85th Meeting of the
Coastal Engineering Research Board
"System-Based Perspectives of the Coast:
A Focus on Pacific Northwest
Hilton Portland and Executive Tower
Portland, OR
23-25 September 2008

Actions for Change Systems-Based Approach

Kate White, PhD, PE
Lead, USACE Actions for Change Theme 1:
Comprehensive Systems Approach
kathleen.d.white@usace.army.mil

ACTIONS for CHANGE

USACE Comprehensive Systems Approach

- **Why? Convergence of many events**
  - **Interagency Performance Evaluation Task Force**
  - **Actions for Change**
  - **Aging Infrastructure**
  - **FY06 Watershed Study Initiative**
  - **O&M Budget Regions**
  - **Good to Great**
  - **Emerging strategic events**
- **AFC Theme 1: Comprehensive Systems Approach**

ACTIONS for CHANGE

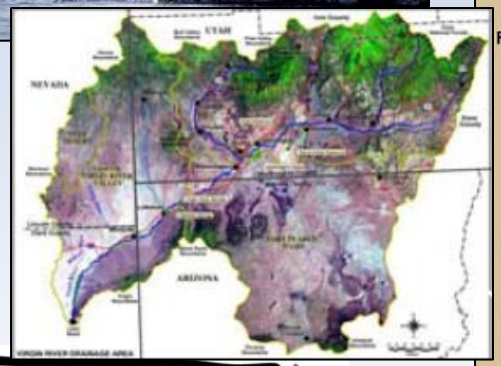
The 10 Pieces of U.S. Infrastructure We Must Fix Now – Popular Mechanics May 2008

1. Circle Interchange, Chicago
2. Brooklyn Bridge, New York
3. Industrial Canal Lock, New Orleans
4. Water System, Atlanta
5. Alaskan Way Viaduct, Seattle
6. Lake Okeechobee, Florida
7. Dover Bridge, Bonner County, Idaho
8. Wolf Creek Dam, Kentucky
9. Sacramento River Levees, California
10. O'Hare International Airport, Chicago

ACTIONS for CHANGE

FY06 Watershed Study Initiative: A Systems Approach

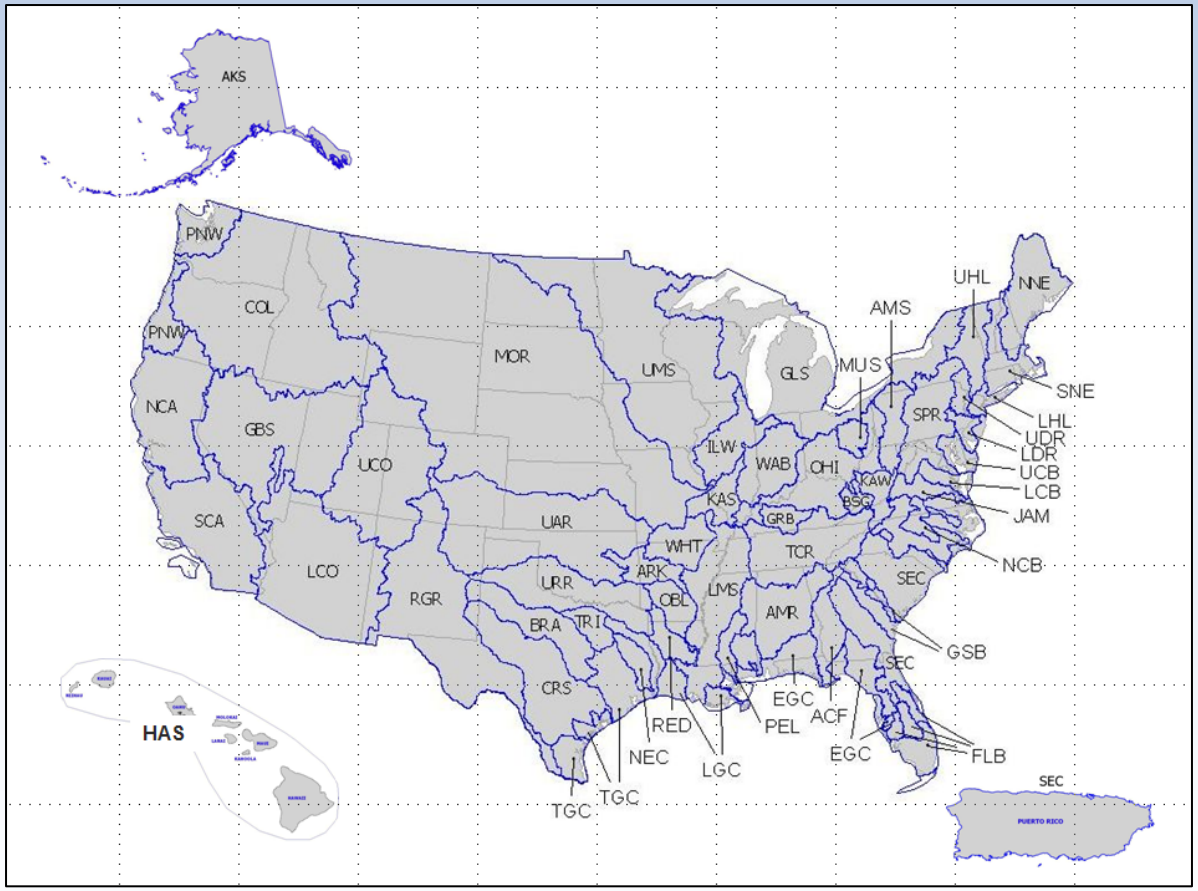
- **FY 06 Energy and Water Development Appropriations Act (P.L. 109-103)**
- **5 pilot studies**
  - **Great Lakes Habitat Initiative**
  - **Middle Mississippi Regional Corridor**
  - **Delaware River Basin, NY, PA, NJ, DE**
  - **Western States Watershed Study**
  - **Virgin River & Tributaries – UT, AZ, NV**

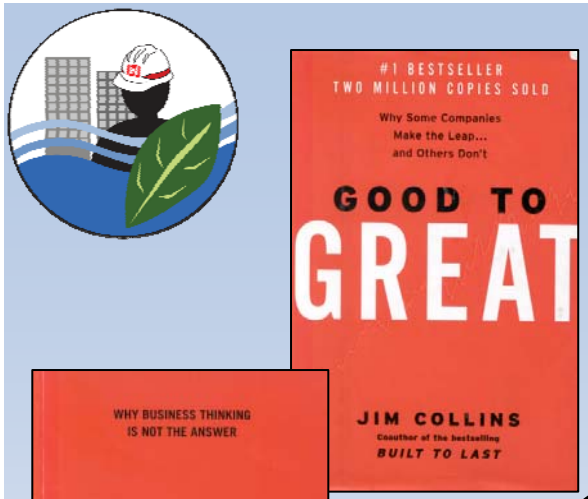


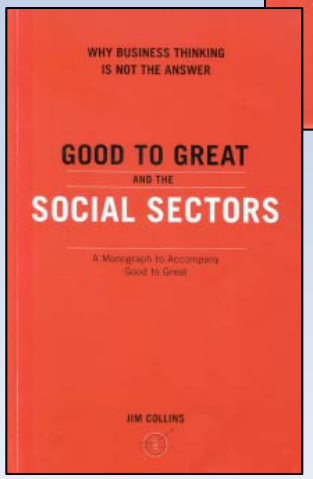
ACTIONS for CHANGE

O&M Budgeting by Regions

- **FY07-FY08:**
  - **21 budgeting regions**
  - **Based on USGS hydrologic unit codes plus navigation tax regions**
- **FY09**
  - **54 regions**
- **FY10+**
  - **52 Regions**







What are we *deeply passionate* about ?
(Core Values/Expertise/Mission)

Building essential and enduring systems that serve the greater good

Sustaining our Nation's Watersheds

What can we be *best in the world* at ?
(Unique contribution / Value - Added)

What drives our *resource engine* ?
(Time /Social Impact / Brand)

" How can we develop a sustainable resource engine to deliver superior performance relative to our mission ? "

Facilitating interdisciplinary, integrated, and enduring water resource solutions

Shared watershed management

Leveraging of resources

ACTIONS for CHANGE

After COL Dornstauder

USACE Emerging Strategic Requirements

- Broader systems approaches
- Consideration of interacting technical, human, organizational and social factors
- Risk-based decision support tools and skills
- Much broader coalitions and collaboration
- Increased public-private partnerships
- Anticipatory engineering
- Focus on sustainability

ACTIONS for CHANGE

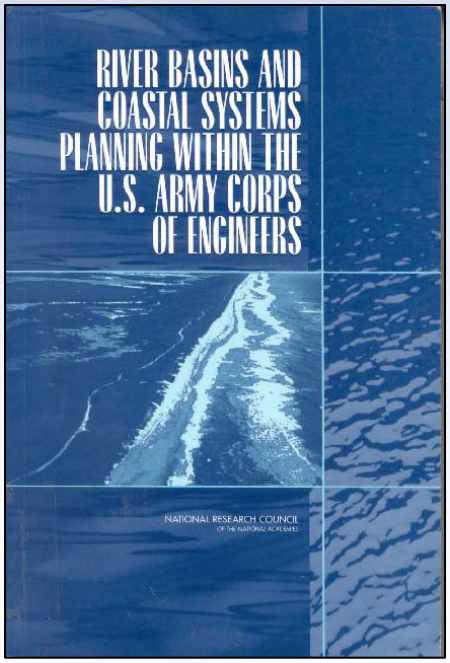
AFC Comprehensive Systems Approach Mission

- **To effect fundamental change in the US Army Corps of Engineers (USACE) by:**
  - **Developing and implementing an integrated, comprehensive and systems based approach in the execution of all our mission areas**
  - **Incorporating anticipatory management to remain adaptable and sustainable over time**
  - **Placing the highest priority on protection of public health and safety**
  - **Realizing the Corps Environmental Operating Principles**

ACTIONS for CHANGE

AFC Comprehensive Systems Approach

- **What is a system?**
  - **A dynamic and complex whole interacting as a structured functional unit**
- **What is a comprehensive systems approach?**
  - **A multidisciplinary, multi-objective, and multi-stakeholder framework supporting "a balanced evaluation of all relevant issues (e.g., hydrologic, geomorphic, ecologic, social, economic)" (NRC 2004, p. 19)**
- **Corps-specific context?**
  - **Shifting the focus on making decisions from individual, isolated projects to an interdependent system, and from local or immediate solutions to regional or long-term solutions, at appropriate scales of space and time**

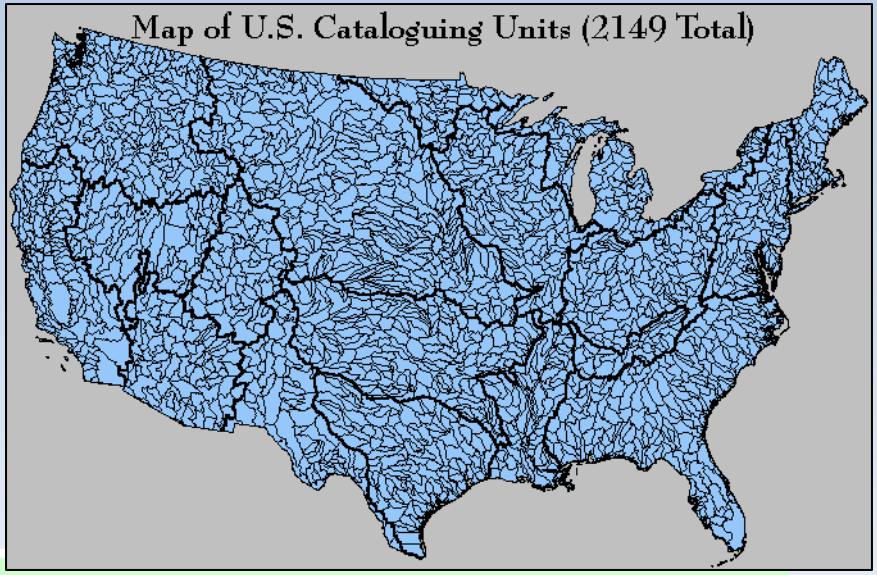


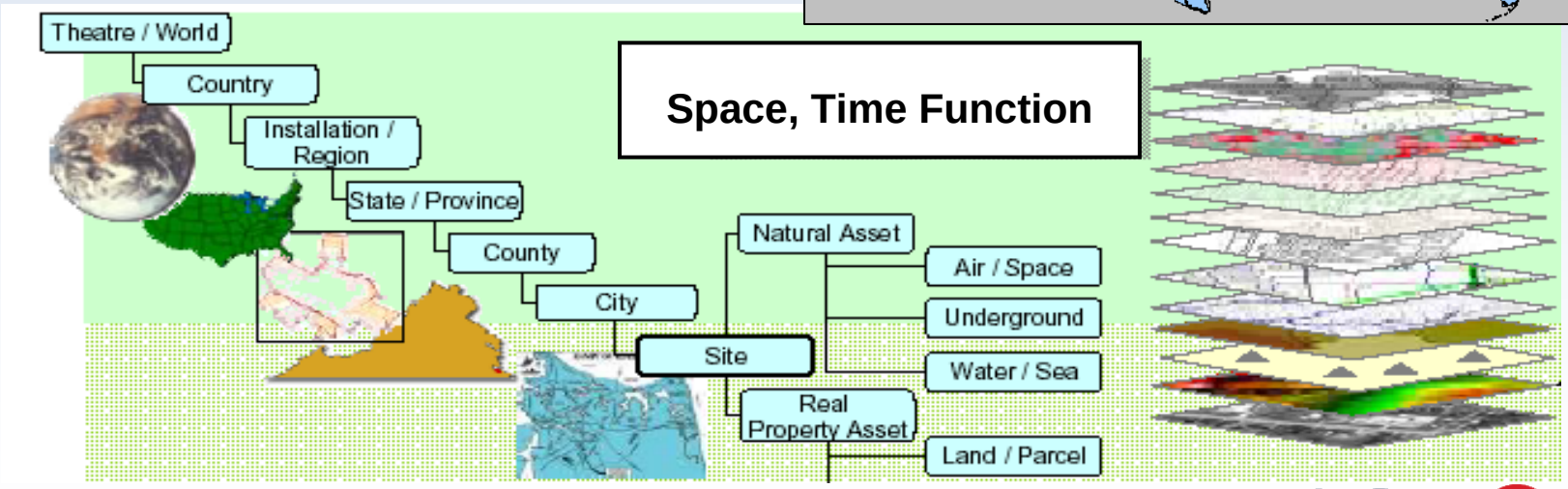
ACTIONS for CHANGE

Familiar Systems

- Hydrologic unit
- Geologic province
- Watershed
- Political unit

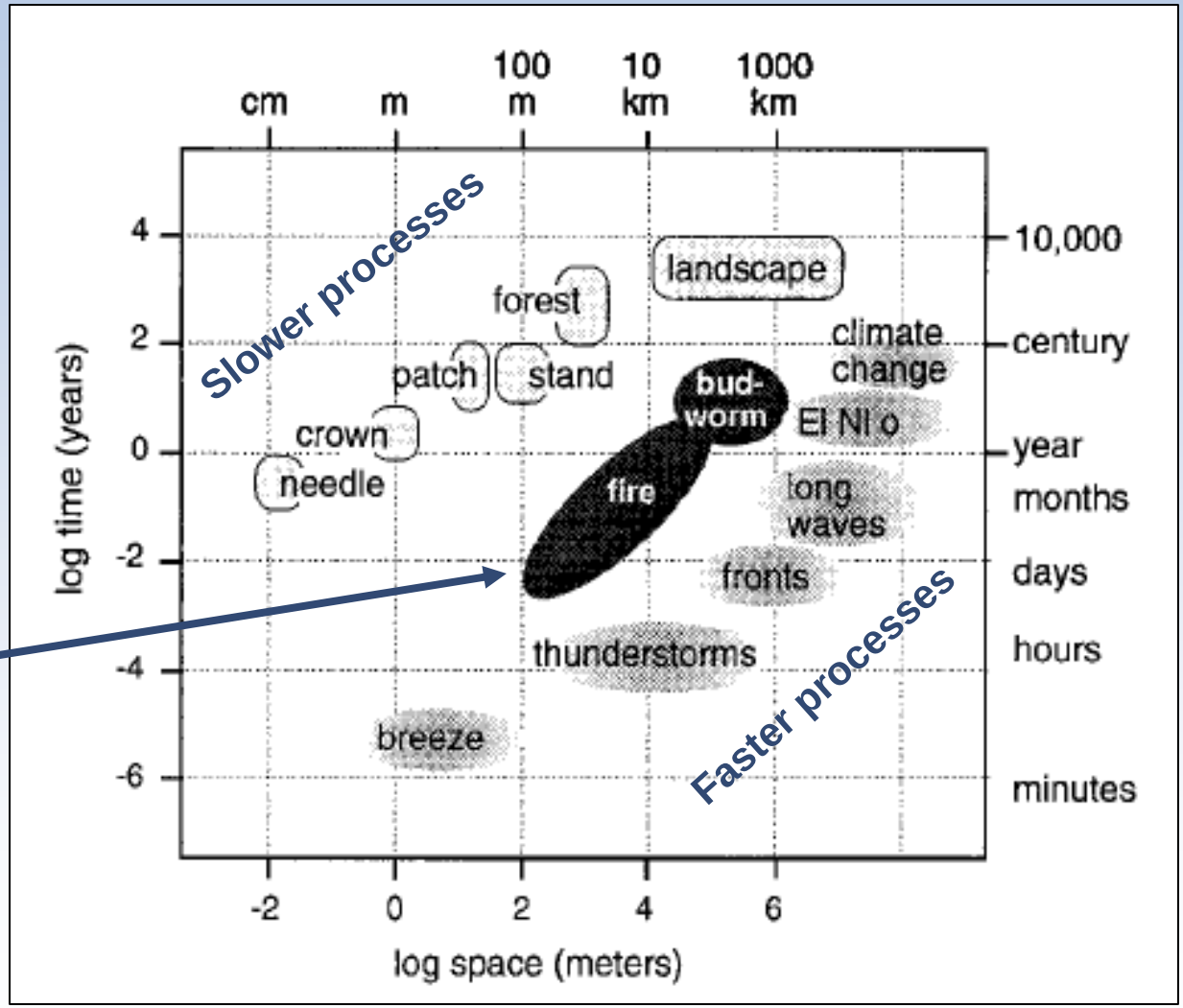
≈ Spatial or physical





ACTIONS for CHANGE

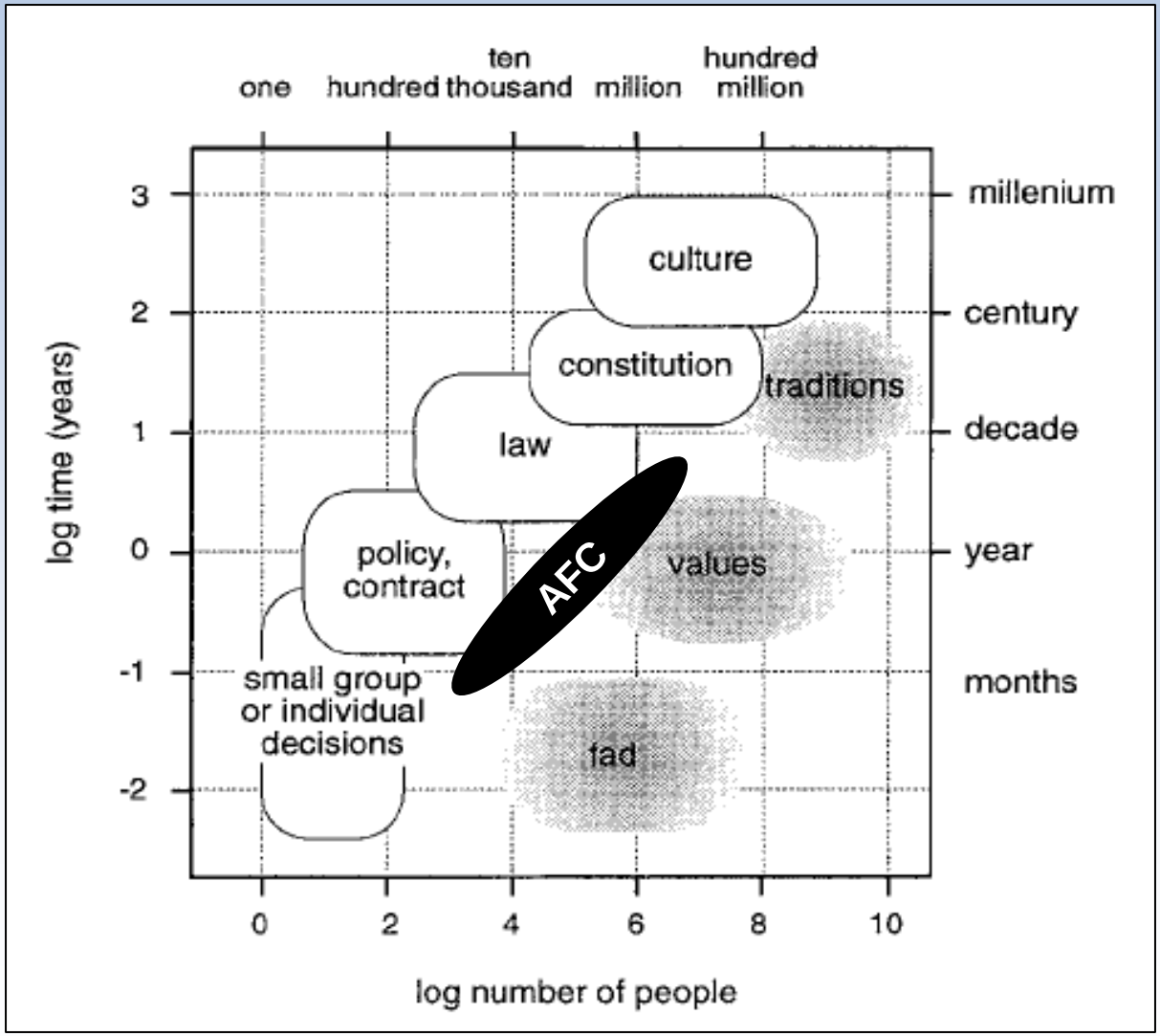
Less Well Understood Systems: Ecological



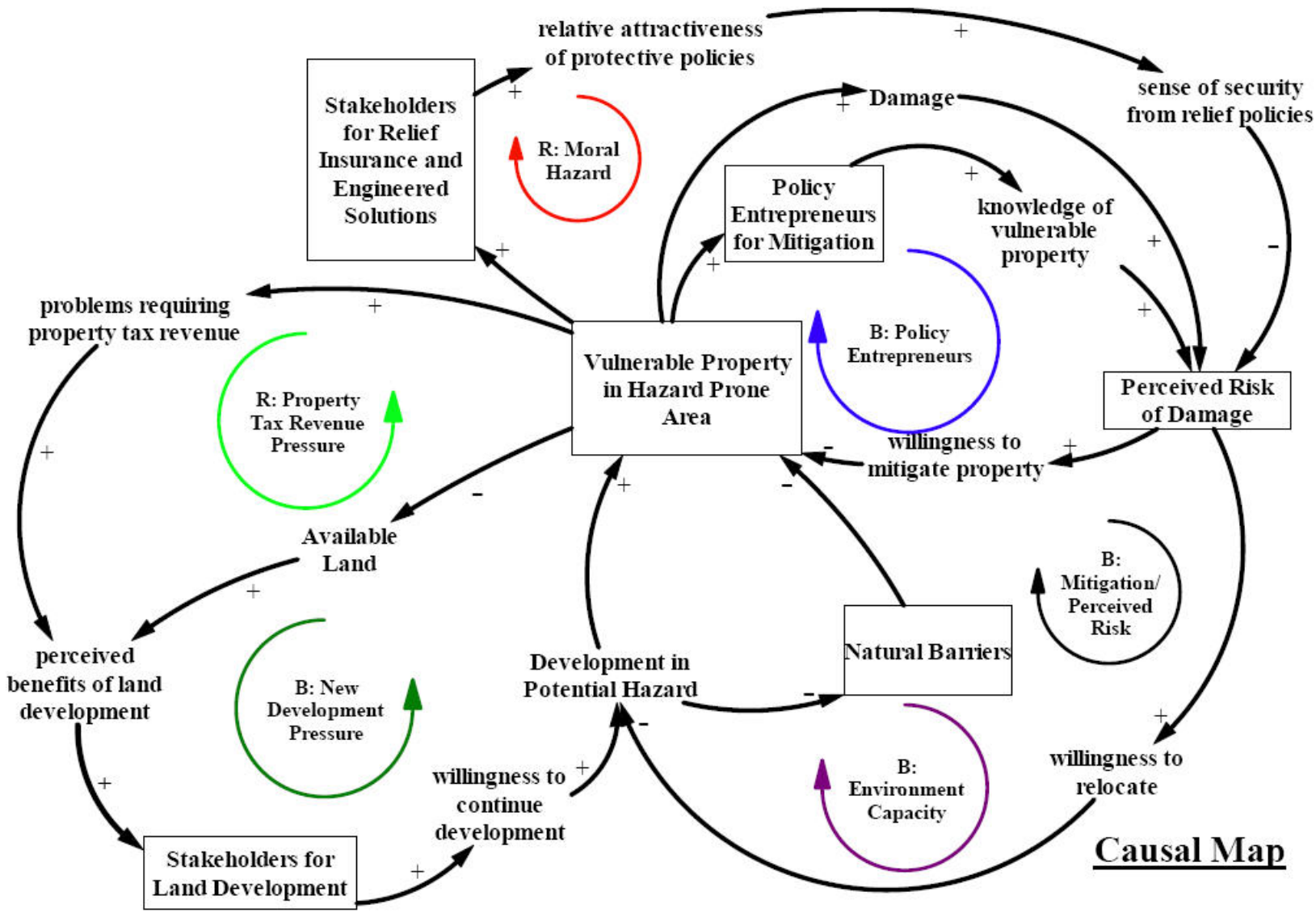
Processes that mediate between faster and slower processes

Holling 2001: Understanding the Complexity of Economic, Ecological, and Social Systems

Less Well Understood Systems: Social



Less Well Understood Systems: Socio-Economic Mapped to Flood Risk

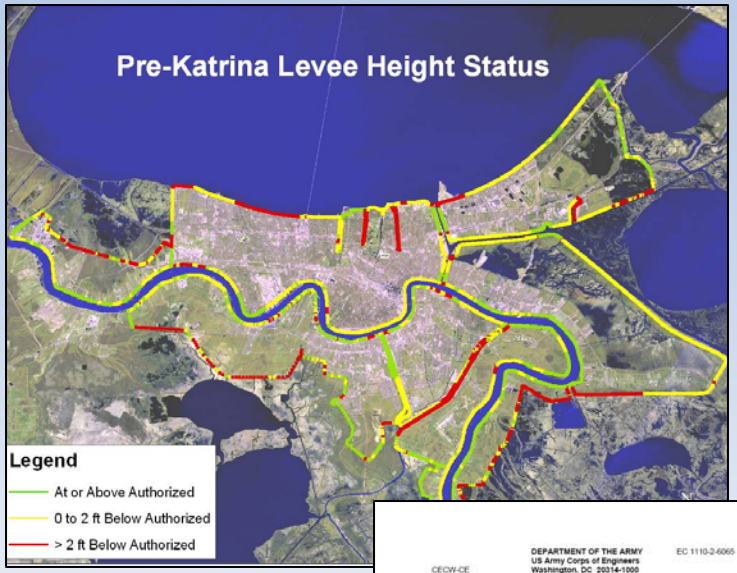


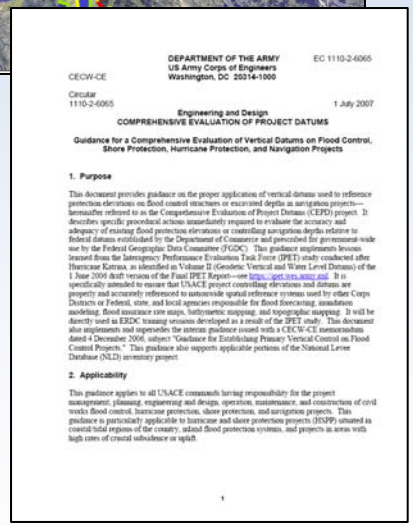
Mapping Systems to Investment Decisions

- **Paraphrased from 5 lessons learned by Jerome Delli Priscoli PhD, Senior Advisor USACE IWR, presented Water Week March 2008:**
  - **Water investments have been a tool for political integration and economic growth in the United Sates for most of its history**
    - **The effectiveness of water resources investments for creating a platform for growth depends greatly on their multi-purpose capacities**
    - **Major water reforms in the U.S. have emerged when water is seen as means to achieving broader ends, such as regional development, public health, and other security ends**
  - **Once built, O&M funding for large-scale water infrastructure is often hard to obtain**
  - **Major unforeseen impacts and costs of our infrastructure investments have become clear, especially ecological**
    - **As we experience impacts, our knowledge changes and thus our view of costs**
  - **The ratio of non-structural/behavioral measures to structural measures matters:**
    - ***If it is too high* - extreme events can crack social system as leaders have no tools to respond other then draconian authoritarian measures**
    - ***If it is too low,* the ecological costs are too high**

AFC Theme 1 Project Delivery Teams

- **Vertical Control**
  - **"Findings of errors [from the IPET Study] of one to three feet in some of the elevations used in design, construction, maintenance, and evaluation of hurricane and flood control structures in New Orleans highlighted the need to ensure that our flood control and navigation projects across the country are referenced to the proper vertical datums…"**
  - **Implement a nationwide datum and subsidence standard for geodetic and water level information within USACE**
  - **POC Jim Garster (ERDC-TEC)**





DEPARTMENT OF THE ARMY
US Army Corps of Engineers
Washington, DC 20314-1000

EC 1110-2-6065

CECW-CE

Circular
1110-2-6065

1 July 2007

Engineering and Design
COMPREHENSIVE EVALUATION OF PROJECT DATUMS

Guidance for a Comprehensive Evaluation of Vertical Datums on Flood Control, Shore Protection, Hurricane Protection, and Navigation Projects

1. Purpose

This document provides guidance on the proper application of vertical datums used to reference protection elevations on flood control structures or excavated depths in navigation projects—hereinafter referred to as the Comprehensive Evaluation of Project Datums (CEPD) project. It describes specific procedural actions immediately required to evaluate the accuracy and adequacy of existing flood protection elevations or controlling navigation depths relative to federal datums established by the Department of Commerce and prescribed for government-wide use by the Federal Geographic Data Committee (FGDC). This guidance implements lessons learned from the Interagency Performance Evaluation Task Force (IPET) study conducted after Hurricane Katrina, as identified in Volume II (Geodetic Vertical and Water Level Datums) of the 1 June 2006 draft version of the Final IPET Report—see https://ipet.wes.army.mil. It is specifically intended to ensure that USACE project controlling elevations and datums are properly and accurately referenced to nationwide spatial reference systems used by other Corps Districts or Federal, state, and local agencies responsible for flood forecasting, inundation modeling, flood insurance rate maps, bathymetric mapping, and topographic mapping. It will be directly used in ERDC training sessions developed as a result of the IPET study. This document also implements and supersedes the interim guidance issued with a CECW-CE memorandum dated 4 December 2006, subject "Guidance for Establishing Primary Vertical Control on Flood Control Projects." This guidance also supports applicable portions of the National Levee Database (NLD) inventory project.

2. Applicability

This guidance applies to all USACE commands having responsibility for the project management, planning, engineering and design, operation, maintenance, and construction of civil works flood control, hurricane protection, shore protection, and navigation projects. This guidance is particularly applicable to hurricane and shore protection projects (HSPP) situated in coastal/tidal regions of the country, inland flood protection systems, and projects in areas with high rates of crustal subsidence or uplift.

1

Lieutenant General Carl A. Strock, Memorandum For Major Subordinate Commands, December 2006

AFC Vertical Control PDT

- **Lead, Jim Garster, USACE ERDC-TEC**
- **Team Members:**

  <u>USACE</u>
  - **Bill Bergen, HQ USACE (Land/Hydro Surveying)**
  - **Nancy Blyler, HQ USACE (Geospatial Interface to the USACE)**
  - **Mark Huber, USACE New Orleans (Data Collection/Subsidence)**
  - **Kevin Knuuti, USACE Sacramento (Datums in Coastal regions)**
  - **Dave Robar, USACE Jacksonville (Geodetic/Water Level)**
  - **Andrew Garcia, ERDC-CHL (Coastal Engineering)**

  <u>NOAA</u>
  - **Dave Doyle, NOAA NGS (Datums)**
  - **Steve Gill, NOAA CO-OPS (Tidal Datums)**
  - **Jerry Hovis, NOAA CO-OPS (Tidal Datums)**
  - **Ed Myers, NOAA Office of Coast Survey (OCS) (Tidal Datum Transformations/VDATUM)**
  - **Ronnie Taylor, NOAA NGS (Vertical Datums)**

ACTIONS for CHANGE

Vertical Control PDT Accomplishments

- EC 1110-2-6065 "Comprehensive Evaluation of Project Datums: Guidance for a Comprehensive Evaluation of Vertical Datums on Flood Control, Shore Protection, Hurricane Protection, and Navigation Projects"
  - Develop ER and EM to replace EC
  - Currently reviewing all Engineer Manuals, Regulations, Circulars
- Initial training and certification for district datum coordinators (April/May 2007)
- Database to track the progress of projects compliance with EC 1110-2-6065 and track changes to project control, especially in subsidence areas of the country
- Prepared information for inclusion in Planning Guidance Notebook May 2008
- Report on evaluation/review of project vertical datums, to include cost to correct non-compliant projects
  - Interim report May 2008
  - Final Report July 2008

ACTIONS for CHANGE

Project Delivery Teams

- **Temporal and Spatial System Changes**
  - **ASCE post-Katrina review panel stressed need to incorporate new and changing information**
  - **Develop guidelines and recommend policy and program changes along with supporting technologies, to address dynamic processes, temporal and spatial changes and their impacts to USACE projects on watershed, regional or system scale (e.g., subsidence, climate change and variability, altered seismicity, sea level change)**
  - **POC Rolf Olsen (IWR)**

POLICYFORUM

CLIMATE CHANGE

Stationarity Is Dead: Whither Water Management?

Climate change undermines a basic assumption that historically has facilitated management of water supplies, demands, and risks.

P. C. D. Milly,[1*] Julio Betancourt,[2] Malin Falkenmark,[3] Robert M. Hirsch,[4] Zbigniew W. Kundzewicz,[5] Dennis P. Lettenmaier,[6] Ronald J. Stouffer[7]

Systems for management of water throughout the developed world have been designed and operated under the assumption of stationarity. Stationarity—the idea that natural systems fluctuate within an unchanging envelope of variability—is a foundational concept that permeates training and practice in water-resource engineering. It implies that any variable (e.g., annual streamflow or annual flood peak) has a time-invariant (or 1-year–periodic) probability density function (pdf), whose properties can be estimated from the instrument record. Under stationarity, pdf estimation errors are acknowledged, but have been assumed to be reducible by additional observations, more efficient estimators, or regional or paleohydrologic data. The pdfs, in turn, are used to evaluate and manage risks to water supplies, waterworks, and floodplains; annual global investment in water infrastructure exceeds U.S.$500 billion (*1*).

The stationarity assumption has long been compromised by human disturbances in river basins. Flood risk, water supply, and water quality are affected by water infrastructure, channel modifications, drainage works, and land-cover and land-use change. Two other (sometimes indistinguishable) challenges to stationarity have been externally forced, natural climate changes and low-frequency, internal variability (e.g., the Atlantic multidecadal oscillation) enhanced by the slow dynamics of the oceans and ice sheets (*2*, *3*). Planners have tools to adjust their analyses for known human disturbances within river basins, and justifiably or not, they generally have considered natural change and variability to be sufficiently small to allow stationarity-based design.

[1]U.S. Geological Survey (USGS), c/o National Oceanic and Atmospheric Administration (NOAA) Geophysical Fluid Dynamics Laboratory, Princeton, NJ 08540, USA. [2]USGS, Tucson, AZ 85745, USA. [3]Stockholm International Water Institute, SE 11151 Stockholm, Sweden. [4]USGS, Reston, VA 20192, USA. [5]Research Centre for Agriculture and Forest Environment, Polish Academy of Sciences, Poznań, Poland, and Potsdam Institute for Climate Impact Research, Potsdam, Germany. [6]University of Washington, Seattle, WA 98195, USA. [7]NOAA Geophysical Fluid Dynamics Laboratory, Princeton, NJ 08540, USA.

*Author for correspondence. E-mail: cmilly@usgs.gov.

An uncertain future challenges water planners.

In view of the magnitude and ubiquity of the hydroclimatic change apparently now under way, however, we assert that stationarity is dead and should no longer serve as a central, default assumption in water-resource risk assessment and planning. Finding a suitable successor is crucial for human adaptation to changing climate.

How did stationarity die? Stationarity is dead because substantial anthropogenic change of Earth's climate is altering the means and extremes of precipitation, evapotranspiration, and rates of discharge of rivers (*4*, *5*) (see figure, above). Warming augments atmospheric humidity and water transport. This increases precipitation, and possibly flood risk, where prevailing atmospheric water-vapor fluxes converge (*6*). Rising sea level induces gradually heightened risk of contamination of coastal freshwater supplies. Glacial meltwater temporarily enhances water availability, but glacier and snow-pack losses diminish natural seasonal and interannual storage (*7*).

Anthropogenic climate warming appears to be driving a poleward expansion of the subtropical dry zone (*8*), thereby reducing runoff in some regions. Together, circulatory and thermodynamic responses largely explain the picture of regional gainers and losers of sustainable freshwater availability that has emerged from climate models (see figure, p. 574).

Why now? That anthropogenic climate change affects the water cycle (*9*) and water supply (*10*) is not a new finding. Nevertheless, sensible objections to discarding stationarity have been raised. For a time, hydroclimate had not demonstrably exited the envelope of natural variability and/or the effective range of optimally operated infrastructure (*11*, *12*). Accounting for the substantial uncertainties of climatic parameters estimated from short records (*13*) effectively hedged against small climate changes. Additionally, climate projections were not considered credible (*12*, *14*).

Recent developments have led us to the opinion that the time has come to move beyond the wait-and-see approach. Projections of runoff changes are bolstered by the recently demonstrated retrodictive skill of climate models. The global pattern of observed annual streamflow trends is unlikely to have arisen from unforced variability and is consistent with modeled response to climate forcing (*15*). Paleohydrologic studies suggest that small changes in mean climate might produce large changes in extremes (*16*), although attempts to detect a recent change in global flood frequency have been equivocal (*17*, *18*). Projected changes in runoff during the multidecade lifetime of major water infrastructure projects begun now are large enough to push hydroclimate beyond the range of historical behaviors (*19*). Some regions have little infrastructure to buffer the impacts of change.

Stationarity cannot be revived. Even with aggressive mitigation, continued warming is very likely, given the residence time of atmospheric CO_2 and the thermal inertia of the Earth system (*4*, *20*).

A successor. We need to find ways to identify nonstationary probabilistic models of relevant environmental variables and to use those models to optimize water systems. The challenge is daunting. Patterns of change are complex; uncertainties are large; and the knowledge base changes rapidly.

Under the rational planning framework advanced by the Harvard Water Program (*21*, *22*), the assumption of stationarity was

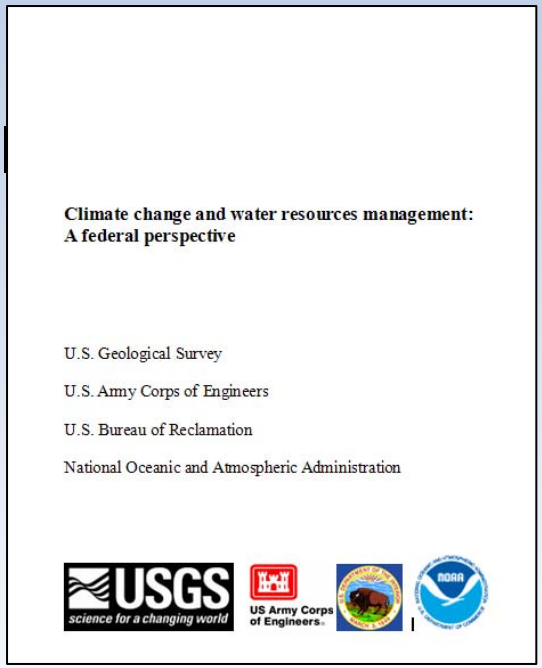
Published by AAAS

Downloaded from www.sciencemag.org on February 13, 2008

ACTIONS for CHANGE

Temporal and Spatial System Changes PDT

- **PDT members:**
  - **Rolf Olsen, IWR, PDT lead**
  - **Kate White, CRREL, AFC Theme 1**
  - **Larry Murphy, NWD**
  - **Brian Harper, IWR, AFC Theme 2**
  - **Tom Kendall, SPN**
  - **Glenn Landers, SAJ**
  - **Accomplishments:**
  - **Interagency (USACE, USGS, Reclamation, NOAA) climate paper**
    - **draft presented to senior leaders 18 July 2008**
    - **Internal agency review 12 Sept 2008**
    - **Revised raft to senior leaders 22 Sept 2008**


Climate change and water resources management:
A federal perspective

U.S. Geological Survey

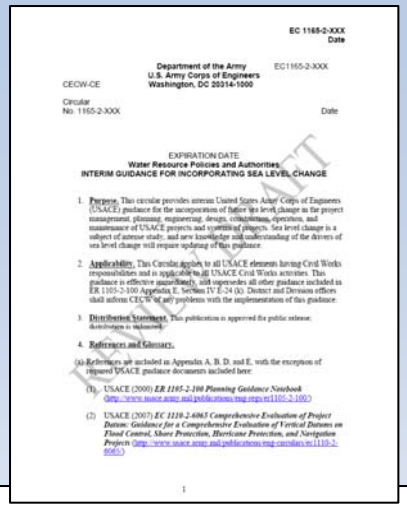
U.S. Army Corps of Engineers

U.S. Bureau of Reclamation

National Oceanic and Atmospheric Administration

Temporal and Spatial System Changes PDT

- **Task 1: Interim Guidance for Sea Level Change**
  - **PDT members**
    - **Rolf Olsen, IWR**
    - **Steve Gill, NOAA National Ocean Service**
    - **Robert Mason, USGS**
    - **Kevin Knuuti, SPK**
    - **Jeff Gebert, NAP**
    - **Andrew Garcia, ERC-CHL**
    - **Kate White, AFC Theme 1**
  - **Request for guidance March 2008**
  - **Interim guidance:**
    - **Internal Review August 2008**
    - **Interagency review Sept 2008**
  - **Geospatial representation of project vulnerability to sea level change Nov 2008**



EC 1165-2-XXX
Date

Department of the Army
U.S. Army Corps of Engineers
Washington, DC 20314-1000

CECW-CE

EC1165-2-XXX

Circular
No. 1165-2-XXX

Date

EXPIRATION DATE
Water Resource Policies and Authorities
INTERIM GUIDANCE FOR INCORPORATING SEA LEVEL CHANGE

1. Purpose. This circular provides interim United States Army Corps of Engineers (USACE) guidance for the incorporation of future sea level change as the project management, planning, engineering, design, construction, operation, and maintenance of USACE projects and systems of projects. Sea level change is a subject of intense study, and new knowledge and understanding of the drivers of sea level change will require updating of this guidance.

2. Applicability. This Circular applies to all USACE elements having Civil Works responsibilities and is applicable to all USACE Civil Works activities. This guidance is effective immediately and supersedes all other guidance included in ER 1105-2-100 Appendix E, Section IV E-24 (k). District and Division offices shall inform CECW of any problems with the implementation of this guidance.

3. Distribution Statement. This publication is approved for public release; distribution is unlimited.

4. References and Glossary.

(a) References are included in Appendix A, B, D, and E, with the exception of required USACE guidance documents included here:

(1) USACE (2000) *ER 1105-2-100 Planning Guidance Notebook* (http://www.usace.army.mil/publications/eng-regs/er1105-2-100/)

(2) USACE (2007) *EC 1110-2-6065 Comprehensive Evaluation of Project Datum: Guidance for a Comprehensive Evaluation of Vertical Datums on Flood Control, Shore Protection, Hurricane Protection, and Navigation Projects* (http://www.usace.army.mil/publications/eng-circulars/ec1110-2-6065/)

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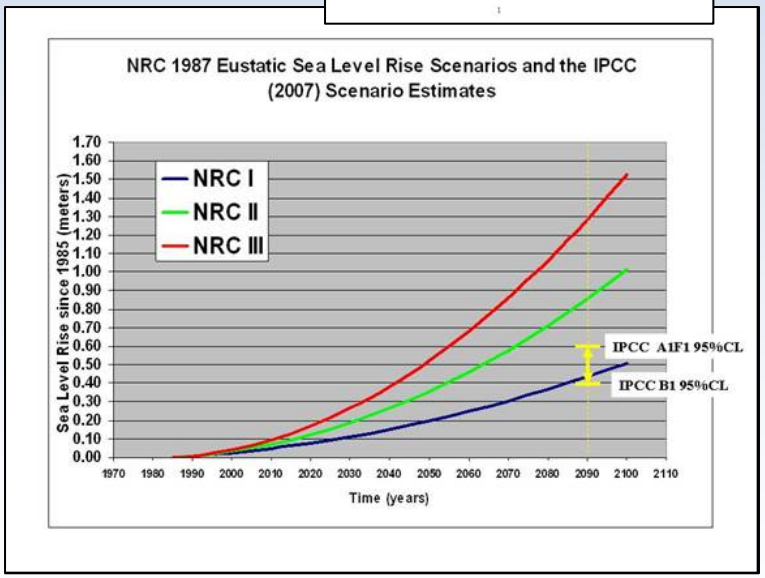
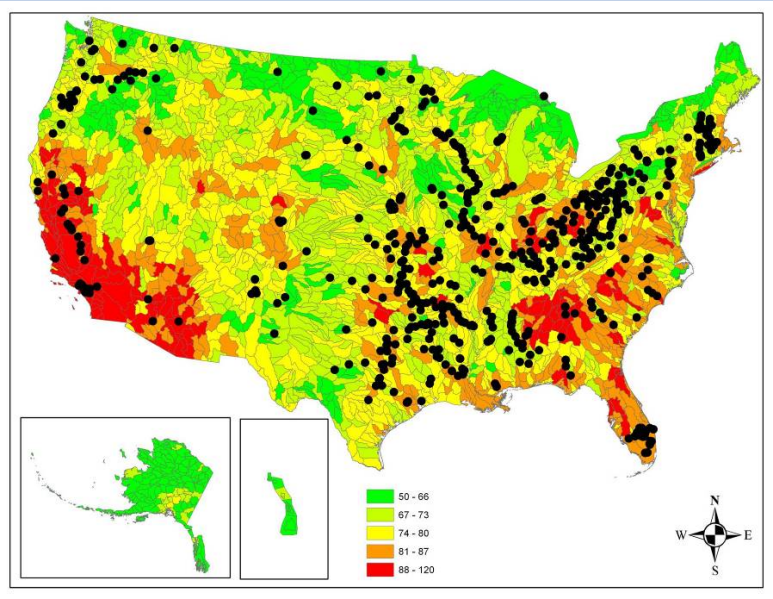


ACTIONS for CHANGE

Temporal and Spatial System Changes PDT

- **Task 2: Incorporating Climate into Water Control**
  - **PDT members**
    - **Larry Murphy, NWD**
    - **Stu Townsley, SPK**
    - **Bob Buchholz, NWP**
    - **Glen Stevens, NAP**
    - **Deborah Lee, LRD**
    - **Chris Smith, SAD**
    - **Gary Estep, SWD**
    - **S.K. Nanda, MVD**
  - **Workshop Oct 2008**
  - **Strategic plan for how USACE water managers will address observed and potential climate change impacts Dec 2008**
  - **Assessment of sensitivity to water control (Elisabeth Jenicek, CERL)**
  - **Guidance to incorporate climate change into water management 2009**
  - **Development of procedures and tools to incorporate climate change 2009-2010**



ACTIONS for CHANGE

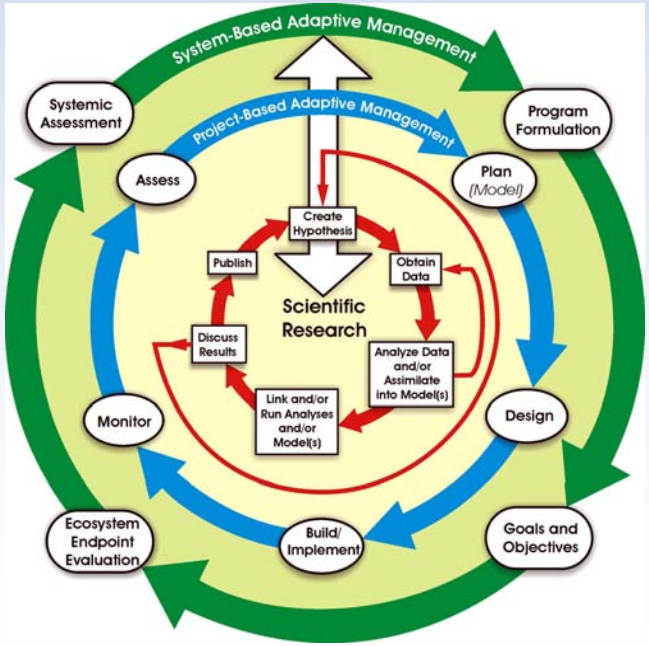
Temporal and Spatial System Changes PDT

- **Task 3: Nonstationary frequency and risk PDT**
  - **PDT members to be determined, but will include national and international experts and USACE staff**
  - **Workshop on alternatives to assumption of hydrologic stationarity including commissioned papers first quarter 09**
  - **Working groups on hydrologic frequency estimation with climate change and variability 2009-2010**
  - **Development of risk management techniques in coordination with Actions for Change Theme 2 team 2009-2010**
- **Task 4: Seismicity PDT**
  - **PDT members to be determined, but will include USACE staff, USGS, and other national and international experts**
  - **White paper on identifying vulnerability of Corps infrastructure to seismic events with suggestions for adaptation**
  - **Develop geospatial representation of vulnerability**
- **Additional tasks:**
  - **Climate change and coastal management**
  - **Climate change impacts on ecosystems**
  - **Climate change impacts on USACE regulatory program**

ACTIONS for CHANGE

Adaptive Management PDT

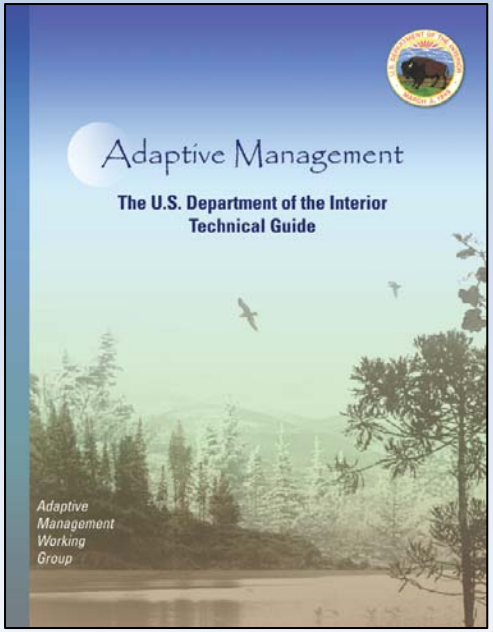
- **Overall charge:**
  - **Develop a framework for adaptive management that can be incorporated into USACE Civil Works projects to allow for flexible decision making in the face of uncertainty**
  - **Result will be a business process aimed at balancing economic, social, and ecological factors for a sustainable future**
- **PDT members (some tentative):**
  - **Ken Barr, MVR lead**
  - **Martha Bullock, RS/GIS CX**
  - **Casey Kruse, NWO**
  - **Steve Bartell, PhD, E2 Consultants,**
  - **Tomma Barnes, MVN**
  - **Craig Fischenich, ERDC-EL**
  - **Bradley Thompson, MVR**
  - **Dave Tipple, SAJ**
  - **Marci Cook, NWP**
  - **David Vigh, Ecosystem PCX**



ACTIONS for CHANGE

Adaptive Management PDT

- **Task 1 underway:**
  - **Update of 2003 Planning Associates review of adaptive management**
  - **Includes coordination with Upper Mississippi, Everglades, Missouri River, Coastal Louisiana, Columbia River, study leads for FY06 GE Watershed studies and ECOPCX**
  - **Completion date Sept 2008**
- **Task 2, completion date November 2008**
  - **Update EMRRP Special Report 34 to reflect the current state of watershed planning in USACE CW projects.**
- **Task 3**
  - **Based in part on Task one, develop a USACE Guide to Adaptive Management will be prepared**
  - **Guide will be modeled after the 2007 DOI guide and in consideration of The NRC review of Adaptive Management for Water Resources Planning 2004**
  - **completion date December 2008**



ACTIONS for CHANGE

Sustainable Solutions PDT

- **Mission Statement – Facilitate transformation of USACE activities to achieve sustainability in everything we do.**

- **PDT Members:**
  - **Frank Appelfeller, LRD, Leader**
  - **Dr. Kate White, AFC T1**
  - **Dr. Richard Cole, IWR**
  - **Susan Durden, IWR**
  - **Rich Schneider, ERDC-CERL**
  - **Karen Baker, CESI**
  - **Sue Ferguson, LRN**

ACTIONS for CHANGE

Sustainable Solutions PDT

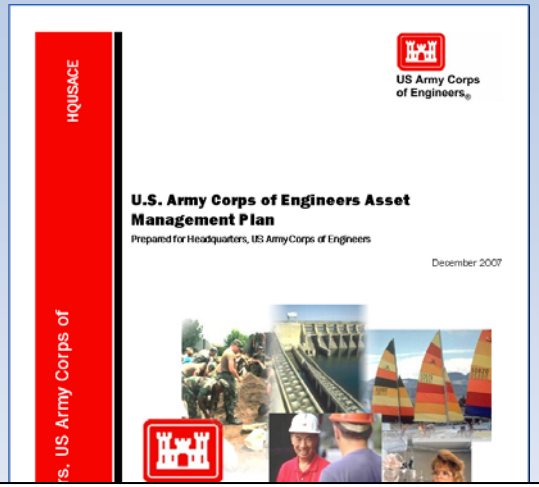
- Major tasks and milestones:
  1. Sustainability Baseline
  2. Benchmark Sustainability
  3. Culture and Sustainability Ethic
  4. Management Principles for Sustainability
  5. Sustainability Integration
  6. Sustainability Performance Indicators
  7. EOP Actualization
  8. Pilot Tests of Sustainability
  9. Sustainability Knowledge Transfer
  10. Sustainability & Strategic Management Integration

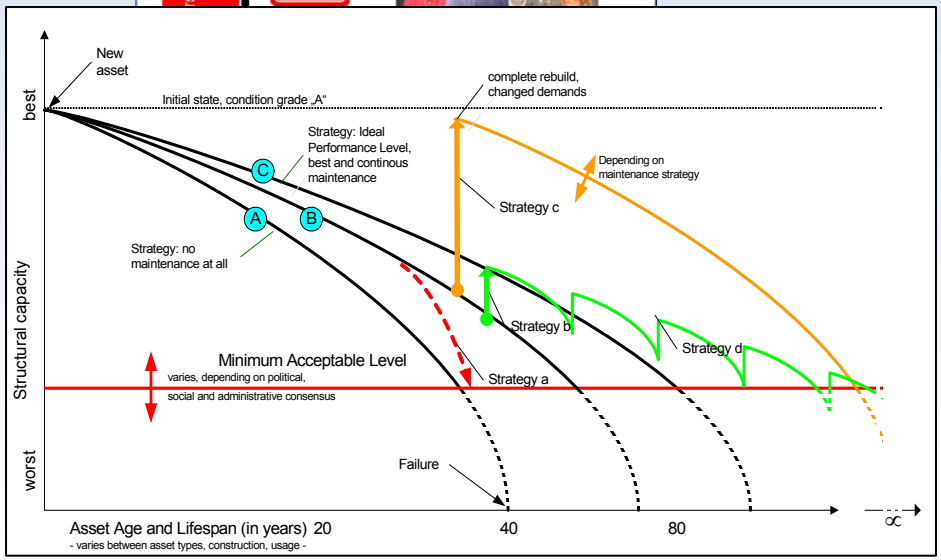
- 100-day projects:
  - 1.1 - Theory and definitions of sustainability
  - 1.2 - Current USACE sustainability practices
  - 1.3 – Authorities for watershed/comprehensive studies
  - 2.1 – Benchmark sustainability practices
  - 2.3 – Opportunities for NEPA to support sustainability
  - 3.1 – Recommended definition of sustainability
  - 10.2 – Review Strategic Plan for Army Sustainability

ACTIONS for CHANGE

Theme 1 - Project Delivery Teams

- **Post-Construction System Evaluation**
  - **Service life of USACE aging infrastructure is often extended beyond design life, thus it is imperative that a proactive, resilient, and sustainable system wide approach to life cycle asset management be implemented**
  - **Enhance multi-objective decision making for post-construction evaluation of project outcomes, leveraging enhanced data collection and integrating existing management and geospatial databases.**
  - **POC Jose Sanchez (HQUSACE)**

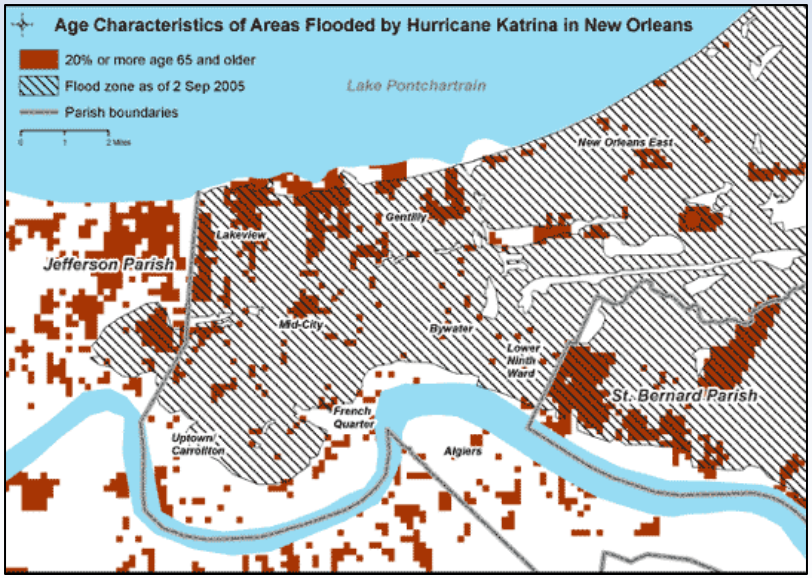




ACTIONS for CHANGE

Multi-Objective System Planning and Policy PDT

- **Approach:**
  - **Planning and engineering tools for improved understanding of the system within which a proposed system component will perform**
  - **Develop a comprehensive, adaptive, systems approach for multi-objective planning that places the highest priority on protection of public health and safety**
  - **Address unanticipated consequences and impacts of cost sharing**
- **PDT Members**
  - **Susan Durden IWR PDT lead**
  - **William Bailey SAM @ SAS**
  - **Vechere Lampley LRN (on detail to SWD)**
  - **Shawneen O'Neill SWT**
  - **Mark Dunning IWR, retired**
  - **Jason Needham, HEC**

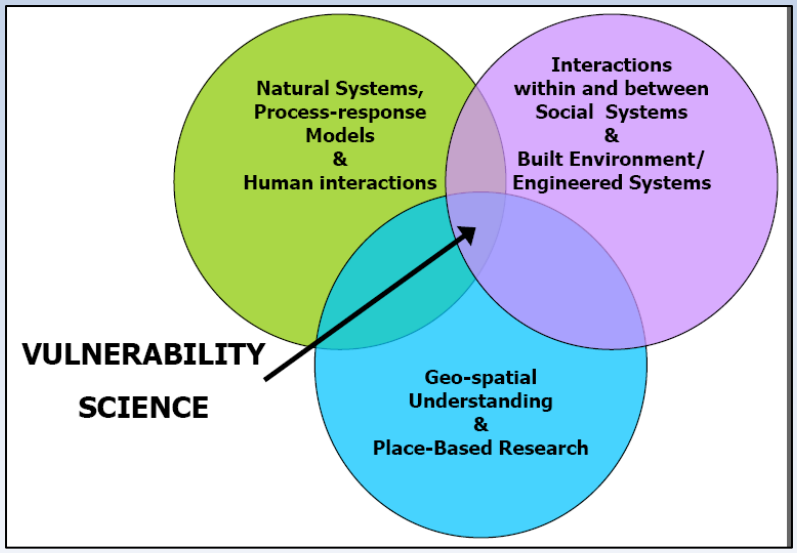


http://nasadaacs.eos.nasa.gov/articles/2006/2006_hurricanes.html

ACTIONS for CHANGE

Multi-Objective System Planning and Policy PDT

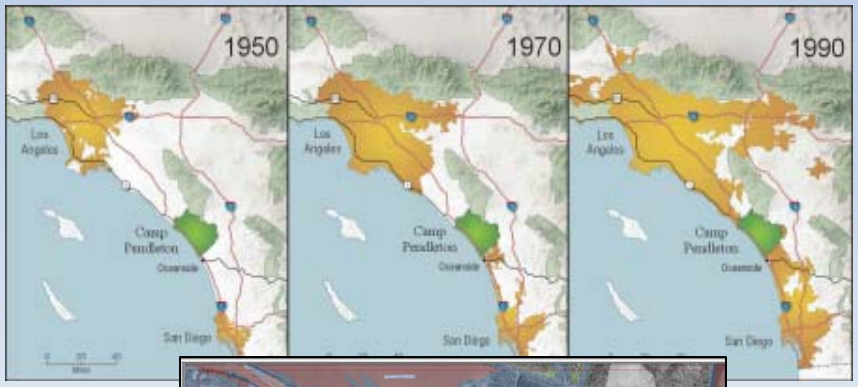
- **Accomplishments**
  - **Corps is a Systems Agency**
    - **Examine and use our strong legacy of systems analysis to address future needs**
    - **White Paper, in progress**
    - **Foundation for future guidance and studies**
  - **Social and Place Vulnerability**
    - **Meshing social and physical parameters for a complete analytical approach in a GIS format**
    - **Product is tool for field, in progress**

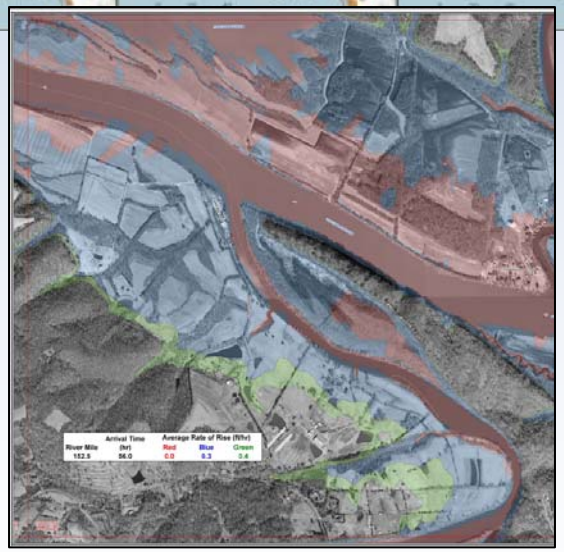


http://www.orau.gov/DHS_RE_Summit07/Presentations/Cutter.pdf

Incremental Changes to USACE Systems

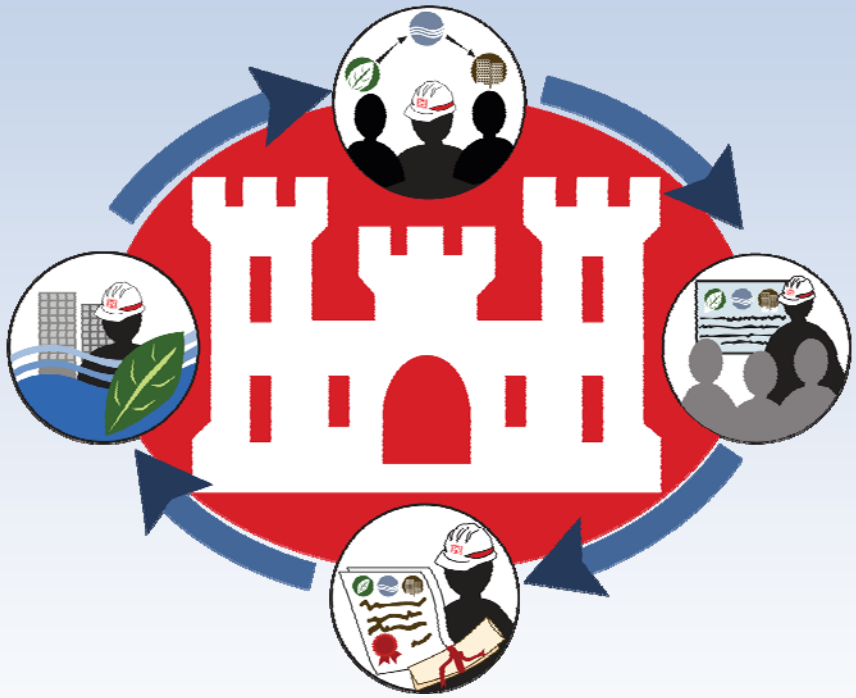
- **A comprehensive systems approach will direct the focus of making decisions away from individual, isolated projects to the collective evaluation of all components within an interdependent system**
- **Support comprehensive evaluation capability for incremental changes affecting USACE projects on a watershed and regional basis**
- **POC Jim Westervelt (ERDC-CERL)**





ACTIONS for CHANGE

Questions?



To learn more about Actions for Change
visit us on the web at
https://maps.crrel.usace.army.mil/AFC/

ACTIONS for CHANGE

Background Slides

USACE Campaign Plan

Other External Reports including WRDA 2000 Section 216 Reports

IPET

HPDC

Other Internal Reports

12 Actions for Change

IPET

Interagency Performance Evaluation Task Force

HPDC

Hurricane Protection Decision Chronology

ACTIONS for CHANGE

Chief's 12 Actions ⇒ 4 Themes

Theme 1 - Comprehensive Systems Approach

- Action 1 - Employ integrated, comprehensive and systems-based approach
- Action 5 - Employ adaptive planning and engineering systems
- Action 6 - Focus on sustainability

Theme 2 - Risk Informed Decision Making

- Action 2 - Employ risk-based concepts in planning, design, construction, operations, and major maintenance
- Action 7 - Review and inspect completed works

Theme 3 - Communication of Risk to the Public

- Action 9 - Effectively communicate risk
- Action 10 - Establish public involvement risk reduction strategies

Theme 4 - Professional and Technical Expertise

- Action 3 - Continuously reassess and update policy for program development, planning guidance, design and construction standards
- Action 4 - Employ dynamic independent review
- Action 8 - Assess and modify organizational behavior
- Action 11 - Manage and enhance technical expertise and professionalism
- Action 12 – Invest in research

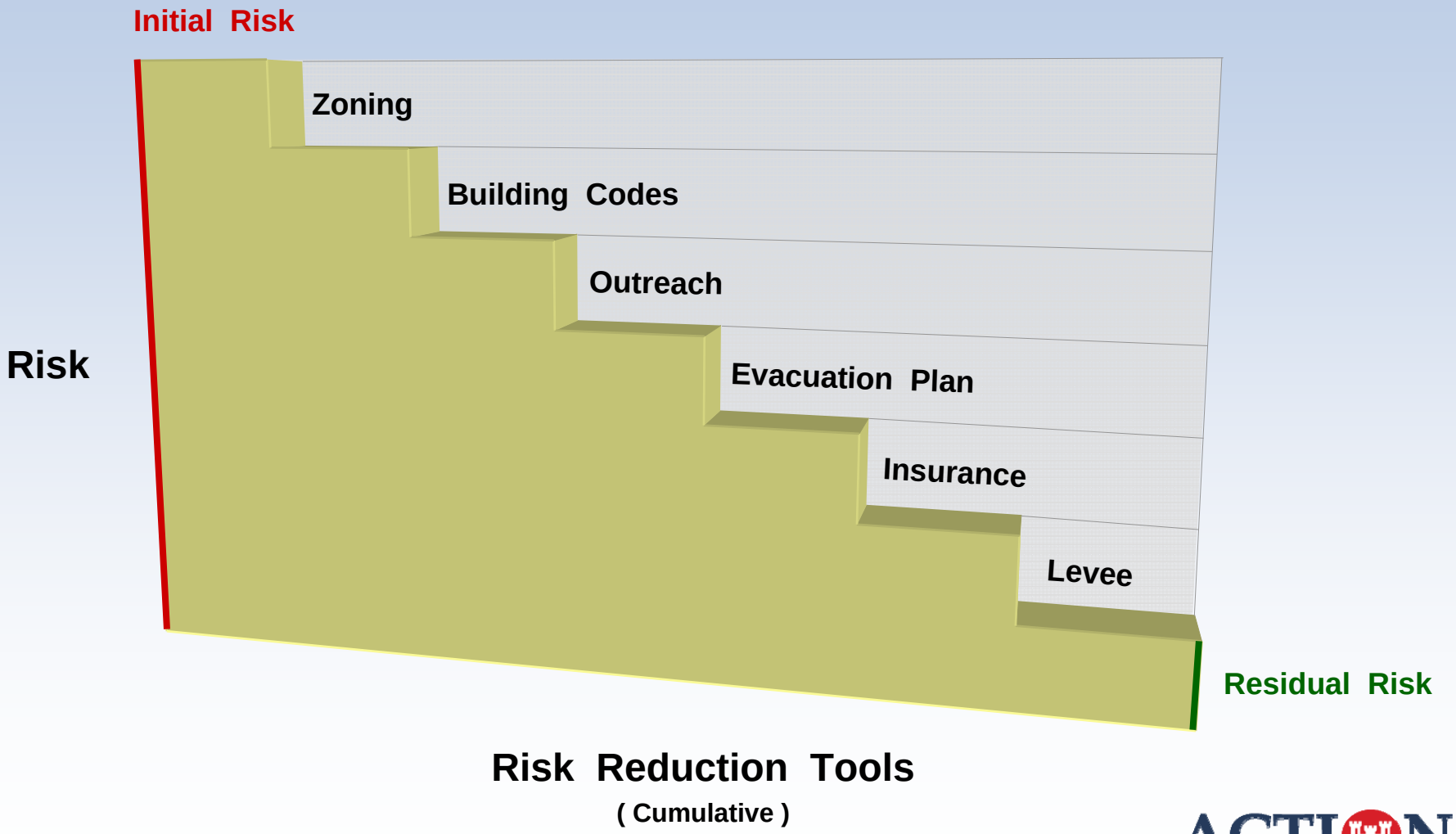
Note on Adaptive Management

"Adaptive management [is a decision process that] promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. *It is not a 'trial and error' process, but rather emphasizes learning while doing.* Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits."

From DOI Technical Guide (2007) after NRC (2004), emphasis added

ACTIONS for CHANGE

Residual Risk: A Key Component of Flood Risk Management



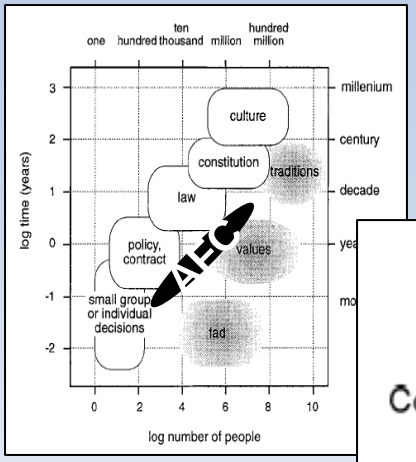
ACTIONS for CHANGE

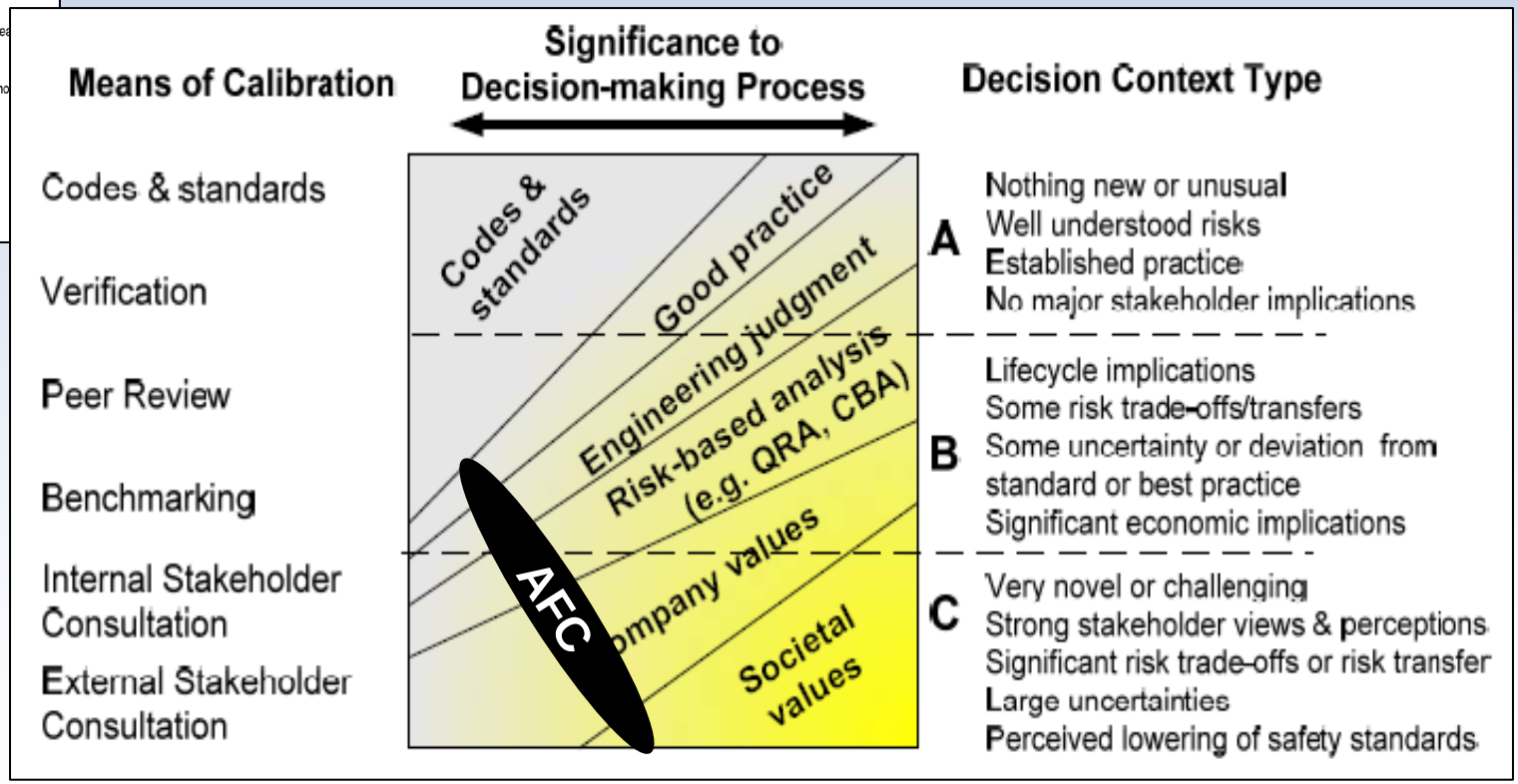
Flood Risk Management from a Comprehensive Systems Approach

- **We must think of our systems in terms of the resources contained within and the processes acting on them**
- **We must engage our partners and take advantage of the tools and technologies available to us**
- **We must consider and communicate risk**
- **We must manage flood risk together**

ACTIONS for CHANGE

Mapping Systems to Risk Decisions





UKOOA Framework

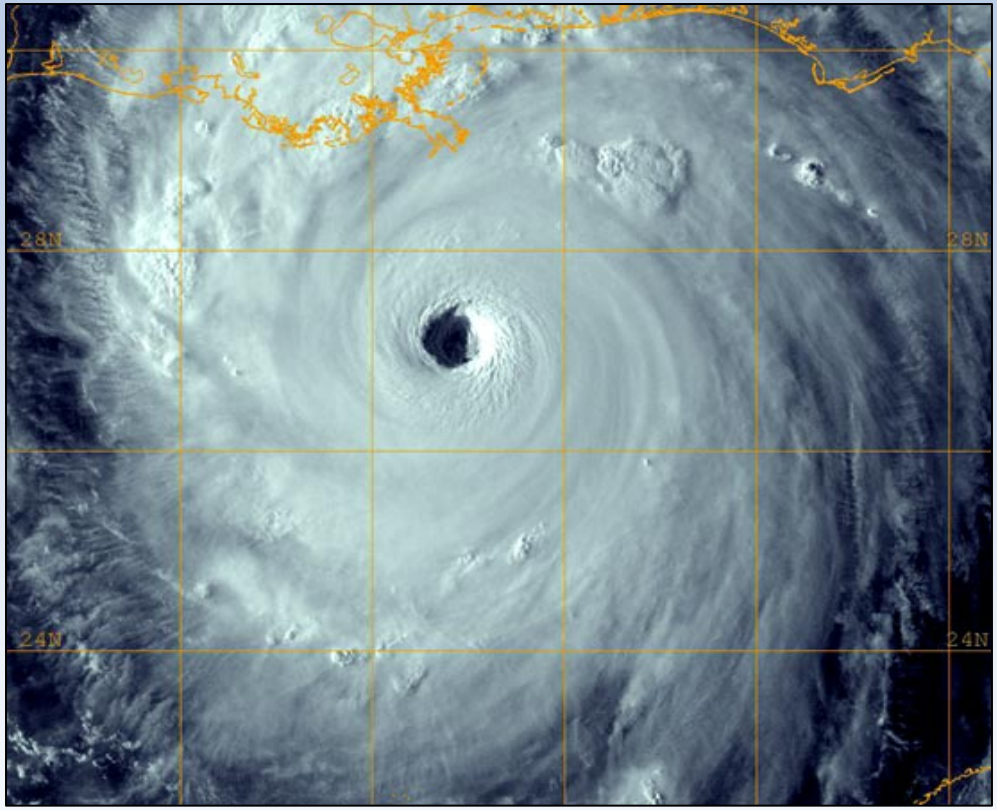
Holling 2001: Understanding the Complexity of Economic, Ecological, and Social Systems

Objectives of a Comprehensive Systems Approach

- **Implement a more holistic approach to water resources by considering space, function, time, and the human dimension**
- **Integrate and enhance partnerships with sponsors, stakeholders, Tribal Nations, Federal, State and local agencies, academia, private sector, NGOs**
- **Balance sustainable development and environmental protection**
- **Benefit from standardization and expanded use of spatial data and visualization tools**
- **Recognition and communication of risk**

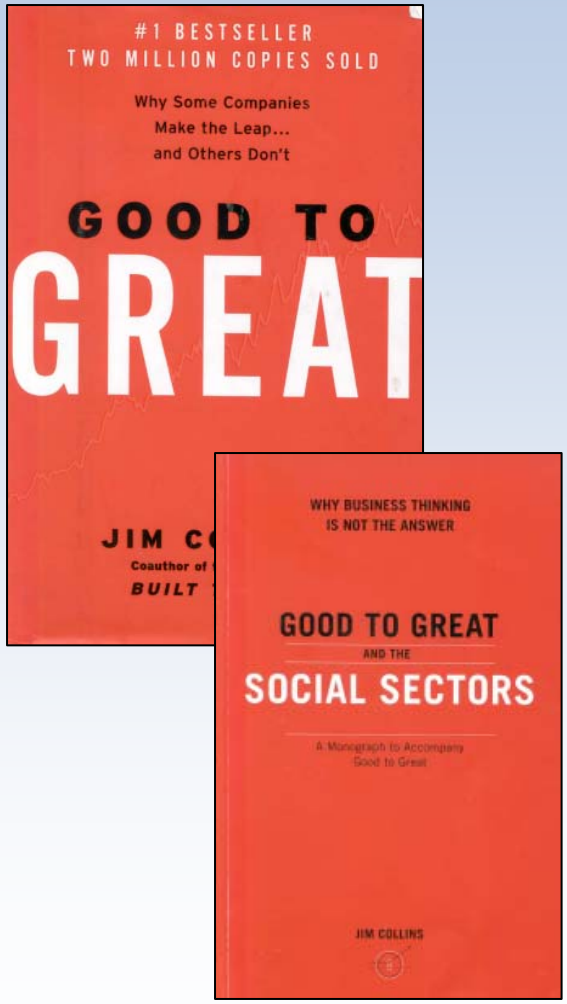
ACTIONS for CHANGE

Deterministic, project-based, with NED as highest priority



Risk-based comprehensive system approach to integrated water resources management with public safety as highest priority

ACTIONS for CHANGE



"The fox knows many small things, the hedgehog knows one big thing."

What are we passionate about?
What drives our resource engine?
What can we be best in the world at?

- **No organization can be best in the world at everything**
- **It's not about what we <u>want</u> to be the best at, it's what we <u>can</u> be the best at**

ACTIONS for CHANGE

Actions for Change
Bottom Line Up Front

"The Corps is responsible for the projects we build and manage, and we are accountable to the American people ….. for those who doubt us, words alone will not restore confidence. We are mindful that the public trust is earned when we follow through on our actions."

- **Lieutenant General Strock**

"Deliver."

- **Lieutenant General Van Antwerp**

ACTIONS for CHANGE

Rebuilding America Special Report: How to Fix U.S. Infrastructure – Popular Mechanics May 2008

"The urgent pace is the only sign of the collapse of the old I-35W bridge, which occurred on this spot six months ago. The debris was quickly cleared away, and in the aftermath, the Minnesota Department of Transportation (Mn/DOT) pledged to open a new bridge by Dec. 24, 2008. In a business where it can take years just to get a permit, this is an improbably ambitious schedule. 'We know that eyes are on us, but that's a good thing,' says John Chiglo, Mn/DOT's manager for the project. '**Re-establishing public trust is something we felt needed to be done. Something was lost that day, when the bridge collapsed**.'

"And not just in Minnesota. To many Americans, the I-35W disaster wasn't an isolated tragedy, **but the latest in a barrage of infrastructure failures — from the northeastern blackout in 2003 and the breached New Orleans levees in 2005 to falling concrete in Boston's Big Dig in 2006.** Perhaps the nation had passed a tipping point and was entering a period of steep physical decline."

ACTIONS for CHANGE

Last thoughts…..

- **Haimes 1991 in Total Risk Management: "As the importance of risk is better understood and its analysis is incorporated within a broader and more holistic management framework … The field of risk analysis will lose some of its current mystique, gain a wider recognition, and more closely merge with the field of systems engineering / systems analysis /operations research."**

- **Kahane 2004, 2007 in Solving Tough Problems: the use of multiple scenarios allows us to "recognize meaningful changes and adapt to them quickly"**