Arthur R. Marshall Loxahatchee National Wildlife Refuge Completely Mixed Flow Model

William Roth[1], *Ehab A. Meselhe*[1], *Michael G. Waldon*[2] and *Hongqing Wang*[1]
[1]Center for Louisiana Water Studies, Institute of Coastal Ecology and Engineering, University of Louisiana-Lafayette, Lafayette, LA, USA
[2]Arthur R. Marshall Loxahatchee National Wildlife Refuge, U.S. Fish and Wildlife Service, Boynton Beach, FL, USA

Arthur R. Marshall Loxahatchee National Wildlife Refuge exists as the only soft-water remnant (58,275 ha) of the Northern Everglades. Alterations in the water quality, quantity, and timing have resulted in myriad impacts to the Refuge. Therefore, it is paramount to develop an effective means to study the impact of the hydrodynamic and water quality changes.

This presentation cites further development of a Completely Mixed Flow (CMF) model of the Refuge. The initial approach divided the area into several compartments (cells), and modeled both a water budget and the constituent transport for the Refuge. At its inception, this model was developed as a spreadsheet (Microsoft Excel) water balance model driving the USEPA water quality model WASP. Both represent the initial step toward an effective management tool for studying various hydro/nutrient loading scenarios for the Refuge.

The compartments from the initial model have been refined to better represent a pseudo-spatial variance in the Refuge. The new cell design is based upon a cluster analysis of the water quality data collected at marsh sampling sites in the Refuge. This analysis grouped sites with similar water quality into individual clusters. Each of the station clusters now defines an area (cell) within the Refuge. The resultant model structure is compartmentalized based on these cells, and is implemented using the differential equations solver Berkeley Madonna (www.**berkeleymadonna**.com). In addition to chloride and sulfate, this version of the model incorporates phosphorus cycling as described by Walker and Kadlec in the Dynamic Model for Everglades Stormwater Treatment Areas (DMSTA).

Key messages relevant to restoration:

- Cluster analysis showing trends in water quality data provides an analytic approach to model compartment delineation.
- The Berkeley Madonna program provides a convenient user interface paired with an efficient computational engine, both of which support the development of a simple model for the Refuge.
- Simple compartmental model efficient for simulating and analyzing first-order scenarios.

Contact Information: William Roth, P.O. Box 42347, Lafayette, LA, USA 70504-2347, Phone: 337- 482-0631, Fax: 337- 482-0698, Email: wbr9736@louisiana.edu