EARLY RESULTS FROM EVALUATION OF TWO-STAGE LAGOONS AND CONSTRUCTED WETLANDS TREATMENT OF DAIRY WASTE EFFLUENT

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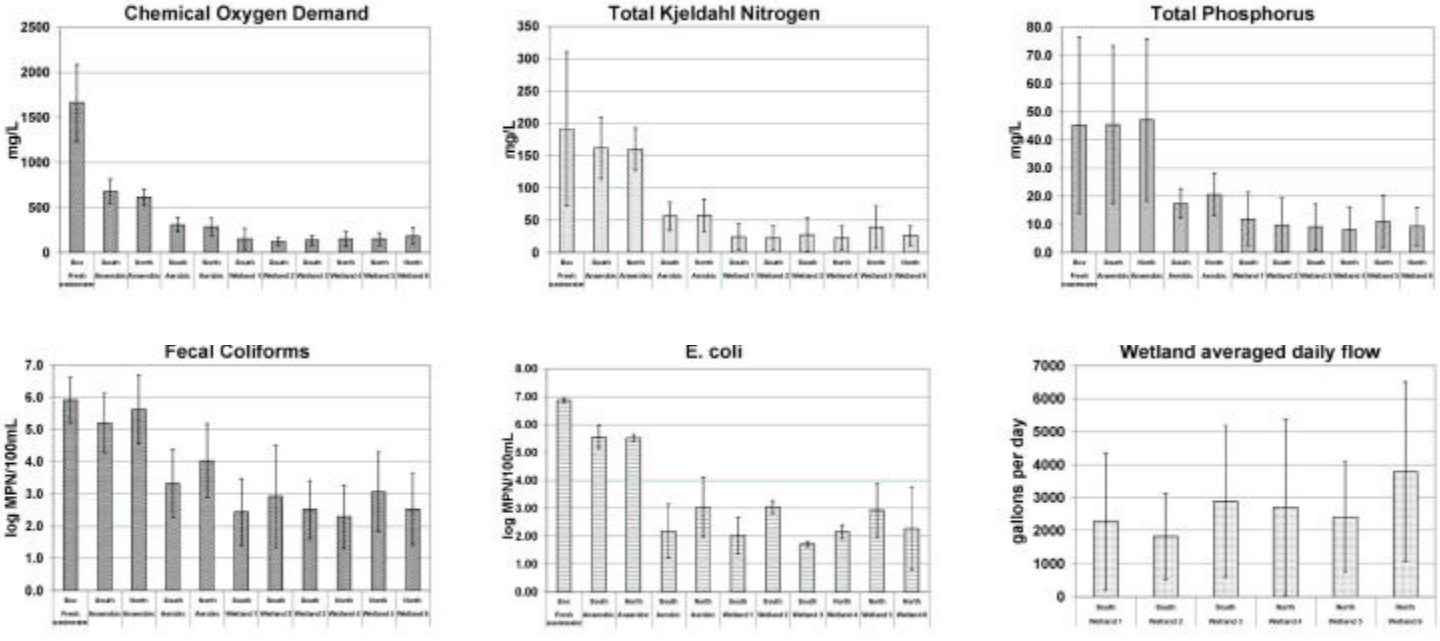
PROBLEM

The dairy industry is a vital component of the economy in the Lake Pontchartrain Basin. There are nearly 230 enterprises (120 cows/farm) currently operating in the northern-most regions of the Basin, near the border between Louisiana and Mississippi. In the recent past, dairy waste effluent has been cited as a source of nutrients and coliform contamination of the northern basin tributaries and ultimately the Lake itself. Consequently, all dairy operations have been required to install single-stage lagoon system. The single-stage treatment, while considered a BMP, does have limitations. Waste and effluent must be periodically pumped out and land applied to recycle nutrients. This practice is time-consuming and must take into consideration the current levels of N and P of the receiving acreage, season of the year application will occur, hydration of the soil prior to application, and timing of such events in order to avoid rainfall and runoff after land application.

RESEARCH DESIGN

The Dairy Wastewater Treatment Evaluation System consists of replicated two-stage lagoons and constructed wetlands. Approximately 7,000 gallons of untreated dairy waste and wash-water enters the system twice daily (am and pm). Wastewater is pumped to the distribution box and equally split between two 156 x 93 x 9 foot **anaerobic lagoons**. Wastewater flows by gravity through the system, independently for each of the replicates. The effluent enters the next treatment stage, two 232 x 134 x 6 foot **aerobic lagoons**, at each new influx of wastewater. The outflow from the aerobic lagoons is distributed among six 102 x 42 x 3 feet tertiary treatment cells (**constructed wetlands**). Wetlands 1, 3, 4 and 6 are control cells consisting of spontaneously emerging native wetland plants, comprising of filamentous algae and duckweed. Wetland 2 and 5 were each planted with 175 Pickerelweed (*Pontederia cordata*) rhizomes of similar masses (**treatment cells**). Water quality monitoring began June 1, 2005 and has been conducted bi-weekly at all sites, starting with the untreated dairy wastewater and at the terminal end of each stage of the treatment system. Samples have been analyzed for the following characteristics: total solids, fecal coliforms, E. coli (*Escherichia coli*), nitrate, total Kjeldahl nitrogen (**TKN**), NH_3-N, NH_3-N (%TKN), total phosphorus (**TP**), chlorophyll-A, chemical oxygen demand (**COD**), dissolved oxygen, pH, temperature, and average daily flow rates into each wetland.

SELECTED PRELIMINARY RESULTS AND OBSERVATIONS



The figures above show averages and standard deviations of data collected throughout 4.5 months, including late spring until late summer 2005. The recent landing of hurricane Katrina compromised the stands of Pickerelweed. Sampling was suspended for two months. Plants in both constructed wetlands seem to have been affected similarly and are expected to recover to pre-Katrina densities. Possible consequences to the project design remain uncertain. On the other hand, some preliminary trends can be gleaned from the data gathered previously. Most water quality characteristics seem to decline as wastewater moves through the treatment system. This decrease is especially noticeable between the non-treated dairy effluent and the anaerobic lagoons (COD), and between anaerobic and aerobic stage lagoon treatments (TKN, TP, fecal coliforms and E. coli). Less obvious, a decrease in the concentration of some parameters (fecal coliforms, TKN and TP) may suggest further potential for treatment with wetlands cells. Some interesting questions may arise when control and planted cells are compared. We see no clear trend suggesting that heavy biomass of Pickerelweed plants are any more effective than naturally occurring wetland plants such as duckweed and filamentous algae at improving water quality parameters. In fact, it may actually have a negative effect on fecal coliforms and E. coli, likely caused by wildlife contamination. Some of those issues will be addressed in the future if our observations are confirmed by statistical analyses.

FUTURE PLANS

The study planned for next year is designed to by-pass the aerobic lagoons. Dairy wastewater will flow directly from anaerobic lagoons into wetlands cells. This could significantly reduce costs to dairymen by avoiding the large construction needed to provide adequate aeration in aerobic lagoons compared to smaller wetland cell.