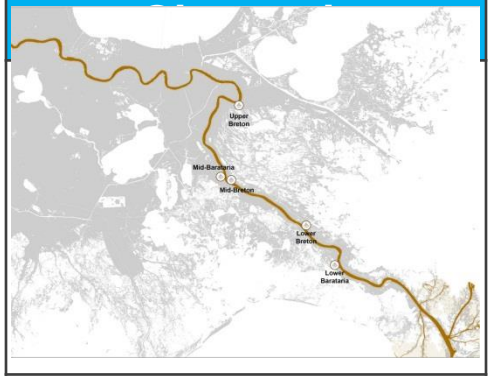


Mississippi Sediment Diversions

Building On What We Know

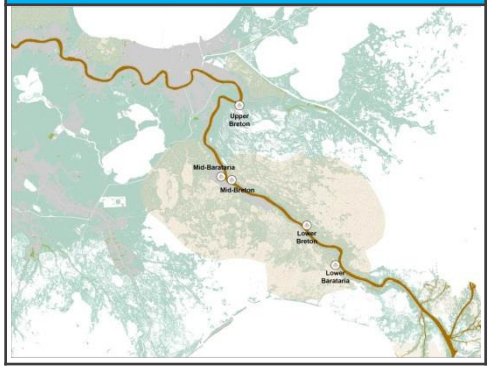
Mississippi River

Diversion

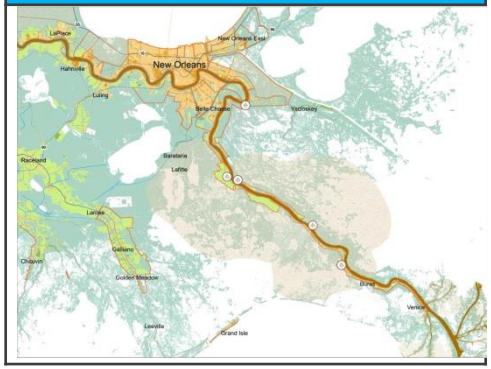


Outfall Areas

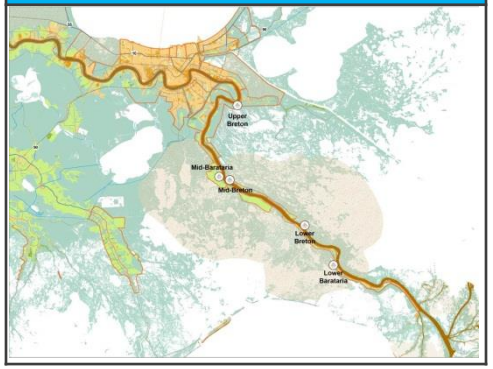
Basin-Wide Influence



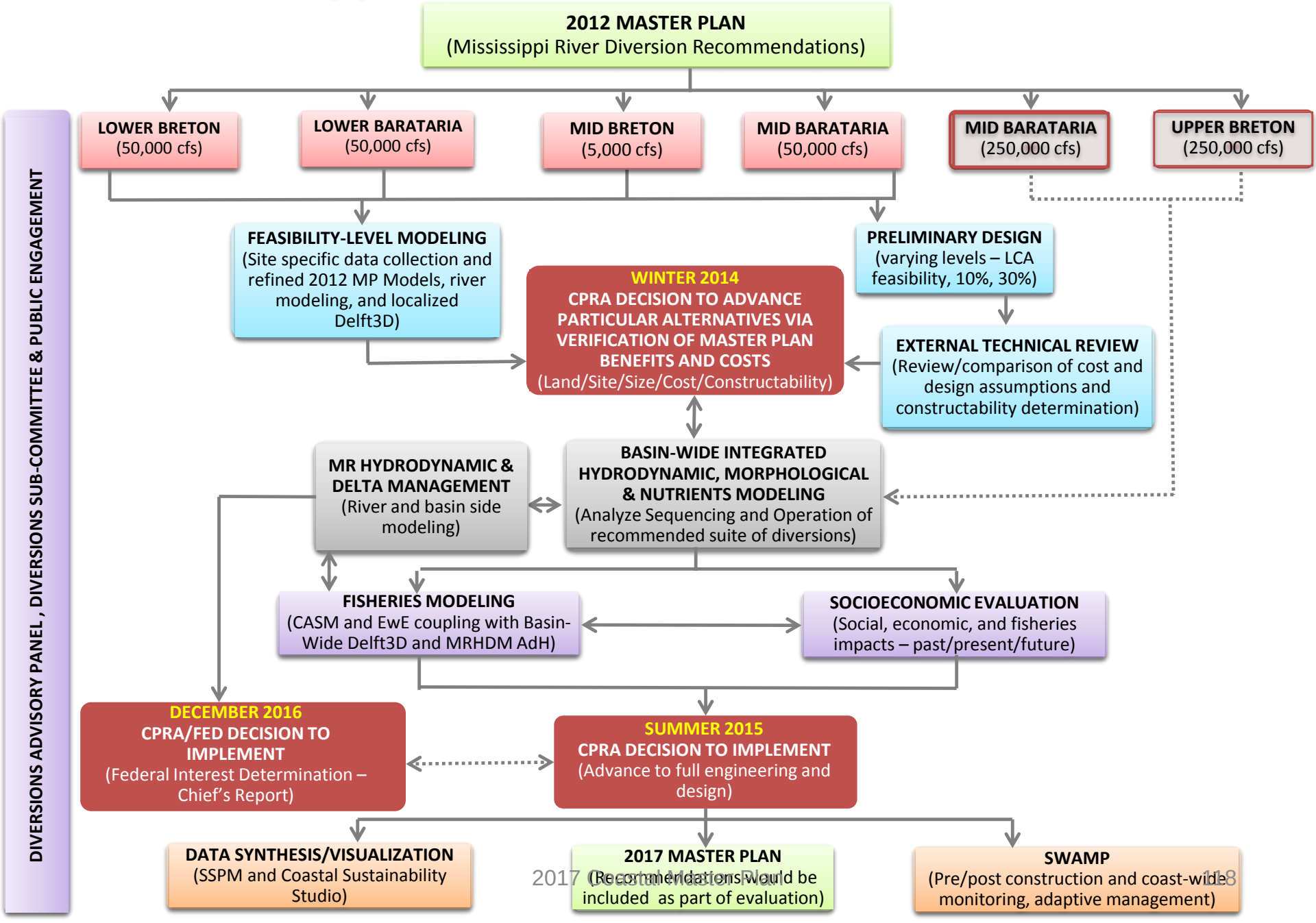
Coastal Communities



System Management

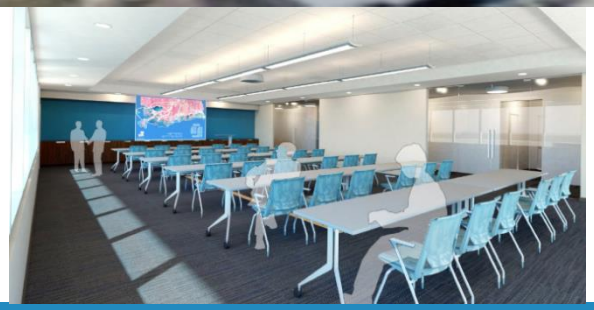


Mississippi River Sediment Diversions: Process



Center for River Studies

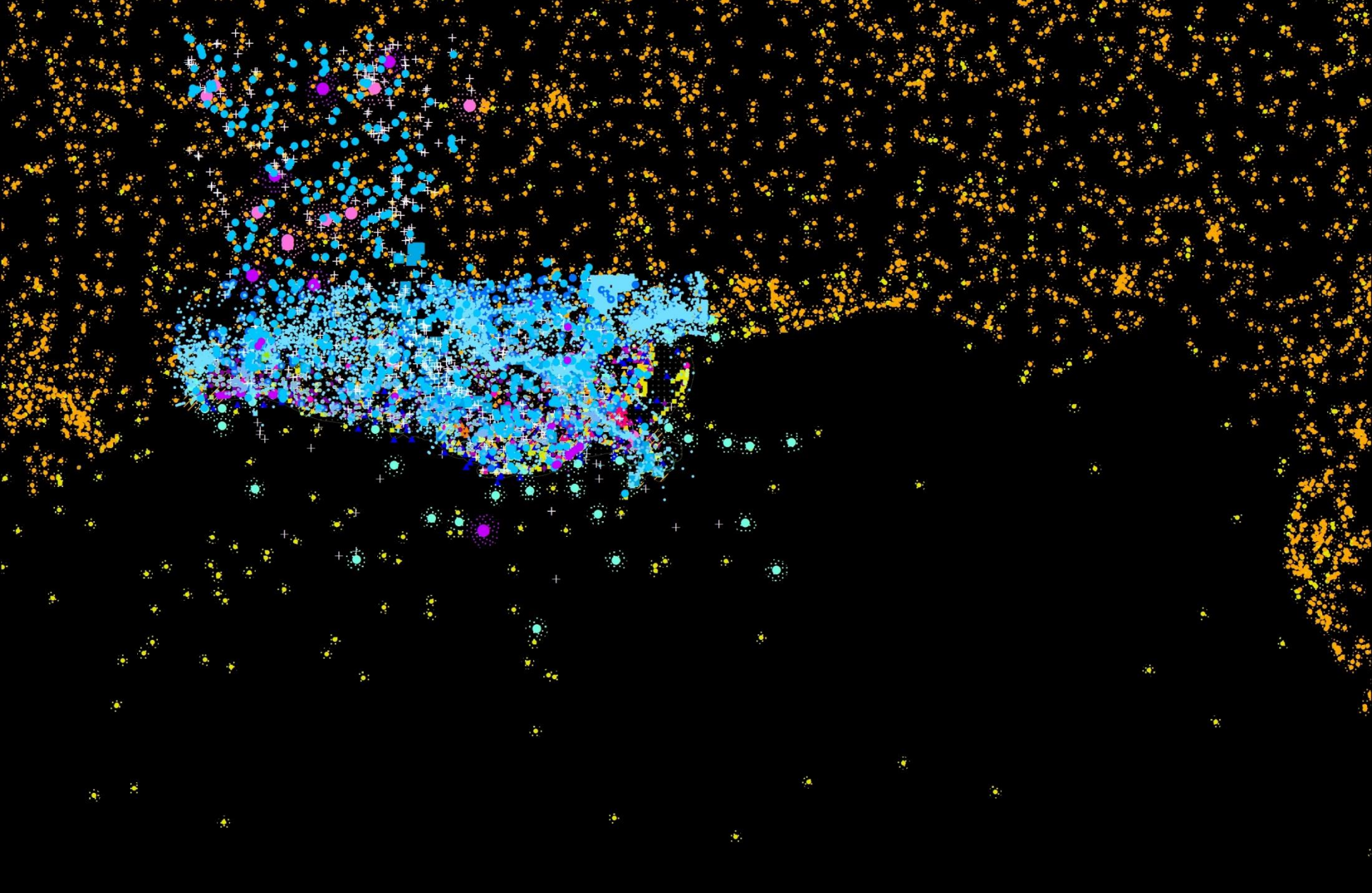
The Water Campus



Implementing the Master Plan

Monitoring and Reporting our Progress

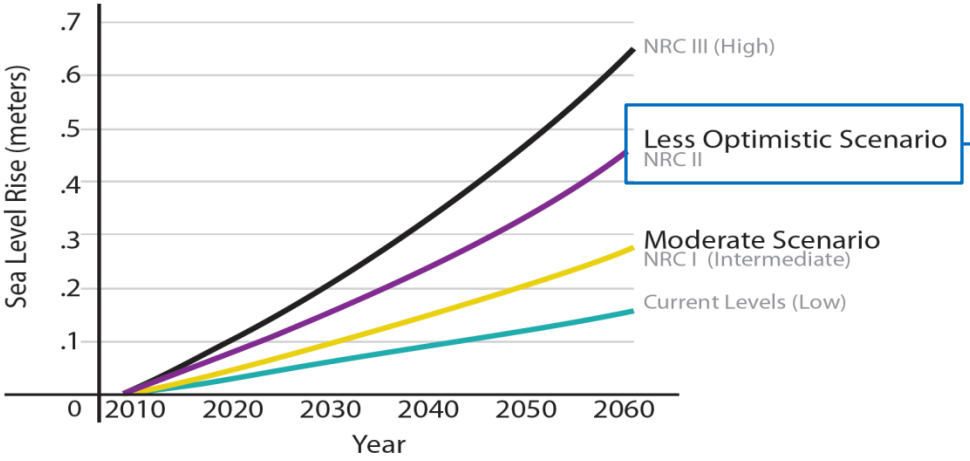
- Continue and expand monitoring stations along the coast
- Modify tools based on on-going monitoring to help better predict future conditions
- Assess monitoring data, formalize feedback loops and triggers for modifications
- Expand monitoring to include Performance Measures that provide an indication of our progress toward achieving the objectives of the Master Plan
- Measure and report on project performance and system response



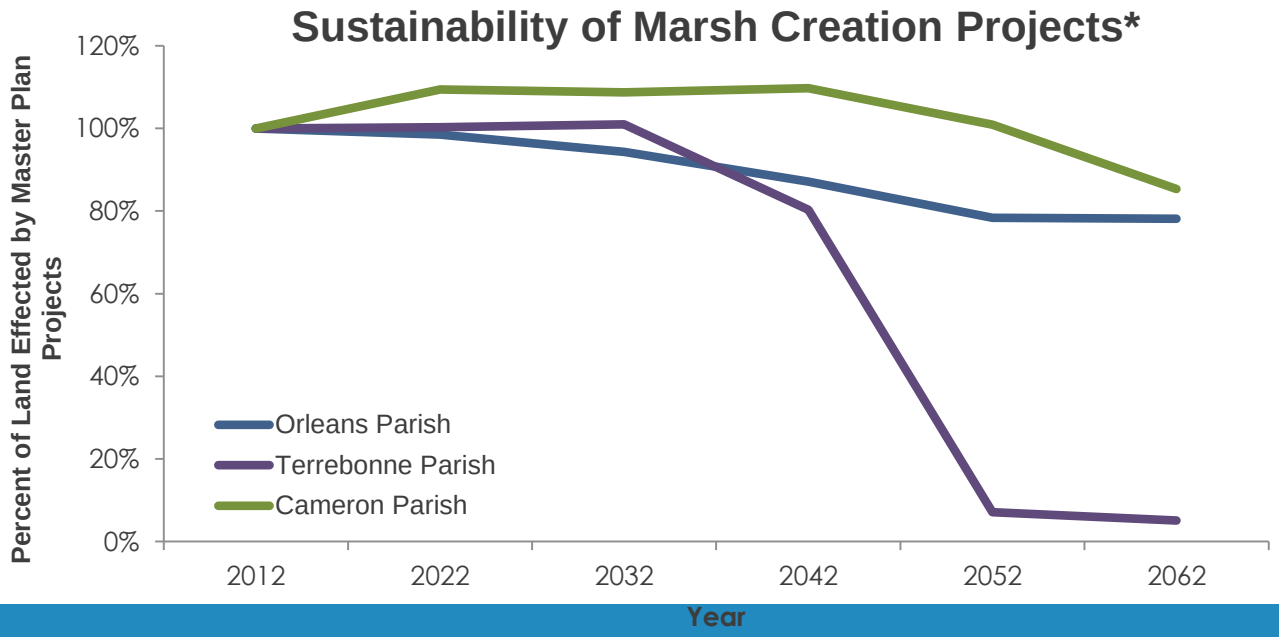
Systemwide Assessment & Monitoring Program

Implementing the Master Plan

Tackling Future Challenges

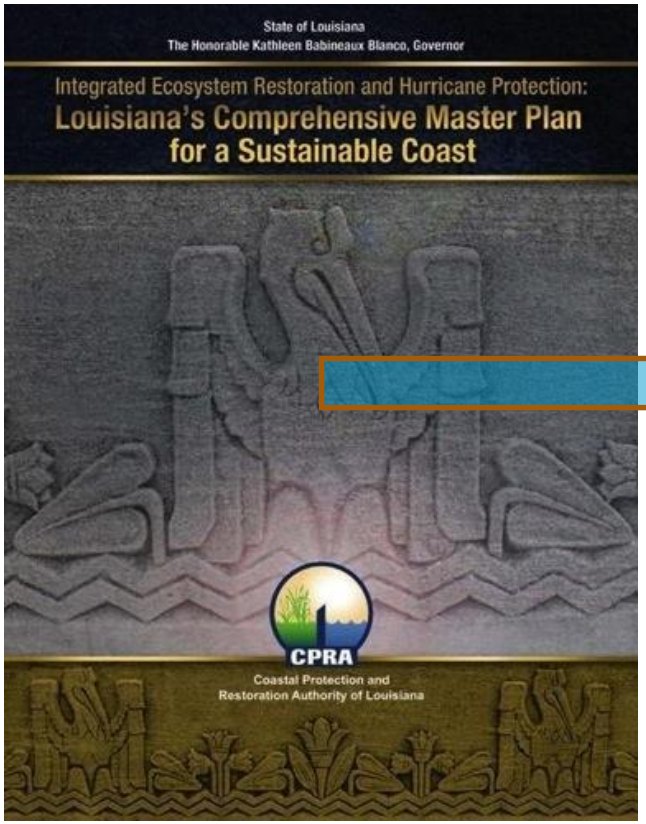


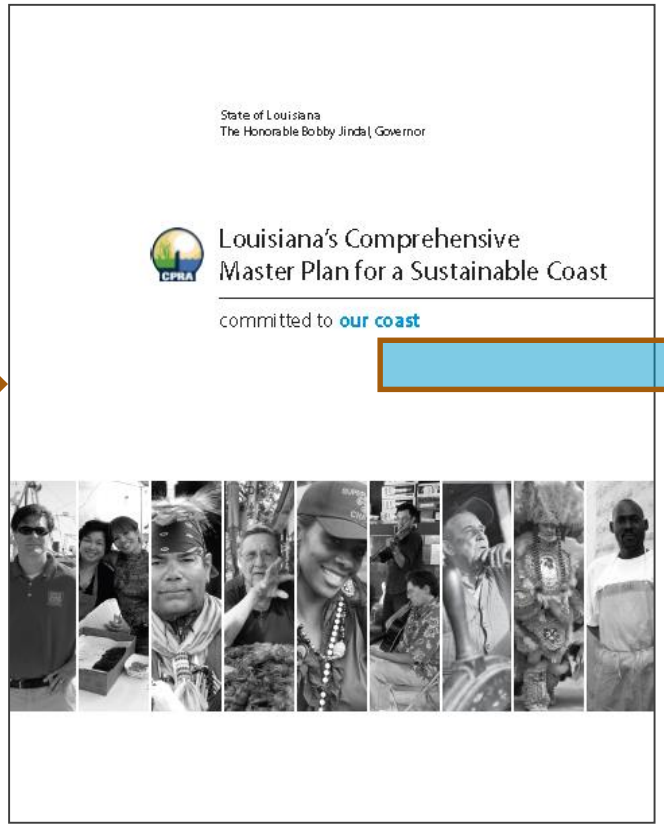
Climatic changes can challenge the sustainability of some proposed projects requiring adaptation



Implementing the Master Plan

Adaptive Planning Built In





2017 Coastal Master Plan

The Louisiana Legislature requires that the Master Plan be updated every five years with the latest science and technical information.

Advancements and Updates

- Implementation of the model improvement plan
- Potential for project list modification
- Public input and political acceptance
- Development of Flood Risk and Resilience Program
- Socio-economics and fisheries distribution analysis for areas in Breton, Barataria and Terrebonne

Advancing our Technical Analysis

Coastal Protection and Restoration Authority
450 Laurel Street, Baton Rouge, LA 70804 • coastal@la.gov • www.coastal.la.gov

2017 Coastal Master Plan

Model Improvement Plan

Report: Version II
Date: August 2013, *revised March 2014*
Prepared By: The Water Institute of the Gulf

THE WATER INSTITUTE
OF THE GULF

committed to **our coast**

2017 Model Improvement Plan

Collaborative Team of over 70 Experts

Modeling Decision Team

Directs and coordinates model improvements and analysis

COASTAL PROTECTION AND RESTORATION AUTHORITY CPRA

THE WATER INSTITUTE OF THE GULF

Subtask Leaders and Members:

LSU LOUISIANA STATE UNIVERSITY

Deltares Enabling Delta Life

UNIVERSITY OF LOUISIANA Lafayette

USGS science for a changing world

MOFFATT & NICHOL

COASTAL ENGINEERING CONSULTANTS INC.

CB&I

THE UNIVERSITY of NEW ORLEANS

ARCADIS

GEORGE MASON UNIVERSITY

RAND CORPORATION

Dynamic Solutions LLC

THE UNIVERSITY OF SOUTHERN MISSISSIPPI GULF COAST

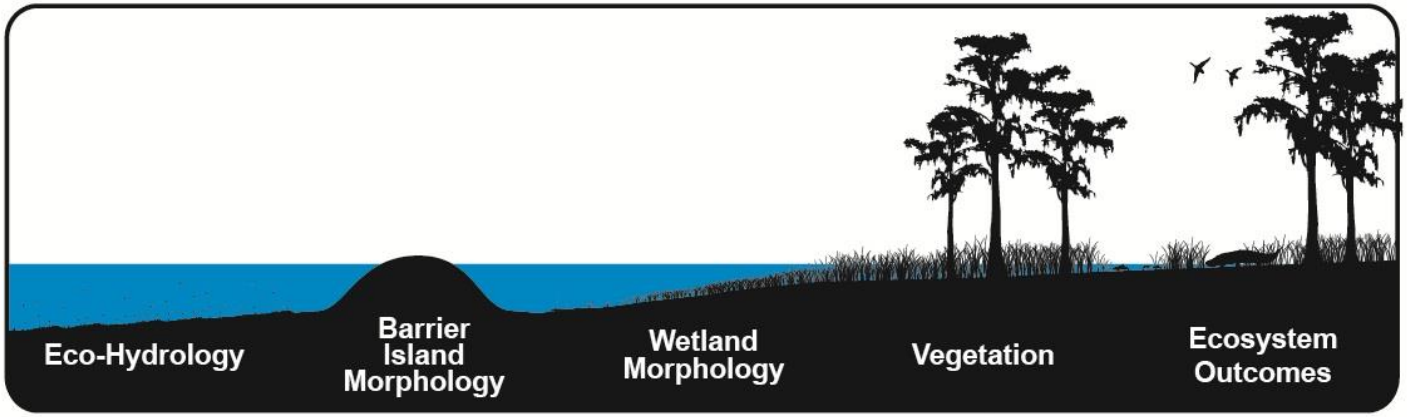
SOUTHEASTERN LOUISIANA UNIVERSITY

FENSTERMAKER Experience | Innovation | Results

Ecopath Research and Development Consortium

2017 Model Improvement Plan

Integrated Compartment Models (ICMs)



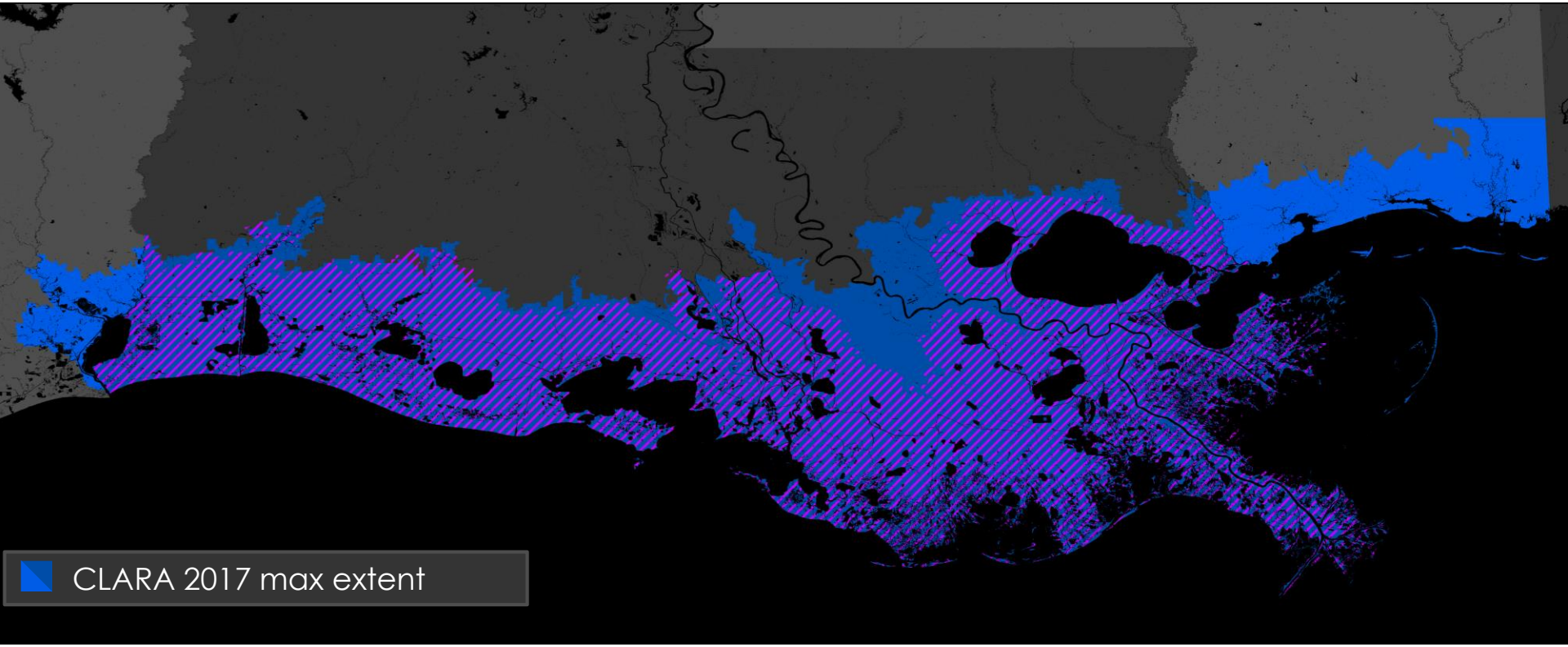
CLARA Model Improvement Plan

Model Updates for the 2017 Master Plan

- Expand study region further inland to reflect an expanding floodplain
- Develop a higher-resolution spatial unit of analysis
  - Previous: U.S. Census block centroids
  - New: At least 1x1 km grid
- Update
  - Data on individual structures/parcels (selected parishes)
  - Strategic assets and critical infrastructure
  - 2010 Census updates
- Validate CLARA with Hurricane Isaac flood and damage data

Geospatial Improvements

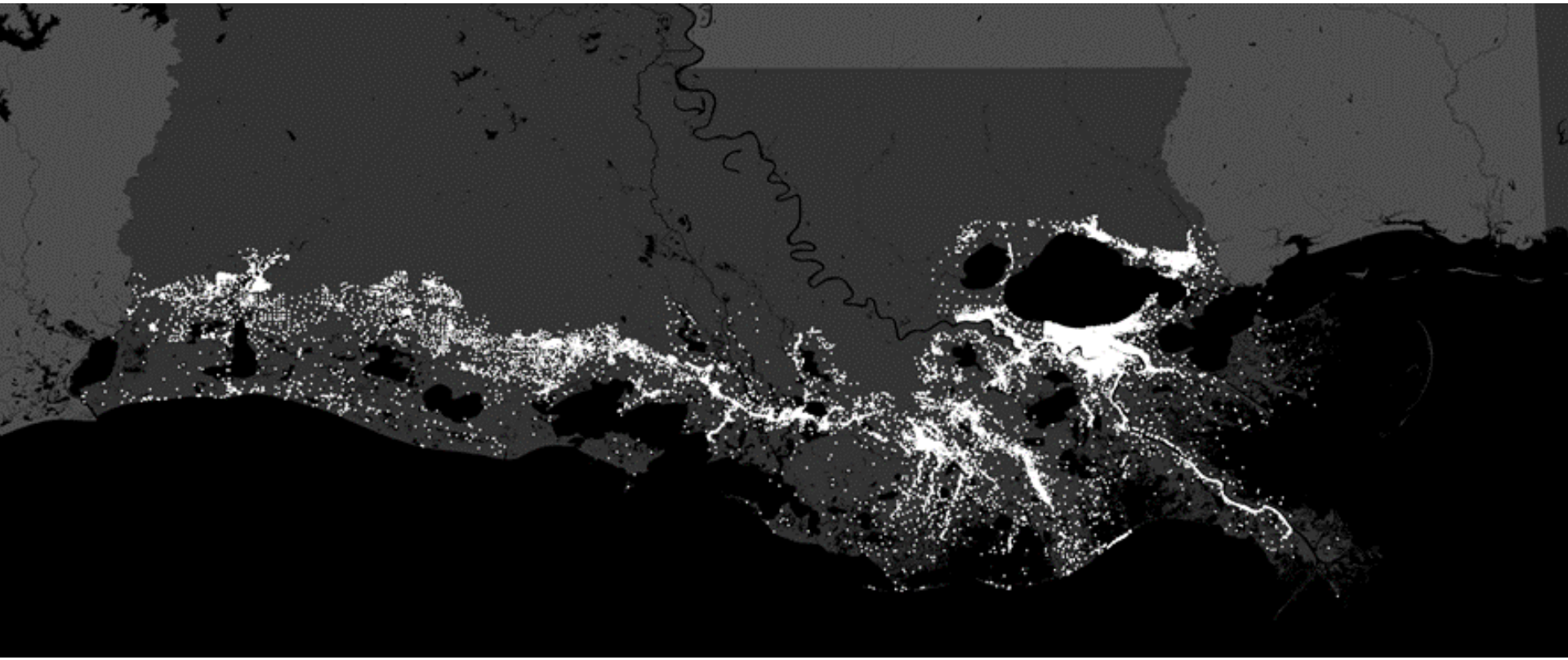
Expanding the Study Region



Geospatial Improvements

Developing a New Spatial Unit

- CLARA v1.0 included ~35K census block centroids

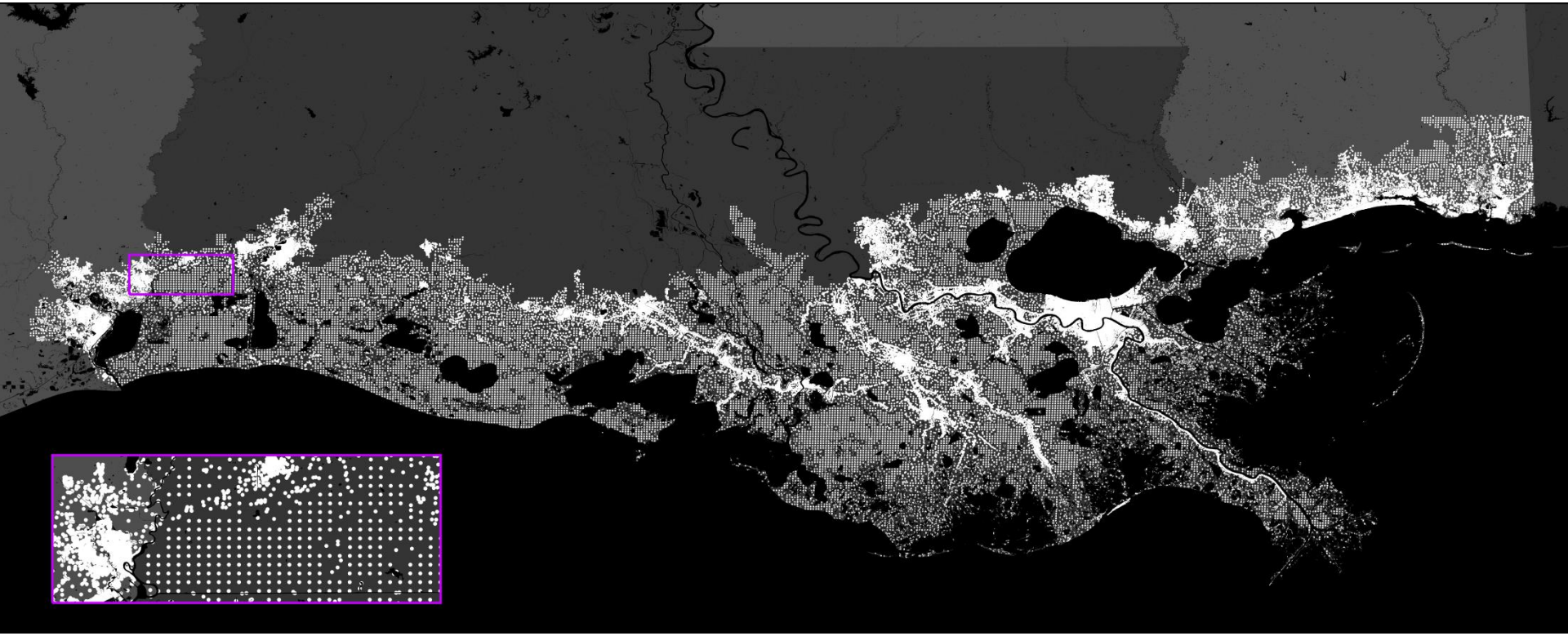


2000 US Census block centroids within 2012 max extent

Geospatial Improvements

Developing a New Spatial Unit

- CLARA v2.0 includes ~114,000 grid points
  - Note: ~90K points in LA, ~14K in MS, ~10K in TX



- **CLARA 2017 grid points**

THANK YOU

coastal.la.gov

Karim.Belhadjali@La.Gov