U.S. Case Studies: Assessment

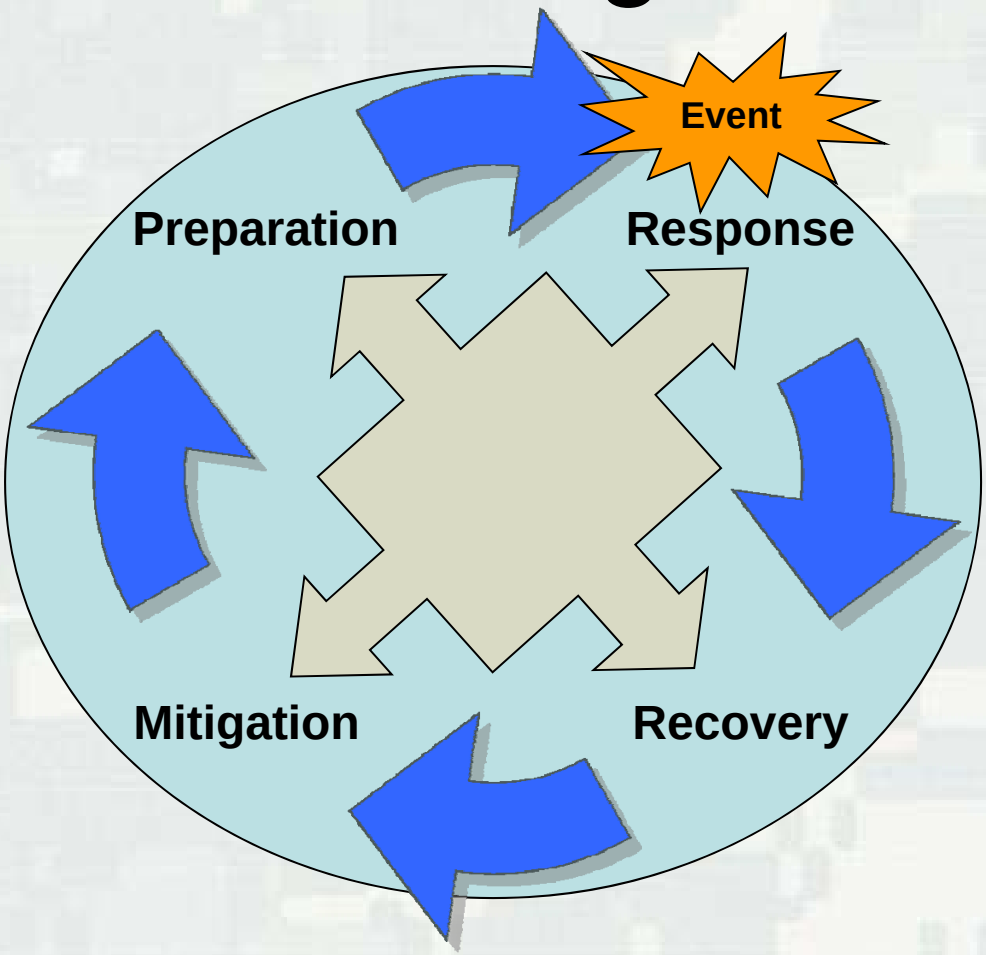
Edward J. Hecker

Chief, Office of Homeland Security and Provost Marshal, Directorate of Civil Works

4-Lateral Exploration of Risk-Informed Flood Management Approaches

October 1, 2009

Flood Risk Management Cycle



Flood-Focused Collaboration

NATIONAL FLOOD RISK MANAGEMENT PROGRAM

US Army Corps of Engineers® FEMA ASFPM nafsma

Mission: To integrate and synchronize the ongoing, diverse flood risk management projects, programs and authorities of the US Army Corps of Engineers with counterpart projects, programs and authorities of FEMA, other Federal agencies, state organizations and regional and local agencies.

- Intergovernmental Flood Risk Management Committee

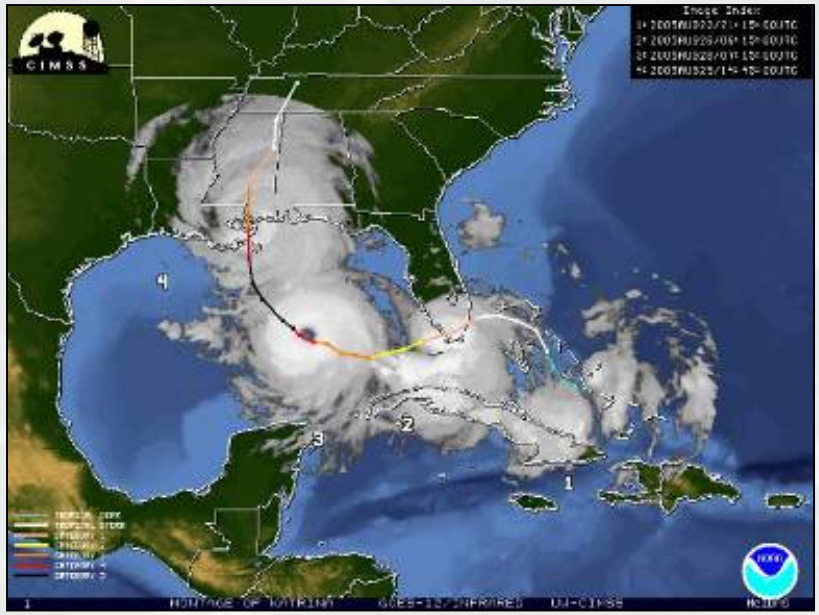
US Army Corps of Engineers® FEMA ASFPM nafsma

- Interagency Levee Task Force

US Army Corps of Engineers USDA FEMA U.S. Small Business Administration SBA Your Small Business Resource

Case Study 1: Gulf Coast

- Hurricane Katrina
  - Highest recorded wave and surge conditions
  - Multiple storm damage reduction projects
  - Impacts:
    - 200 miles of damaged levees
    - 1800 deaths
    - $30B property loss
    - $200B indirect loss
    - Flood depths >15 feet



Case Study 1: Gulf Coast

- Hurricane protection system did not operate as a system
  - Planning and design need to be system-based
  - Methods should reflect dynamic nature of system
  - Hazard and engineering knowledge practices must be regularly evaluated
  - Single design storm approach should be replaced with more robust probability-based methods

Case Study 1: Gulf Coast

- Hurricane Katrina created record surge and wave conditions
  - Sophisticated modes are essential to accurately characterize storm surge and waves
  - Models need increased ability to simulate barrier islands, marshes, and wetlands
  - More robust instrumentation required
  - Safe havens needed for pump and power operators

Case Study 1: Gulf Coast

- System Performance
  - Hurricane structures need to be designed as part of a complete systems-based approach
  - Design should recognize and take into consideration the variable nature of the hazard
  - Existing infrastructure should be reviewed frequently in light of new knowledge, practices, and knowledge
  - Armoring back side of levees is necessary to prevent catastrophic breaching, protect system integrity
  - Maintenance is crucial

Case Study 1: Gulf Coast

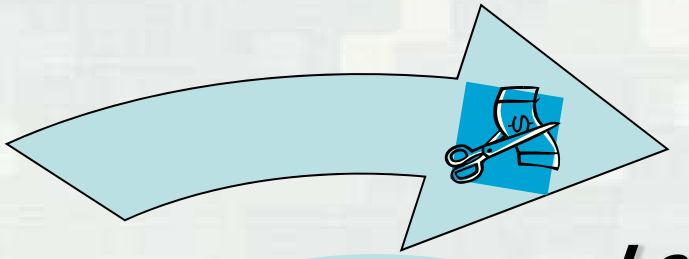
- Consequences
  - Half the direct losses may have been averted had catastrophic breaching not occurred
  - System resiliency would have reduced impacts and enabled quicker recovery
  - Emergency planning and response must focus more on those unable to self-evacuate
  - Indirect consequences as devastating as direct
  - Water depth related to recovery
  - More information need on “natural infrastructure”

Case Study 1: Gulf Coast

- Risks
  - Risk assessment needed to analyze probability and consequences
  - Consequences related most strongly to water depth and number of people and value of property relying on system
  - Emergency preparedness, prior evacuation are key to reducing risk to life and safety
  - Communicating risk is difficult
  - Quantitative estimates of vulnerability to flooding and risk are a powerful awareness tool

Case Study 1: Gulf Coast

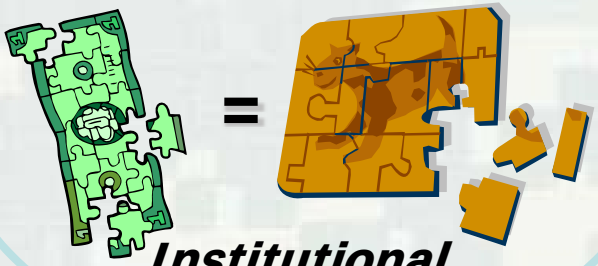
Tyranny of Incremental Decisions



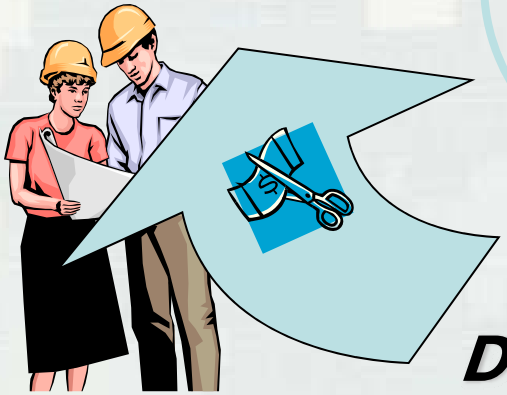
Loss of Vision for an Integrated System

Lack of Dynamic Use of New Information

Shared Sensitivity to Cost Concerns



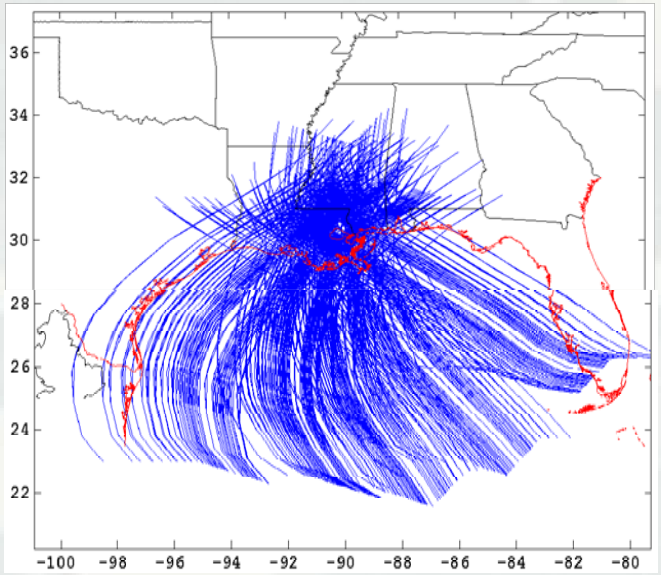
Institutional Response



Organizational Decision-Making Issues

Case Study 1: Gulf Coast

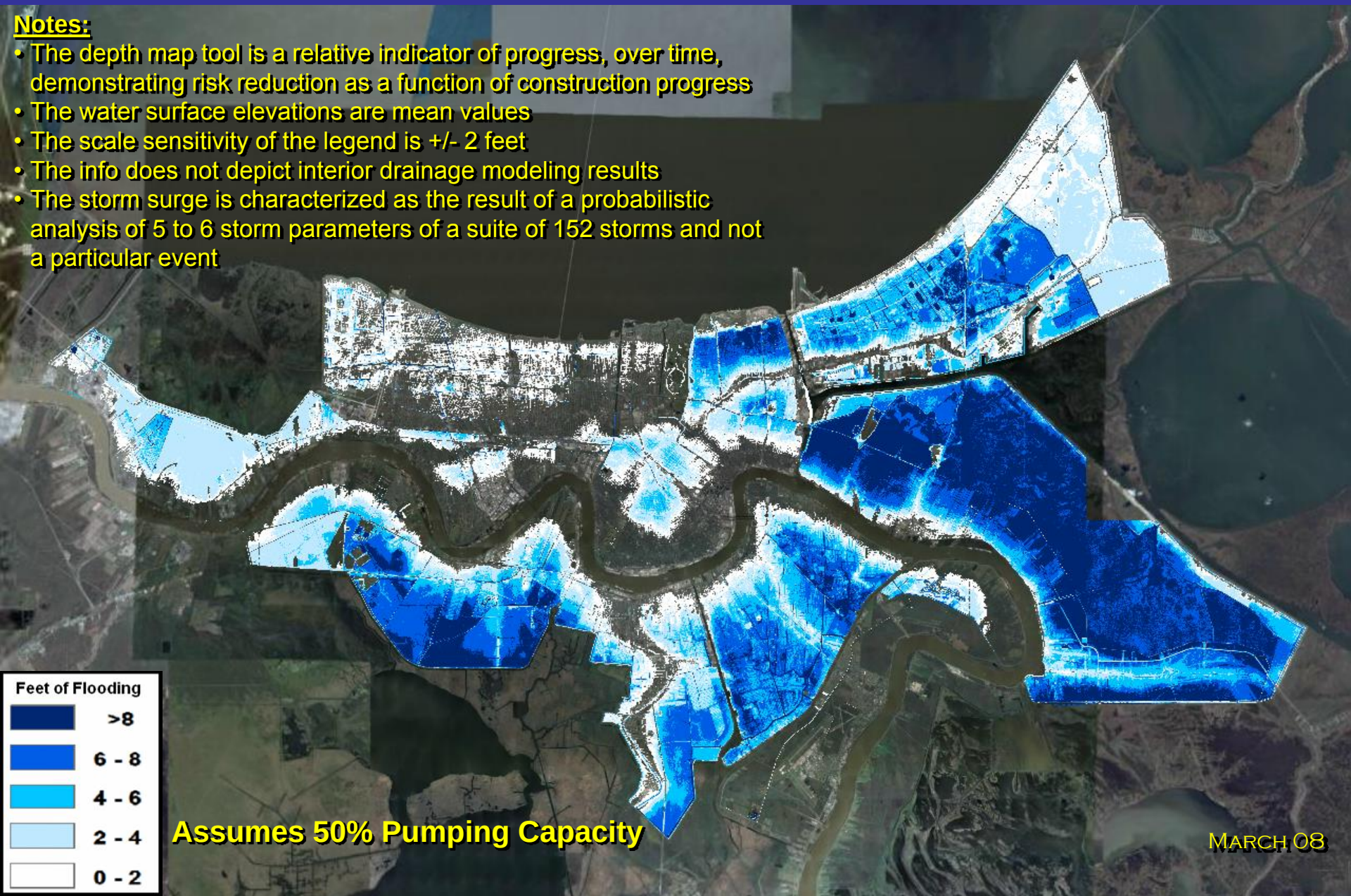
- Assessment Tools
  - Identification and communication of risks
  - Models
  - Flood risk mapping
  - “Natural infrastructure”
  - Multiple scenario approach
  - Adaptive management



Currently, you have a 1% chance every year of flooding this deep from Hurricanes

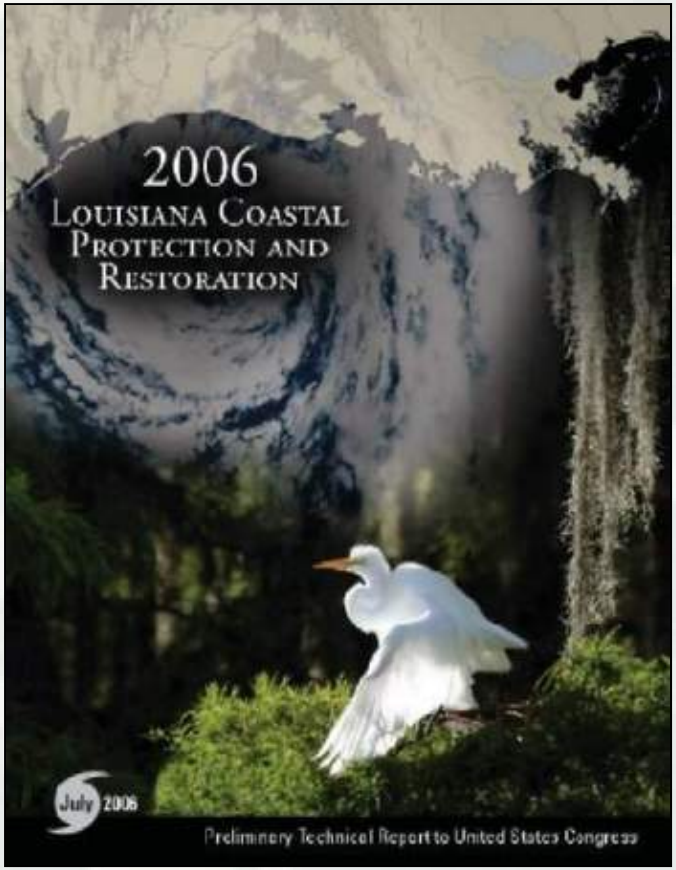
Notes:

- The depth map tool is a relative indicator of progress, over time, demonstrating risk reduction as a function of construction progress
- The water surface elevations are mean values
- The scale sensitivity of the legend is +/- 2 feet
- The info does not depict interior drainage modeling results
- The storm surge is characterized as the result of a probabilistic analysis of 5 to 6 storm parameters of a suite of 152 storms and not a particular event



Louisiana Coastal Protection and Restoration (LACPR)

- Authorized Technical Report – post Katrina: integration of coastal restoration and higher levels of storm damage risk reduction
- Collaboration with State of LA and State Master Plan
- Multiple lines of defense strategy
  - Coastal restoration/protection
  - Structural measures
  - Non-structural features
- Describes need for using risk reducing / informing decision making process
- NAS review of final report ongoing
- Target report completion – Sep 2009



Case Study 2: Sacramento and San Joaquin Rivers

- 3 hydrologic regions
- 450 miles long, 50 miles wide
- Highly productive agricultural area
- Important ecosystem
- Home to 4.4 million people

Case Study 2: Sacramento and San Joaquin Rivers

Problem Areas

- Inadequate Channel Capacity
- Levee Deficiencies
- Erosion
- Declining Habitat
- Institutional Barriers
- Threatened & Endangered Species
- Development within the Floodplains

Case Study 2: Sacramento and San Joaquin Rivers

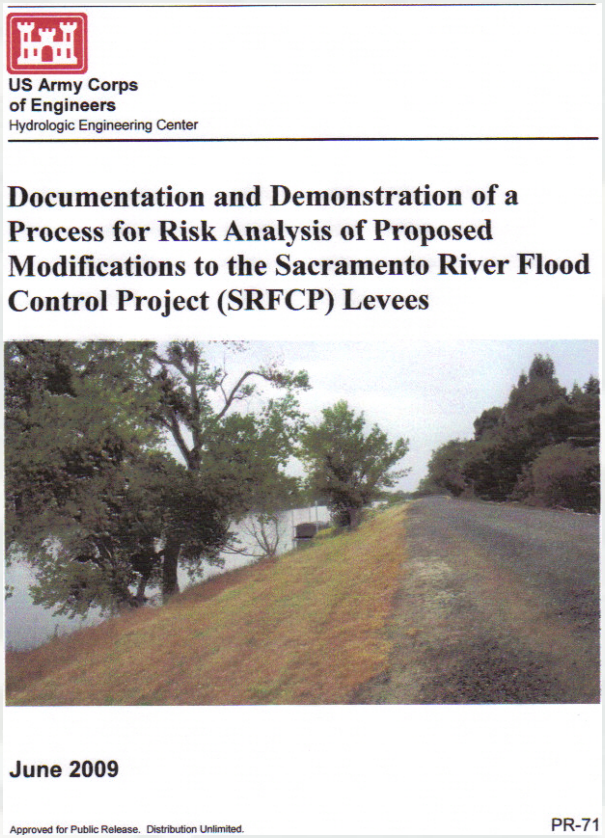
Models

- HEC-HMS: Rainfall-Runoff
- HEC-RSS/FCLP: Reservoir Optimization
- HEC-5: Hourly Flood Simulation
- Geotechnical analysis – Levee Reliability
- UNET/FLO-2D: Hydraulic Models
- HEC-FIA/FDA: Economic Models
- EFM: Ecosystems Function Model

Case Study 2: Sacramento and San Joaquin Rivers

System-wide Application of Risk Analysis Tool

- Sacramento River System
- Undertaken by HEC
- Defined process
- Demonstrated use of risk analysis tools
- Report issued June 2009


US Army Corps
of Engineers
Hydrologic Engineering Center

Documentation and Demonstration of a Process for Risk Analysis of Proposed Modifications to the Sacramento River Flood Control Project (SRFCP) Levees

June 2009

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Questions?