

2005 Georgia Water Resources Conference Abstract
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**Multi-Year Research on the Use of Constructed Wetlands for Advanced
Wastewater Treatment**

The use of constructed wetlands for tertiary wastewater treatment is emerging as a cost-effective wastewater treatment technology. Constructed wetlands are theoretically designed and operated so that the target constituents have ample time to interact with wetland substrates and microbiota to effect constituent removal necessary to achieve water quality discharge limits. Unfortunately, engineering natural systems is complicated and operational criteria are poorly defined. Long-term research is needed that compares design configurations as well as performance since each constructed wetland system is subjected to a variety of stochastic events (i.e. wind speed and direction, sedimentation due to pulsed rain events, plant dispersal and plant succession).

The 650-acre constructed wetland system in Augusta, Georgia was developed in three phases, beginning with a 60-acre pilot study that evaluated use of the technology for ammonia and BOD removal. The pilot study was operated from 1997 – 1999. Design changes resulting from the pilot study were incorporated into Phases 2 and 3, which were completed in 2000 and 2002 respectively. During 2003-2004, an innovative optimization study was conducted to compare performance criteria between wetland cells of different design configurations, age, planting schemes, and operational criteria such as depth and flow. The cells were monitored using multiprobe HydroLab® technology. Water quality analyses included BOD, TSS, Nitrate+Nitrite, TKN, Ammonia, Orthophosphorus and Total Phosphorus. Continuous weather data were also collected using a GroWeather® monitoring station.

The results of this research indicated that wetland cell performance was similar regardless of design, age, planting scheme, flow rates and various operational manipulations. The study suggested cell orientation to prevailing winds and duckweed cover may have impacted treatment efficiency. Nitrogen removal may also have been compromised by nitrogen import from large colonies of roosting redwing blackbirds as well as blue-green algae blooms. There is also evidence that suggests preferential flow patterns and stagnant zones within the cells may be potentially decreasing efficiency and overall removal performance. A tracer study is planned to evaluate aboveground and belowground processes that may alter the theoretical homogenous flow design of constructed wetland systems.