American Water Resources Association
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Climate Change Adaptation
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Wednesday, June 17
1:30 PM – 3:00 PM
SESSION 20: Coastal Adaptation and Resiliency

Interactions between Wetlands, Economies and Hurricanes in a Changing Climate: Toward Valuing Adaptation Strategies - Luke Boutwell, Louisiana State University, Baton Rouge, LA (co-author: J. V. Westra)

Coastal communities along the gulf coast are annually threatened by coastal storms. Population grown, land-use change and potentially changing storm regimes are likely to increase coastal vulnerability to these events. Increasingly, coastal management entities are managing land resources to reduce the economic impact of natural disasters. This is true in Louisiana where coastal storms are regular events and land loss is increasing coastal vulnerability. The Louisiana Coastal Master Plan allocates billions of dollars to coastal restoration projects, many of which are intended to mitigate economic damages from tropical storms and hurricanes. Despite this significant proposed investment, the risk reduction value provided by these projects is not well known, and the wisdom of using wetlands as storm buffers has been questioned. This analysis uses model simulation data and hurricane impact data to estimate the parish- level impacts of hurricanes along the US Gulf Coast. Using this information, a damage model is estimated that describes economic damages as a function of population, wetland protection and storm intensity. The model's parameters are used to compute the effects of wetland loss and hurricane frequency and intensity on the vulnerability of coastal communities. Future scenarios of wetland loss and hurricane regimes are imposed to estimate the increase on coastal storm vulnerability that can be expected under these scenarios. The value of wetlands for storm damage mitigation is estimated under current and possible future condition to illustrate how wetlands can be used, in the right context, as cost- effective climate adaptation measures. The approach taken here can be replicated for other coastal areas, and challenges for this replication are addressed.

Climate Vulnerability Assessment - Stamford Hurricane Barrier, Stamford, CT - Patrick O'Brien, Engineering Research and Development Center, Environmental Laboratory, Hanover, NH (co-authors: K.White, H. Moritz)

USACE is currently conducting phased screening-level analyses of coastal projects, which will be followed by detailed assessments for vulnerable projects. In spring 2013, USACE began a streamlined vulnerability assessment at a representative coastal Civil Works project be conducted by an interdisciplinary and interagency team, with the results to help guide future

more detailed vulnerability assessments. The Stamford Hurricane Barrier (SHB) was selected as a good example of a multipurpose project with multiple components for analysis. The SHB project was designed in 1962 to provide navigation and flood risk reduction benefits for the area surrounding the East Branch of the harbor. Construction of this project started in May 1965 and ended in January 1969. The project consists of three elements. The first, a barrier at the East Branch of Stamford Harbor, is composed of a 2,850-ft-long earthfill dike with stone slope protection. It has an elevation of 17 ft. 1962 mean sea level (MSL). A 90-ft-wide opening is provided for navigation, and a pump station discharges interior drainage. The project is designed so that closures of the navigation gate will keep coastal tidal flooding from impacting the inner harbor. The gate is opened during low tide to allow any high water that has collected in the harbor (e.g., precipitation, stormwater) to drain. Gate closures have averaged 11 per year over the project life. A tiered approach to the streamlined assessment is employed per USACE ETL 1100-2-1 using the three scenarios prescribed by ER 1100-2-8162. The qualitative assessment has defined the major climate related impacts and ranked them in order of most likely occurrence: increase in gate closures, potential for interior flooding increases due to closure frequency and duration, finally, over topping of the SHB gates and dikes, which will become more likely at progressively higher frequency events over time due to the impact of sea level change. A quantitative assessment in progress analyzes individual project components, including electrical, mechanical and structural components. An additional analysis cycle will proposes adaptation measures per ETL 1100-2-1 and will assess changes in time-dependent risks resulting from these measures.

Multi-Stakeholder Approach to Natural and Nature-Based Features Metrics - Susan Meredith Taylor, Abt Associates, Bethesda, MD (co-author: K. Burks-Copes)

Natural and nature-based features (NNBF) are becoming important elements of building resiliency and reducing risk to coastal communities in the face of climate change and increasing coastal storm damage threats. NNBF are now being considered, evaluated, implemented and encouraged by many federal, state and local agencies, as well as the private sector from non-governmental conservation organizations to engineering and research firms. However, there is no consensus on a set of performance metrics to evaluate the success of NNBF projects, nor is there concrete evidence that NNBF will perform over time, whereas engineering guidance and performance is well established for built infrastructure. Thus, uncertainty exists in the ability of NNBF to reduce risk, provide ecological benefits, and do so in a cost effective manner Collaboration among a range of entities is essential to ensure efficiency, full use of interdisciplinary expertise, and to avoid duplication. Focused research is needed to reduce uncertainties inherent with evaluating and quantifying the ability for NNBF to increase resiliency, and to advance the understanding of the risk reduction benefits of NNBF and the ecosystem goods and services associated with traditional gray or hard infrastructure. In the last year, an interagency, multi-stakeholder working group has been meeting to facilitate dialogue and promote the use of NNBF in the planning and implementation of risk reduction measures that produce a full array of economic, ecological and social benefits for human communities nationwide. Representative agencies and organizations in this group consist of a diverse and complementary set of authorities and capabilities for implementing these solutions including

the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the National Oceanographic and Atmospheric Administration, and numerous state, local and non-governmental organizations such as the The Nature Conservancy. The primary objective of the NNBF Workgroup is to develop and identify performance metrics and the key attributes of NNBF, and begin to evaluate the cost effectiveness. Close collaboration has promoted the development of practical, nationally consistent performance criteria and measures to reduce vulnerability from slow and persistent hazards and acute events. In particular, we identify key attributes of NNBF across multiple missions and objectives, recognizing that metrics must be objective-based. Our group conducted a process based approach for the identification of relevant priorities and metrics for agencies, organizations and practitioners. We use existing pilots to support proof of concept for NNBF ability to provide restoration, resilience, cost competitiveness, and co-benefits.

A Resilient Living Shoreline and Green Infrastructure System for a Low-lying Coastal Community - Ed Morgereth, Biohabitats, Inc., Baltimore, MD

This project was implemented with the goals of reducing local nuisance flooding and drainage problems, improving stormwater run-off quality, enhancing the estuarine shoreline condition, and providing environmental education and stewardship opportunities for the community. This project strives to be a model for other low-lying coastal communities to improve resiliency. The design and construction of the project was funded by the Maryland Department of Natural Resources, and the Chesapeake Bay Trust. The project design includes a living shoreline linked to a green infrastructure system of roadside bioswales, sand filters and pocket wetlands. A series of grade controls were used in the roadside swales to provide positive drainage, and increase water storage in the swales. The living shoreline incorporates a cobble beach bar and native tidal wetland plantings. During storm flows the roadside bioswales deliver run-off through the wetlands to the living shoreline area. Constructed in spring 2014 this project has been embraced by the community and is providing ecosystem services benefits.