New England Federal Partners
Interagency Meeting on Climate Change in the Northeast
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US Army Corps of Engineers
Three-Page Narrative

Requirement: Provide a description of USACE roles and Responsibilities with climate change, tools and resources available to stakeholders, examples of current projects, and potential partnerships, especially with respect to three ecoregions: built environment, marine ecosystems and living marine resources, and vulnerable coastal ecosystems and with a focus on adaptation and knowledge acquisition.

Domain of USACE jurisdiction. The US Army Corps of Engineers (USACE) is the largest water resources operating agency in the United States. For more that 230 years, the USACE has supplied engineering solutions to water resources needs, including navigation, flood and coastal storm damage reduction, protection and restoration of aquatic ecosystems, hydropower, water supply, recreation, regulatory, and disaster preparedness and response. Approximately 12 million acres of land and water resources are under the jurisdiction of the USACE, and the USACE implements new water resources development projects with non-Federal sponsors each year. We also apply Civil Works expertise to support Military program operations that promote peace and stability around the globe.

Most important influences of climate change to USACE. Understanding the potential impacts to both natural and man-made systems is critical to USACE, especially as we plan today for water resources that will be sustainable in the future, and make permit decisions affecting waters of the United States and development trends. The most important influences of climate change on USACE missions will be changes in temperature, changes in precipitation quantity, intensity and form (snow vs. rain), and changes in sea levels, winds and wave patterns. Climate change impacts affect water availability, water demand, water quality, stormwater and wastewater infrastructure, flood and coastal storm infrastructure, wildland fires, ecosystem functioning, coastal zone functioning, navigation, and energy production and demand. All of these factors affect the water resources projects operated by the USACE and its non-Federal sponsors, many designed and constructed before climate change was recognized as a potential influence.

How will these affect the USACE? The entire portfolio of USACE Civil Works water resources infrastructure and programs, existing and proposed, could be affected by climate change and adaptation to climate change, which affect design and operational assumptions about resource supplies, system demands or performance requirements, and operational constraints. This portfolio includes over 600 dams, 1,000 coastal structures, 250 locks, and 300 major seaports. Our 75 major hydropower projects, with nameplate capacity of more than 20GW, supply more than 24% of US hydropower (about 3% of US electricity). Both droughts and floods can affect the operations of these projects. Numerous regulatory decisions made by USACE will be informed by climate change impacts and adaptation considerations throughout the U.S., especially in western states.

What is the role of knowledge acquisition? Climate change requires water resources managers to move from an equilibrium – or stationary – paradigm to one of constant evolution that recognizes the dynamic nature of physical and socio-economic processes. We must anticipate surprise and unexpected events, both natural and socio-economic, and be able to respond effectively in a timely manner. Water resource managers now and in the future must make assumptions and decisions about supplies, demands, weather, climate, and operational constraints at varying space and time scales and uncertainty. We must provide our stakeholders and partners with data and information that allows them to make risk-informed decisions as well. Over time, uncertainty may decrease as we increase our knowledge of climate change, its impacts, and the effects of adaptation and mitigation options (including unintended consequences). The use of rigorous adaptive management, where

decisions are made sequentially over time, allows adjustments to be made as more information is known. The use of longer planning horizons, combined with updated economic analyses, will support sustainable solutions in the face of changing climate that meet the needs of the present without compromising the ability of future generations to meet their own needs. As noted in USGS Circular 1331 (see below), USACE recognizes that "*Long-term monitoring networks are critical for detecting and quantifying climate change and its impacts. Continued improvement in the understanding of climate change, its impacts, and the effectiveness of adaptation or mitigation actions requires continued operation of existing long-term monitoring networks and improved sensors deployed in space, in the atmosphere, in the oceans, and on the Earth's surface….Monitoring needs to focus on locations that describe the climate signal (for example, upstream and downstream from major water-management infrastructure or in vulnerable ecological reaches).*"

Specific actions to adapt or respond to climate change. The USACE is working closely with other Federal, tribal, state and local agencies and stakeholders to develop consistent and integrated approaches, policies, methods, and technologies supporting adaptation to climate change. Specific actions include:

- Participation in the Intergovernmental Panel on Climate Change **(IPCC) assessment reports**, most notably by Dr. Gene Stakhiv, who co-chaired the first IPCC Water Resources Group, serving as lead author in the second and third IPCC reports, and participating as a reviewer of the fourth IPCC report.

- USACE developed an initial adaptation strategy, reflected in previous testimony to Congress (May, 2007) based on a "**proactive adaptive management**" approach, which includes the following actions:
  - Implementing risk-based planning and design of infrastructure to account for climate uncertainties;
  - Developing a new generation of risk-based design standards for infrastructure responsive to extreme events (floods and droughts);
  - Life-cycle management of aging infrastructure;
  - Vulnerability assessment of water infrastructure;
  - Increased inspections and oversight of infrastructure during operation and maintenance;
  - Increased research and development oriented to climate change and variability;
  - Developing improved forecasting methods for improved reservoir and emergency operations;
  - Strengthening emergency management and preparedness plans for all USACE projects and assisting local communities in upgrading their plans and participation.

- USACE formed an **interagency workgroup** representing the two major water resources operating agencies – USACE and the Bureau of Reclamation – and the two major science agencies supporting water resources management – U.S. Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA, National Weather Service and Office of Atmospheric Research). One result was a February 2009 report on "Climate Change and Water Resources Management: A Federal Perspective"(USGS Circular 1331). This report presents the best available science to help water managers prepare for and adapt to the effects of climate change on the nation's water resources.

- USACE is developing and implementing an **integrated, comprehensive, systems-based, and risk-informed approach** in the execution of all mission areas as part of the USACE Actions for Change. The changes will incorporate anticipatory and adaptive management so that systems remain adaptable and sustainable over time. The changes will ensure that USACE can incorporate new information and knowledge throughout a system's life cycle to ensure satisfactory safety and performance.

- USACE formed a team of water managers to develop strategies for how water management can better adapt to a changing climate through better implementation of **integrated water resources management**, which the IPCC says should be the framework for climate change adaptation.

- USACE conducted **workshops to explore competing demands** in California during spring 2007 with water managers from Federal, state, local and private agencies and organizations. As a result of these workshops, USACE is considering more flexible reservoir operations, better use of forecasts, and more monitoring of real-time conditions in the watersheds to support climate adaptation. USACE continues to work to upgrade reservoir simulation modeling capability and is developing methods for the consistent use of downscaled climate models for hydrologic studies in cooperation with Reclamation.

- USACE is revising guidance on how to incorporate future sea-level change projections into the life cycle of USACE projects with the active participation of USGS and NOAA's National Ocean Service (NOS). The guidance suggests **a multiple scenario approach** so we are prepared both to implement flexible planning and engineering adaptations accounting for a range of possible sea-level changes and to recognize meaningful changes that may require additional response.

- Modern ice core drilling techniques and the resulting ice core science studies were pioneered by the USACE beginning in 1949, including the first deep ice cores in both the Greenland (1966) and Antarctic (1968) ice sheets. This work included significant **international collaboration**, a tradition that continues today, most notably through International Polar Year activities and participation in such international organizations as the Permanent International Association of Navigation Congresses (PIANC).

- **Research and development** activities in the USACE include improvements to numerical models for reservoir simulation, studies of climate impacts to western USACE projects, and a primer to guide use of downscaled climate models. Better understanding of climate impacts driving adaptation is developed through such collaborative R&D as Sea ice Experiment: Dynamic Nature of the Arctic (SEDNA), the seasonal ice zone observing network (SIZONET), Study of the Northern Alaska Coastal System (SNACS),snow cover at regional scale in barren lands (SnowStar 2007), the International Trans-Antarctic Science Expedition (ITASE I and II), and atmosphere-snow exchange studies in Greenland.

- USACE is revising guidance to incorporate future **sea-level change** projections into planning and engineering design with the active participation of USGS and NOAA's National Ocean Service (NOS).

- OMB has supported a $5M investment in **climate change adaptation** in the President's FY10 budget request, with a special emphasis on adaptive management in the face of uncertainty.

- USACE has American Recovery and Reinvestment Act (ARRA) support for a new, two-year contract position for the purpose of producing **fine-resolution projections** of future climate change. These projections will be freely distributed to researchers, decision-makers, and members of the public who need quantitative information about future climate change in the U.S.

- USACE is evaluating **mitigation measures**. We are planning to identify carbon sources and methods to measure and value carbon uptakes and emissions for USACE activities so that we are well prepared to manage the carbon cycle of USACE projects. We are also involved in evaluations of the installation of non-federal hydropower at USACE facilities.

How will USACE assess the effectiveness of climate change adaptation? The USACE follows the IPCC approach in defining adaptation as adjustments or changes in decision environments undertaken with the objectives of enhancing resilience or reducing vulnerability to observed or expected changes in climate. Adaptation options include modifications to operations, demand management, and infrastructure changes. We are developing methods, policies, and processes to assess the effectiveness of climate change adaptation. We anticipate that assessment will include an evaluation of how well alternative adaptation measures improve system flexibility to perform well over a wide range of future scenarios.

USACE welcomes and looks for collaboration at all levels as we move ahead with climate change knowledge acquisition, adaptation, and mitigation.