CPRA
Coastal Protection and Restoration Authority of Louisiana

# Overview of Existing and Planned Mississippi River Sediment Diversions

**Wes LeBlanc, CPRA**

NOAA/NGI Gulf Hypoxia Research Coordination Workshop
July 14, 2014

# Louisiana is Experiencing a Coastal Crisis

**1,880** square miles lost since the 1930s

Currently losing over **16** square miles per year

# Existing Freshwater Diversions (not including emergency spillways)

| *Diversion* | *Discharge Capacity (cfs)* |
|---|---|
| Bayou Lafource Siphon | 300 |
| Caernarvon Freshwater Diversion | 8,000 |
| Channel Armor Gap | 2,500 |
| Coquille Siphon | 250 |
| Davis Pond Freshwater Diversion | 10,000 |
| Naomi Siphon | 2,100 |
| Violet Siphon | 300 |
| West Pointe a la Hache Siphon | 2,100 |
| West Bay Sediment Diversion | 20,000 |
| White's Ditch Siphon | 250 |

**TOTAL PRESENT DISCHARGE CAPACITY: 45,800 cfs**



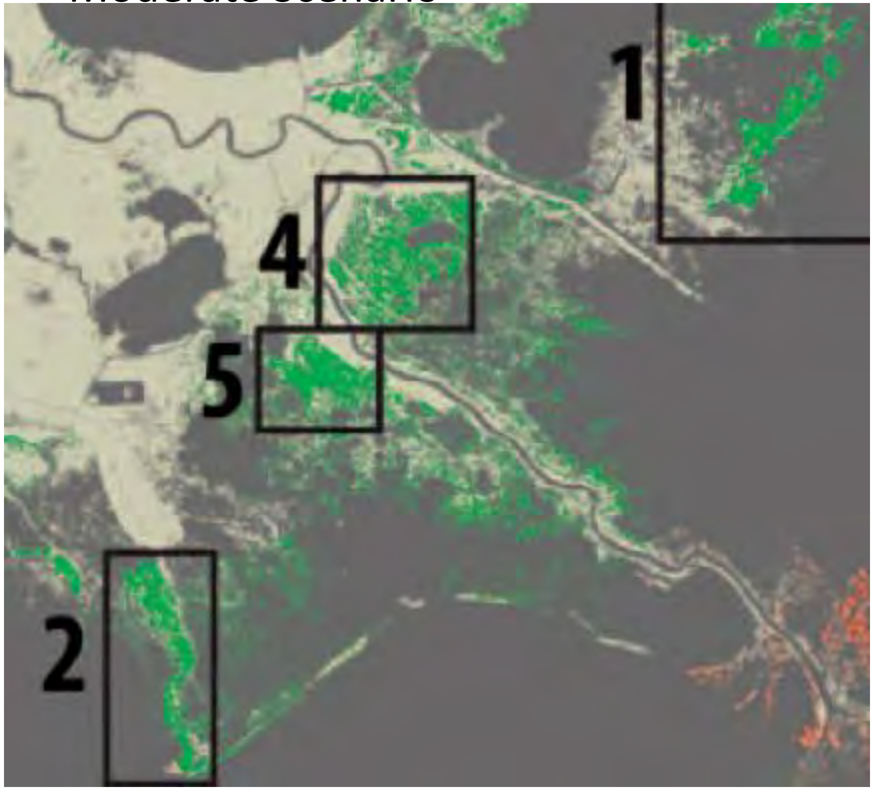
1998
N
Louisiana Department of Natural Resources
0 0.31mi


May 3, 2004
2004
US Census Bureau
© 2010 Europa Technologies
Image © 2010 DigitalGlobe
© 2010 Google
©2009 Google
Imagery Date: May 4, 2004
lat 29.834636° lon -89.908713° elev 0 ft
Eye alt 15492 ft

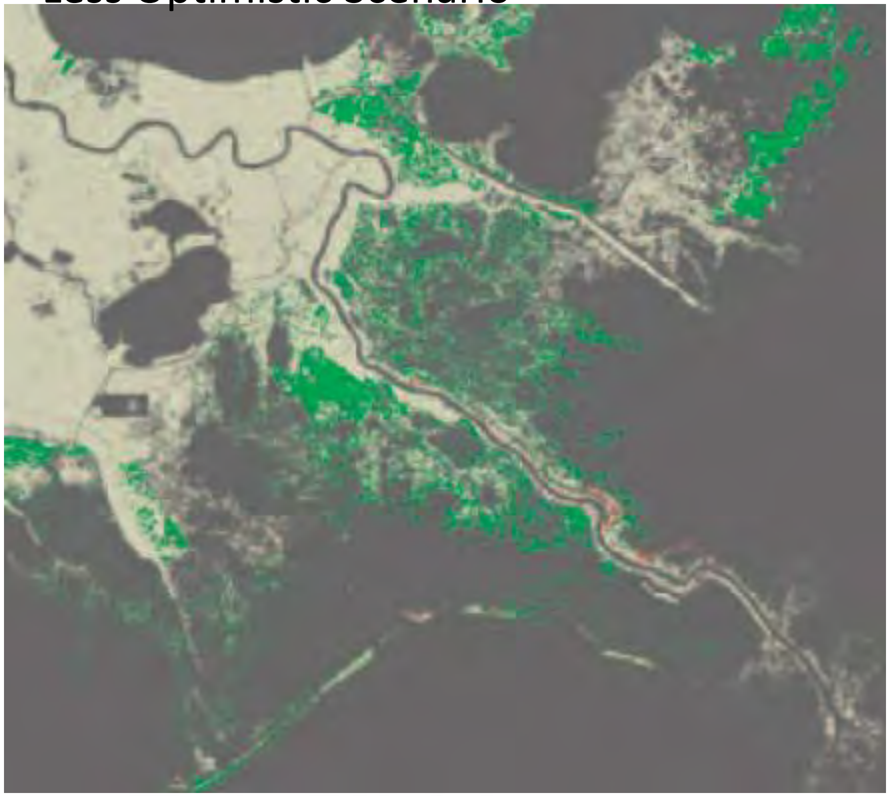

Oct 11, 2007
1998
2010
2007
© 2010 Europa Technologies
US Census Bureau
Image USDA Farm Service Agency
© 2010 Google
©2009
Google
Imagery Date: Jul 23, 2007
lat 29.834636° lon -89.908713° elev 0 ft
Eye alt 15492 ft

# Diversions Can Build and Maintain Land

Moderate Scenario



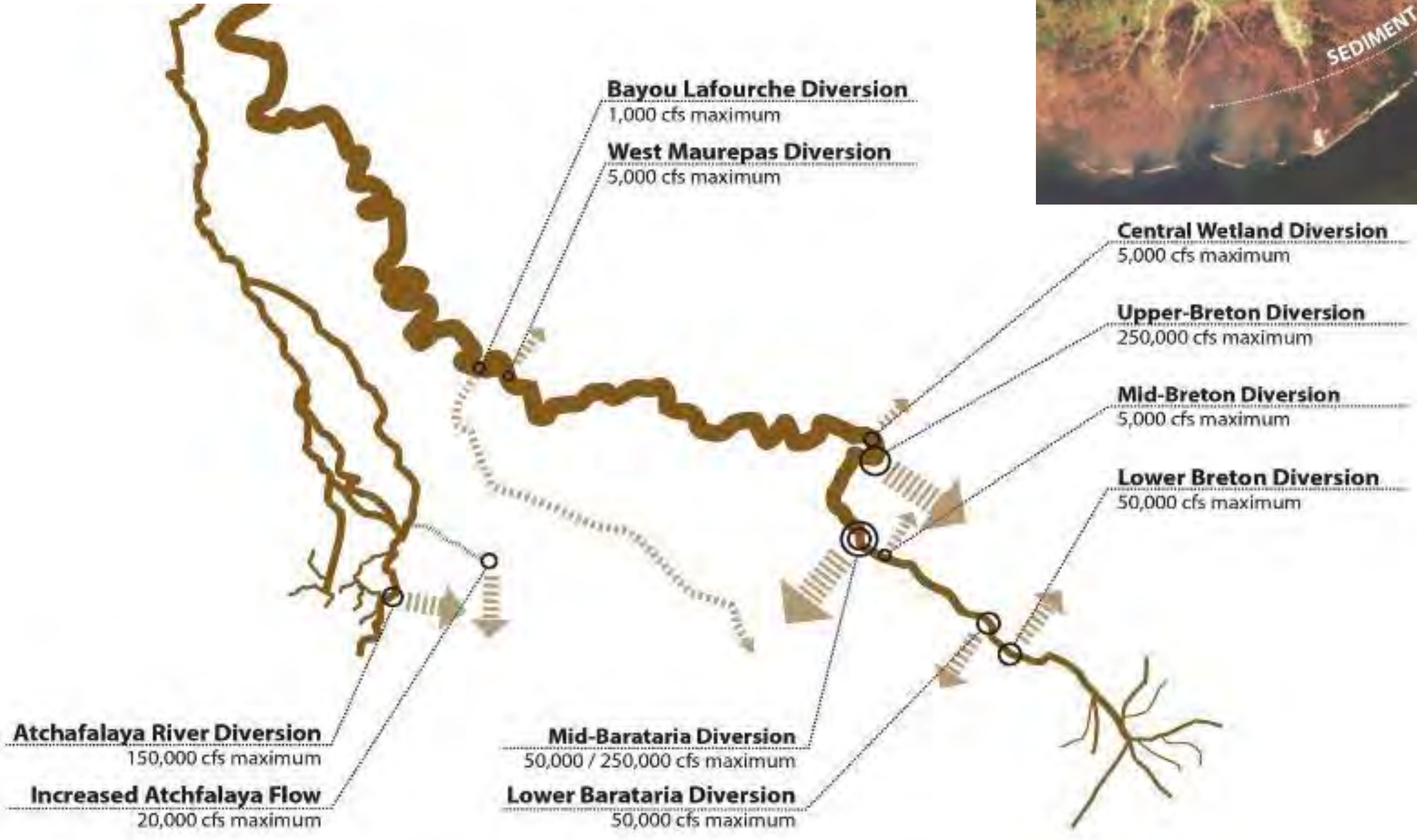

Less Optimistic Scenario



We know that diversions can increase the sustainability of marsh creation projects by supporting increased accretion and delivering nutrients to stimulate vegetation growth.

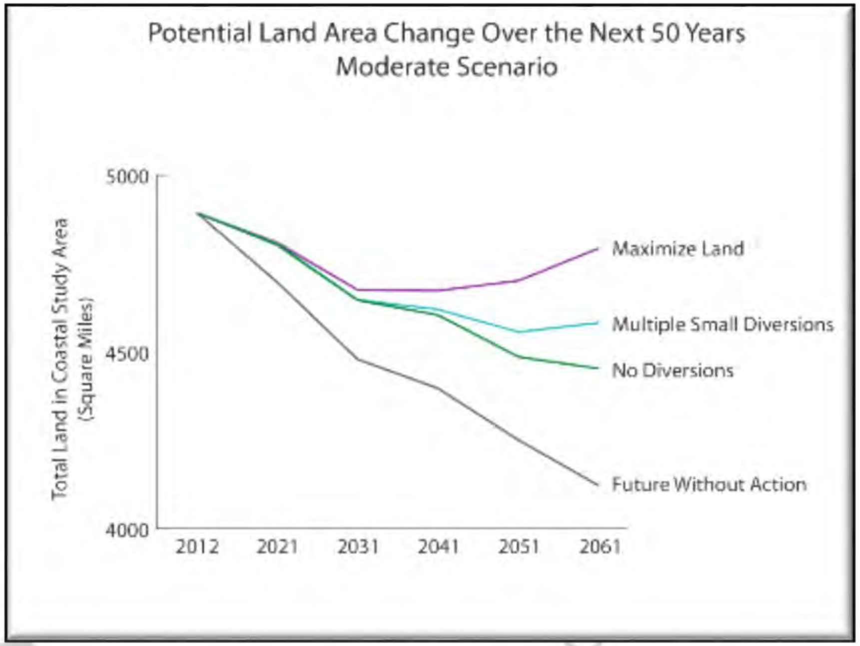
*Couvillion et al 2013*

# Keystone of the 2012 Master Plan: Reconnecting the River

# Master Plan Diversion Considerations

- **Considered three maximum discharge capacities: 5,000 cfs, 50,000 cfs, and 250,000 cfs, as well as larger use of the River (i.e., channel realignments). Other diversion sizes considered in a few cases where individual projects had already been planned in detail.**




# Diversions in the Master Plan

## *Freshwater Diversions*

| Diversion | Size | Status |
|---|---|---|
| Bayou Lafourche Diversion | Up to 1,000 cfs | Construction/Operations<br>(Phase I and II funded at $40 million through CIAP) |
| Central Wetlands Diversion | Up to 5,000 cfs | Project Planning |
| West Maurepas Diversion(s)*<br>• Maurepas/Hope Canal Diversion<br>• Convent/Blind River Diversion | Up to 5,000 cfs<br>Up to 2,000 cfs<br>Up to 3,000 cfs | --<br>Maurepas Diversion: Engineering & Design<br>Convent/Blind River Diversion: Project Planning |

*The West Maurepas Diversion may consist of two ongoing diversion projects, Maurepas/Hope Canal Diversion (up to 2,000 cfs) and Convent/Blind River Diversion (up to 3,000 cfs) for a total discharge of up to 5,000 cfs.

Freshwater Diversion Locations

# Diversions in the Master Plan

## *Mississippi Sediment Diversions*

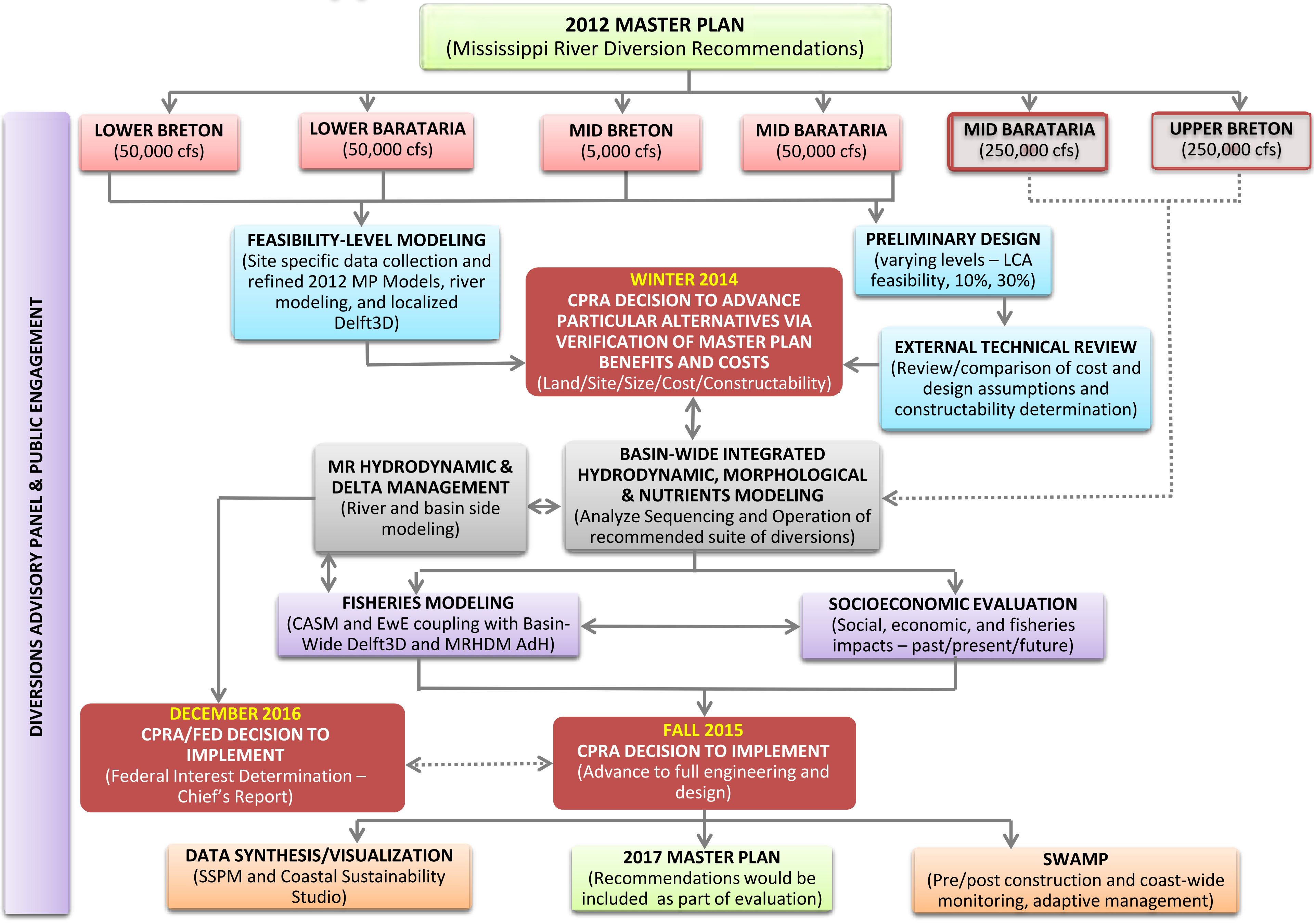
Mississippi Sediment Diversion Locations

| Diversion | Size | Status |
|---|---|---|
| Mid-Barataria Sediment Diversion* | Up to 75,000 cfs | Project Specific Planning (E&D) |
| Mid-Breton Sediment Diversion* | Up to 35,000 cfs | Basin Level Planning |
| Lower Barataria Sediment Diversion | Up to 50,000 cfs | Basin Level Planning |
| Lower Breton Sediment Diversion | Up to 50,000 cfs | Basin Level Planning |
| Upper Breton Sediment Diversion | Up to 250,000 cfs | 2nd Implementation Period |
| Mid Barataria Sediment Diversion | Up to 250,000 cfs | 2nd Implementation Period |

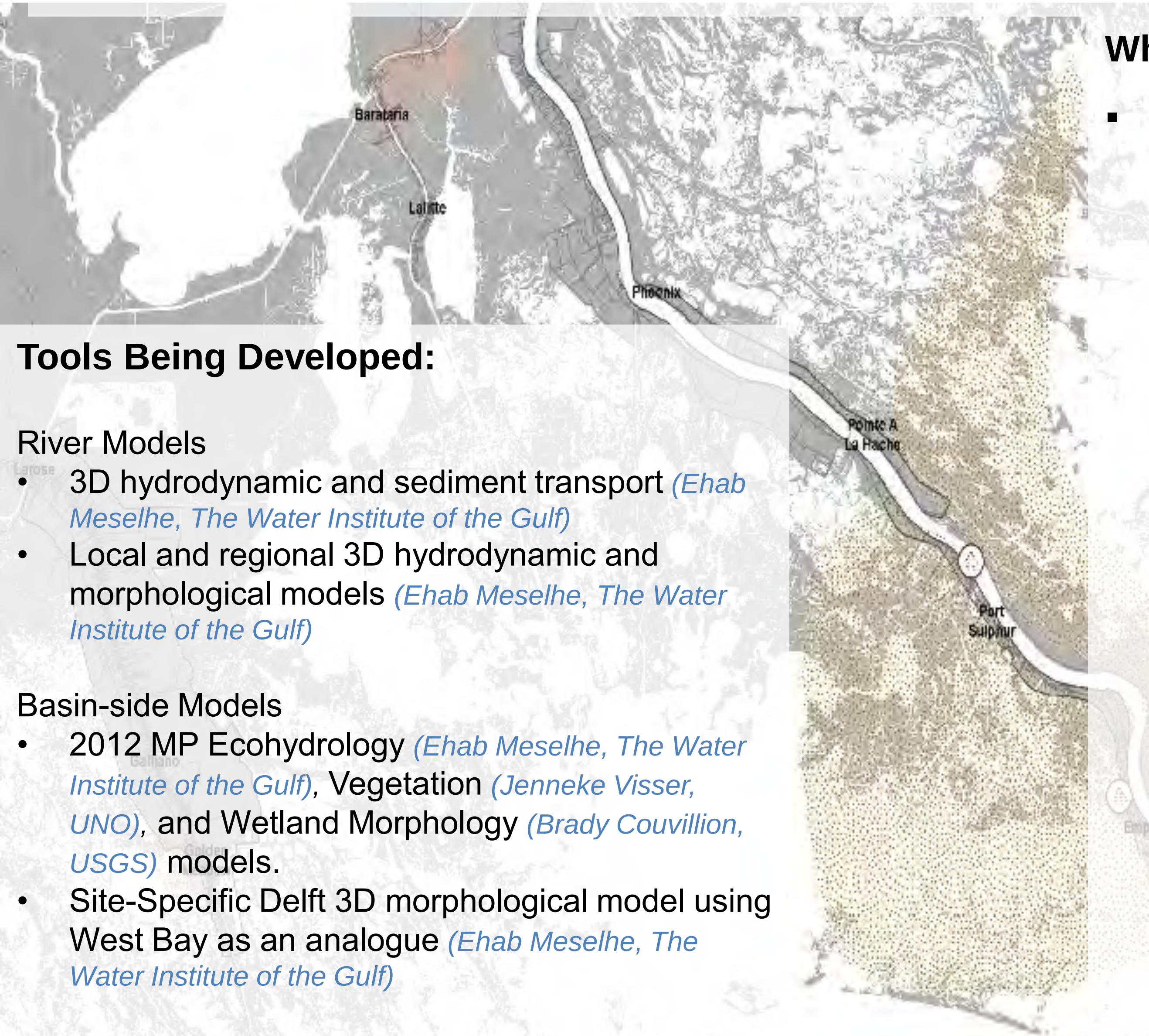
*Diversion capacities have been refined through the LCA projects Myrtle Grove and White's Ditch:

- Mid-Barataria Sediment Diversion capacity has increased from 50,000 cfs in the 2012 Coastal Master Plan to 75,000 cfs to increase sediment capture ratios at the project site.
- Mid-Breton Sediment Diversion is considering operation 5,000 cfs and 35,000 cfs.

# Mississippi River Sediment Diversions: Process



# Lower Breton and Lower Barataria Diversions




## What we will evaluate:

- Screening information for site selection:
  - Flow, nutrient and sediment load into the basin
  - Sediment/water ratios
  - Impacts to navigation
  - River morphology
  - Flood stage
  - Long-term assessment (~50 years
  - Wetland building
  - Future projections of wetland vegetation
  - Nutrient dynamics
  - Guidance for engineering features to stimulate wetland development
  - Impacts to sediment delivery
  - Operations and maintenance of diversion systems
  - Long term diversion performance
    - RSLR and subsidence
    - Effects on river morphology

## Tools Being Developed:

River Models

- 3D hydrodynamic and sediment transport *(Ehab Meselhe, The Water Institute of the Gulf)*
- Local and regional 3D hydrodynamic and morphological models *(Ehab Meselhe, The Water Institute of the Gulf)*

Basin-side Models

- 2012 MP Ecohydrology *(Ehab Meselhe, The Water Institute of the Gulf)*, Vegetation *(Jenneke Visser, UNO)*, and Wetland Morphology *(Brady Couvillion, USGS)* models.
- Site-Specific Delft 3D morphological model using West Bay as an analogue *(Ehab Meselhe, The Water Institute of the Gulf)*

*All models runs will use site specific data *(Mead Allison, The Water Institute and Sam Bentley, LSU)*

# Mid Breton Sediment Diversion


**Tools Being Developed:**

River Models

- 3D hydrodynamic and sediment transport *(Ehab Meselhe, The Water Institute of the Gulf)*

Basin-side Models

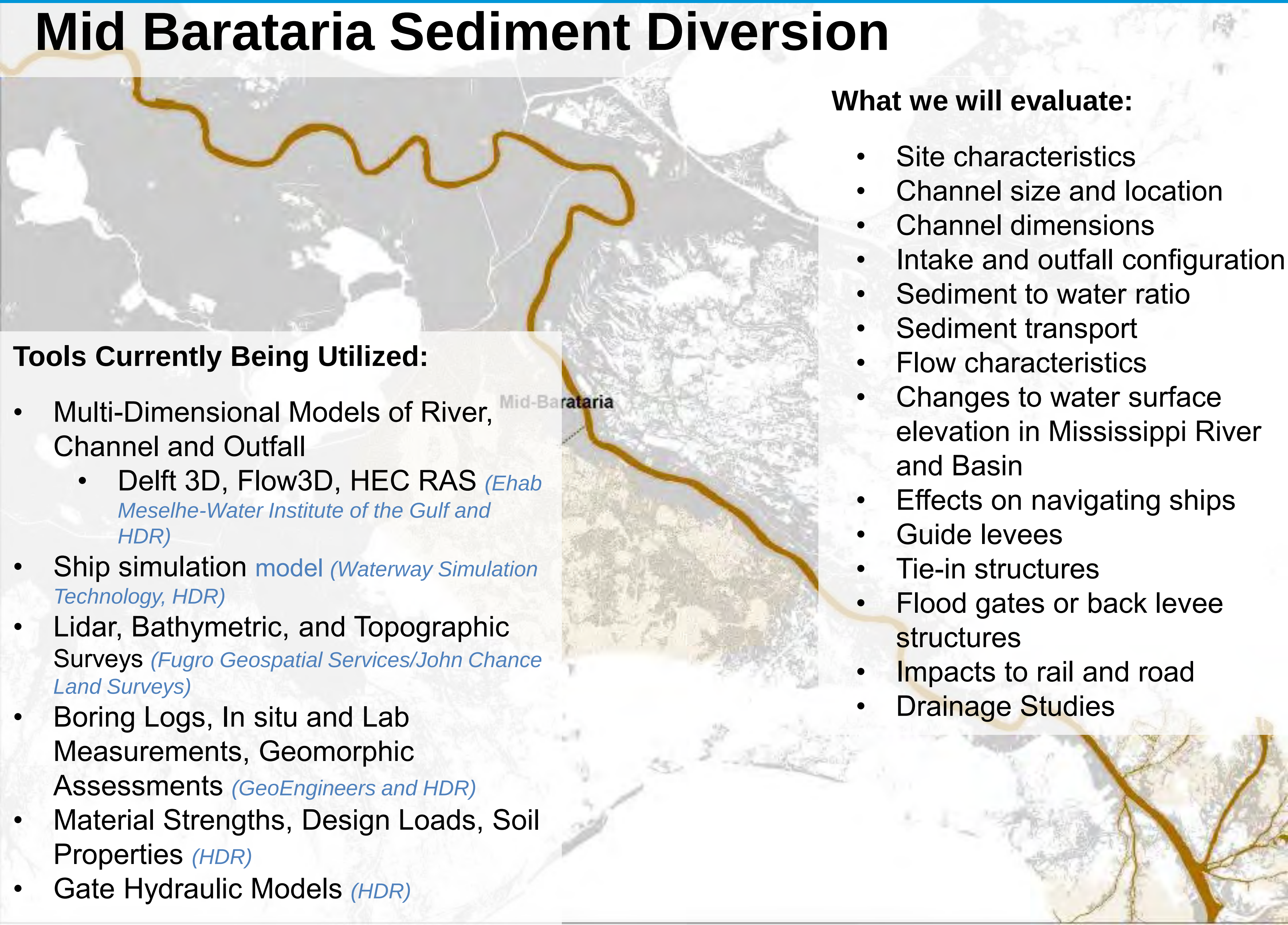
- 2012 MP Ecohydrology *(Ehab Meselhe, The Water Institute of the Gulf)*, Vegetation *(Jenneke Visser, UNO)*, and Wetland Morphology *(Brady Couvillion, USGS)* models using site specific data collection *(Mead Allison, The Water Institute of the Gulf)*

**What we will evaluate:**

- Sediment, hydrodynamic, and nutrient load into the basin
- Long-term assessment (~50 yrs)
- Preliminary estimates of wetland building
- Future projections of wetland vegetation
- Nutrient dynamics

*Also evaluated under LCA. Recommended a 35,000 cfs diversion operated for two months each spring.

# Mid Barataria Sediment Diversion




**Tools Currently Being Utilized:**

- Multi-Dimensional Models of River, Channel and Outfall
  - Delft 3D, Flow3D, HEC RAS *(Ehab Meselhe-Water Institute of the Gulf and HDR)*
- Ship simulation model *(Waterway Simulation Technology, HDR)*
- Lidar, Bathymetric, and Topographic Surveys *(Fugro Geospatial Services/John Chance Land Surveys)*
- Boring Logs, In situ and Lab Measurements, Geomorphic Assessments *(GeoEngineers and HDR)*
- Material Strengths, Design Loads, Soil Properties *(HDR)*
- Gate Hydraulic Models *(HDR)*

**What we will evaluate:**

- Site characteristics
- Channel size and location
- Channel dimensions
- Intake and outfall configuration
- Sediment to water ratio
- Sediment transport
- Flow characteristics
- Changes to water surface elevation in Mississippi River and Basin
- Effects on navigating ships
- Guide levees
- Tie-in structures
- Flood gates or back levee structures
- Impacts to rail and road
- Drainage Studies

# Mississippi River Hydrodynamic Study

**What we will evaluate:**

- Water and sediment resources available for restoration
- Effects on navigation
- Sedimentation and effects on river maintenance
- Reduced transport in the river
- Effects on river flood control
- Nutrients and harmful pollutants in the river

**Tools Being Developed:**

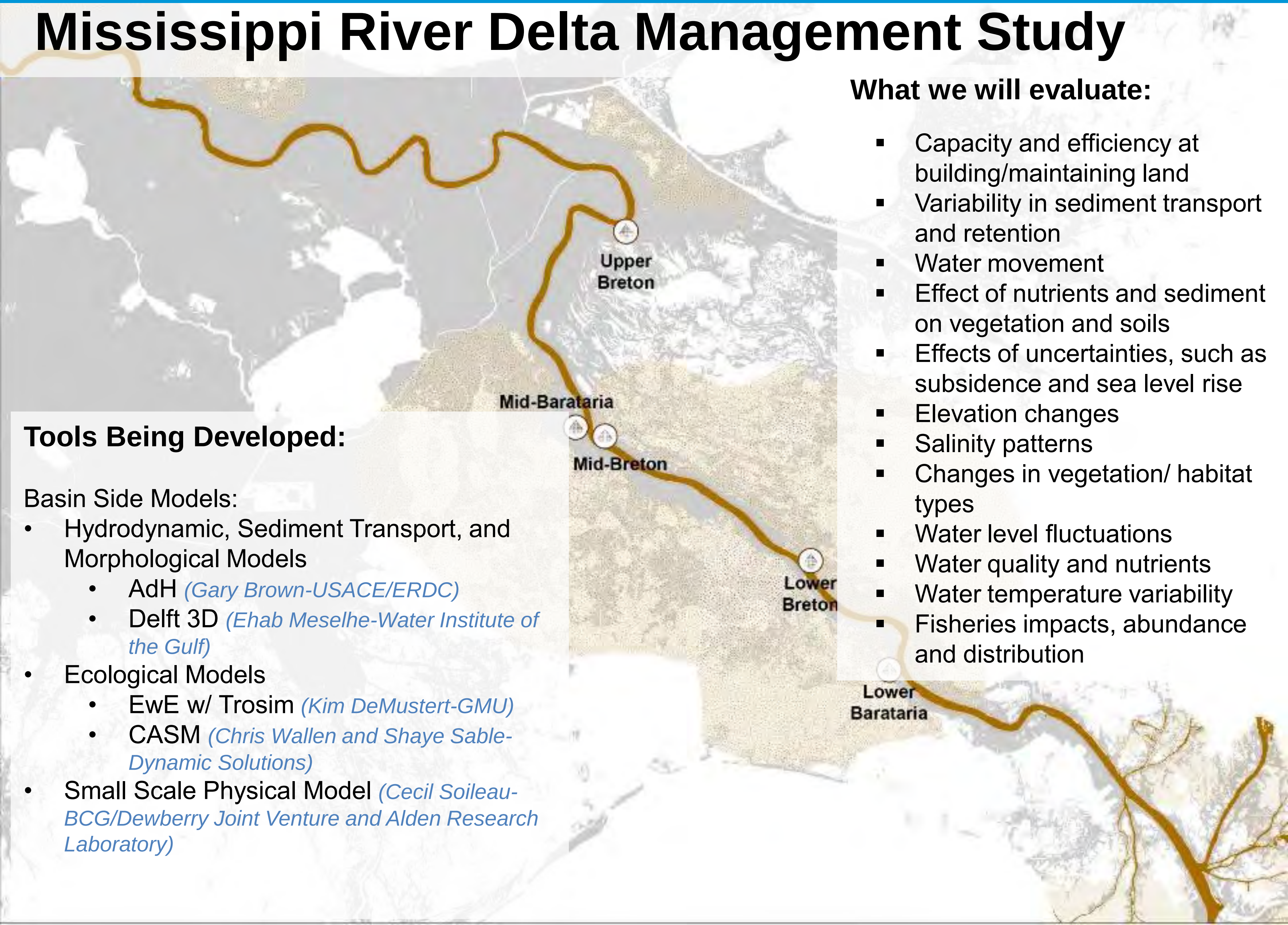
Models:
- One-Dimensional Models
    - HEC-6T *(Tony Thomas-Mobile Boundary Hydraulics, Ike Mayer and Mike Trawle-BCG)*
- Multi-Dimensional Models
    - ADH-SedLib Multi-D Model *(Gary Brown-USACE/ERDC)*
    - Delft 3D Multi-D Model *(Alex McCorquodale-UNO, Steve Ayres-USACE/MVN, and Ehab Meselhe-Water Institute of the Gulf)*
    - FVCOM Multi-D Model *(Ioannis Georgiou-UNO)*
    - Flow3D Multi-D Model *(Ehab Meselhe-Water Institute of the Gulf)*
- Small Scale Physical Model *(BCG, Cecil Soileau-BCG/Dewberry Joint Venture and Alden Research Laboratory)*

Geomorphic Assessment *(David Biedenharn-Biedenharn Group and Charlie Little-USACE/ERDC)*

Data Collection *(Mead Allison-Water Institute of the Gulf and Thad Pratt-USACE/ERDC)*

Data Management *(Christina Hunnicutt and Craig Conzelmann-USGS; Melany Larenas and Beth Forrest-CB&I)*

# Mississippi River Delta Management Study




**What we will evaluate:**

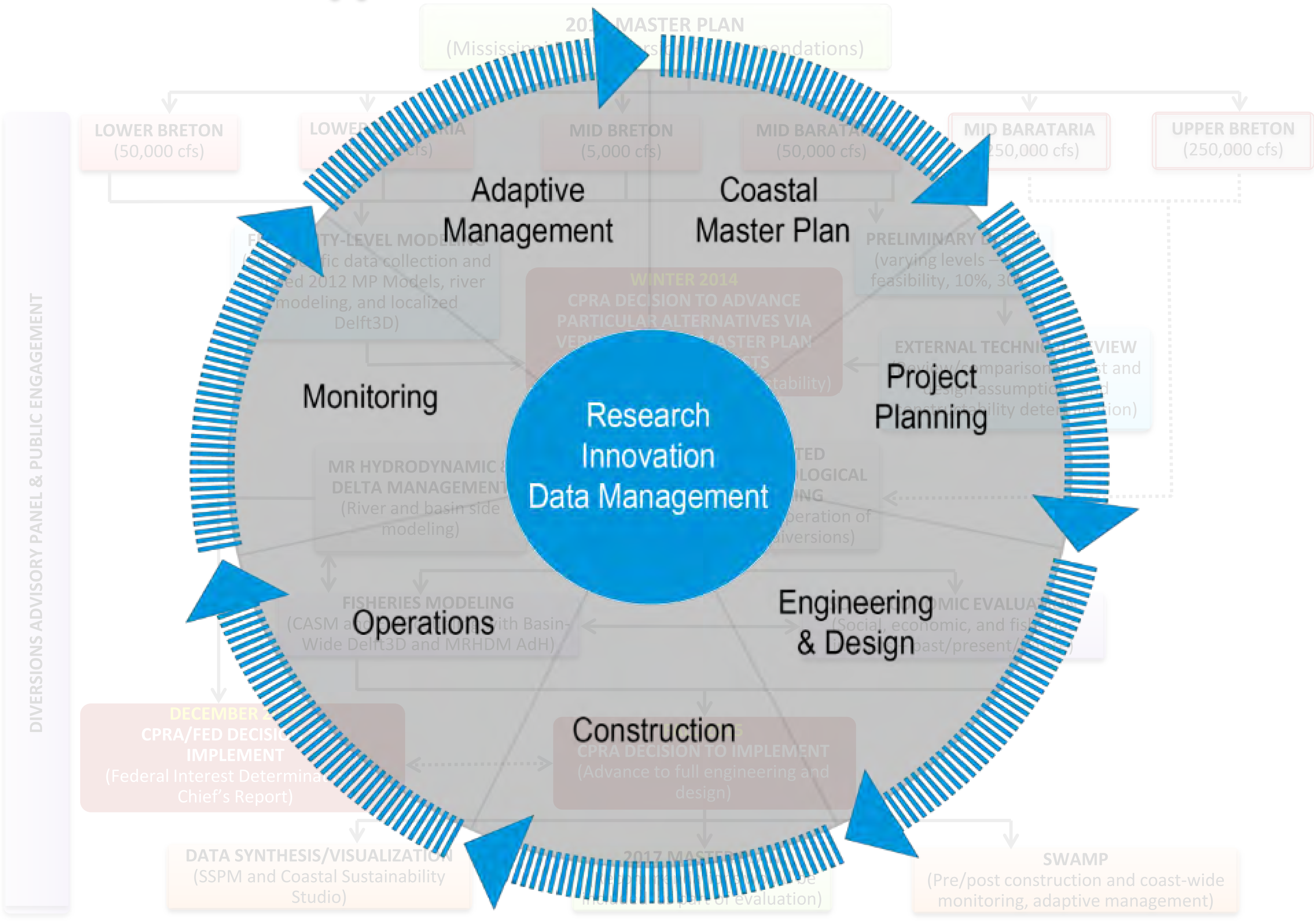
- Capacity and efficiency at building/maintaining land
- Variability in sediment transport and retention
- Water movement
- Effect of nutrients and sediment on vegetation and soils
- Effects of uncertainties, such as subsidence and sea level rise
- Elevation changes
- Salinity patterns
- Changes in vegetation/ habitat types
- Water level fluctuations
- Water quality and nutrients
- Water temperature variability
- Fisheries impacts, abundance and distribution

## Tools Being Developed:

Basin Side Models:

- Hydrodynamic, Sediment Transport, and Morphological Models
  - AdH *(Gary Brown-USACE/ERDC)*
  - Delft 3D *(Ehab Meselhe-Water Institute of the Gulf)*
- Ecological Models
  - EwE w/ Trosim *(Kim DeMustert-GMU)*
  - CASM *(Chris Wallen and Shaye Sable-Dynamic Solutions)*
- Small Scale Physical Model *(Cecil Soileau-BCG/Dewberry Joint Venture and Alden Research Laboratory)*

# Mississippi River Sediment Diversions: Process



# Addressing Key Considerations and Uncertainty

- Public Engagement
- Fisheries Modeling
- Data Collection and Adaptive Management
- Socioeconomic Evaluation
- Data Synthesis and Visualization
- Diversions Advisory Panel

# QUESTIONS?