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**Wednesday, Nov. 11**  
**8:30 AM – 10:00 AM**  
**SESSION 40: Planning I**

**Assessing Vulnerability to Natural Hazards: An Impact-Based Method and Application to Drought in Washington State - Matthew Fontaine**, Herrera Environmental Consultants, Inc, Seattle, WA (co-author: Anne C. Steinemann)

Recent drought has had severe impacts throughout Washington State. These impacts are expected to increase as demands increase for limited and uncertain water supplies. In the wake of the state-declared 2005 drought, we conducted a comprehensive study of drought and water shortages in Washington State. In this study we analyzed impacts of recent droughts by conducting interviews with more than 60 representatives of five different sectors of the state: agriculture, municipal water supply, environment, power, and recreation. To analyze the results of this study we developed a technique for assessing vulnerability using measures of exposure, sensitivity, and adaptive capacity. Historically, vulnerability assessments have focused on analyzing the hazard itself, absent information on its causes and mitigations. The Vulnerability Assessment Method (VAM) we developed uses data and heuristics acquired from affected stakeholders to assess not only the hazard, but also the causes of vulnerability, potential for adaptation, previous impacts, and ways to mitigate future impacts. We apply the VAM when assessing drought vulnerability across 34 sectors in Washington State. Interviews were focused on representatives who had known difficulties with water shortages and droughts, and included a range of questions, such as how droughts have affected water users in the past, what lessons they have learned in dealing with droughts, and what information and resources could improve their ability to adapt in the future. Results indicate highest vulnerability for dryland farmers, farmers with junior water rights, select fisheries, ski area operators, and the green industry. Through validation exercises, we demonstrate the VAM's internal consistency and broader applicability. Contributions of the VAM include its incorporation of stakeholder data, quantitative assessments of underlying vulnerability components, and applicability to other areas and types of hazards such as effects of climate change. This presentation will cover the VAM methods and results, as well as the information reported by interviewees, such as lessons learned from dealing with past droughts, strategies for dealing with future droughts, indicators used to monitor drought, and information and resources that could increase adaptive capacity.

**New Approaches for Allocating Costs and Capacities in Regional Infrastructure Projects - N. Jordan Dimick**, CDM, Denver, CO (co-author: John Rehring)

Aging infrastructure, increasing demands, and uncertainty in water supply reliability have created a need for new infrastructure and major capital improvements for water providers. Many utilities are collaborating on regional infrastructure projects to increase cost efficiencies, improve reliability, and facilitate implementation. By negotiating and working collaboratively with other water providers, cost savings can often be achieved while bringing together the critical mass required for regional project sustainability. However, providers may have conflicting interests and differing objectives. Infrastructure capacity and cost allocation models can be used to size infrastructure, analyze alternatives, and allocate project capacities and costs (capital and operations and maintenance) to help partnering utilities in the negotiation and creation of a governance structure. In this presentation, the application of these models will be discussed with two case studies—the South Metro Water Supply Authority's regional renewable supply project and the Oklahoma City regional water supply study. In each case, a single Excel planning model was developed for all of the project participants, which analyzed available daily capacities in existing infrastructure and modified future infrastructure design capacities based on individual members' feedback. The planning model was built upon a capital and operations and maintenance cost estimating spreadsheet, which analyzed project capacities based on the cumulative individual participants' allocated

project capacities. During several participant workshops individual entities were able to review projected allocated project costs while refining their design capacities based on their individual deliveries requirements. By having a unified planning model, which instantaneously adjusts participant costs based on changes in project capacities, individual participants can protect their needs while working in a collaborative manner to achieve large scale regional projects.

**Using Multiple Research Methods to Assess Conflict and Common Ground in Storm And Wastewater Management in the Lower Kaskaskia River Basin - Mae Davenport**, Department of Forestry, Southern Illinois University Carbondale, Carbondale, IL (co-authors: Erin Seekamp, Christopher Slemp, Joan Brehm)

Storm and wastewater management along the urban-rural interface poses serious challenges to communities, especially those facing increasing urbanization pressures with aging water management infrastructure. Inspiring community-level commitment to watershed planning requires both a baseline understanding of community members' beliefs associated with water resources and the development of a forum for open dialogue between stakeholders. A participatory research approach was adopted to better understand community perspectives on water resources in urban, village, and agricultural watersheds of the lower Kaskaskia River basin. The study was designed to assess (1) common ground and conflict in perceptions of watershed health and (2) shared and contrasting visions for future watershed conservation initiatives. This information will serve as a starting point for increasing community awareness of water management problems, facilitating more effective communication about water resource conservation practices, and ultimately, strengthening community commitment to sustainable watershed management. This paper reports specifically on attitudes and beliefs associated with storm and wastewater management issues in southwestern Illinois. Social data were gathered through key informant interviews and focus groups with community planners and managers, water resource professionals, and concerned citizens. The qualitative data were supplemented with quantitative data collected in a resident survey. To ensure community participation and project transparency, we recruited local stakeholders to join a community research team (CRT). The CRT is provided progress reports, assists in the development of a residential survey instrument, and serves as a liaison in community outreach programs. To date, the CRT has 65 members. Preliminary study findings indicate that growth and stormwater management are common concerns of stakeholders' regardless of watershed type. Representatives from urban, village and agricultural watershed identified stream pollution, flooding and loss of forested habitat as problems. However, stakeholders varied in their beliefs about the sources of these problems or how to address them. Lack of funding, limited citizen awareness, and the clash between economic development and community preservation values were identified as constraints to watershed management initiatives. Recommendations for inspiring community commitment to sustainable watershed management will be presented.

**Real-Time Conjunctive Water Administration in Large Interconnected Arid River Basins. - John Koreny**, HDR, Seattle, WA (co-authors: Steve Thurin, Emily Larson)

Water development in the U.S. went through three phases. Phase I: Diversion of natural river flow in the late 1800s to the 1920s. Phase II: Conflict between water users, litigation and court decrees and Federal support for the construction of storage reservoirs to the 1950s. Phase III: Large-scale ground water development, increased irrigation efficiency and the demand for instream flow. The effect of ground water allocations on surface water was not evaluated during Phase II. Now water users and administrators are evaluating how junior-priority ground water pumping depletions will be administered during shortages in basins traditionally managed by surface water accounting practices and rules. This is an issue for natural river flow and reservoir storage, since ground water depletions can impact both. Determining injury and providing effective administration during shortages is challenging. Information, predictive tools, administrative techniques and mitigation strategies need to be developed and tested before a shortage occurs. Effective mitigation requires regulation, technical knowledge, an open and transparent procedure and a strong water market. Mitigation solutions will develop when the real value of water is established. Climate change, the need to maintain instream flow and an increasing demand for water will only increase pressure for effective administration. This is a pressing issue and in many arid river basins. One example is in Southeastern Idaho, where delivery calls have been made by senior-priority irrigation

surface water users and the Bureau of Reclamation and spring flow users against junior-priority ground water users. The ESPA extends over about 20,000 square miles in Southeastern Idaho and forms the upper part of the Snake River Basin. About 50,000 ground water rights were allocated for wells pumping ground water over 1.6 million acres which are junior in priority to surface water rights. Total irrigation from ground water and surface water sources is about 2.4 million acres. The seniors seek mitigation or curtailment of hydrologically-connected junior-priority ground water users. This presentation will summarize the methods used to evaluate injury, the process being used to address the water delivery calls and the issues surrounding real-time administration of ground water and surface water supplies.