American Water Resources Association
2009 SUMMER SPECIALTY CONFERENCE
Adaptive Management of Water Resources II
June 29 – July 1, 2009
Snowbird, UT

Monday, June 29
3:30 PM – 5:00 PM
Session 10: Market-based Approaches Using Adaptive Management

1. Going With the Flow: Using a Water Quality Model to Operationalize Water Quality Trading - Arthur Caplan, Utah State University, Logan, Ut (co-authors: Bethany T. Nielson, Matthew Baker)

This paper accomplishes three objectives. First, a novel water-quality modeling approach is used to estimate (i) nonpoint source (NPS) loadings at the field level (rather than at the watershed or sub-watershed levels), and (ii) delivery ratios at the sub-watershed level (rather than being arbitrarily chosen). Second, our study area includes two receptor points (rather than the typical case of a single receptor point), therefore enabling us to demonstrate how multiple receptor points can be incorporated into a water quality trading (WQT) framework. Third, we develop a basin profile that can be used by regulators to identify specific trades, whether point-to-point, point-to-nonpoint, or nonpoint-to-nonpoint. The profile is operational, in the sense that it is easily updatable and can be generalized to any watershed. We demonstrate how the profile can be used to assess potential trading opportunities.

2. Virginia's State-wide Nitrogen and Phosphorus Credit Trading Program – A Discussion of History, Market Structure, and Trading Policies - Cody Stanger, CH2M HILL, Salt Lake City, UT (co-authors: Mark Haley, Glenn Harvey, Chris Pomeroy, Lisa Bacon)

Virginia has embarked upon an ambitious program to reduce water quality impairments in the Chesapeake Bay and its major tributaries by 2010. Point source dischargers have received individual mass-based wasteload allocations (WLAs) to be implemented through a Clean Water Act watershed general NPDES permit for nitrogen and phosphorus discharges. In the absence of nutrient trading, most of the state's 127 significant wastewater treatment facilities, both municipal and industrial, would be required to meet their wasteload allocations independently through treatment plant upgrades or other process improvements. The resulting demand for designers, construction contractors, skilled labor, and materials could significantly increase the capital cost of compliance, already estimated at approximately two billion dollars. In response, a nutrient credit trading program was authorized by the Virginia General Assembly through legislation (HB 2862) passed in the spring of 2005. It allows for the formation of a voluntary credit trading organization, the Virginia Nutrient Credit Exchange Association (The Exchange), consisting of municipal POTW and industrial NPDES permit holders. With grant assistance from the state's Department of Environmental Quality, wastewater dischargers have worked collaboratively to develop and implement a large-scale trading program to improve the overall cost effectiveness of the Chesapeake Bay nutrient reduction effort, to avoid the anticipated "construction crunch" and associated cost impacts, and to accommodate continued economic growth and development within the watershed. This presentation will document the nature and extent of this market-based approach to regulatory compliance, including the Exchange's pricing methodology and policy decisions that govern credit trading. The presentation will also assess the potential state-wide economic impact of the trading program and examine the corresponding effects on Virginia's grant program for municipal dischargers.

3. Watershed Modeling for Water Quality Trading - Bethany T. Neilson, Utah State University, Logan, UT (co-authors: M.E. Baker, C. Bandaragoda, J. S. Horsburgh, D. K. Stevens)

Water quality trading has been proposed as a potential solution to assist in addressing water quality impairments in a cost effective manner. In order to determine if a trading program is feasible, key information regarding both loads (point and nonpoint) and the amount of each load reaching a location of interest (or delivery ratio) is necessary. While point source loading estimates are relatively simple to determine, nonpoint source loads and downstream delivery ratios are much more difficult. Watershed managers presented with this challenge often have limited information about stream conditions and, due

to privacy conventions, almost no information about discretionary land management activities such as fertilizer application. Thus, watershed loading models employed in decision-making result in loads lumped across each watershed and little, if any explicit spatial information, limiting their utility in developing trading gradients. We modified a well-established, semi-distributed hydrologic model linked to an instream transport model to obtain seasonal field loads and associated delivery ratios required to support a water quality trading program. Example calculations resulting in tradable loads of phosphorus in an agricultural watershed are presented to show how the information resulting from the modeling framework can be utilized to calculate delivered loads as well as the amount of pollution a field or farm owner could potentially trade. Our results show this approach to be an objective and physically-based foundation for the development of water quality trading programs that include nonpoint sources of pollution.

4. Adaptive Management and Ecosystem Services - Malka Pattison, U.S. Dept. of the Interior, Washington, DC

Adaptive management, learning through management, and adapting based on what is learned, can play a critical role in helping to better align market forces with conservation objectives. Adaptive management can be used to reduce the uncertainties that currently impede integrating ecosystem services considerations into resource decisionmaking. Despite their importance, ecosystem services, the goods and services people receive from ecosystems, are generally not fully taken into account in resource management decisions. This is partly because ecosystem services are ecologically, economically, and geographically complex, and sometimes not well-suited to markets. In addition, the spatial and temporal scales at which resource management decisions are made often differ from those at which ecosystem processes operate, resulting in institutional and governance issues. Adaptive management can be used to increase learning and reduce uncertainty in the following areas: Ecology – Despite major advances in our understanding of biophysical processes, ecosystem complexity makes modeling, and mapping them a challenge. Adaptive management can help improve our understanding of the biophysical production functions, making it possible to improve our ability to model and predict cause and effect. Geography – Using ecosystem services to inform decisionmaking will require, among other things, the generation of better maps to identify where ecosystem services are produced and the value and flow of their benefits. Adaptive management can be used to develop interdisciplinary approaches to integrate geography, ecology, and economics with other disciplines (demography, hydrology, etc.). Economics – Economics offers tools for identifying the tradeoffs of alternative management strategies, delivering different mixes of ecosystem services, and designing incentives and programs. Adaptive management can be used to evaluate and develop improved standards for valuing ecosystem services, even those for which dollar values cannot be set. Institutions – Establishing markets and other institutional structures for ecosystem services will require developing effective governance and management strategies. Adaptive management can create “learning organizations” that are better able to incorporate ecosystem services into decisionmaking.