U.S. Department of the Interior
U.S. Geological Survey

South Florida Ecosystem Program—Internal Surface-Water Flows

Introduction

The South Florida Ecosystem Restoration Program is an intergovernmental effort to reestablish and maintain the ecosystem of south Florida. One element of the restoration effort is the development of a firm scientific basis for resource decision making. The U.S. Geological Survey (USGS) provides scientific information as part of the South Florida Ecosystem Restoration Program. The USGS began its own project, called the South Florida Ecosystem Program, in fiscal year 1995 for the purpose of gathering hydrologic, cartographic, and geologic data that relate to the mainland of south Florida, Florida Bay, and the Florida Keys and Reef ecosystems.

Historical changes in water-management practices to accommodate a large and rapidly growing urban population along the Atlantic coast, as well as intensive agricultural activities, have resulted in a highly managed hydrologic system with canals, levees, and pumping stations. These structures have altered the hydrology of the Everglades ecosystem on both coastal and interior lands. Surface-water flows in a direction south of Lake Okeechobee have been regulated by an extensive canal network, begun in the 1940's, to provide for drainage, flood control, saltwater intrusion control, agricultural requirements, and various environmental needs. Much of the development and subsequent monitoring of canal and river discharge south of Lake Okeechobee has traditionally emphasized the eastern coastal areas of Florida. Recently, more emphasis has been placed on providing a more accurate water budget for internal canal flows.

Importance of Flow and Water-Quality Information for Ecosystem Management

As part of the South Florida Ecosystem Restoration Program, the U.S. Army Corps of Engineers and the South Florida Water Management District (SFWMD) propose mod-ified water deliveries to Indian Tribal lands, Big Cypress National Preserve, and other noncoastal areas of south Florida. The proposed modified water deliveries are designed to provide flood protection and water-delivery benefits to agricultural lands as well as partial restoration of historic ecosystem conditions within both Seminole and Miccosukee Tribal lands (fig. 1). The effects that these proposed modified water-delivery changes will have on Indian Tribal lands can only be determined if internal flows and associated water quality are accurately known. The Everglades Construction Project, which developed as a result of the South Florida Ecosystem Restoration Program, required diversion of the C-139 Basin surface water to storm treatment area 5 (fig. 1, STA-5) and will cause a change in the volume and quality of the water subject to Tribal entitlement.

Project Goal

The objective of this project is to evaluate approaches for quantifying freshwater flows to and from Native American lands and to provide various hydrologic data to support other Federal and State hydrologic investigations. The implementation and development of strategically locating streamflow and water-quality gaging sites will provide information for determining future surface-water flow requirements. Subsequent studies based on accurate flow calibrations generated by these sites will be used for computation of nutrient loadings in the canal system. Providing continuous-flow data at selected impact points for internal basins will complement the eastern flow canal discharge network and allow for surface-water releases that are more accurately timed. The accounting of all significant hydrologic inflows and ouflows to the Everglades ecosystem of the south Florida mainland is a key element of the South Florida Ecosystem Program.

Acoustic Techniques for Flow Measurement

Before the development of currently available acoustic instruments, it was very difficult to gage flows in a highly regulated network of canals and streams. Standard methods for field data collection and flow computations are impractical and inaccurate because of the low velocities, flow reversal, and the presence of submerged aquatic plants. With state-of-the-art acoustic instrumentation, such as the acoustic velocity meter (AVM) and the Acoustic Doppler Current Profiler (ADCP), it is possible to more accurately gage flows in this type of environment because of the ability of AVM's and ADCP's to quickly measure low or rapidly changing water velocities. AVM systems have proven to be accurate instruments in the measurement of water velocities along a horizontal path across a stream and can be permanently installed to collect continuous velocity data, which, along with water-level data, are used to produce continuous records of discharge.

ADCP instruments can be used to measure water velocities in three dimensions. These measurements can then be used to calculate the total flow through a stream section at a given time. The ADCP uses the Doppler shift from four acoustic beams transmitted downward (at set angles) to measure the velocity of water, depth, and distance traveled across the stream transect. Field measurements made with the ADCP's can be used to develop relations between continuous recording gages collecting AVM velocities and discharge at gaged sites.

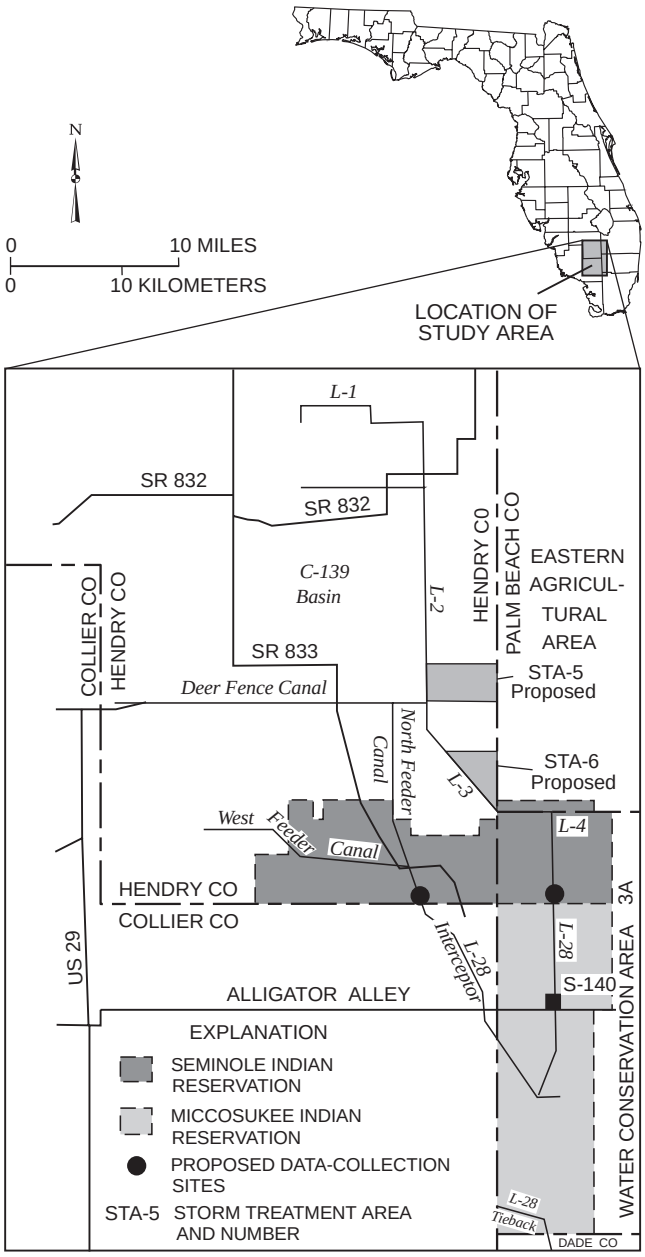

Figure 1. Study area showing location of Tribal lands, proposed data-collection sites, and major canals and levees.

Data Collection

Two new continuous water-level, AVM discharge, and water-quality sites (fig. 1) will be added in conjunction with the larger plan to monitor internal surface-water flows. Sites will be located at critical water-delivery points for which information is lacking on both the L-28 and L-28 interceptor canals (fig. 1). In addition to the SFWMD's existing network, a joint effort between the USGS and SFWMD is planned to be initiated to construct, calibrate, monitor, quality assure, and produce daily water-level, discharge, and nutrient loading tabulations. The SFWMD will provide assistance by installing flow-weighted samplers at USGS AVM gaging sites for nutrient analysis (nitrogen and phosphorus) in conjunction with streamflow monitoring.

Product Plans

Daily water-level, discharge, and nutrient loading computations will be made. Plans are to publish all these data in the USGS report "Water Resources for South Florida: Volume 2A" on a yearly basis, starting in the second year of the 4-1/2-year project (5/1/1996 to 9/30/2000).

Project Schedule

Tentative dates and the planned project activities are summarized below:

9/96: Automated remote site data stream command program language development by the USGS to facilitate SFWMD telemetry.

10/96: Construction and instrumentation of sites by the USGS with telemetry programming assistance from the SFWMD. The USGS begins calibration.

4/98: Daily value streamflow and stage computations and statistics completed for the 1997 fiscal year and published in the USGS publication "Water Resources Data for South Florida: Volume 2A." Nutrient loading computations to be made available in a yet to be determined format.

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