DEP Agreement No.: G0024

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Project Title: Demonstration of Water Quality Best Management Practices for Beef Cattle Ranching in the Lake Okeechobee Basin

Summary of Project Accomplishments

1) Task 1: The Project work plan is complete.

2) Task 2: Identification of cooperators is complete.

3) Task 3: Nutrient Management Assessments have been obtained from NRCS and DACS.

4) Task 4: Selecting specific sites for BMP demonstration is complete.

5) Task 5: Monitoring for the December, 2004- November, 2005 pre-BMP period is complete.

6) Task 6: The Amendments Evaluation Task is complete.

7) Task 7: BMP implementation is complete.

8) Task 9: Hydrologic Monitoring of BMP effectiveness (Sanjay Shukla):

Analyses of the pre- and post-BMP data for the Ditch Fencing and Culvert Crossing (DFCC) and Wetland Water Retention (WWR) BMPs are continuing. The following sections describe the additional analyses that were carried out during this reporting period.

(A) Additional statistical analyses to evaluate the DFCC BMP effectiveness

A weighted ANCOVA (Analysis of Covariance) model was developed using Proc GLIMMIX in SAS v9.2 (SAS Institute, Cary, NC) to compare month-wise Total Phosphorus (TP) and Total Nitrogen (TN) loadings for the pre-and post-BMP periods. The daily loadings at flume 3 (downstream from the DFCC BMP site) were modeled as a function of the year and month and of the continuous covariate, total daily loadings at flumes 1 and 2 combined (upstream from the DFCC BMP site). For comparing the effect of the BMP, pairwise contrasts of the months in 2005 versus the same months in each of the subsequent years were carried out. This additional statistical analysis will be incorporated into the manuscript that has been written on the DFCC BMP evaluation.

(B) Estimation of groundwater Phosphorus (P) and Nitrogen (N) loadings to the DFCC BMP site

To determine the loadings of N and P at the DFCC BMP site (170 m long ditch), a mass balance was performed for the loadings between the upstream and downstream regions of the BMP site. To determine the accurate N and P loadings generated at the BMP site, the groundwater contributions of N and P should be taken into account. To estimate the groundwater contributions of N and P, groundwater flow to the BMP site and the concentrations of N and P in the groundwater is needed. To estimate the groundwater flow contribution, water table depths monitored at six wells installed in a transect vertical to the ditch at the BMP site were used in the Dupuit equation (Figure 1). TN and TP loads were calculated based on groundwater flow and nutrient concentrations for water samples collected from the wells. Average DON (Dissolved Organic Nitrogen), TN and TP loads for the wet periods (June-October) for the entire
monitoring period (one pre-BMP and three post-BMP years) were 3.05, 4.75, and 0.44 kg, respectively. The groundwater contributions of N and P will be incorporated in the DFCC BMP evaluation manuscript and the final report.

Fig. 1. The ditch section at the DFCC BMP site with the transect wells and four additional wells used to estimate the groundwater N and P loadings. All distances are in meters.

A manuscript on the estimation and analyses of the groundwater contribution of N and P to the BMP site for three years (2006-2008) is under preparation for its submission to a refereed journal. This will be submitted to a refereed journal as a technical report.

(C) Comparison of Acoustic Doppler Velocimeter (ADV) and flume flow

The BMP study involves the estimation of nutrient loadings which are calculated using both the flow volume and the nutrient concentrations. To check the accuracy of the flow measured by the flumes, the flow rates measured by the Acoustic Doppler Velocimeter (ADV) and the flume were compared for the wetland site 4. A storm (Tropical storm Fay) period was selected to compare the flow rates measured by the ADV and the flume (Figure 2). There was a good agreement between the Flume and ADV flow rates ($R^2 = 0.97$).

Fig. 2. Flow rates measured by the Acoustic Doppler Velocimeter and the flume at wetland 4.
(D) Use of LIDAR elevations data for delineation of the sub-watersheds within Pelaez Ranch.

To accurately evaluate the water quality BMP effectiveness, the contributing drainage areas (sub-watersheds) within the entire study site should be correctly delineated. Efforts are underway to use the LIDAR elevation data to better identify the sub-watershed boundaries within the entire ranch site.

9) Task 10: Hydrologic Model Evaluation (Sanjay Shukla):

The Hydrologic Model Evaluation using ACRU 2000 is complete.

The WAM model is being updated by incorporating additional monitoring data. Incorporation of the LIDAR elevation data to the model is underway. Configuring the model and compiling it with new spatial data involve several steps which include generation of GIS coverages (grid files and raster files).

WAM was developed by a private engineering consulting firm, Soil and Water Engineering Technology (SWET). Since the release of WAM by SWET in 2000, several enhancements have been made to the model. The current modeling work not only involves the incorporation of additional observed data but also configuring and troubleshooting the compatibility issues of the model with additional GIS datasets. The next report will include WAM evaluation results.

10) Task 11: The Economic Evaluation Task is complete.

11) Task 12: BMP Education (Sanjay Shukla):

No BMP education events occurred during January 1-March 31, 2009. A rancher workshop is expected to occur before June 2009. Results of the workshop will be present in the final report.