



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2002SC4B

Title: Renovating Water for Conservation and Reuse: Developing Design Parameters for Constructed Wetlands for Domestic Wastewater Treatment and Mitigation

Project Type: Research

Focus Categories: Water Use, Waste Water, Water Quality

Keywords: Conservation, reuse, constructed wetlands, tertiary treatment, water quality

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Abstract

The Problem. Water quality and quantity in South Carolina are often coupled. As water resources dwindle with persistent drought, water quality characteristics often decline concomitantly. Mandated by the Clean Water Act (CWA - Section 303d), recent evaluations of water resources in northwestern S.C. by the S.C. Department of Health and Environmental Control have indicated that inorganic nutrients and fecal coliforms are the primary constituents of concern in terms of impairment of waters for designated uses. Other waters in the state (particularly estuarine waters in populated coastal areas) are similarly impaired to the extent that shellfishing and contact recreation have been limited or prohibited resulting in serious economic impacts. These water quality problems arise from a variety of point and nonpoint sources. Problems of this sort are numerous and easy to identify. Under the CWA, plans must be developed based on sound science and engineering to restore impaired waters through a Watershed Restoration Action Strategy. Critically needed, however, are scientifically defensible, cost-effective and sustainable solutions for these water quality problems. Constructed wetlands have been used in a number of situations as part of integrated management approaches for renovating wastewaters for conservation and reuse. This project focuses on design and use of constructed wetlands as an integral part of integrated strategies for water conservation and reuse to protect and enhance downstream water quality in a watershed setting. Methods. This project involves design, construction and monitoring of a full-scale constructed wetland for tertiary

treatment of domestic wastewater for reuse. Measurements of typical water quality parameters (TN, NH₃, NO₃, TP, Ortho-P, BOD₅, COD, TSS, fecal coliforms and E. coli) in inflow wastewater and outflow treated water from the constructed wetland will be conducted bimonthly to indicate the performance achieved using this specifically designed system. Analogous pilot-scale constructed wetlands will also be built to conduct experiments designed to provide site-independent rate coefficients (kinetics) and other essential parameters that readily permit accurate transfer of this technology to other sites and situations. Experiments will be conducted across seasons with varying wastewater strength or concentration and flows. Data will be analyzed and modeled to discern temperature-normalized rate coefficients and anticipated performance from hot to cold weather. Experimental trials will be used in conjunction with physical and chemical analyses to determine the suitability of treated outflow water for reuse for a variety of irrigation purposes.

Objectives. The objectives of this research are: 1) to design, construct and monitor the performance of a full-scale constructed wetland and analogous pilot-scale constructed wetlands for tertiary treatment of domestic wastewater for reuse; 2) to measure kinetics and performance of specifically designed constructed wetlands to remove nitrogen, phosphorus, organics, solids and fecal coliforms from secondary and primary treated wastewater; and 3) to characterize the outflow water from the constructed wetland treatment system in terms of its suitability for reuse in golf course irrigation or for plantings for shoreline erosion control, wildlife, and power line beautification and enhancement. An allied objective that will be accomplished as a result of this research will produce site independent design coefficients and parameters that will ensure successful transfer of this technology to other sites. Results will be published in peer-reviewed journals and presented at regional meetings and workshops.