National Oceanic and Atmospheric Administration
NOAA Restoration Center

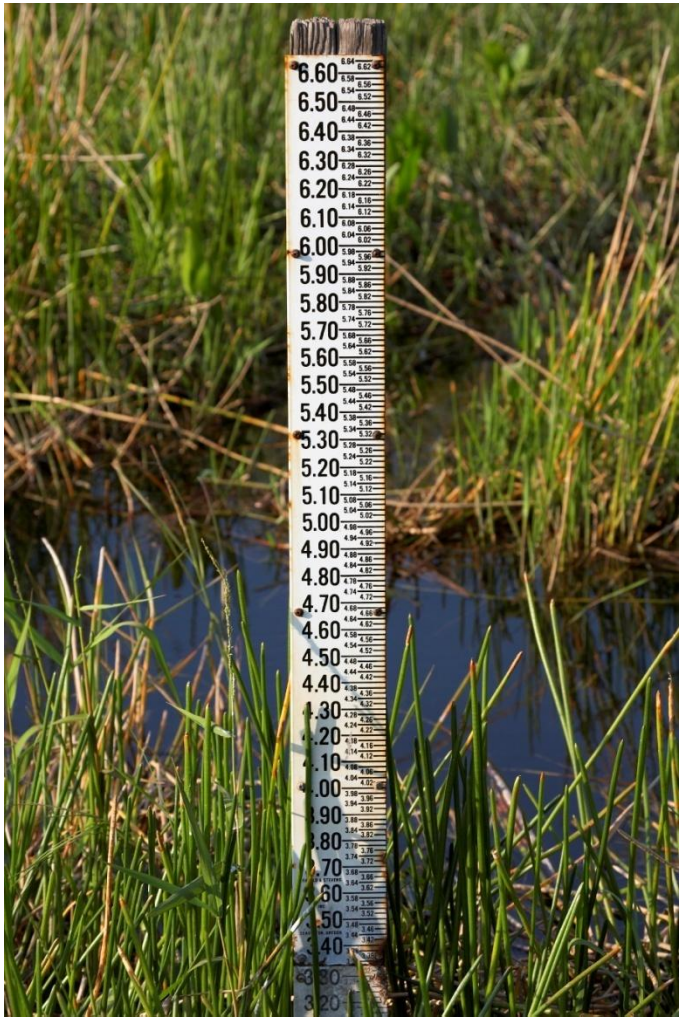
Addressing Sea Level Rise Impacts on Tidal Wetland Restoration Projects

The Development of NOAA Design Guidance and Potential Applications

Helen McMillan and Bethany Bearmore

NCER 2011
Baltimore, Maryland
August 4, 2011

Why develop guidance?



- OHC/OCRM Programmatic Framework for Considering Climate Change Impacts in Coastal Habitat Restoration, Land Acquisition and Facility Development Investments (May 2010)
- Design needs for current projects/ Requests from partners

Goal

- Develop guidance for incorporating relative (local) sea level rise into tidal wetland restoration project design
- Northeast Region focused
- Primary use: to ensure sustainability of projects receiving Restoration Center funding
- Secondary: for partners to use in the selection and design of their projects

Development process

- Assemble steering committee
- Develop white paper
- Hold expert workshop
- Create draft guidance
- Test guidance on projects

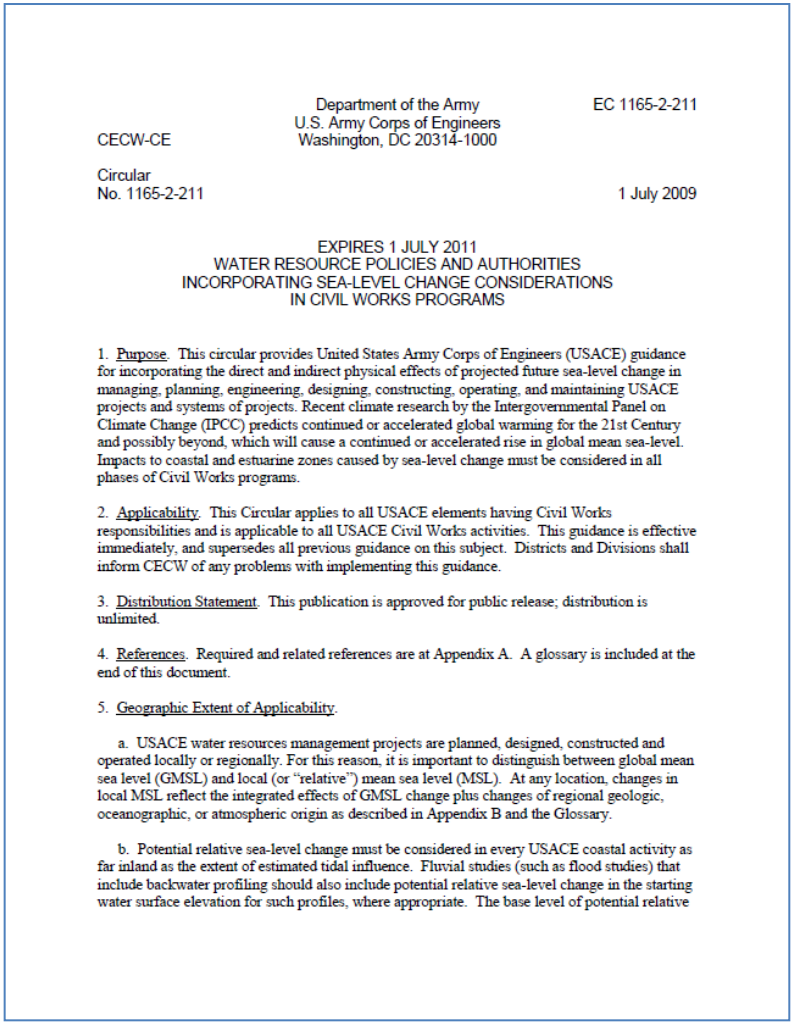
Draft Guidance

5-step process

- **Step 1:** Predict relative sea level rise at site over 50 years
- **Step 2:** Gather relevant information on project area
- **Step 3:** Conduct relative SLR impact analysis
- **Step 4:** Incorporate sea level rise analysis into project design
- **Step 5:** Develop plan for project maintenance and monitoring

Step 1: Predict relative sea level rise at site over 50 years

- Require that projects use the US Army Corps methodology (2009) to predict future water elevations at site:
  - predict low, medium and high scenarios at site for 50 years in the future



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

CECW-CE

EC 1165-2-211

Circular
No. 1165-2-211

1 July 2009

EXPIRES 1 JULY 2011
WATER RESOURCE POLICIES AND AUTHORITIES
INCORPORATING SEA-LEVEL CHANGE CONSIDERATIONS
IN CIVIL WORKS PROGRAMS

1. Purpose. This circular provides United States Army Corps of Engineers (USACE) guidance for incorporating the direct and indirect physical effects of projected future sea-level change in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects. Recent climate research by the Intergovernmental Panel on Climate Change (IPCC) predicts continued or accelerated global warming for the 21st Century and possibly beyond, which will cause a continued or accelerated rise in global mean sea-level. Impacts to coastal and estuarine zones caused by sea-level change must be considered in all phases of Civil Works programs.

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 previous guidance on this subject. Districts and Divisions shall inform CECW of any problems with implementing this guidance.

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

4. References. Required and related references are at Appendix A. A glossary is included at the end of this document.

5. Geographic Extent of Applicability.

a. USACE water resources management projects are planned, designed, constructed and operated locally or regionally. For this reason, it is important to distinguish between global mean sea level (GMSL) and local (or "relative") mean sea level (MSL). At any location, changes in local MSL reflect the integrated effects of GMSL change plus changes of regional geologic, oceanographic, or atmospheric origin as described in Appendix B and the Glossary.

b. Potential relative sea-level change must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence. Fluvial studies (such as flood studies) that include backwater profiling should also include potential relative sea-level change in the starting water surface elevation for such profiles, where appropriate. The base level of potential relative

Step 2: Gather relevant information on project site

Required:

- Base map of the site, including:
  - Site elevation/surface topography and bathymetry
  - Habitat/vegetation zones
  - Tidal elevations
  - Locations and elevations of critical infrastructure
  - Anthropogenic and natural barriers to wetland migration
- Historic conditions (geomorphic and site history)

May be necessary:

- Rate of wetland accretion
- Freshwater inflows
- Water velocities and depths
- Suspended sediment concentrations
- Potential flooding from storm events
- Additional information as needed for site and modeling

Step 3: Conduct relative sea level rise impact analysis

Required analysis:

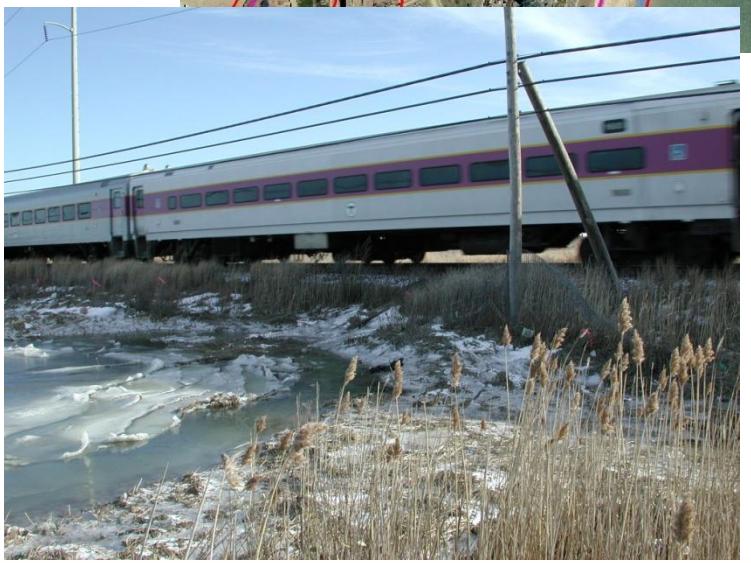
1. Ecological impacts
   a) Habitat/vegetation zones
   b) Tidal range
   c) Inland migration
   d) Fish and shellfish
   e) Protected resources
   f) Coastal geomorphology

Step 3: Conduct relative sea level rise impact analysis (cont.)

Required analysis (cont.):

2. Infrastructure impacts
   a) Project infrastructure
   b) Adjacent property and resources

3. Storm and flooding impacts
   a) Floodplain effects



Step 4: Incorporate sea level rise analysis into project design

- Goal: to use the analysis completed in Step 3 to inform the project design
- Specific guidance:
  - At a minimum, projects should be designed for the current rate of sea level rise (low scenario), medium and high should be considered depending on risks/benefits
  - Managers should consider targeting elevations at the high end of the growth range for desired plant community to add resiliency to SLR
  - To allow for inland/landward migration, projects should consider maintaining or protecting transition/buffer zones, incorporating gradual slopes, and removing barriers where possible

Step 5: Develop plan for project maintenance and monitoring

- Adaptive management
- Recommend one year of pre-restoration, and 3 years post-restoration monitoring
- Recommended monitoring parameters:
  - Accretion rates
  - Topographic and bathymetric elevations
  - Habitat/vegetation zones
  - Hydrology/tide elevations
  - Soils and sediment

Current status

- On-going test projects:
  - Mayo Creek Salt Marsh Restoration, Wellfleet, MA
  - Herring River, Wellfleet, MA
  - Heinz Refuge, Philadelphia, PA
- Steps were easy to follow
- Cost an additional 1k to 3k to the existing modeling effort

Next steps

- Post Draft Document on OHC/RC website as a workshop manual for testing and comments
- Revise based on comments from test cases and public
- Seek input at relevant conferences
- Finalize and publish

in early FY12

Acknowledgements

Steering Committee:

- Mary Andrews, NOAA Restoration Center
- Bethany Bearmore, NOAA Restoration Center
- Kirk Bosma, Woods Hole Group
- David Burdick, University of New Hampshire
- Donald Cahoon, USGS Patuxent Wildlife Research Center
- John Catena, NOAA Restoration Center
- Jana Davis, Chesapeake Bay Trust
- Hunt Durey, Massachusetts Division of Ecological Restoration
- Janet Freedman, Rhode Island Coastal Resources Management Council
- Eric Hutchins, NOAA Restoration Center
- Georgeann Keer, Massachusetts Division of Ecological Restoration
- Danielle Kreeger, Partnership for the Delaware Estuary
- Helen McMillan, NOAA Restoration Center
- Jim Morris, University of South Carolina
- Charles Roman, National Park Service

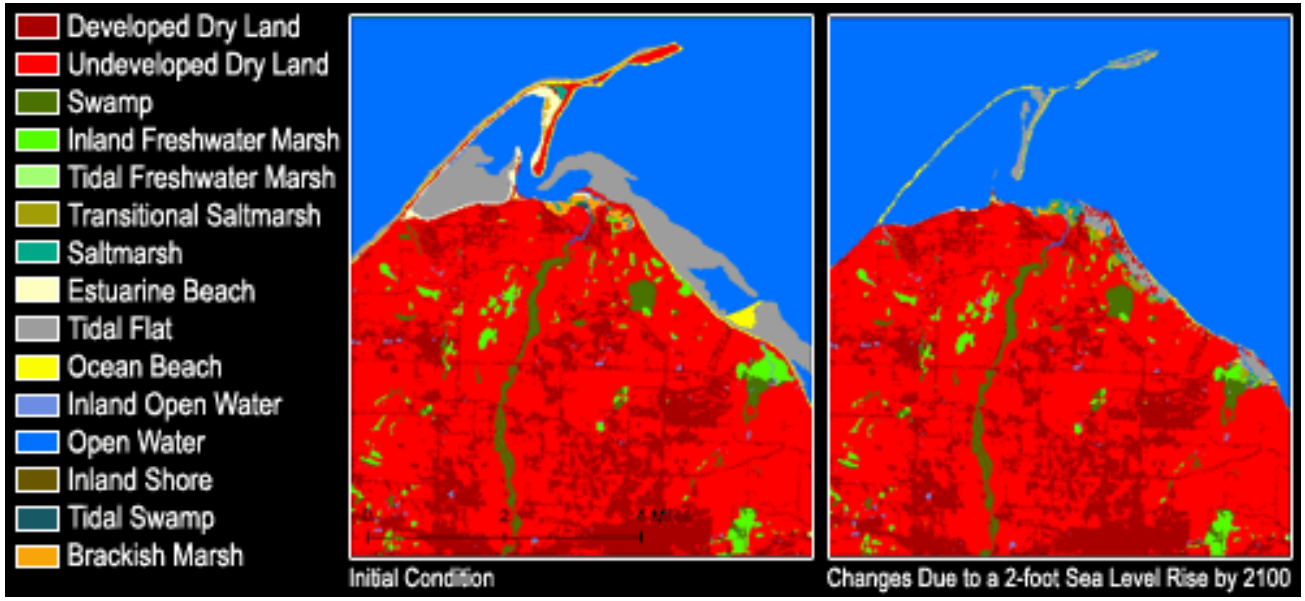
Questions?

Barren Island restoration, MD

Backup Slides

Guidance on incorporating sea level rise into regional prioritization and selection

- Tools/analyses:
  - SLAMM (Sea Level Affecting Marshes Model)
  - CCSP Mid-Atlantic wetland survival analysis
  - Coastal Resilience tool (TNC)



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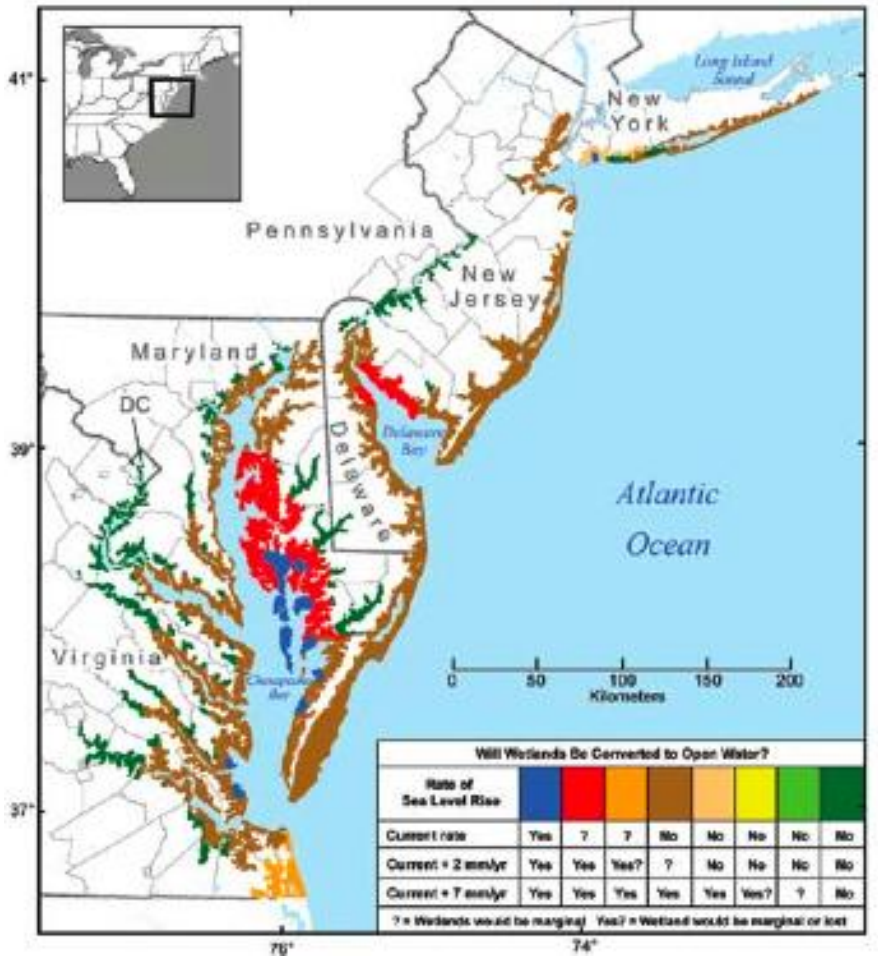

Reed et al. 2008

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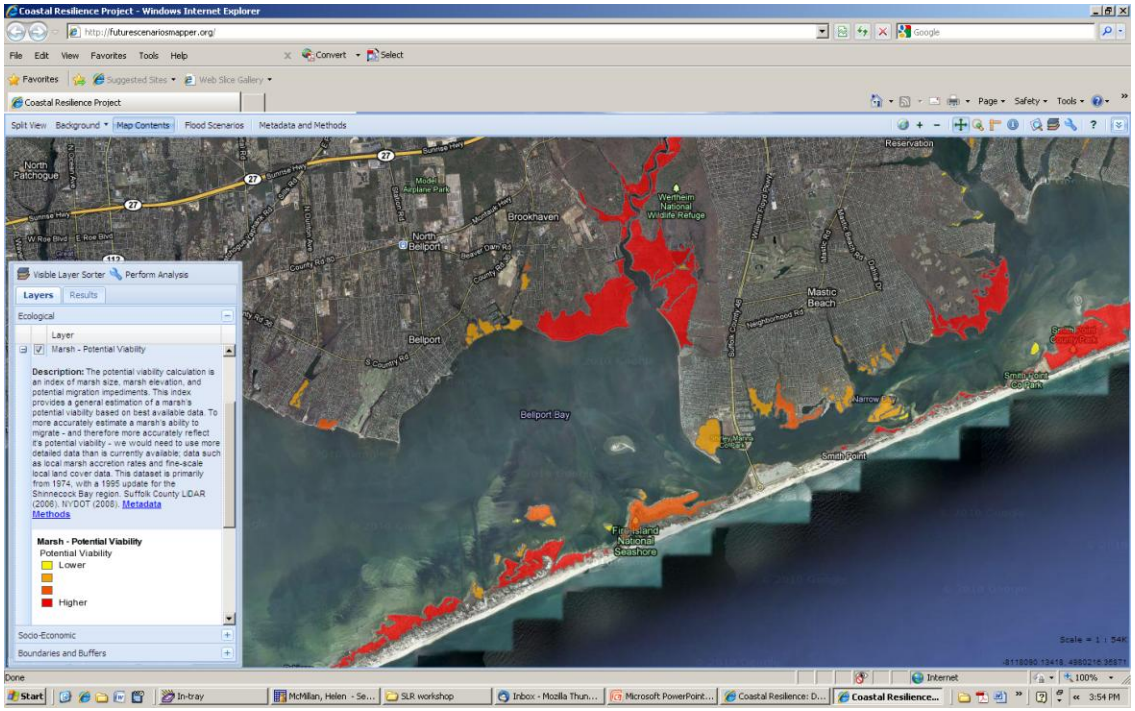
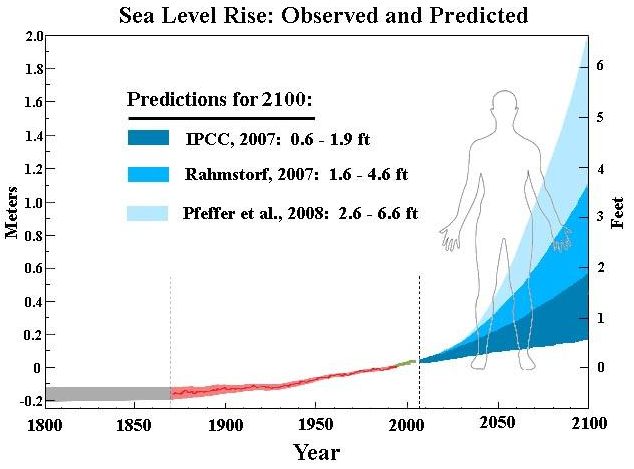


5. Research Needs/Areas for Future Study

- Local-scale sea level rise projections
- Current elevation data
- Wetland elevation and accretion trend data
- Increased modeling capability and ease of use



(Masters 2009)