American Water Resources Association
2015 SUMMER SPECIALTY CONFERENCE
Climate Change Adaptation
June 15 - 17, 2015
New Orleans, LA

Monday, June 15
1:30 PM – 3:00 PM
SESSION 2: Economics of Adaptation

A Cost-Benefit Approach to Coastal Adaptation - Craig Diamond, The Balmoral Group, Tallahassee, FL (co-authors: V. Seidel, A. Barker, C. Cortez, P.Yacobellis)

The community of Old Bar (Greater Taree Local Government Area, New South Wales, Australia) faces difficult decisions due to coastal erosion and shoreline recession. The community's economy relies on its proximity to the coast, but continued costs and hazards of ongoing erosion have prompted reconsideration of State and local positions on coastal management. Prior community plans rejected the concept of "planned retreat," and State policy did not accommodate financing of mitigation efforts other than engineering/construction solutions. While a sea wall at Old Bar had been demonstrated to be feasible from a physical perspective, deployment may result in the loss of the beach and associated community character. The Balmoral Group conducted a cost-benefit study to address the direct, indirect, and non-market costs, as well as community, recreational and environmental benefits of the coastal management options under consideration. Scenarios included two hazard (or risk) lines, both of which reflected sea level rise. The analysis found that for Old Bar the most cost effective option is Planned Retreat with Easements. This adaptive approach to shoreline recession yields approximately $35 million in net benefits over a 20-year horizon in contrast to a seawall (-$9 million) and the Base Case (-$70 million). The report suggested that new ways to finance solutions to coastal erosion are needed, rather than focusing solely on engineering works. The landmark study prompted the Greater Taree Council to reconsider its Coastal Zone Management Plan, and the Office of Environment and Heritage to reject funding of the sea wall. The Office subsequently has undertaken reforms to deal with financing solutions for Councils. In negotiations with the Office, the Council noted strategies that could assist landowners to leave their properties, including the waiving of stamp duty tax for the purchase of a new property and the waiving of property taxes. In announcing the change in direction, the Minister for the Environment noted that "It is important for local government to have options that work with, rather than against, the natural coastal processes and hazards at play along the NSW coastline." The NSW Government intends to review its coastal management legislation, and will include consideration of financing of adaptation to coastal risks.

Economic Analysis of Nature Based Climate Change Adaptation - Gretchen Greene, ENVIRON International, Ridgefield, WA (co-authors: G. Reub, F. Kristanovich, B. Battalio, S. Newkirk, L. Verdonne, E. Vanderhoek)

The Nature Conservancy (TNC) has a long history of working with coastal communities in Ventura County and has developed a decision-support network, Coastal Resilience, which provides tools and information to better inform stakeholders on climate change and disaster risk reduction, while emphasizing the important role of ecosystems in this process. This approach has been adopted in a variety of geographies. This study is part of TNC's Coastal Resilience Ventura (CRV) project (http://coastalresilience.org/project-areas/ventura-county-introduction). The work builds on the prior forecasting and mapping of climate change-induced hazards that have been developed through this cooperative effort. Currently, proposed responses to climate change-induced sea level rise (SLR) are often focused on defensive engineering or 'coastal armoring approaches' such as building dams, levees and channels to control flooding, and building or reinforcing seawalls to protect from SLR. Such engineered responses may be necessary in some instances, but they will not be sufficient to address the full scope of climate change impacts and can cause their own adverse impacts to natural systems. Working with input from local stakeholders, two alternative adaptation scenarios for the coast of Ventura County, California were developed. This paper will explore the appropriate economic analysis involving the quantification of all benefits and all costs of the climate change adaptation decision. The effort will first cover the Net Ecosystem Services Analysis, or NESA approach that is used to combine financial metrics with environmental metrics for decision making. Then, a dashboard will be developed that can help decision makers explore the outcome of their choices by varying the discount rate used in the analysis, the flood frequency, and the value of an acre of saltwater wetland. This research shows an effective way to make climate change adaptation decisions by blending environmental gains and losses with traditional monetary metrics in a theoretically consistent manner. The results should also suggest that nature-based approaches to climate change adaptation can provide benefits in terms of damages reduced that are comparable to coastal armoring approaches. Conclusions will address the benefits and costs for the coastal armoring approach, the benefits and costs for the nature based approach, and how the value of saltwater wetlands may play into the question of which approach is preferred. This research is intended to inform municipal decision makers about climate change adaptation choices. To this end, the research product has been structured to allow local decision makers to explore which alternatives perform the best across a variety of assumptions. This dashboard approach will evaluated for how applicable the approach is to stakeholders. The analysis will also include estimates for wave damages (which has not been extensively studied before in economic terms), although it does not include other storms at different frequencies and so may be considered a low estimate of damages and a low estimate of the benefits from adaptation.

Drought Management under a Changing Climate: Using Cost-Benefit Analyses to Assist Drinking Water Utilities - Richard Krop, The Cadmus Group, Inc., Santa Monica, CA (co-authors: J. Blue, N. Hiremath)

In support of the National Oceanic and Atmospheric Administration's Sectoral Applications Research Program (SARP) and in partnership with the Water Research Foundation and the University of Nebraska-Lincoln's National Drought Mitigation Center, Cadmus is currently

working with drinking water utilities to help identify and prioritize best management practices for drought mitigation in response to climate change. We examined the value and feasibility of utilities using cost-benefit analysis (CBA) to assess potential drought management alternatives. We identified potential effects of drought on drinking water utility infrastructure and operations, and the associated costs incurred by utilities and their customers, the environment, and society as a whole. We also identified leading practices in drought management planning from utilities working to ensure that they can provide clean and safe drinking water as the frequency and severity of droughts increases under climate change. These practices may involve augmenting supply, including: hauling water, purchasing water or acquiring new water rights or transfers, new reservoirs or other storage infrastructure, digging new or deeper wells, lowering intakes, or interconnections with other utilities. A variety of leading drought management practices, some of which are long-term, also involve demand management. These practices include: public outreach, temporary conservation/restrictions, retrofitting programs, xeriscaping incentives, metering, and reuse/recycling programs. The team convened a workshop in December, 2014 in Denver, CO to develop case studies of utilities' diverse experiences with drought management and their associated costs. Using information gathered at and after the workshop, we provide examples of utility data that are useful for illustrating how CBA can be used to select appropriate drought mitigation practices.

Economic Assessment Tools for Infrastructure Resilience Projects - Federal Transit Administration - Hazard Mitigation Cost Effectiveness (HMCE) and Tool Flood Recurrence Interval Calculator for Benefit-Cost Analysis - John Squerciati, Dewberry, Fairfax, VA (co-authors: K. Zomorodi, A. Schildge)

Hurricane Sandy struck the northeast coast in late October 2012, seriously damaging public transportation networks and exposing the vulnerability of critical transit infrastructure to major storms and flooding in this area. As part of the Disaster Relief Appropriations Act of 2013, the Federal Transit Administration (FTA) was authorized to issue grants to reduce the risk of damage to public transportation from future disasters in the affected areas. In 2014, the FTA conducted a competitive discretionary funding program which awarded funds to a number of projects aimed at increasing the resilience of public transit systems. A central component in FTA's award program was an economic evaluation of the cost-effectiveness of all proposed projects. To help determine the optimal allocation of grant resources, the FTA worked with Dewberry Consultants LLC (Dewberry) to develop a Hazard Mitigation Cost Effectiveness (HMCE) tool to assess the cost-effectiveness of proposed resilience projects against future storm impacts. Applicants were required to use the HMCE tool; which is a versatile benefit-cost analysis tool that was specifically developed for transit resilience projects. The HMCE tool was initially developed in coordination with the Federal Emergency Management Agency (FEMA) following discussions of the tools and approaches that FEMA uses for benefit-cost analysis (BCA) of hazard mitigation projects for buildings and other infrastructure; such as the Damage-Frequency Assessment (DFA) module. The HMCE tool has a user-friendly spreadsheet structure that allows users to submit quantitative information about the project and its benefit-cost ratio, including the estimated damages and losses from specifically identified hazards (recorded historical and/or expected theoretical events) and the reduction in the anticipated losses as a

result of the proposed project. Various modes of transportation including subway/inner city rail, light/commuter train, intercity passenger rail, bus, and ferry may be considered in the tool. In addition to the HMCE tool, an auxiliary tool called the Coastal Flooding Recurrence Interval (RI) calculator was quickly developed to aid with accurate HMCE evaluations. This tool allows estimating a consistent set of RIs for recorded costal flood elevations and accounts for the impact of Sea Level Rise (SLR). The impact of SLR was modeled in this tool based on suggestions FEMA issued in a Memorandum in late 2013. The Dewberry team received grant applications and supporting documentation for 61 projects that included 78 analyses that we reviewed and evaluated using the HMCE tool, and provided recommendations to FTA regarding the correct use of the tool and the sufficiency of supporting analysis documentation. This presentation explains the development and application of the FTA HMCE tool and accompanying Coastal Flooding RI calculator, and how these tools can be used to promote sound investment of grant funds toward transit resilience projects to protect against future natural disasters.