To: Representatives of the Technical Oversight Committee
Nick Aumen, Everglades National Park
Mike Waldon, A.R.M. Loxahatchee National Wildlife Refuge
Paul DuBowy, Jacksonville District, Army Corps of Engineers
Garth Redfield, South Florida Water Management District
Frank Nearhoof, Florida Department of Environmental Protection

From: Matt Harwell and Laura Brandt, A.R.M. Loxahatchee National Wildlife Refuge

Date: 23 February 2005

Re: Quarterly Update on Enhanced Water Quality Monitoring and Modeling Program for the A.R.M. Loxahatchee National Wildlife Refuge

This update is a summary of activities from the previous three months (December 2004 – February 2005) on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. A project overview of this effort is provided in Attachment 1.

The Principals (17 December 2003) requested implementation of the eight recommendations of the TOC (24 July 2003). The Refuge's Enhanced Water Quality Monitoring and Modeling Program addresses four of these recommendations. Specifically:

B. Enhancing Monitoring of the Refuge
Design and implement an enhanced monitoring program to improve spatial and temporal understanding of factors related to phosphorus dynamics.

An expanded water quality monitoring network (a combination of transects and individual sites) has been designed and established (Fig. 1). Complete sampling of the network occurred in December 2004, all but three sites in January 2005, and all but eight sites in February 2005 (Figs. 2-4). The results of these analyses will be presented at future TOC meetings. Final data for monthly samples continue to be publicly posted on DBHYDRO by the SFWMD.

The monitoring transects have been equipped with water conductivity data loggers to collect conductivity and temperature data. This information will be used to understand and refine operations, when possible, to minimize canal water intrusion into the interior marsh. Seven transects have been instrumented, two in cooperation with the USGS.

C. Modeling of the Refuge
1. *Develop a water quality / hydraulic model for the Refuge with a phosphorus cycling component.*
3. *Develop and track a simple phosphorus mass-balance for the Refuge.*

A contract has been established with Dr. Ehab Meselhe (University of Louisiana – Lafayette) for the development of these modeling tools for the Refuge. The first phase of this effort involves a model selection process.

Current Status:

- Dr. Meselhe made initial visit to Refuge
- Model selection process in progress
- This phase of the project set to be completed by Spring 2005

Separately, a contract has been established with Dr. Vince Neary (Tennessee Technological University) to establish an external technical panel to provide review of the model selection process and the development of the modeling tool(s) over time.

Current Status:

- Technical Panel met 28 January 2005 (co-sponsored by PBCC's Environmental Science & Technology Program). Meeting attended FWS, USACE, USGS, SFWMD, others.
- Technical Panel report from this phase to be completed by Spring 2005.
- Current information on the review panel posted at: http://www.geocities.com/mwaldon/AdvisoryPanel/ModelAdvisoryPanel.html

C. Modeling of the Refuge

2. *Evaluate issues associated with phosphorus loads and transports within the L-40 and L-7 canals.*

A canal monitoring contract with Dr. Samira Daroub (UF – IFAS) is ongoing. This effort conducts canal hydrographic surveys and synoptic water quality surveys.

Current Status:

- Survey protocols and plans for both sediment and water quality surveys have been drafted.
- The first sediment survey field effort is complete, and these data are undergoing initial review.
- The canal water quality survey component will begin in early CY 05.

Finally, below is a brief list on some of the "next steps" from previous updates, including their status:

- Complete personnel actions necessary to complete the project.
    - A water quality ecologist (Donatto Surratt) started 15 February 2005. A water quality technician (Rob Smith) will join the Refuge 20 March 2005.
- Develop database management approach for data from the project
    - In progress
- Refine information presentation approaches
    - In progress
- Ongoing data analysis
    - In progress

- The monitoring program will be presented at the 1st Nat. Conf. on Ecosystem Restoration in Orlando (Dec. 5-9th)
    - Brandt, L. A., Harwell, M. C., Waldon, M. G. (2004) Assessing data needs for ecosystem management: Enhancing an existing long-term water quality monitoring network for the Northern Everglades. Poster at the First National Conference on Ecosystem Restoration. December, 2004.

Attachment 1:

Enhanced Water Quality Monitoring and Modeling Program for the
A.R.M. Loxahatchee National Wildlife Refuge

Project Overview

In FY 04, a Congressional appropriation was specifically targeted to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) for development of an enhanced water quality monitoring network and to develop hydrodynamic and water quality modeling tools. The appropriation is intended, in part, to improve the scientific understanding of water quality issues in the Refuge and provide information that can be incorporated into water management decisions to better protect of Refuge resources.

An initial work plan was developed by Refuge staff outlining studies in four areas: (1) increased monthly water quality sampling sites; (2) monitoring of canal water intrusion using surface water conductivity transects into the interior marsh; (3) characterization of sediment and water quality in the perimeter canals of the Refuge; and, (4) development of hydrodynamic and water quality modeling. These four areas are consistent with long-term goals identified in the Refuge's 15 year Comprehensive Conservation Plan and recommendations made by the Technical Oversight Committee for addressing exceedances observed in interim phosphorus levels within the Refuge (http://www.sfwmd.gov/org/ema/toc/archives_mtgs.html#2004). The plan was provided to State, other Federal, and Tribal partners for review and comment in February 2004, and was subsequently improved based on constructive comments received. The plan is available at: http://www.sfwmd.gov/org/ema/toc/archives/docs/refuge_final_work_plan_2004-2006.pdf. An additional appropriation in 2004 allowed for extending the duration of the program and for adding a canal monitoring component to the program.

The Refuge's existing water quality monitoring network (used for Federal Consent Decree compliance [EVPA]; Fig. 1) is estimated to cover approximately 60% of the Refuge, leaving 40% of the marsh uncharacterized, predominantly in the outer, impacted regions of the marsh. The additional monthly sampling as part of the enhanced water quality monitoring program focuses on these uncharacterized areas (Fig. 1). This information can then be used to refine operations, when possible, to minimize canal water intrusion into the interior marsh. Sampling for the enhanced water quality monitoring program is designed to be as similar as possible as the compliance monitoring program (e.g., same collection protocols, collection staff, laboratory analyses by SFWMD, data QA/QC, data availability, etc.).

The goal of the modeling exercise is to provide support for Refuge management decisions and planning related to water control operations, water supply, and water quality and provide a foundation for future ecological studies. The model will be maintained to support future management decisions, model development, and monitoring planning. Preliminary modeling is anticipated to be available in FY 06, with completed model(s) available for management decision support in early FY 07.

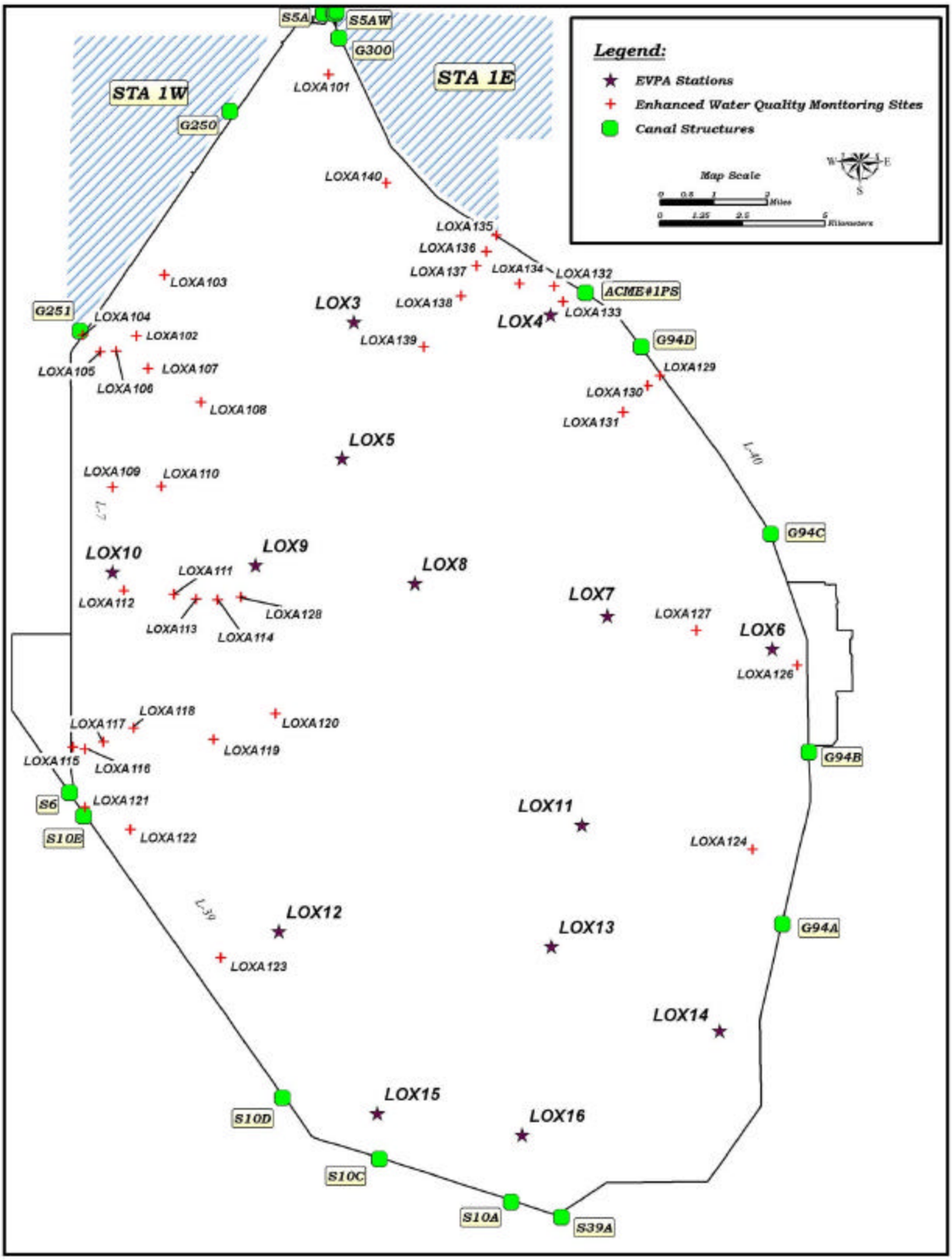

Figure 1: Map of A.R.M. Loxahatchee National Wildlife Refuge showing location of the existing Federal Consent Decree compliance monitoring network (EVPA stations; ★) and the new, enhanced water quality monitoring program stations (+).

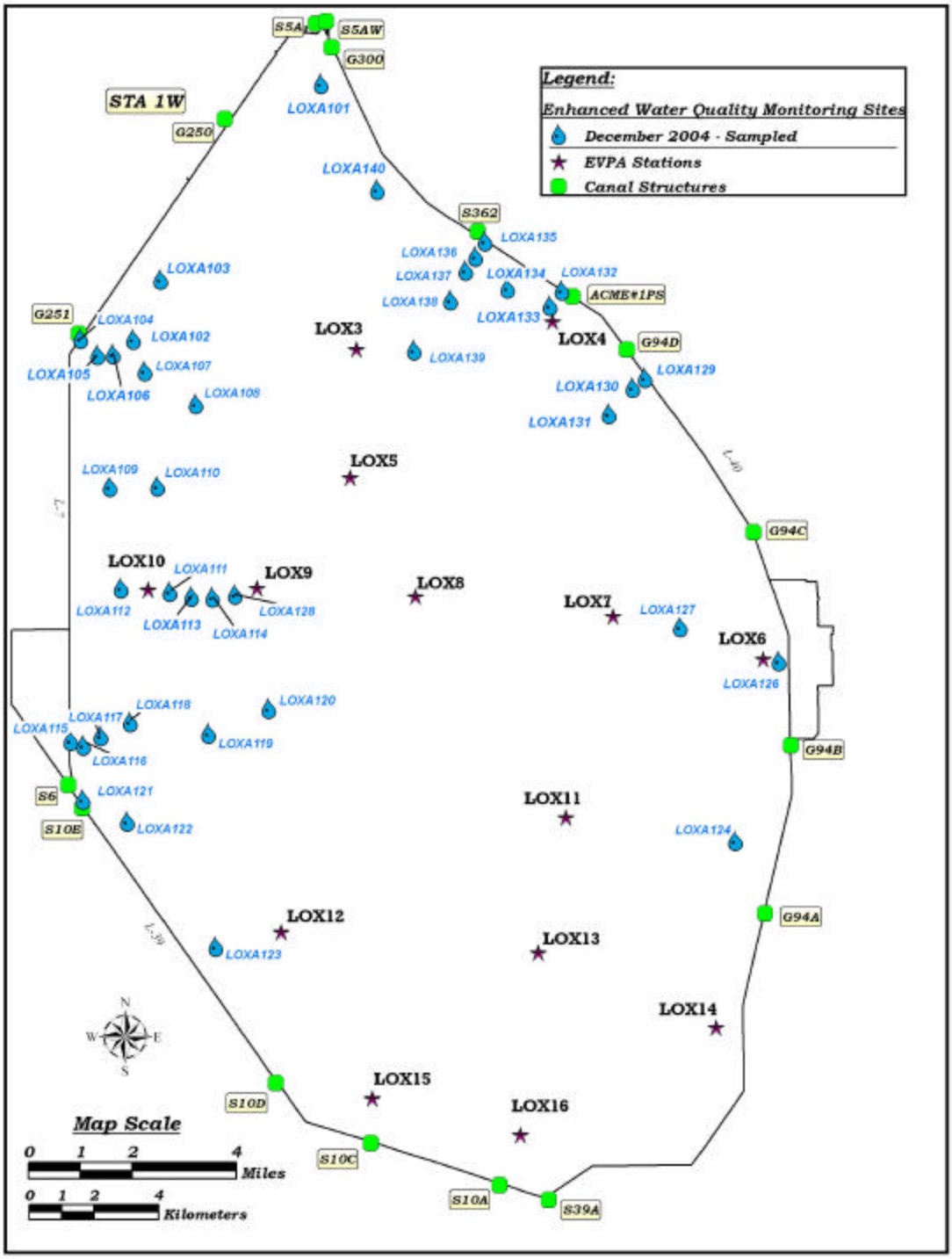

Figure 2: December 2004 map of enhanced water quality monitoring program stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge.

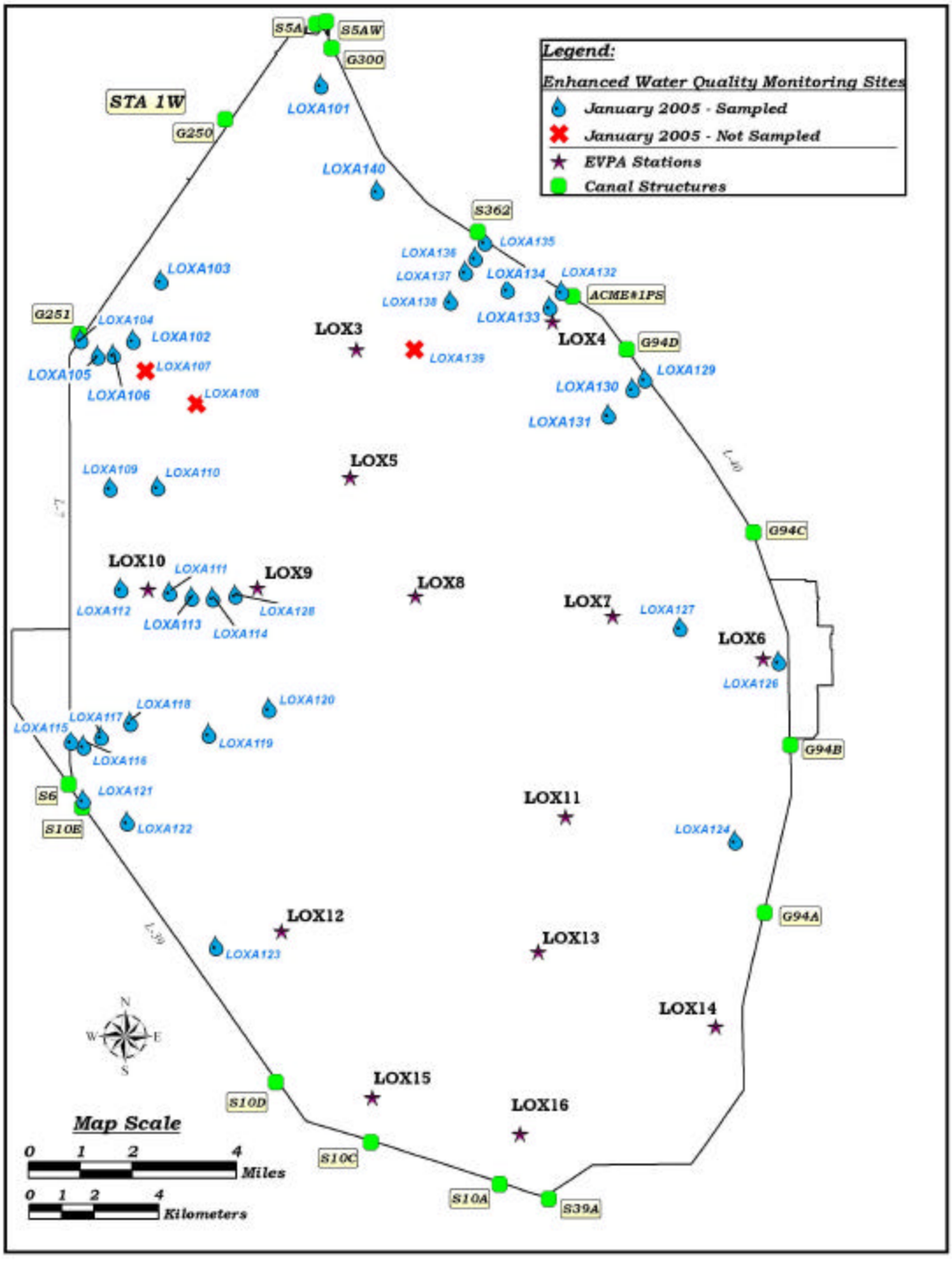

Figure 3: January 2005 map of enhanced water quality monitoring program stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge.

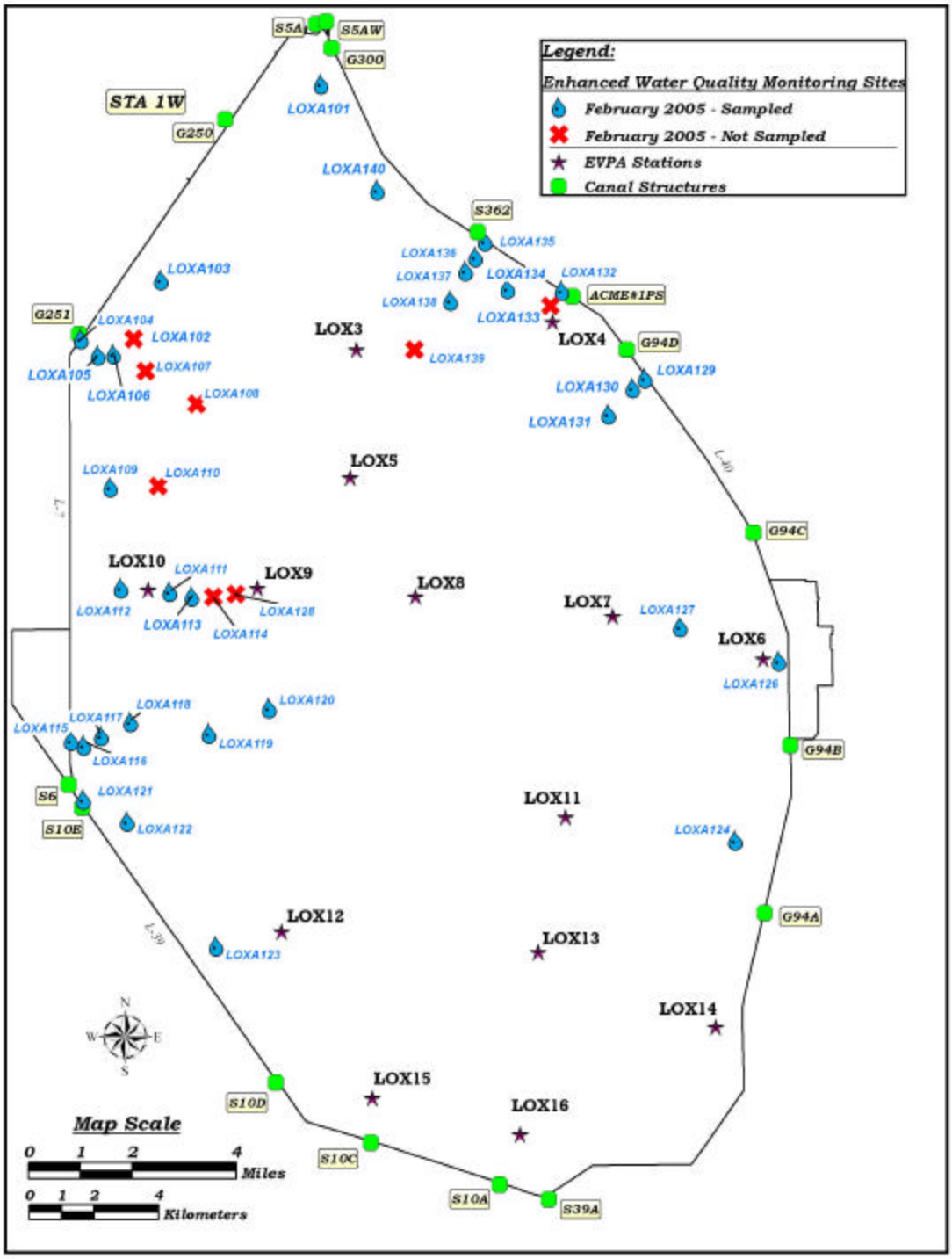

Figure 4: February 2005 map of enhanced water quality monitoring program stations sampled (water drop symbol) in the A.R.M. Loxahatchee National Wildlife Refuge.