FACULTY RESEARCH FUND

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Proposal Title: Feasibility situation of agricultural storm water runoff harvesting for water reuse and nutrients recovery.

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Feasibility simulation of agricultural stormwater runoff harvesting for water reuse and nutrient recovery

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Abstract

A significant amount of US freshwater withdrawal (~40%) is used for irrigation. Stormwater runoff sweeps fertilizer nutrients including nitrogen (N) and phosphorus (P) compounds from croplands and causes eutrophication and ecotoxicity impacts on water environment. Meanwhile, fertilizer production involves high energy demand for ammonia (NH_3) synthesis and consumption of limited P mineral reserves. If water and nutrients from harvested storwmater runoff can be reused on site, following benefits are expected: (1) conserving water quantity and P mineral reserves, (2) protecting water quality; and (3) saving energy for irrigation and ammonia synthesis. This study aims at simulating the feasibility of agricultural stormwater runoff harvesting for water reuse and nutrient recovery. Water reuse potential will be quantified by comparing temporal stormwater runoff generation to irrigation schedule. The runoff volume will be simulated using a hydrologic model for a few rice fields in Jonesboro, AR. Irrigation schedules investigated for the rice fields will be correlated to the runoff generation in order to optimize storage volumes and the water reuse potential. Nutrient recovery is possible through precipitating struvite ($MgNH_3PO_4$), a slow-release fertilizer, from N and P compounds contained in the runoff. Its precipitation potential will depend on the concentrations of N and P compounds fluctuating with rainfall intensity and fertilizer application schedule. Accordingly, runoff samples will be taken from the rice fields in rain events and analyzed to predict the struvite precipitation potential. Thus, the water reuse and nutrient recovery potential of agricultural stormwater runoff will be determined. In future research, the environmental and economic impacts of water pollution mitigation, energy saving from irrigation and fertilizer production, and P mineral conservation will be quantified according to the potential simulated in this study.