

Water Resource Planning and Engineering for the Lake Okeechobee Watershed Project

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An aerial view of the Lake Okeechobee Watershed shoreline with Lake Okeechobee in the background.

HDR has been providing comprehensive water resources engineering and planning services in support of the Lake Okeechobee Watershed (LOW) project for the U.S. Army Corps of Engineers Jacksonville District and the South Florida Water Management District since 2001.

The primary objectives of this study have been to identify cost-effective water management and water quality improvement solutions that will contribute towards holistic restoration of the Lake Okeechobee and the Greater Everglades Ecosystems in Florida.

As part of the Comprehensive Everglades Restoration Plan (CERP), one of the largest and most expensive ecosystem restoration efforts in the world, solutions such as the LOW project will provide for increased water storage, significant land and habitat restoration, and balanced approaches to improved hydraulic connectivity to downstream areas of South Florida.

Lake Okeechobee is a vital component of the Greater Everglades Ecosystem. It is the largest body of freshwater in the Southeastern United States, with a surface area of approximately 730 square miles and an average depth of 8.6 feet. It serves as a critical link between the lakes and rivers that

flow from the north, the St. Lucie and Caloosahatchee estuaries to the east and west and the Everglades wetlands and bays to the south. Lake management impacts water supply, flood protection and the health of natural systems throughout South Florida.

The Lake provides a number of benefits to society and nature, including water supply for agriculture, urban areas and the environment; flood protection; a multimillion-dollar sports and commercial fishing industry; and habitat for South Florida's phenomenal array of wildlife, including wading birds, migratory waterfowl and numerous threatened and endangered species such as the Everglades Snail Kite.

The natural resources of Lake Okeechobee have been adversely impacted by the frequency and duration

of extreme high and low lake stages and inflow of nutrient-rich (primarily phosphorus) stormwater runoff from its watershed. The LOW project will contribute towards the holistic restoration of Lake Okeechobee, the St. Lucie and Caloosahatchee Estuaries and the Northern Everglades Ecosystems by improving the timing and frequency of lake stages (through capture and storage of stormwater runoff in the watershed) and treatment of stormwater runoff (nutrient load reduction) prior to discharge into the lake. Storage of water in the watershed will also prevent permanent loss of precious freshwater resources to tide.

The LOW project consists of four distinct components. It was the first of the 68 projects to be funded under CERP, which is aimed at restoring, protecting and preserving the Greater Everglades Ecosystem in Florida. The plans presented in CERP for the four LOW project components were conceptual and needed advanced engineering and planning before they could be considered for full implementation.

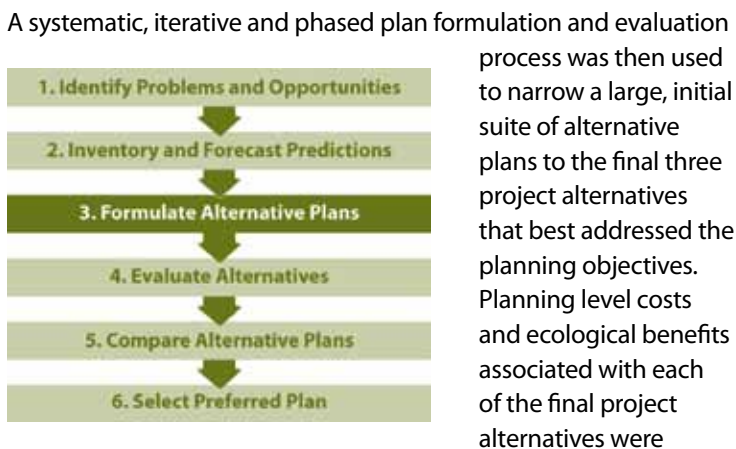
HDR's team of water resources planners, engineers and scientists, led by project manager Anwar Khan, has assisted an interagency Project Delivery Team (PDT) in conducting a comprehensive technical evaluation of alternative plans. These

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plans are designed to meet the authorized project purposes in a cost-effective manner while achieving and maintaining overarching CERP objectives, such as flood control and water supply.

The 1,800-square-mile (1.2 million acres) LOW project study area is a subset of the much larger LOW. To facilitate planning, the study area was divided into five planning areas based on hydrologic boundaries.

Consistent with the USACE six-step planning guidance, the planning process was initiated by identifying problems and opportunities and characterizing existing and future without project conditions in the study area.



compared to each other, as well as the no action alternative, using predetermined local and regional performance measures. The best performing plan was identified as the Tentatively Selected Plan (TSP).

The TSP includes three above-ground reservoirs that will collectively provide:

- A total storage capacity of approximately 272,823 acre-feet
- Two stormwater treatment areas which, along with the reservoirs, will collectively provide annual average phosphorus load reduction of approximately 74.3 metric tons
- A 3,730-acre isolated wetland restoration project

The total initial cost for the TSP has been estimated at approximately \$2 billion (2008 estimates). The TSP project features have a cumulative footprint of approximately 33,430 acres. Upon implementation, the TSP is projected to contribute a total of 87,073 annual average habitat units to the Greater Everglades Ecosystem. Project benefits are expected to be realized over the 50-year CERP planning horizon (through 2050).

A variety of innovative modeling tools were developed, tested and utilized during this project to assist in the formulation and evaluation of alternative plans that would meet the project objectives in a cost-effective manner. Many of the tools were specifically developed in response to project needs, as off-the shelf tools were either not available or deemed to be inadequate.

Project-specific, customized modeling tools developed for the LOW project included the Land Suitability Model (LSM), the Lake Okeechobee Watershed Project Combinatorial Analyses Program (LOWCAP), the Reservoir Optimization Model (RESOPT), the Ecologic Value Model (EVM) and the OASIS Simulation of the LOW (O-SLOW).

In several cases, use of the customized modeling tools resulted in significant time and cost savings for the project sponsors. For example, to help select potential sites for project features, the project team developed a Geographic Information System (GIS)-based application called the Land Suitability Model (LSM).

This spatial data tool incorporates multiple land characteristics (siting constraints) as discrete data layers and allows quick visual determination of land areas with the fewest siting constraints. The tool made it possible for regulatory agency staff and stakeholders to actively collaborate in the site selection process in a workshop environment.

Use of this automated application saved both time and money and promoted stakeholder buy-in. An unintended yet beneficial outcome of using this tool is that results can easily be duplicated to make it easier to validate the siting decision. The LSM was well received not only by project sponsors, but also by other regulatory agencies. Since then, HDR planners have used similar applications to support site selection for other large-scale restoration projects.

Significant project cost and time savings also were made possible through the use of the O-SLOW model. This tool allowed the planner to simulate hydrologic performance and compute ecologic benefits associated with a range of diverse alternative plans under existing and future project conditions in a relatively short time. The only other available regional model (South Florida Water Management Model) was found to be overly complex and time consuming, and its use would have significantly impacted the project schedule.

In addition, several off-the-shelf water resources modeling tools such as the Watershed Assessment Model, the Dynamic Model for Stormwater Treatment Areas, the Criterium Decision Plus Model and the IWR-PLAN, also were used to assist in decision making.

In the next phase of the project, HDR will prepare a Project Implementation Report to seek congressional authorization of the project. National Environmental Policy Act issues and appropriate documentation such as Supplemental Environmental Impact Statements will be integrated into the PIR. ♦

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