

USACE Flood Risk Management (FRM) R&D Strategic Plan



Dr. Jeffery P. Holland, *HQ Directorate of R&D*

Mr. Anthony R. Niles, *HQ Deputy Director of Civil Works R&D*

Mr. William R. Curtis, *Technical Director for FRM R&D*

Presented by Mary A. Cialone

U.S. Army Corps of Engineers

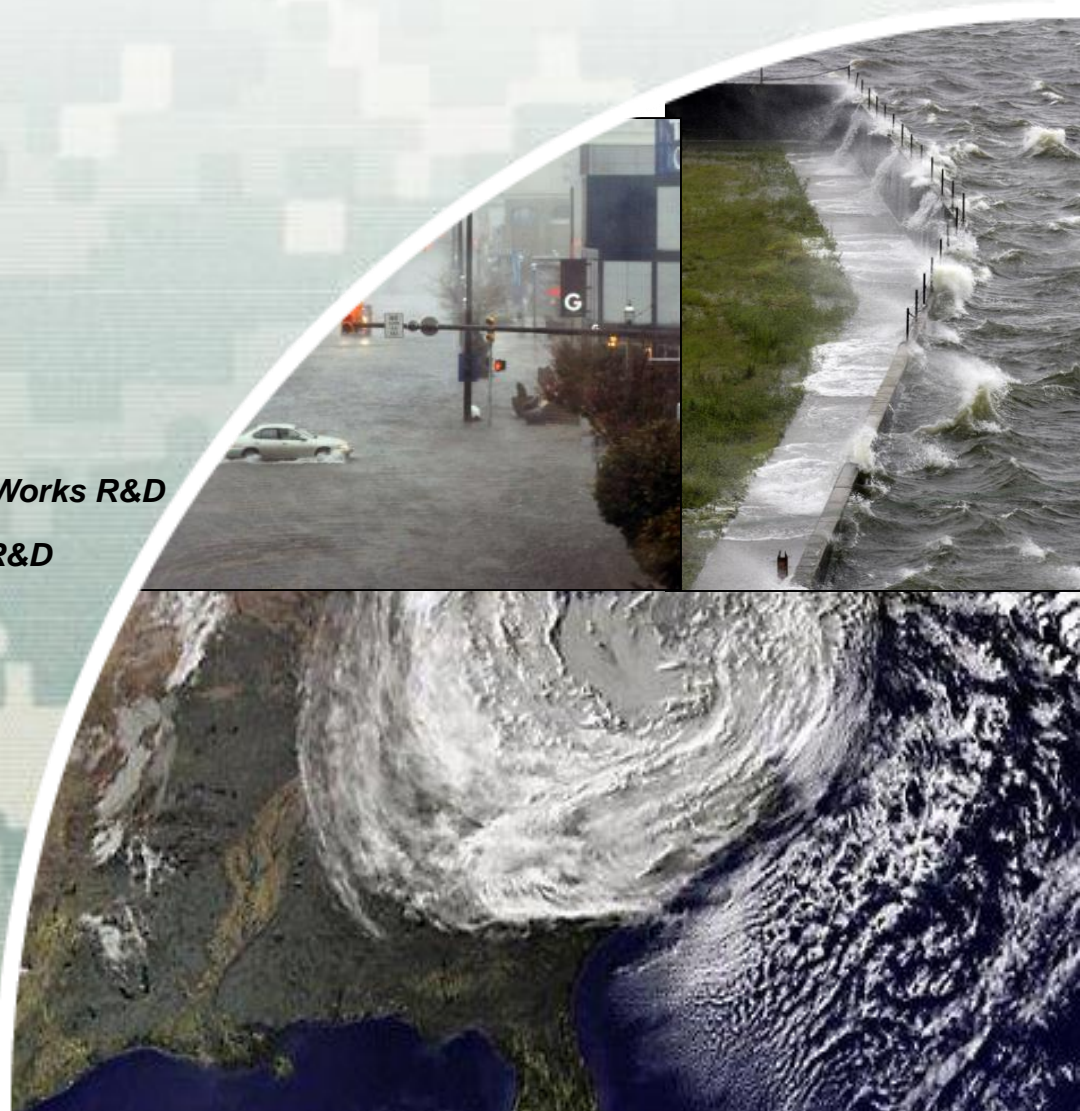
Engineer Research & Development Center

Coastal & Hydraulics Laboratory



®

10 Sep 2015



USACE Civil Works Program

FRM Critical Objectives

- Reduce the nation's flood risk
- Increase resilience to disasters
- Develop balanced water management strategy – competing needs for available water, affordable energy, sustainable ecosystems



Background

- Flood risk is escalating world-wide due to:
 - Changes in population demographics
 - Climate change
 - Aging and inadequate infrastructure



Flood Risk Management Strategy

Long-Range Drivers

- Rising flood risk: *demographic shift, climate change, aging/inadequate infrastructure*
- Increasing coastal populations and infrastructure: *as of 2010, > 50 % of the US population (164 million) lived in coastal watershed counties; an additional 180 million tourists visited annually (NOAA 2013)*
- Climate change: *frequency/intensity of precipitation/storm patterns, water level change, temperature change*
- Aging infrastructure: *some structures more than 100 years old*
- Water supply/Competing demands: *exacerbated by population densities*
- Declining ecosystems: *lost habitat due to erosion, development, water level change, declining biodiversity, pollution, hypoxia, salinity change*
- Fiscal austerity: *limited and declining federal budgets and resources*

National Oceanographic and Atmospheric Administration (NOAA) (2013) National Coastal Population Report, Population Trends from 1970 to 2020. NOAA's State of the Coast Series, March, pp 1–22.

<http://stateofthecoast.noaa.gov/features/coastal-population-report.pdf>

FRM R&D Strategic Plan

Purpose/Vision/Mission

- Develop 5-yr road map for future R&D
- Identify scientific and engineering solutions to support the nation's flood risk management challenges
- Conduct R&D to reduce the nation's risk from flood and coastal disasters while energizing the economy, sustaining environmental resources, and promoting community resilience



FRM R&D Strategic Plan

Approach

- Identify gaps in Science & Technology
- Advance the Science & Technology to meet the USACE challenges in the FRM plan



Actions



Nation's Flood Risk



Five Key Challenge Themes

R&D Goals established around themes; Capabilities to support these goals



Risk Reduction

Long Term (5-year) R&D Goal

Develop R&D tools and technology to mitigate future disasters, streamline disaster response, and improve recovery



Challenge Areas

- Pre- and post-event response forecasting and planning
- Hazard identification and risk assessment
- National flood risk assessment and strategy
- Immediate and long-term recovery science & technology

R&D Opportunities: Science & Engineering

- Understand the risk (who/where/what)
- Understand the forcing before the event
- Recovery/rebuilding





Increased Resilience

Long Term (5-year) R&D Goal

Mainstream resilience into practice; maintain resilient infrastructure; increase community resilience; and effectively sustain natural and modified systems



Resilience: the ability of a **system** to **Prepare for**, **Resist**, **Recover**, and **Adapt** to achieve **functional performance** under the stress of disturbances through time

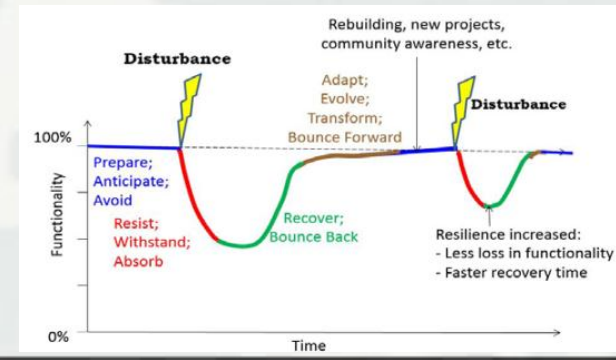
Challenge Areas

- Inventory & assessment tools (baseline)
- Quantitative approach to predict future performance to withstand/recover
- Resilience guidance in day-to-day practice
- Integrated approach to promoting resilience (socio-economic, natural, & built environment)

R&D Opportunities: Science & Engineering

- Establish resilience related solutions, metrics, and standards
- Assess the impact of near-term flooding threats & long-term flood risk projection
- Identify trigger events

“Coastal Resilient Communities....Develop a Strategy for implementing a Coastal System Risk Assessment Plan”



Sustainable Infrastructure

Long Term (5-year) R&D Goal

New, improved engineering tools, risk management methods, & monitoring capabilities that support our aging infrastructure
(2.5 billion replacement value, 700 dams, 270 locks, 14700 miles of levees, 1200 coastal structures)



Challenge Areas

- Risk management tools & technologies
- Design/operation flexibility to adapt to changing demands/needs
- Evaluate/improve infrastructure integrity

R&D Opportunities: Science & Engineering

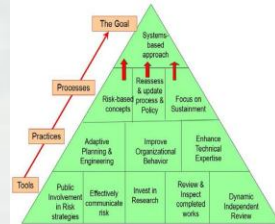
- Improve physics-based analysis of internal erosion, seepage, overtopping, breaching of structures, sediment transport & coastal landscape evolution...evaluate structural integrity
- Analyze/quantify risk/probabilities associated with defects/failure mechanisms → catastrophic failure
- Develop modeling tools of soil-water behavior for predicting design loading/potential failure



Systems Approach

Long Term (5-year) R&D Goal

Adapt & develop tools that optimize and support a systems approach to managing the nation's flood risk



Challenge Areas

- Resilient, sustainable systems
- Systems analysis (*hydrologic, geomorphic, & political boundaries*)
- Inter-relationship of system components
- Multi-disciplinary teams (*balance natural, social, and built systems needs*)
- Integrating projects & systems (*functions, interactions, budgets, authorization*)

Science & Engineering/ System Scale Analysis & Modeling

- Define/classify system attributes (*as related to FRM needs*)
- Understand inter-relationship of hydrology, hydrodynamics, water quality, sediment processes within the larger system (*with multi-disciplinary teams*)
- Understand the response of adjacent or connected systems to episodic, seasonal, multiple, or large-scale events & predict system evolution (*regional scale model applications*)
- Develop/incorporate *network analysis* into system scale evolution to identify *critical component* relationships & cascading impacts
- Develop rapid analysis tools for alternative plans/tracking system changes



Communication/Collaboration

Long Term (5-year) R&D Goal

Using collaboration and communication, promote and apply the best science and technology for improving the nation's ability to manage flood risk (...because an effective FRM strategy requires a strong risk communication plan and effective transition of research to applications)

Challenge Areas

- Risk communication & decision support tools (engineering, socio-economic, & environmentally sustainable management strategies)
- User-friendly, accessible data & products (*transition the best science and technology to end users*)
- Collaborative R&D with innovative partnering/financing (*transition R&D technologies to market*)

R&D Opportunities

Risk Communication & Decision Support

- Science-informed/cross-discipline products & decision support tools
improve communication planners, economists, environmentalists, engineers, & policy makers
- Common risk communication messaging/products
- National understanding/coordination of flood risk

Transition of R&D to Applications and Operations

- Outreach activities
- Online tools and interactive training (*for E&S to learn community engagement and outreach skills*)
- Open source data/models (*promote partnerships*)
- Multi-disciplinary technical assistance to communities to understand risk



Collaboration and Partnering Strategic Priorities

(from USACE Civil Works R&D Strategy December 2013)

By collaborating and Partnering we can:

- Learn new best practices
- Leverage R&D opportunities
- Develop collaborative projects
- Test new tools, technologies, methods, and materials

Working with and Seeking Input from Other Agencies in R&D

Reviewers Input Requested:

1. Do the goals and opportunities in the Draft Plan reflect the most pressing issues in flood risk management? Please identify any obvious omissions or gaps.
2. What are the highest priority needs in FRM R&D from your perspective on what areas or problems should the USACE focus?
3. Is your organization currently engaging in R&D in FRM? If so, specify.
4. Identify any current opportunities for collaboration, alignment, or data and resource sharing.
5. What steps do you think will improve future collaboration and/or address the R&D challenges for FRM?
6. Provide any references or points of contact the USACE should consider in development of this strategic plan.

