Navigating a Changing Climate

The role of sediment management in climate change mitigation and adaptation

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A Global Climate Agenda* Action Objectives

- To **improve sector-wide awareness** of climate change; of the challenges waterborne transport infrastructure will face; and of potential solutions or opportunities
- To **create and facilitate knowledge networks**, promoting the sharing of experience and good practice between state and non-state actors at international, regional and national levels
- To develop or facilitate the preparation of **technical good practice guidance**, training opportunities and web-based resources
- To provide a **coordinated, global focal point**: a 'centre of excellence' intended to support the owners, operators and users of waterborne transport infrastructure in building the capacity needed to navigate the changing climate

* http://newsroom.unfccc.int/climate-action/global-climate-action-agenda

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Partners

- The World Association for Waterborne Transport Infrastructure (PIANC)
- International Association of Ports and Harbors (IAPH)
- International Harbour Masters' Association (IHMA)
- International Maritime Pilots' Association (IMPA)
- International Bulk Terminals Association (IBTA)
- Smart Freight Centre (SFC)
- European Dredging Association (EuDA)
- European Sea Ports Organisation (ESPO)
- Institute of Marine Engineering, Science and Technology (IMarEST)
- Inland Waterways International (IWI)

Navigating a Changing Climate
Action Plan

Actions developed under four themes:

1. Expand network of partners and supporters, **raise awareness** of climate-related issues throughout the sector
2. Promote actions to reduce (net) greenhouse gas emissions and encourage a shift towards **low carbon** infrastructure and operations
3. Improve preparedness, **strengthen resilience** and enable the waterborne transport infrastructure sector to **adapt** to climate change
4. Encourage new ways of thinking: Working with Nature, and identifying sustainable and **integrated solutions**

http://navclimate.pianc.org

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Theme 2. Low carbon

Actions include:

- IAPH World Ports Climate Initiative: includes carbon footprinting, onshore power supply, environmental ship index
- Global Logistics Emissions Council methodology for calculating supply chain logistics emissions; SFC now harmonising methods for ports and terminals
- ESPO Green Guide chapter on energy consumption and climate change, EcoPorts tools embed climate change components
- **EuDA leading on developing strategy for capture and storage of atmospheric CO_2 'Blue Carbon' initiative**
- PIANC's Working Group 188 carbon management for ports/inland waterways

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Blue carbon

- Important concept for the navigation sector
- Blue carbon projects are initiatives designed to enhance, restore or create certain types of aquatic habitats that act as a sink for carbon
- Carbon stored in ocean and coastal biotopes notably **mangroves, tidal marshes, and seagrass beds** can have storage rates double that of a tropical rainforest
- Many of these habitats also play an important role in coastal management e.g. absorbing wave energy, improving water quality or acting as fish nursery areas
- **Sediment is a vital resource for many blue carbon projects**
- For further information and examples see conference outputs at http://navclimate.pianc.org/news/key-messages-from-navigating-a-changing-climate-conference

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Theme 3. Adaptation

Maritime and inland navigation may need to adapt to:

- Increases in flooding frequency or severity due to sea level rise or precipitation changes
- Increased frequency of extreme wind, wave or storm conditions
- Changes in sediment transport, erosion and accretion
- Potential for changes in fog characteristics or other visibility issues
- Air and water temperature increases, ocean chemistry change
- Changes in ice cover

Why act? Ensure navigational safety, reduce downtime, protect business continuity

Action: publish sector-specific technical adaptation guidance for ports and inland waterways (**PIANC Working Group 178**)

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PIANC WG 178

Methodological framework for adaptation decision-making

- Define the challenge; engage stakeholders; develop ownership
- Prepare inventory of critical infrastructure assets and operations
- Understand key climatic drivers, future climate scenarios/projections
- Consider risks: exposure, sensitivity, consequence, likelihood, timings
- Refer to toolbox of measures (includes hard/soft; structural/physical; behavioural/operational; institutional/policy options)
- Understand adaptation concepts: maladaptation; resilience; adaptive management; quick wins; win-wins; low hanging fruit; no/low regrets
- Nature-based measures can offer resilient solutions with co-benefits: **sediment is a vital resource for many nature-based solutions**
- Evaluate, select, implement and monitor preferred option

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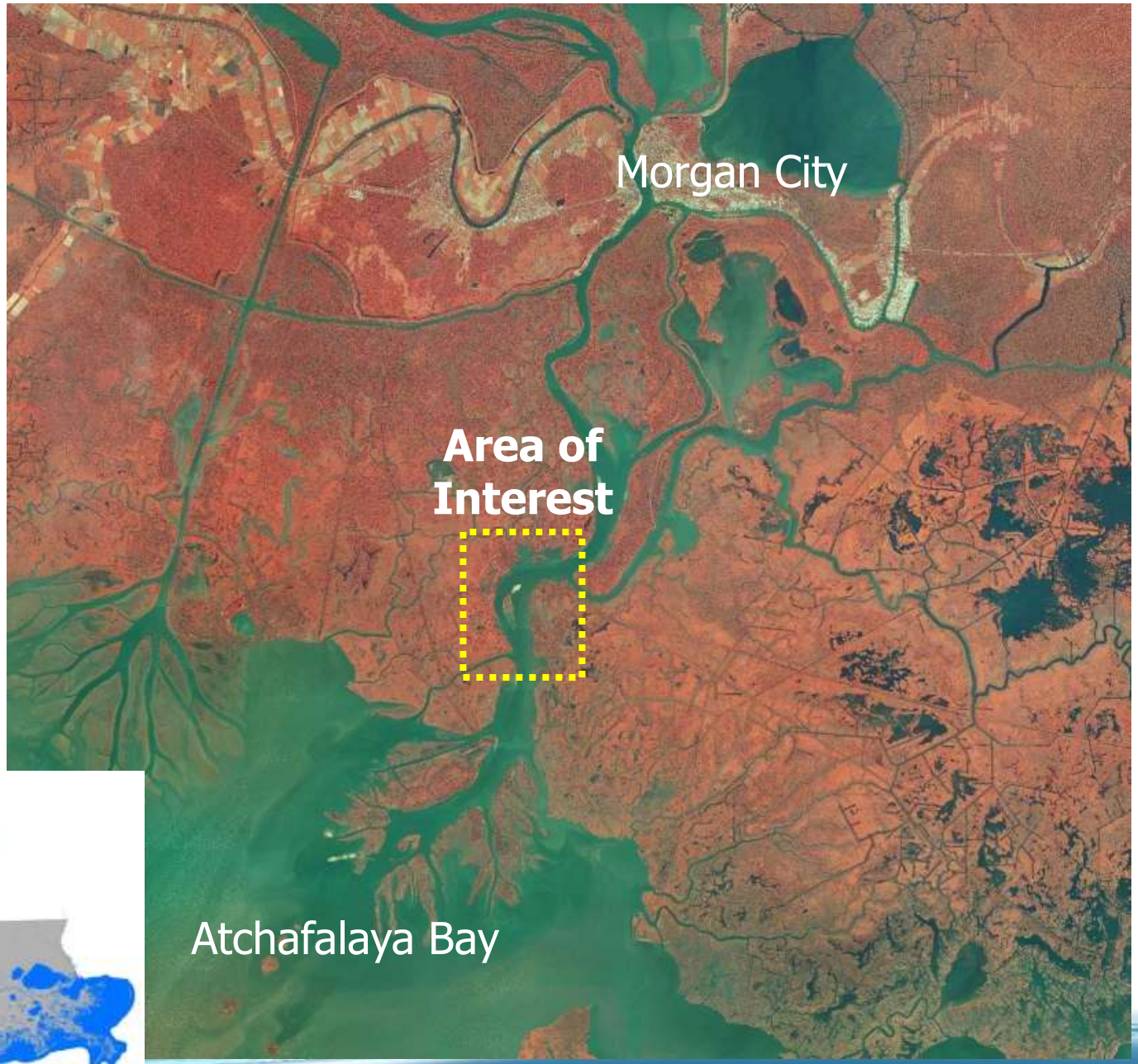
Theme 4. Integration

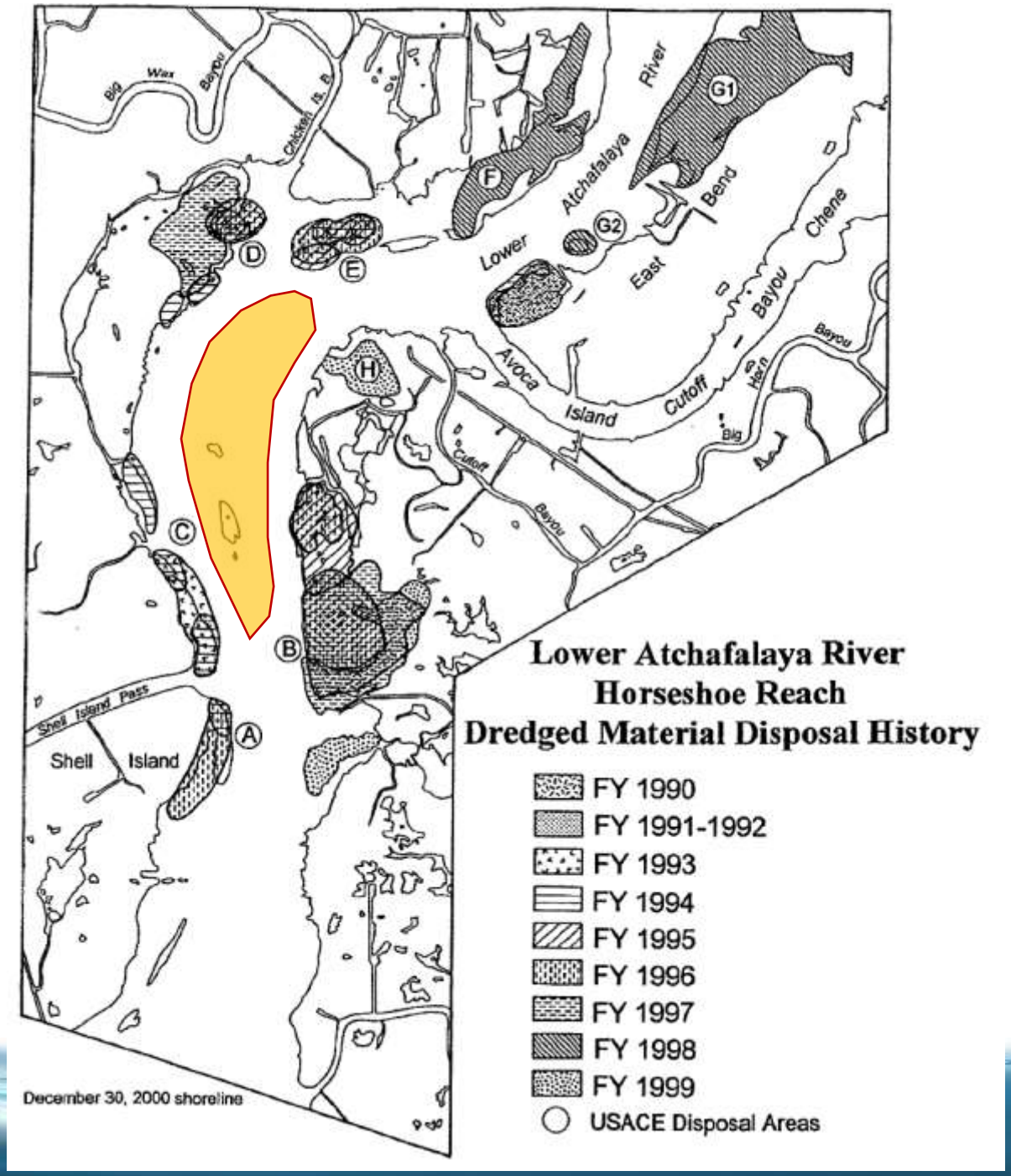
- Intermodality: flexible, interconnected transport solutions
- Working with Nature, Building with Nature, Engineering with Nature
- Integrated coastal zone management
- **Sediment is a vital resource for many WwN, BwN, EwN solutions as well as for ICZM**

Examples of beneficial uses of dredged material

< **Horseshoe Bend EwN project, USA**

Mersey Estuary > WwN project, UK


Morgan City
Area of Interest
Atchafalaya Bay



Problem

Capacity of Bankline Disposal Areas Exhausted

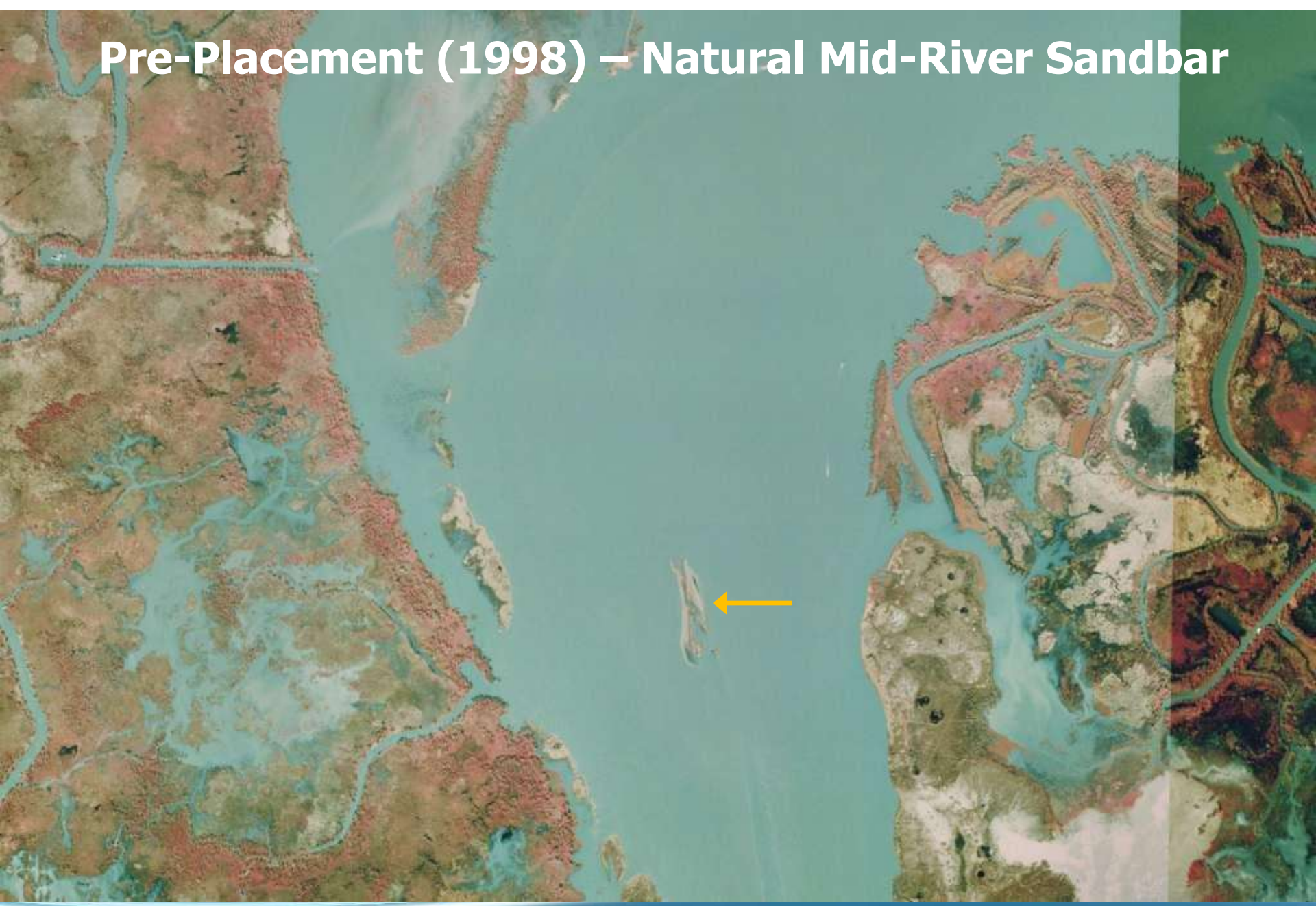
Alternatives

~~Conversion of Wetland Disposal Areas into Upland~~

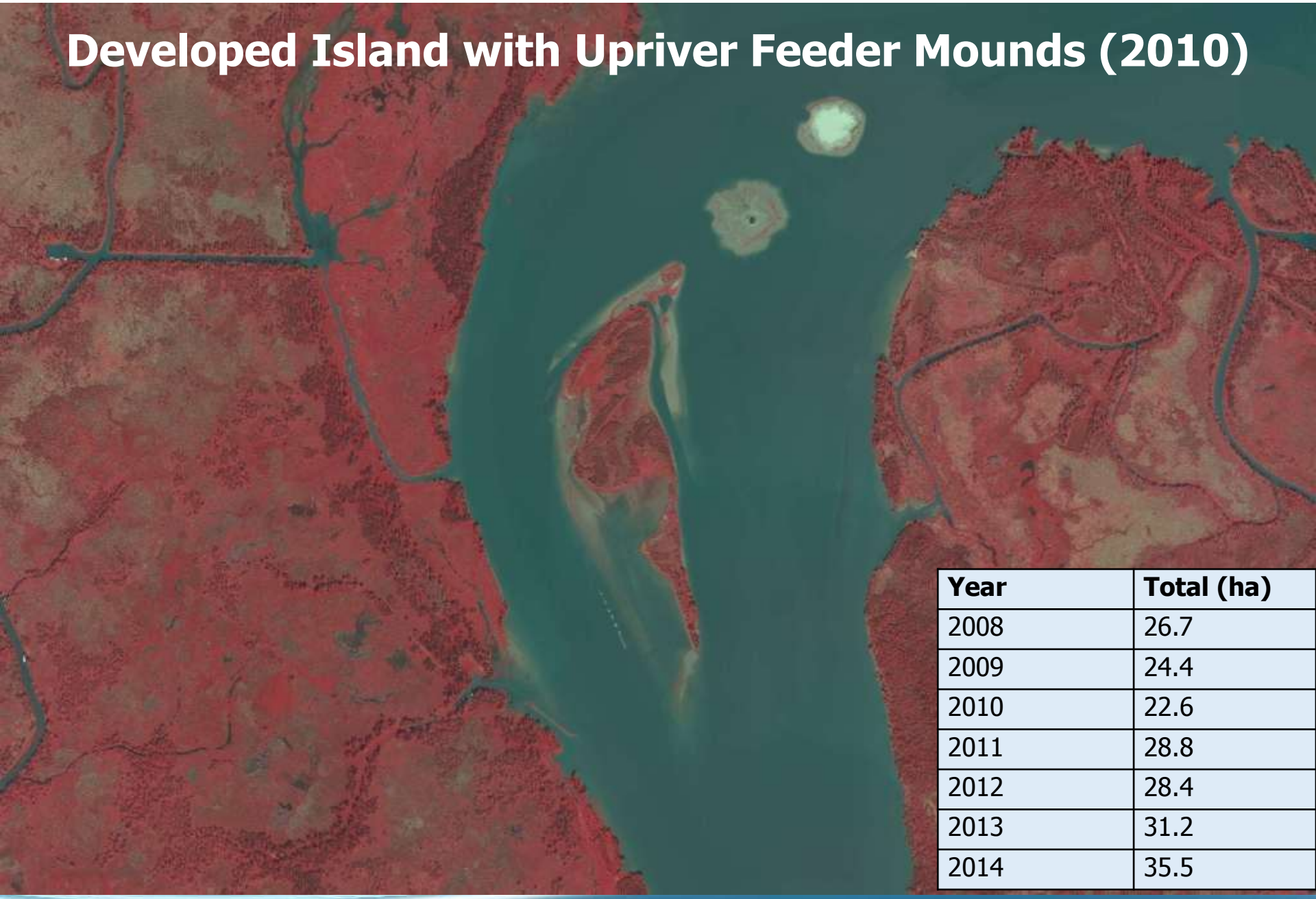
~~Open Water Disposal in Atchafalaya Bay~~

Mid-River Mounding of Dredged Material

Pre-Placement (1998) – Natural Mid-River Sandbar



Developed Island with Upriver Feeder Mounds (2010)



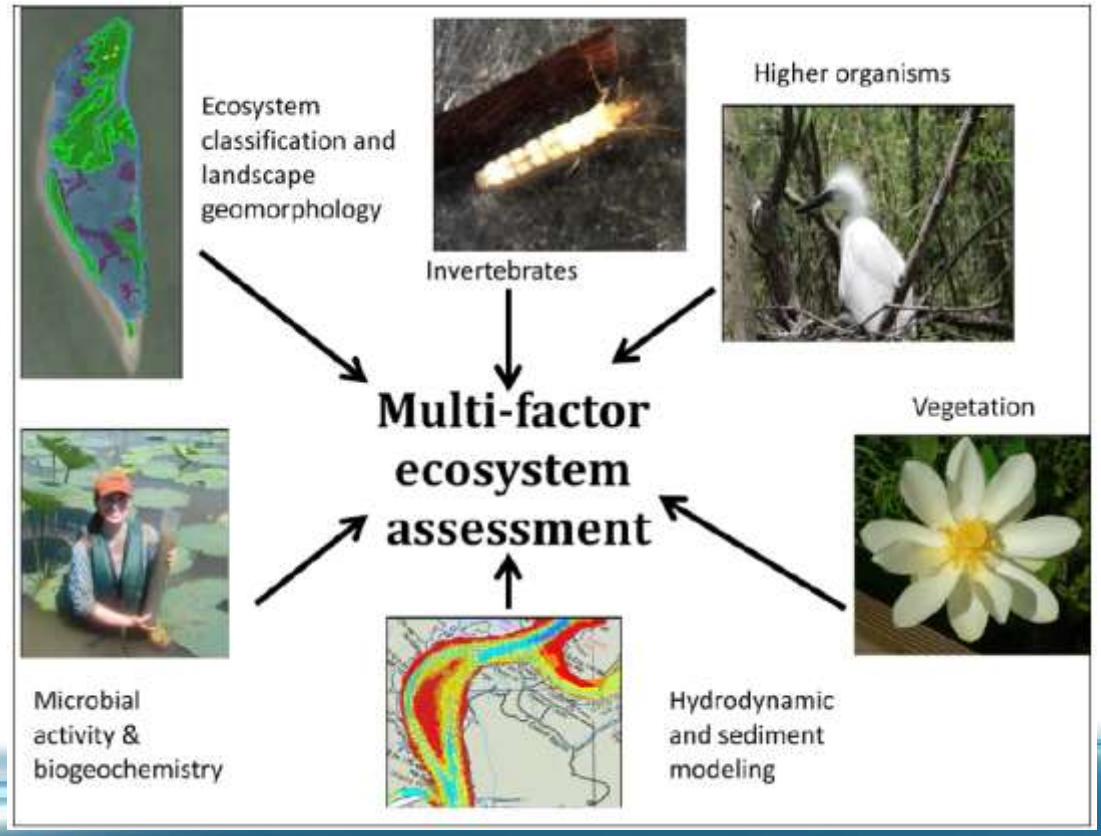
Year	Total (ha)
2008	26.7
2009	24.4
2010	22.6
2011	28.8
2012	28.4
2013	31.2
2014	35.5

Horseshoe Bend Island Dredging Project

Problem: Limited options for dredged material placement alternatives

Solution: Innovative EWN placement technique created wetland island

Approach: Ecological assessment documented ecosystem services benefits



Case Study: ES Metrics

Assessment Metrics	Environmental Services
Ecosystem mapping	Environmental sustainability/ habitat, recreation
Vegetation communities Faunal survey Invertebrate communities	Support for local and migratory species, nesting bird rookeries, and fisheries
Soil characterization Soil nutrient concentrations Soil nutrient retention capacity	Carbon sequestration, water quality improvement
Hydrodynamic and sediment transport modeling	Navigation, energy savings, safety

Case Study: ES Metrics

Habitat:

- 86 plant species present
- 10+ bird species in large nesting colonies
- Support for local fisheries

Water quality:

- Removal of excess nutrients

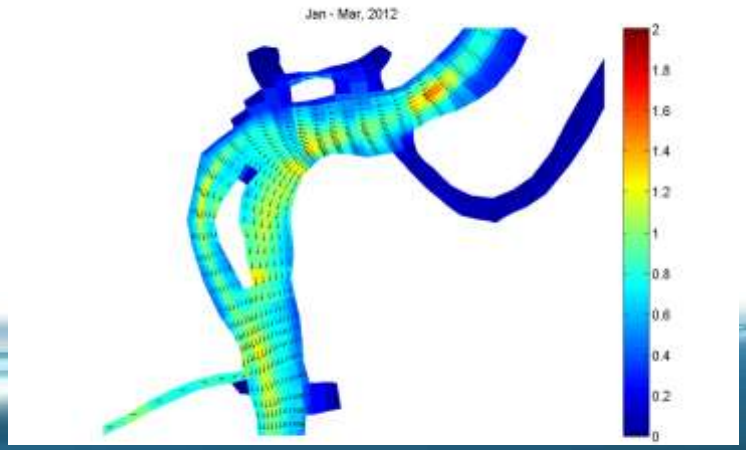
Recreation:

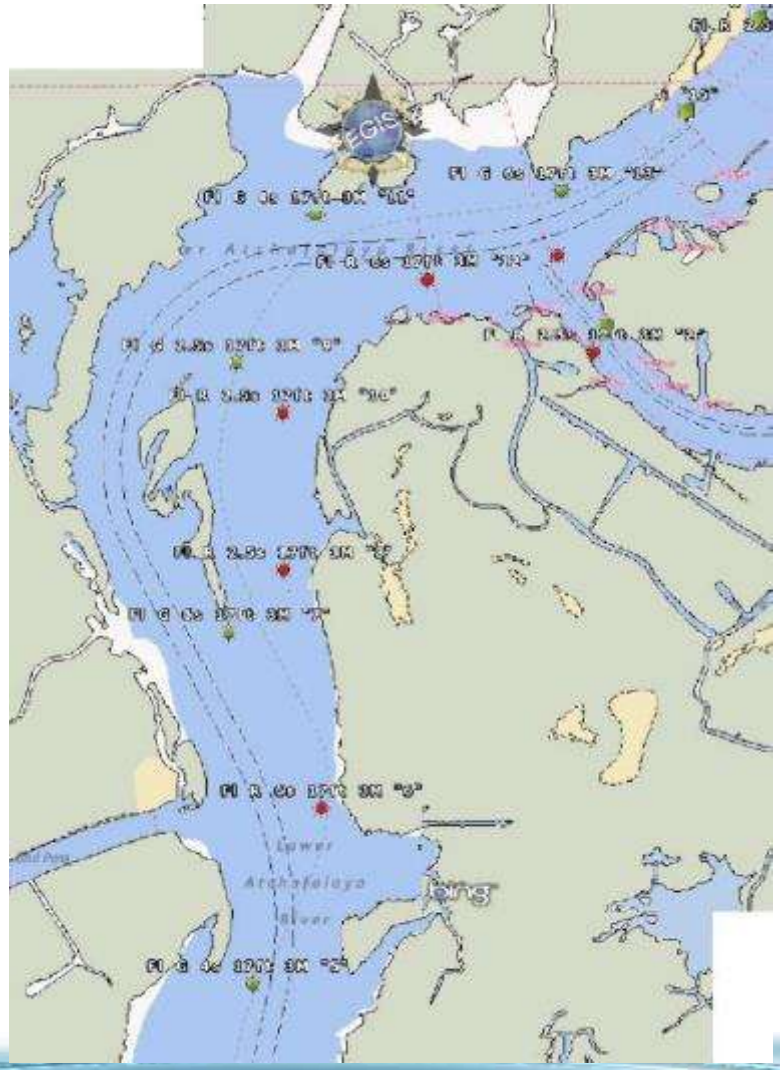
- Fishing, waterfowl hunting, camping

Case Study: ES Metrics

Hydrodynamics and Navigation:

- Increased flow velocity and sediment transport
- Decreased the need for additional dredging
- Allowed for channel realignment, reduced fuel use and travel time, increased safety





Case Study: Quantifying ES Benefits

Environmental Services	Metrics	Benefit
Environmental Sustainability/ Habitat	Four distinct wetland habitats: Aquatic bed 19 ha Forest 10 ha Emergent 4 ha Scrub shrub 1.5 ha	Provides diverse habitat for 86 plant species, >10 bird species, as well as reptiles, mammals, and aquatic invertebrates
Human Safety	Straightening navigation channel pathway	Created island allowed for re-routing of the navigation channel, eliminating a sharp turn while decreasing potential safety risks
Carbon sequestration	336 mega grams carbon accumulated in wetland soil	Long term carbon storage removes CO_2 from atmosphere

Case Study: Quantifying ES Benefits

Environmental Services	Metric	Benefit	Estimated Economic Value
Water quality improvement	1645 kg excess nitrate-nitrogen removed/yr	Excess nutrient removal by soil denitrification decreases hypoxia in the Gulf of Mexico	$16,450/yr
Climate regulation	186 metric tons CO_2 equivalent reduction/yr	Decreases greenhouse gas emissions	$2,400/yr
Recreation	35 hectares utilized for hunting, fishing, and birdwatching	Increased opportunities for public access	$560/yr
Transportation support	86,000 liters of fuel saved/yr	Cost savings for transportation	$54,000/yr
Navigation	57% reduction in dredging requirements	Decreased channel maintenance dredging costs	$4,300,000/yr

Case Study: Summary

- Multi-factor approach improved assessment Engineering with Nature approaches produced equivalent outcomes to natural wetlands
- ES valuation results highlights the full benefits of USACE dredging project
- Documenting ES benefits promotes use of innovative solutions



Case Study: Products and Recognition

Berkowitz, Kim, Beane, Evans, Summers, Suedel, Flanagin, Corbino. 2017. A Multi-Factor Ecosystem Assessment of Wetlands Created Using a Novel Dredged Material Placement Technique in the Atchafalaya River, Louisiana. ERDC/EL TR-17-X.

Berkowitz, Green, VanZomeren, White. 2016. Ecological Engineering. 97: 381–388.

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Suedel, B., Berkowitz, J., Kim, S., Beane, N., Summers, E., Evans, D, and Corbino, J. 2015. Terra Et Aqua. 140:26-31.

Berkowitz, Beane, Evans, Suedel, Corbino. 2014. Use of strategic placement of dredged sediments to support Horseshoe Island in the Atchafalaya River, Louisiana: A preliminary ecological survey. ERDC TN-EWN-14-4.

2015 Western Dredging Association
Gold Environmental Excellence Award

2017 Western Dredging Association
Adaptation to Climate Change Award

PIANC Working with Nature certified

Thanks for listening!

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