M E M O R A N D U M

To: Frank Metzler, Tetra Tech, Inc.
Eric Bush, USACOE

From: William Walker

Subject: Report on Task 2 – Compile Data & Assess Modeling Needs
Enhancement of DMSTA to Support CERP Applications
Contract No. DACW17-02-D-0019
Task Order 0004 Water Quality Modeling for CERP Projects

Date: May 26, 2004

Task 2 Description:

> "Data to support DMSTA application to the identified projects will be compiled. This will include project engineering features and inflow hydrologic time series for at least 3 CERP alternatives (Existing (2000) Condition, Future Without Project (2050) Condition, and Future With CERP (2050) Condition). Specific modeling needs will be identified for these projects and compared with existing DMSTA capabilities and features. A brief report will be prepared summarizing the features of the demonstration projects, supporting data, and proposed DMSTA enhancements, including changes in model structure, input/output formats, and calibrations"

Under Task 1 of this effort, three CERP projects were selected for use in identifying modeling needs and demonstrating model applications:

- EAA Reservoir Project
- C-44 Reservoir/STA Project
- Taylor Creek/Nubbin Slough Reservoir/STA Project

Table 1 describes general features of each project, as extracted from the 2003 CERP Annual Report. This memo summarizes the information compiled and lists DMSTA enhancements that seem appropriate to support applications to these and other CERP projects. While the projects are in various stages of definition and development, the specific designs and inflow time series are not critical to the model enhancement effort. The projects are sufficiently defined with respect to general objectives, conceptual configurations, and data characterizing the flows to be stored and/or treated. Model development and demonstration will be based upon hypothetical design configurations that are generally representative of the project, rather than specific plans. No attempt will be made to keep pace with changes in project features or objectives as they may evolve over the next year. The projects appear to have been good choices in that they contain number of general and unique features requiring model refinements that are practical and achievable in subsequent tasks.

EAA Storage Reservoirs (Figure 1). While a variety of configurations are being explored, the demonstration will be based upon configurations and inflow time series compiled by SFWMD and its contractors to support its Basin-Specific Feasibility Studies in 2002 (Figure 1). The inflow time series are 31-year SFWMM simulations of CERP alternative D13R performed in 2002. While more recent SFWMM runs have been performed, the 2002 versions are sufficient to identify modeling needs and to demonstrate application. Generally, the reservoirs will capture lake releases and

runoff and release flows to the EAA for irrigation, to other reservoir compartments, or to the STA's for treatment and discharge to the WCA's. Relevant enhancements to DMSTA include increased flexibility for simulating networks of interconnected reservoir/STA cells and utilization of independent hydrologic simulations of water levels and water budgets, in this case supplied by the SFWMM 2x2 model.

The C44 Reservoir/STA (Figure 2). The demonstration will utilize configurations and inflow time series compiled by Camp, Dresser, and McKee to support initial design efforts (Figure 2). Purposes of this project include offline temporary storage and treatment of lake regulatory releases and runoff from local watersheds (C44, portion of C23). Model applications to this project will require increased flexibility for routing reservoir outflows to multiple destinations (e.g. to STA or back to the C44 canal), consideration of reservoir/STA connections via both surface discharge and seepage, and specification of reservoir water levels and outflows based upon an independent hydrologic model. The designs utilize a 21-year historical flow and concentration time series representing inflows to and outflow from the C44 canal.

Taylor Creek/Nubbin Slough (Figure 3). Alternative locations and designs for multiple storage/treatment facilities in this watershed are currently being explored. The demonstration will utilize existing designs for two STA's developed by SFWMD (Figure 4) with a hypothetical upstream storage reservoir. While this scenario will represent a small portion of the total basin project, it is sufficient for demonstration purposes. Relevant time series data include historical flows and concentration data for the basin outlet (S191, Figure 3), as well as simulated values from each sub-watershed derived from a basin-wide runoff and water quality model developed for SFWMD/CERP by Soil & Water Engineering & Technology, Inc..

Currently planned enhancements to DMSTA to be developed in Task 3 include:

- Calibration of the phosphorus removal submodel to data from Florida lakes and reservoirs phosphorus being compiled by SFWMD contractors. Additional data sources will include (1) phosphorus budget data for 27 Florida lakes sampled in the mid-1970's by the EPA National Eutrophication Survey and (2) 6 datasets from Florida lakes north of Lake Okeechobee compiled for SFWMD/CERP by Wetland Solutions, Inc. While a central regional database on stormwater detention ponds has not been found, data from specific facilities may be available from SFWMD and will be further investigated.

- Increased flexibility for specifying the network of treatment reservoirs and treatment cells, including:

    - specification of multiple reservoir and/or STA cells (vs. single reservoir upstream of the STA)
    - additional cells (vs. 6)
    - multiple cell outlets
    - option for specifying multiple inflow time series, each entering a different cell (vs. single inflow time series).
    - more flexible reservoir operation rules (stage/outflow relationships)
    - possible consideration of seepage interactions between reservoir and STA cells.

- Provision for specifying reservoir and/or STA cell water levels and budgets using an independent hydrologic model (such as 2x2 or other more detailed models).

- Generation of output time series for possible linkage to other models

- Possible modification of the phosphorus budget kinetics to reflect tolerance of STA rooted macrophyte vegetation to variable depths (depending upon whether sufficient data are available from operating the STA's or other sources to support this modification).

Model output variables and formats that would be useful for exploring tradeoffs between flood storage and treatment benefits.

Other model enhancements not directly related to this project and developed independently (e.g., additional calibration to full-scale STA data, additional output formats, improved documentation) will also be included in the final product.

Table 1 – Descriptions of Selected Projects in CERP 2003 Report

Comprehensive Everglades Restoration Plan

Annual Report

Pursuant to Section 373.470(7), Florida Statutes

prepared by

South Florida Water Management District

Florida Department of Environmental Protection

January 2004
for the period of
October 1, 2002 through September 30, 2003

1.7.1 C-44 Basin

The recommended plan includes four components within the C-44 Basin. These components include the C-44 West Reservoir and Stormwater Treatment Area, C-44 East Stormwater Treatment Area, and Palmar Complex – Natural Storage and Water Quality Treatment Area. It should be noted that the C-44 canal flows both to the SLE through S-80 and to Lake Okeechobee through S-308. All of the features in the C-44 Basin are located within Martin County. C-23/24 Basin

The recommended plan includes six components within the C-23/24 Basin. These components include the C-23 North Reservoir, C-23 South Reservoir, C-23/24 Stormwater Treatment Area, C-23/44 Stormwater Treatment Area and Diversion Canal, Cypress Creek Complex - Natural Storage and Water Quality Treatment Area, and Allapattah Complex - Natural Storage and Water Quality Treatment Area. An operational feature of the IRL – South Plan know as the northern and southern diversions are accomplished via use of the construction features described for this basin. The C-23/44 Stormwater Treatment Area and Diversion Canal and the Allapattah – Natural Storage and Water Quality Treatment Area are located in Martin County. The balance of the C-23/24 Basin features are located in St. Lucie County.

1.8 Everglades Agricultural Area Storage Reservoirs (G - Phase 1)

This project is the first part of the of the Everglades Agricultural Area Storage Reservoir component. It includes two above ground reservoirs with a total storage capacity of approximately 240,000 acre-feet located on land associated with the Talisman Land purchase in the Everglades Agricultural Area. Conveyance capacity increases for the Miami, North New River, Bolles and Cross Canals are also included in the design of this project. The initial design for the reservoir(s) assumed 40,000 acres, divided into two, equally sized compartments with water levels fluctuating up to 6 feet above grade in each compartment. However, actual design and construction of this first phase may result in multiple reservoirs by maximizing the use of the land acquired through the Farm Bill land acquisition agreements which encompasses up to 50,000 acres.

This project is located in the Everglades Agricultural Area in western Palm Beach County on lands purchased with Department of Interior Farm Bill funds, with South Florida Water Management District funds, and on lands gained through a series of exchanges for lands being purchased with these funds. The area presently consists of land that is mostly under sugar cane cultivation. Implementation of this project will be consistent with the Farm Bill land acquisition agreements. This project will improve timing of environmental deliveries to the Water Conservation Areas by reducing damaging flood releases from the Everglades Agricultural Area to the Water Conservation Areas, reducing Lake Okeechobee regulatory releases to estuaries, meeting supplemental agricultural irrigation demands, and increasing flood protection within the Everglades Agricultural Area.

Compartment 1 of the reservoir would be used to meet Everglades Agricultural Area irrigation demands. The source of water is excess Everglades Agricultural Area runoff. Overflows to Compartment 2 could occur when Compartment 1 reaches capacity and Lake Okeechobee regulatory discharges are not occurring or impending. Compartment 2 would be used to meet environmental demands as a priority, but could supply a portion of Everglades Agricultural Area irrigation demands if environmental demands equal zero. Flows will be delivered to the Water Conservation Areas through Stormwater Treatment Areas 3 and 4. The sources of water are overflow from Compartment 1 and Lake Okeechobee regulatory releases. Compartment 2 will be operated as a dry storage reservoir and discharges made down to 18 inches below ground level.

Taylor Creek/Nubbin Slough Storage and Treatment Area Project Implementation Report (W). This *Project Implementation Report* includes an above ground reservoir with a total storage capacity of approximately 50,000 acre-feet and a stormwater treatment area with a capacity of approximately 20,000 acre-feet in the Taylor Creek/Nubbin Slough Basin. The initial design of this separable element assumed a reservoir of 5,000 acres with water levels fluctuating up to 10 feet above grade and a stormwater treatment facility of approximately 5,000 acres. The final size, depth and configuration of this separable element will be determined through more detailed planning, land suitability analysis and design.

The purpose of this separable element is to attenuate flows to Lake Okeechobee and reduce the amount of nutrients flowing to the Lake. The separable element is designed to capture, store, and treat basin runoff during periods when levels in Lake Okeechobee are high or increasing. The water quality treatment element of this separable element is consistent with the recommendations of the South Florida Ecosystem Restoration Working Group's Lake Okeechobee Issue Team and the Pollution Load Reduction Goals for Lake Okeechobee developed for the Lake Okeechobee Surface Water Improvement and Management Plan (SFWMD, 1997f). The water held in the reservoir would be released to Lake Okeechobee when lake levels decline to ecologically acceptable levels.

Figure 1 – Integration of EAA Storage Reservoir Project with STA's

Basin-Specific Feasibility Studies
Everglades Protection Area Tributary Basins

Evaluation of Alternatives for the ECP Basins

Submitted to

South Florida Water Management District

October 23, 2002
Contract No. C-E023
Project No. 29042

Burns & McDonnell

In Association With

NOVA CONSULTING, INC.

6. INTEGRATED TREATMENT AREAS

This Part 6 presents the results of an evaluation of a more global alternative in which STA-2, STA-3/4, STA-5 and STA-6, as well as the EAA Reservoirs are treated as an integrated whole. The purpose in development of this Integrated Alternative is to assess the extent to which adjustment of the EAA Storage Reservoirs Project as modeled in the SFWMM 2050wPROJ simulation used for the Basin-Specific Feasibility Studies might effectively contribute to an ability to meet the long-term water quality improvement goals of the Everglades Forever Act, while not sacrificing the hydrologic function of the EAA Reservoirs.

> The Integrated Alternative presented in this Part 6 cannot be considered as an optimized solution. The interrelationships of the various stormwater treatment areas and the potential EAA Storage Reservoirs are highly complex. A wide variety of alternatives could, and should, be postulated and considered in detail. Time and budget restraints inherent in the scope of Contract C-E023 permitted the development of but one of the many possible adjustments which could be made to the 2050wPROJ simulation in the interest of water quality improvement, while maintaining the hydrologic function of the Reservoir(s).

South Florida Water Management District
Contract C-E023 Basin-Specific Feasibility Studies
ECP Basins

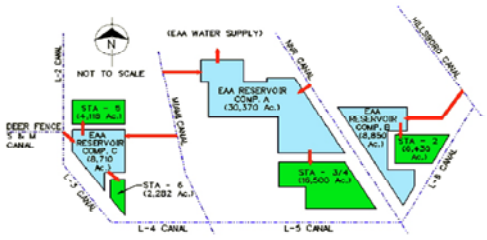


Figure 6.1 General Schematic, Integrated Alternative

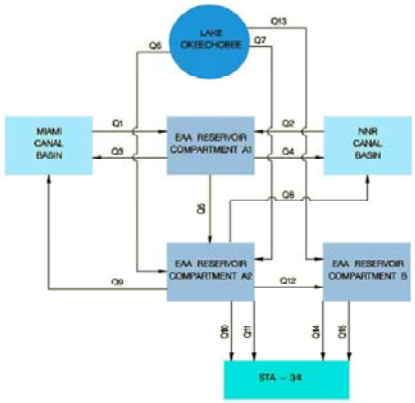


Figure 6.2 EAA Reservoirs Flow Schematic Vicinity STA-3/4

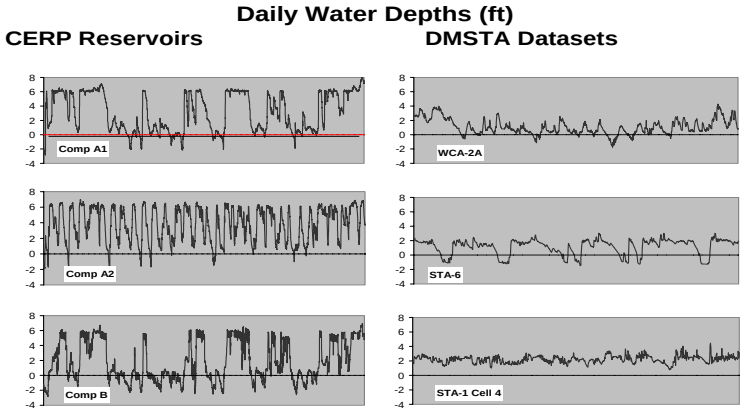
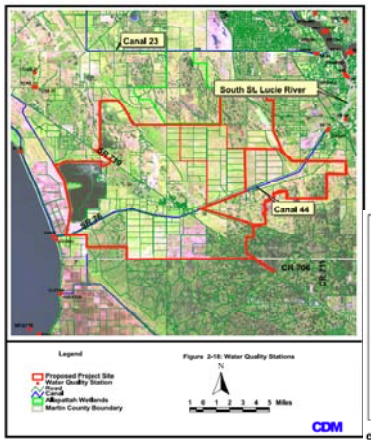
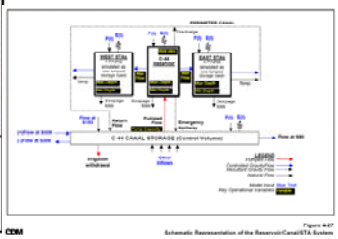
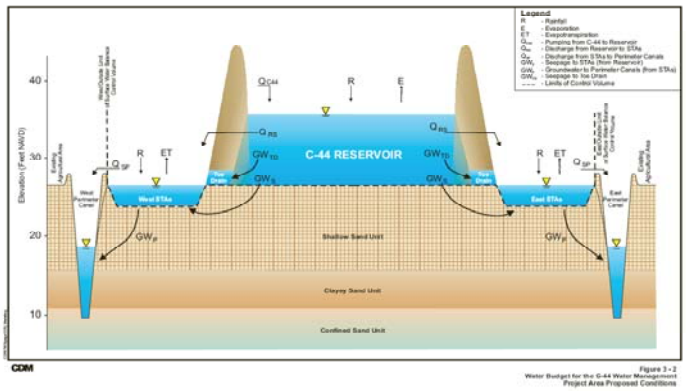


Figure 2 - C44 Reservoir/STA Project







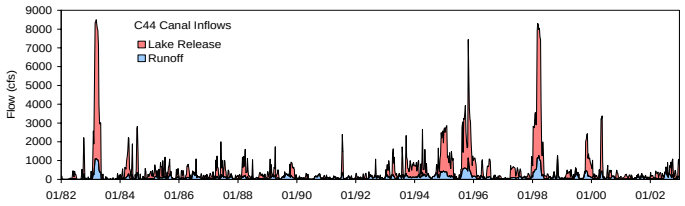
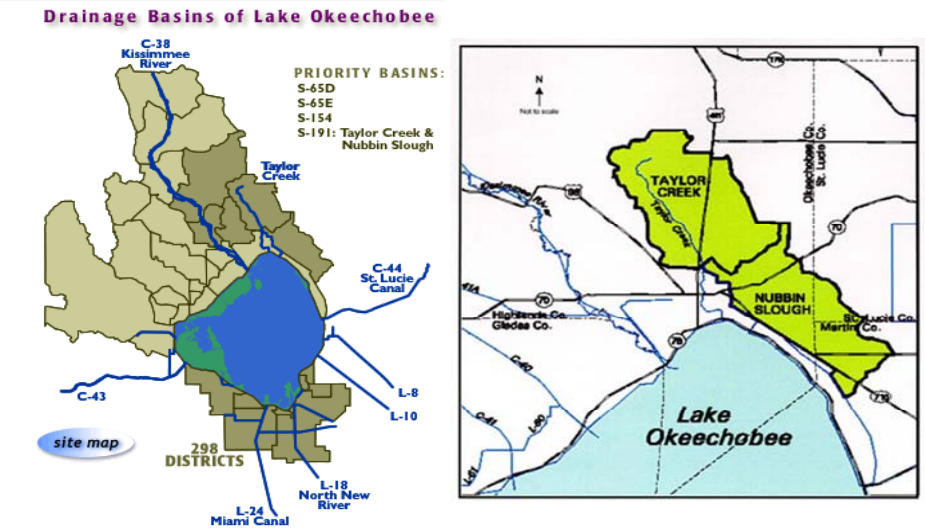
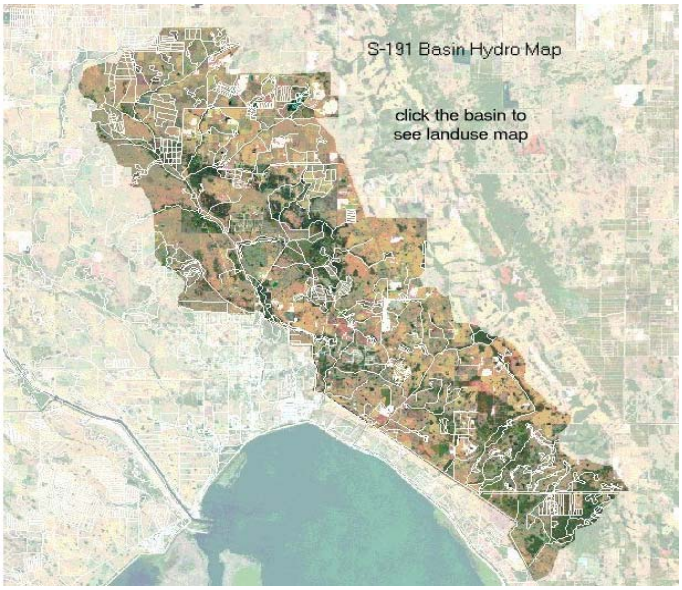


Figure 3 – Taylor Creek / Nubbin Slough Project





Basin Outflow Time Series (S191) SFWMD DBHYDRO

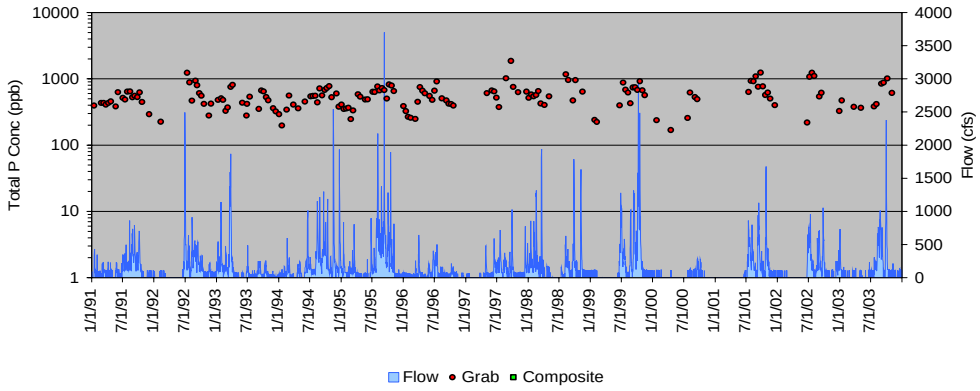
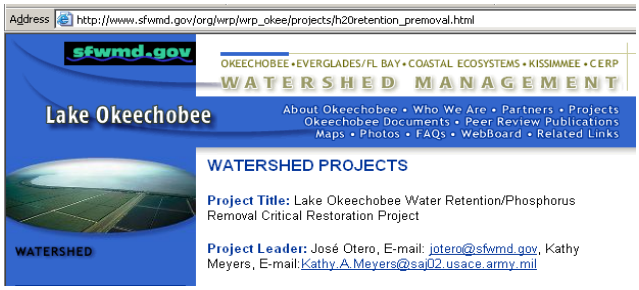


Figure 4 – Taylor Creek / Nubbin Slough STA's



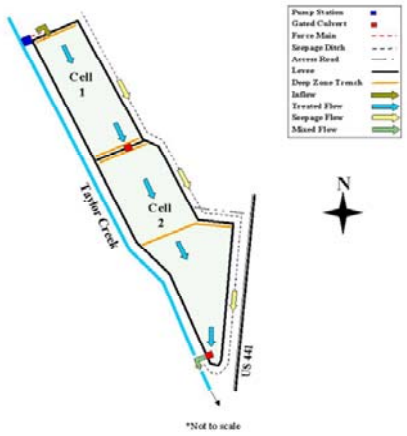
Purpose:

The purpose of this project is to store water runoff and reduce phosphorus on various parcels in the project's basins. Two approaches are used: construction of Stormwater Treatment Areas (STAs) on publicly held lands and restoration of isolated wetlands or construction of retention ponds on private lands.

Goals:

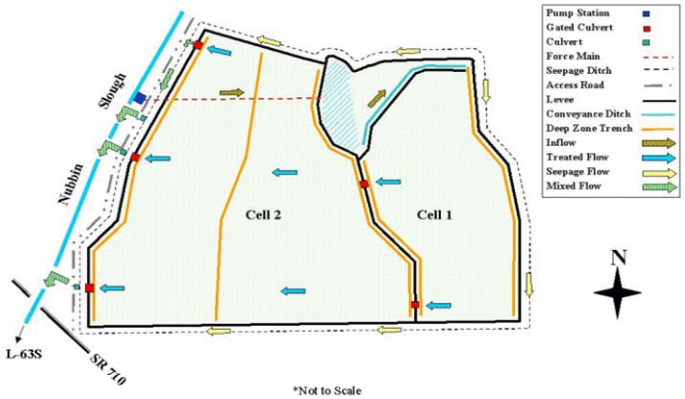
- Provide flow attenuation and reduce phosphorus discharge
- Use public lands for large-scale storage and treatment of water
- Restore isolated wetlands on private lands
- Provide storage for up to the first inch of runoff on private lands

Taylor Creek
STA Structures & Flow*



Construction of a 190-acre STA for Taylor Creek is planned in a publicly held portion of the Grassy Island Ranch, east of Taylor Creek. The purpose is to divert and treat about 10% of the water flow from Taylor Creek. This would be accomplished by allowing the water to flow parallel to the creek for about 1.6 miles, before returning to the creek. The goal for water quality improvement is to reduce phosphorus to the maximum extent possible, given the limited area of the STA relative to the amount of water in Taylor Creek. The project is in the final stages of plans and specifications for both STAs (see Taylor Creek diagram).

Nubbin Slough STA Structures & Flow*



Construction of a 780-acre STA for Nubbin Slough is planned in the former New Palm/Newcomer Dairy. The purpose of this STA is to divert and treat the majority of runoff from Nubbin Slough. This would be accomplished by delivering water from the slough to the east end of the STA. The water would then flow through the treatment wetland and discharge back to the slough. Currently, the phosphorus concentration in the slough is approximately 500 parts per billion (ppb). The STA is expected to reduce the concentration to below the 40-ppb target for Lake Okeechobee (see Nubbin Slough diagram).

A 4,700-acre water management facility is planned on the west side of Taylor Creek to store and treat the majority of the water in the creek. This is part of a separate effort called the Comprehensive Everglades Restoration Plan (CERP).