Hurricane Katrina: A 10 Year Retrospective

Presentation to
National Association of Flood & Stormwater Management Agencies

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Organizational Change: An Imperative

To improve is to change; to be perfect is to change often.

-Winston Churchill
Transformational Drivers

- WRDA (2007)
- ARRA (2009)
- Sequestration (2013)
- President’s Climate Action Plan (2014)
- WRRDA (2014)
- Civil Works Transformation (2008)
- No Earmarks (2010)
- Hurricane Katrina (2005)
- Superstorm Sandy (2012)
Katrina - 2005

$130 B Damages
“It was essential to have the right answers, not just quick answers, because we had to incorporate the results into our restoration and repair mission.”

“……the Corps is accountable and responsible to the American people for the projects we build…….”
IPET Mission
Forensic Analysis and Systemwide Assessment
Using a Risk Framework

HAZARD

Impact Repairs
Impact Future

SYSTEM

CONSEQUENCES

https://ipet.wes.army.mil

http://www.mhclibrary.com
**Bottom Line**

Katrina exposed major gaps in policies, capabilities and practice

- Lack of methods to consider change, in hazards, the system or consequences. Project authorizations and resource streams need to recognize the likelihood of these changes.
- Must better consider life cycle performance of systems. Concepts such as resilience and redundancy are critical as well as adaptive designs to accommodate change, expected and unexpected.
- The need for a risk-based system-wide planning and design methodologies that rigorously incorporate non-economic consequences. These methods should foster collaboration among stakeholders at all levels.
- Aggressively enhance technical competence and evolve guidance and methods to integrate rapidly emerging technologies and knowledge.
- Change requires continuous review of guidelines and projects.
Hurricane Protection Decision Chronology (HPDC)

Purpose & Scope

- Document chronological record of decision making for Lake Pontchartrain & Vicinity Hurricane Protection Project (LP&VHPP)

- Sequence of planning, economic, policy, legislative, institutional & financial decisions that resulted in system in place pre-Katrina

- Intended to complement engineering performance focus of IPET, which provided critical answers to questions about what happened to the system during Katrina

- Along with IPET, expected to inform corporate institutional actions such as the USACE “12 Actions” Initiative
Decision Chronology: Initial Factual Findings

Affirms Key IPET Findings

- **Change/Life-Cycle**
  - Practices and processes for ensuring that new knowledge was incorporated into design were lacking or inconsistent in application

- **Project not an Integrated System**
  - Original unified vision lost as result of incremental changes

- **Risk and Uncertainty**
  - System-wide consideration of residual risk, consequences, and reliability not evidenced in record
On August 24, 2006, LTG Strock, the commander of the United States Army Corps of Engineers, signed and released the “12 Actions for Change”
USACE’s Actions for Change
Programmatic Areas

1. Comprehensive systems approach
2. Risk-informed decision making
3. Communication of risk to the public
4. Professional and technical expertise
12 Actions for Change

1. Develop comprehensive, probabilistic methods for system planning and design.
2. Plan and design projects as parts of larger integrated systems.
3. Employ risk-based planning and design.
4. Reassess design standards.
5. Apply Quality Assurance and Quality Control.
6. Optimize engineered systems.
7. Conduct an organizational assessment.
12 Actions for Change (Cont.)

8. Effectively communicate risk concepts.
10. Restore, maintain & enhance technical expertise and professionalism.
11. Enhance research effort and apply results.
12. Provide technical expertise in service to the Nation.
Response to Katrina - Lessons Learned:

• Employ integrated, comprehensive and systems-based approach
• Reinforce risk-based concepts in planning, design, construction, operations & major maintenance
• Continuously reassess and update policy
• Employ dynamic independent review
• Employ adaptive planning and engineering systems
• Focus on sustainability and resilience
• Review and inspect completed works
• Assess and modify organizational behavior
• Effectively communicate risk
• Establish public involvement risk reduction strategies
• Manage and enhance technical expertise and professionalism
• Invest in research
Flood Risk Lessons Learned

- Absolute protection from floods is not possible. Plan for floods that exceed your system’s capacity; eventually one will come.
- Do not rely on single structural approach. Implement a portfolio of measures.
- Risks must be identified and decisions made based on relative risk – not everyone will get the same protection.
- Decisions must be made with imperfect knowledge - the future will be different from the past.
- Incorporate climate change assumptions into water resources planning and models.
- Responsibilities must be clear - all groups must share responsibilities and take local actions.
- Life-cycle infrastructure needs and costs must be addressed. Mitigation of Disaster Risk Before an Event is Much More Cost Effective than Recovery From a Disaster Once it Occurs.
- The effects of a disaster are felt well outside the immediately affected area.
- Effective communication of risk is essential.
- Full recovery takes a long time.
USACE Post Katrina

- Comprehensive systems approach
- Decision making (Risk informed, Risk Management Center, dam safety and levee programs, Centers of Expertise, etc)
- Science and technology
- Governance
- Communication and collaboration
- Policy and guidance
- WRDA 2007 and WRRDA 2014 (IEPRs, etc)
- Increase adaptation of Resilience concepts
- Focus on reinforced Technical competence
Reduction of risk is a shared responsibility between the individual and all levels of government.
Key Takeaway

Investments in Infrastructure Reduce Risk, Improve Resilience, and Pay Off In the Long Run
Tales of Katrina

Pre-Katrina “System” 2005
50% complete after 50 years
$130 B in Recovery Costs
1833 Lives Lost

New Orleans Before and After Katrina

$14B Post-Katrina System
Designed and Constructed in 6 years
Performed Successfully during Hurricane ISAAC
Relative Quality of US Infrastructure

The World Economic Forum ranks US infrastructure behind that of most other comparable advanced nations.

Overall infrastructure quality index, 2012–13
Top 15 of 144 countries
Scale: 1 = Extremely underdeveloped; 7 = Extensive and efficient by international standards

1. Hong Kong
2. Singapore
3. Germany
4. France
5. Switzerland
6. United Kingdom
7. Netherlands
8. United Arab Emirates
9. South Korea
10. Spain
11. Japan
12. Luxembourg
13. Canada
14. United States
15. Austria

Sector-specific indexes, 2012–13
Out of all 144 countries

- Ports: United States #19
- Roads: United States #20
- Power and telephony: United States #21

SOURCE: World Economic Forum; McKinsey Global Institute analysis
Water Infrastructure Spending

Between 1962 & 2010

Total funding increased % GDP decreased

Greater burden on state and local funding sources as infrastructure ages

Source: Congressional Budget Office based on data from the Office of Management and Budget, the Census Bureau, and the Bureau of Economic Analysis. For details, see the appendix.
USACE CW’s Economic Benefits & Revenues to the Treasury

*(2010-2012 Average)*

Each dollar spent on the USACE Civil Works program generated ~ $16 in economic benefits and $5 in revenues to the U.S. Treasury.

<table>
<thead>
<tr>
<th>Program</th>
<th>NED Benefits (Billions of Dollars)</th>
<th>Net NED Benefits (Billions of Dollars)</th>
<th>U.S. Treasury Revenues (Billions of Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood Risk Management</td>
<td>$59.47</td>
<td>$58.84</td>
<td>$18.90</td>
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<tr>
<td>Coastal Navigation</td>
<td>$9.47</td>
<td>$8.70</td>
<td>$3.70</td>
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<tr>
<td>Inland Navigation</td>
<td>$8.10</td>
<td>$7.51</td>
<td>$2.07</td>
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<tr>
<td>Water Supply</td>
<td>$7.00</td>
<td>$6.98</td>
<td>$0.09</td>
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<td>Hydropower</td>
<td>$2.30</td>
<td>$2.11</td>
<td>$1.37</td>
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<tr>
<td>Recreation</td>
<td>$3.20</td>
<td>$2.91</td>
<td>$1.13</td>
</tr>
<tr>
<td>Leases and Sales</td>
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<td></td>
<td>$0.03</td>
</tr>
<tr>
<td><strong>Total Annual NED</strong></td>
<td><strong>$89.54</strong></td>
<td><strong>$87.05</strong></td>
<td><strong>$27.29</strong></td>
</tr>
</tbody>
</table>

Notes:

1. Net NED benefits are defined as NED benefits less the costs of operations, maintenance, and investigations. Since the costs associated with expenses and oversight by the Assistant Secretary of the Army (ASA) serve all Corps programs, including those we did not calculate benefits for in this report, this report does not account for those costs.

2. The Benefits and Revenues numbers are not additive.
Sustainable Solutions
To America’s Water Resource Needs
Civil Works Strategic Plan 2014-2018

US Army Corps of Engineers®
USACE Civil Works Vision

Contribute to the strength of the Nation through innovative and environmentally sustainable solutions to the Nation’s water resources challenges

Strategic Goals

1. Transform the Civil Works Program and Mission through integration of environment, management, and innovation.
2. Improve the safety and resilience of the Nation’s water resource infrastructure.
3. Facilitate the transportation of commerce goods on the Nation’s coastal channels and inland waterways.
4. Restore, protect, and manage the aquatic ecosystems to benefit the Nation.
5. Manage the Nation’s water resources and systems to provide critical, sustainable services.

Campaign Plan

Goal 2: Steve Stockton
Transform Civil Works
Deliver enduring and essential water resource solutions using effective transformation strategies.

Objective 2a: Theodore Brown
Uplift the Civil Works project planning program and process.

Objective 2b: Mark Mancini
Enhance the Civil Works budget development process to have a greater impact.

Objective 2c: James Dalton
Deliver quality activities and services.

Objective 2d: Edward Bell
Deliver reliable, resilient, and sustainable infrastructure systems.

USACE Civil Works Vision

Contribute to the strength of the Nation through innovative and environmentally sustainable solutions to the Nation’s water resources challenges

Strategic Goals

1. Transform the Program to deliver sustainable water resources through integrated Water Resources Management.

2. Improve the safety and resilience of communities and water resources infrastructure.

3. Facilitate the transportation of commerce goods on the Nation’s coastal channels and inland waterways.

4. Restore, protect, and manage the aquatic ecosystems to benefit the Nation.

5. Manage the life-cycle of water resource infrastructure in order to deliver consistently sustainable services.
Transforming Civil Works
Four Focus Areas

Planning Modernization

Budget Development Transformation

Quality Solutions & Services

Infrastructure Strategy
“A society grows great when old men plant trees whose shade they know they shall never sit in”

Greek Proverb
Questions?
Overarching Strategy

Integrated Water Resources Management

- A holistic focus on water resource challenges and opportunities that reflects coordinated development and management of water and related resources
- IWRM considers economic benefits, ecosystem quality and health and public safety
The Questions to Ask?

- How do we cope with new understandings of climate variability and risks of water-related disasters?
- How do we integrate hard infrastructure with soft behavioral approaches?
- How do we manage ecosystems while still allowing socio-economic growth?
- How are broad ranges of stakeholders brought into the process?
- How do we build new capacity to achieve water security?
- How do we prepare and invest in the future?