

Enhanced Water Quality Monitoring and Modeling Program for the A.R.M. Loxahatchee National Wildlife Refuge Quarterly Update Report – January 2008

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Overview

This update is a summary of activities since the previous status report of October 2007 on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. A project overview, and other detailed information about the program can be found at: http://sofia.usgs.gov/lox_monitor_model/. The primary objective of this overall program focuses on providing information for use in ecological management of the Refuge (Brandt et al. 2004; Harwell et al. 2005; USFWS 2007a, b).

The Refuge's monitoring component of this program also addresses one of the Consent Decree Principals recommendations (17 December 2003):

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.

The Refuge's modeling component of this program also addresses several of the Consent Decree Principals recommendations (17 December 2003):

C. Modeling of the Refuge

- 1. Develop a water quality/hydraulic model for the Refuge with a phosphorus cycling component.*
- 2. Evaluate issues associated with phosphorus loads and transports within the L-40 and L-7 canals.*
- 3. Develop and track a simple phosphorus mass-balance model for the Refuge.*

Information Availability

Through collaboration with USGS, information from the Refuge's Enhanced Water Quality Monitoring and Modeling Program has been made available on the USGS' SOFIA web site at: http://sofia.usgs.gov/lox_monitor_model/.

Final data for monthly samples through May 2006 are publicly posted on DBHYDRO by the SFWMD at <http://www.sfwmd.gov/org/ema/dbhydro/index.html>. Data for June 2006-December 2007 are posted on the Technical Oversight Committee's web site at <http://www.sfwmd.gov/org/ema/toc/index.html>. This report includes information from samples collected through December 2007.

Water Quality Data Analyses Update

The 3rd Annual Report (USFWS, 2007b) was finalized during this quarter and is available on the SOFIA website. This report focuses on extending the period of record captured in the Second Annual Report to December 2006.

Monitoring Update (October 2007 – January 2008)

Sampling of the enhanced water quality monitoring network (**Figure 1**) occurred at 38 stations in October 2007, 36 stations in November 2007, and 38 stations in December 2007 (**Table 1**).

A laboratory processing error occurred in November 2007. As a result, no enhanced monitoring laboratory data for that month are presented here. Further, no enhanced monitoring project laboratory data from November 2007 are available for other statistical analysis. Corrective actions were taken to ensure that similar laboratory processing errors will not occur in the future.

Total phosphorus data available to date for April 2007 to December 2007 are presented in **Table 1**. Maps of stations where samples were collected for October and December 2007 are presented in **Figures 2 and 3**, respectively. LOXA112 and LOXA122 were the two stations not sampled in November 2007 (not shown).

Conductivity sonde deployment information for April 2007 to December 2007 is presented in **Table 2**.

Modeling Update

Model development continues with intensive effort by the modeling team. Significant progress was made in calibrating the chloride concentration component of the spatially-explicit MIKE-FLOOD Refuge model. In October, modelers met with University of Florida Professor H. Carl Fitz. Dr. Fitz traveled to the University of Louisiana at Lafayette campus to exchange information on Everglades modeling, and to assist researchers in understanding the Everglades Landscape Model, ELM. Manuscripts on the use of cluster analysis in compartmental modeling design, and modeling sulfate concentration in the Refuge were drafted by Dr. Hongqing Wang.

Next Steps

The next steps for this program include exploring mechanisms to present information from the Annual Report – in particular the modeling efforts – to a larger audience, continuation of data collection and analysis, additional model development and implementation.

References

http://sofia.usgs.gov/lox_monitor_model/

Brandt, L.A., Harwell, M., Waldon, M. (2004) Work Plan: Water Quality Monitoring and Modeling for the A.R.M. Loxahatchee National Wildlife Refuge: 2004-2006. Prepared for the A.R.M. Loxahatchee National Wildlife Refuge. April, 2004. 33 pp.

Report No. LOXA08-002

Harwell, M. Surratt, D., Waldon, M., Walker, B., Brandt, L. (2005) A.R.M. Loxahatchee National Wildlife Refuge Enhanced Water Quality Monitoring and Modeling Interim Report. April, 2005. 106 pp.

USFWS. (2007a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Monitoring and Modeling Program – 2nd Annual Report – February 2007. LOXA06-008, U.S. Fish and Wildlife Service, Boynton Beach, FL. 183 pp.

USFWS. (2007b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 3rd Annual Report – October 2007. LOXA07-005, U.S. Fish and Wildlife Service, Boynton Beach, FL. 116 pp.

Table 1. Total phosphorus data (ppb) available for April 2007 – December 2007 from the Enhanced Water Quality Monitoring Program for: (a) marsh, and (b) canal stations for the A.R.M. Loxahatchee National Wildlife Refuge. Graphical representation of station locations is shown in Figure 1. November 2007 data were rejected “R” (see text).

a) Marsh stations

Marsh Station	Apr-07	May-07	June-07	July-07	Aug-07	Sept-07	Oct-07	Nov-07	Dec-07
LOXA101	-	-	-	-	20	16	4	R	4
LOXA102	-	-	-	-	-	-	U	R	5
LOXA103	-	-	-	-	-	9	5	R	U
LOXA105	-	-	-	-	24	27	12	R	8
LOXA106	-	-	-	-	6	16	U	R	5
LOXA107	-	-	-	-	-	-	11	R	U
LOXA108	-	-	-	-	-	-	U	R	U
LOXA109	-	-	-	16	6	17	U	R	7
LOXA110	-	-	-	-	U	8	U	R	U
LOXA111	-	-	-	-	U	9	U	R	11
LOXA112	-	-	-	14	U	10	6	R	U
LOXA113	-	-	9	6	U	8	U	R	13
LOXA114	-	-	-	4	U	12	U	R	5
LOXA116	-	-	-	-	99	130*	59*	R	110
LOXA117	-	-	-	-	10	21	12	R	18
LOXA118	-	-	-	-	7	16	U	R	11
LOXA119	-	-	-	-	U	9	4	R	8
LOXA120	16	-	11	9	U	10	5	R	9
LOXA121	X	X	X	X	X	X	X	X	X
LOXA122	-	-	-	13	12	13	6	R	15
LOXA123	X	X	X	X	X	X	X	X	X
LOXA124	-	-	24	12	19	12	7	R	13
LOXA126	-	-	-	14	13	8	U	R	11
LOXA127	-	-	-	-	13	U	U	R	8
LOXA128	-	-	-	-	6	5	U	R	5
LOXA130	-	-	-	11	11	20	7	R	11
LOXA131	-	-	-	8	10	5	U	R	7
LOXA133	-	-	-	-	29	-	120*	R	35
LOXA134	-	-	44	7	18	15	6	R	13
LOXA136	-	-	-	19	13	25	18	R	20
LOXA137	-	-	20	10	U	14	10	R	12
LOXA138	-	-	9	16	U	8	U	R	4
LOXA139	-	-	11	-	U	12	U	R	8
LOXA140	-	-	-	-	U	9	53*	R	10
LOXA141	-	-	-	29	7	12	6	R	6
MAX	16	-	44	29	99	130	120		110
MIN	16	-	9	4	6	5	4		4

U indicates that compound was analyzed but not detected; - = no sample collected

X indicates station no longer sampled; R = data rejected

* sample was re-analyzed sample. Second value: LOXA116, Sept-07 = 120 ppb, Oct-07 = 81 ppb; LOXA133, Oct-07 = 120 ppb; LOXA140, Oct-07 = 12 ppb.

Table 1 cont.

b) Canal stations

Canal Station	Apr-07	May-07	Jun-07	July-07	Aug-07	Sept-07	Oct-07	Nov-07	Dec-07
LOXA104	50	54	29	41	26	46	35	R	37
LOXA115	32	29	14	54	57	36	34	R	20
LOXA129	82	52	270	110	55	37	13	R	41
LOXA132	70	65	200	78	59	27	13	R	36
LOXA135	75	72	130	18	43	27	9	R	34
MAX	82	72	270	110	59	46	35		41
MIN	32	29	14	18	26	27	9		20

U indicates that compound was analyzed but not detected.

Table 2. April 2007 – December 2007 conductivity sonde deployment information, separated by transect, for the A.R.M. Loxahatchee National Wildlife Refuge. X = data collected from sonde deployment during that month. Graphical representation of station locations is shown in Figure 1.

2007									
Site ID	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
LOXA104		X	X	X	X	X	X	X	
LOXA105		X		X	X	X		X	
LOXA106		X		X	X	X		X	
LOXA107		X		X		X		X	
LOXA108		X		X	X	X		X	
LOXA111	X	X	X		X		X		X
LOXA112	X	X	X		X		X		X
LOXA113	X	X	X		X		X		X
LOXA114	X	X	X		X		X		X
LOXA115		X	X	X	X	X	X	X	
LOXA116	X			X			X		X
LOXA117	X			X			X		X
LOXA118	X		X				X		X
LOXA119	X		X				X		X
LOXA120	X		X				X		X
LOXA126	X	X	X		X		X		X
LOXA127	X	X	X		X		X		X
LOXA128	X	X	X		X		X		X
LOXA129	X	X	X	X	X	X	X	X	
LOXA130		X		X		X		X	
LOXA131		X		X		X		X	
LOXA132	X	X	X	X	X	X	X	X	
LOXA133		X		X		X		X	
LOXA135	X	X	X	X	X	X	X	X	
LOXA136		X		X		X		X	
LOXA137		X		X		X		X	
LOXA138		X		X		X		X	
LOXA139		X		X		X		X	
LOXA141									
LOXA142			X	X	X				X
LOXA143			X		X		X		X
LOXA144			X		X		X		X
LOXA145			X		X		X		X
LOXA146			X		X		X		X
LOXA147					X		X		X
LOXA148			X		X		X		X
LOXA149			X		X		X		X
LOXA150			X		X		X		X
LOXA151					X	X	X	X	X
LOXA152					X	X	X	X	X
LOXA153					X	X	X	X	X
I-8C	X	X	X		X		X	X	
LOX04		X		X		X			
LOX06	X	X	X		X		X	X	X
LOX07	X	X	X		X		X	X	X
LOX08	X	X	X		X		X	X	X
LOX09	X	X	X		X		X	X	X
LOX10	X	X	X		X		X	X	X
LOX15			X		X		X	X	X

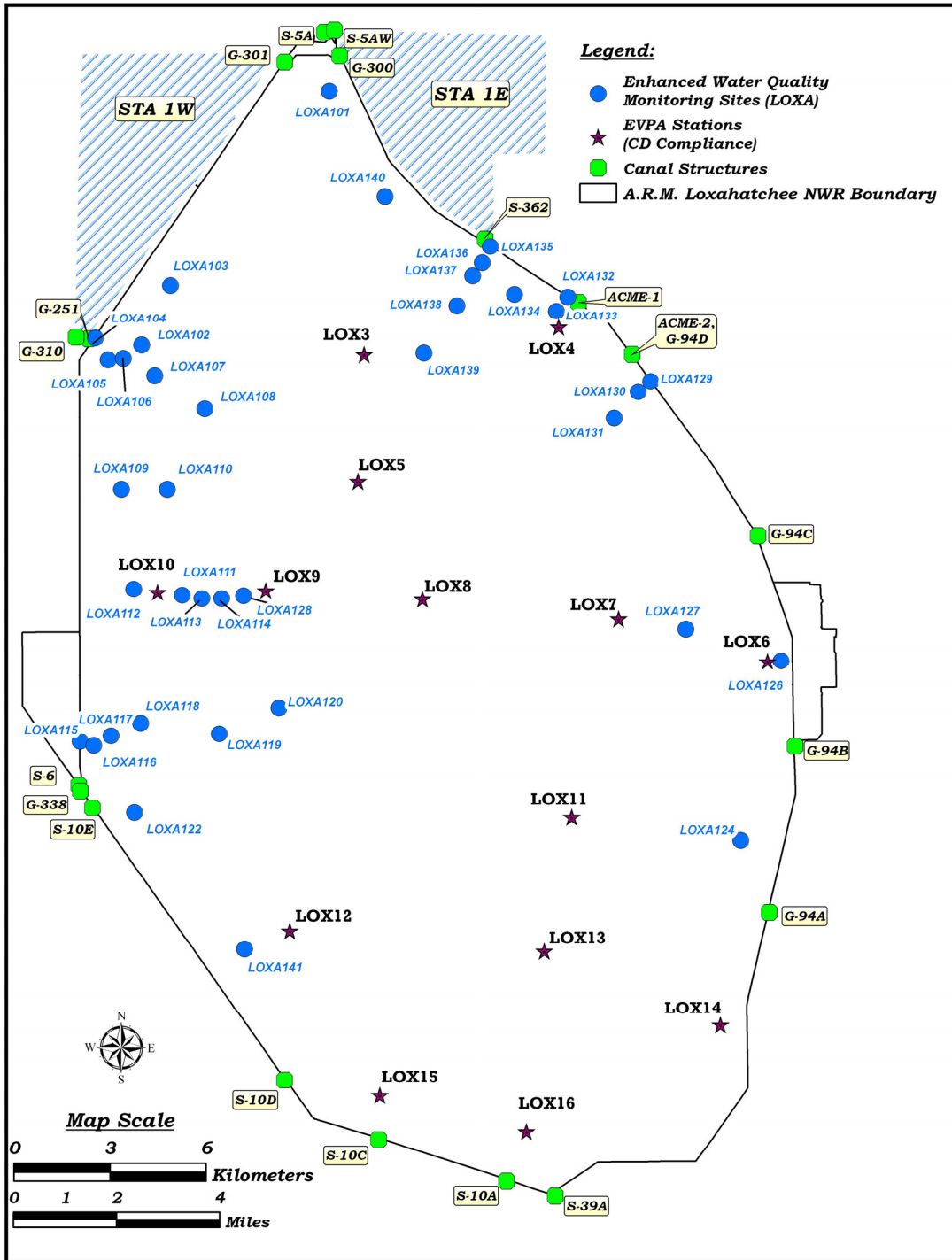


Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

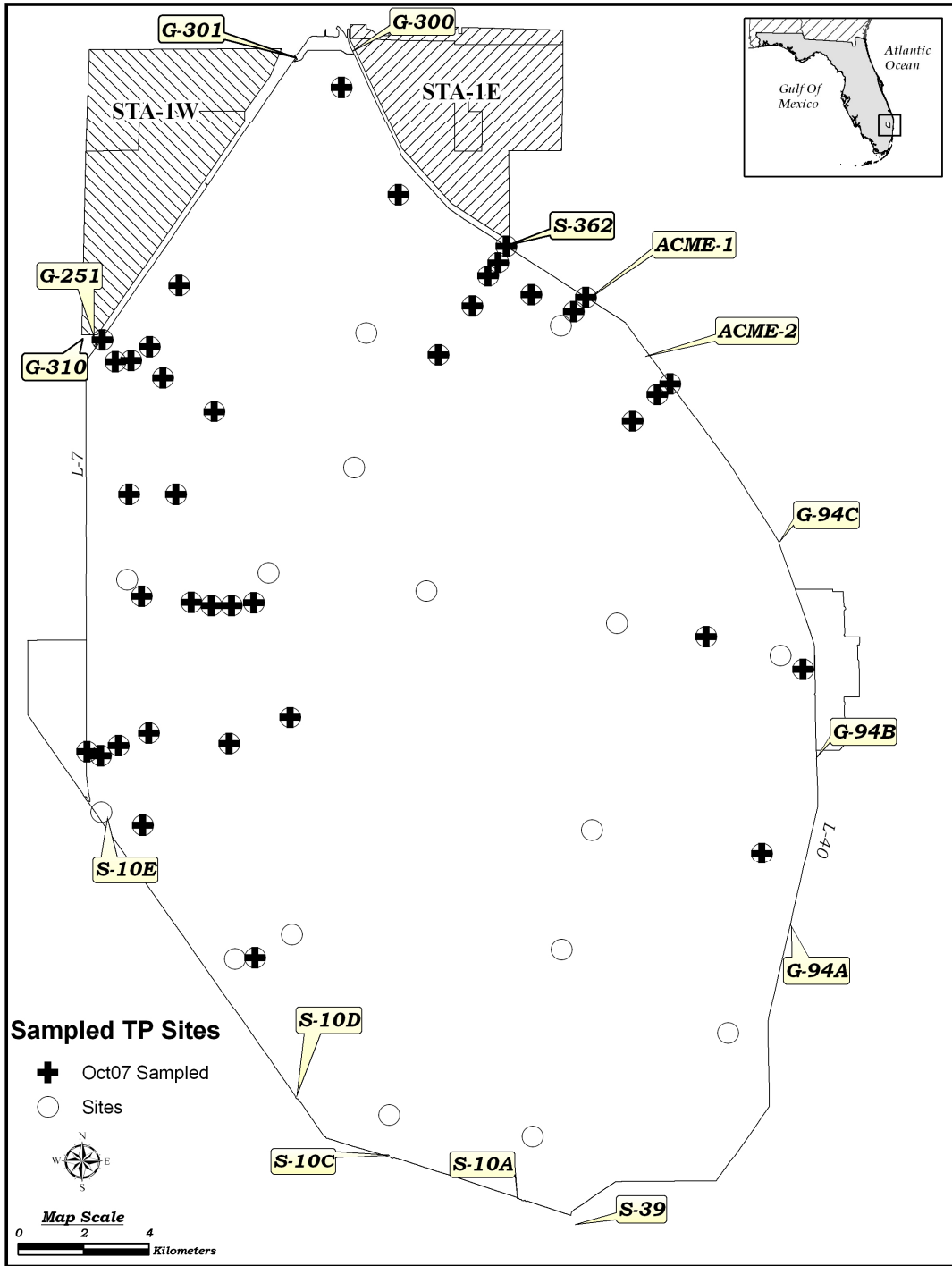


Figure 2. October 2007 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

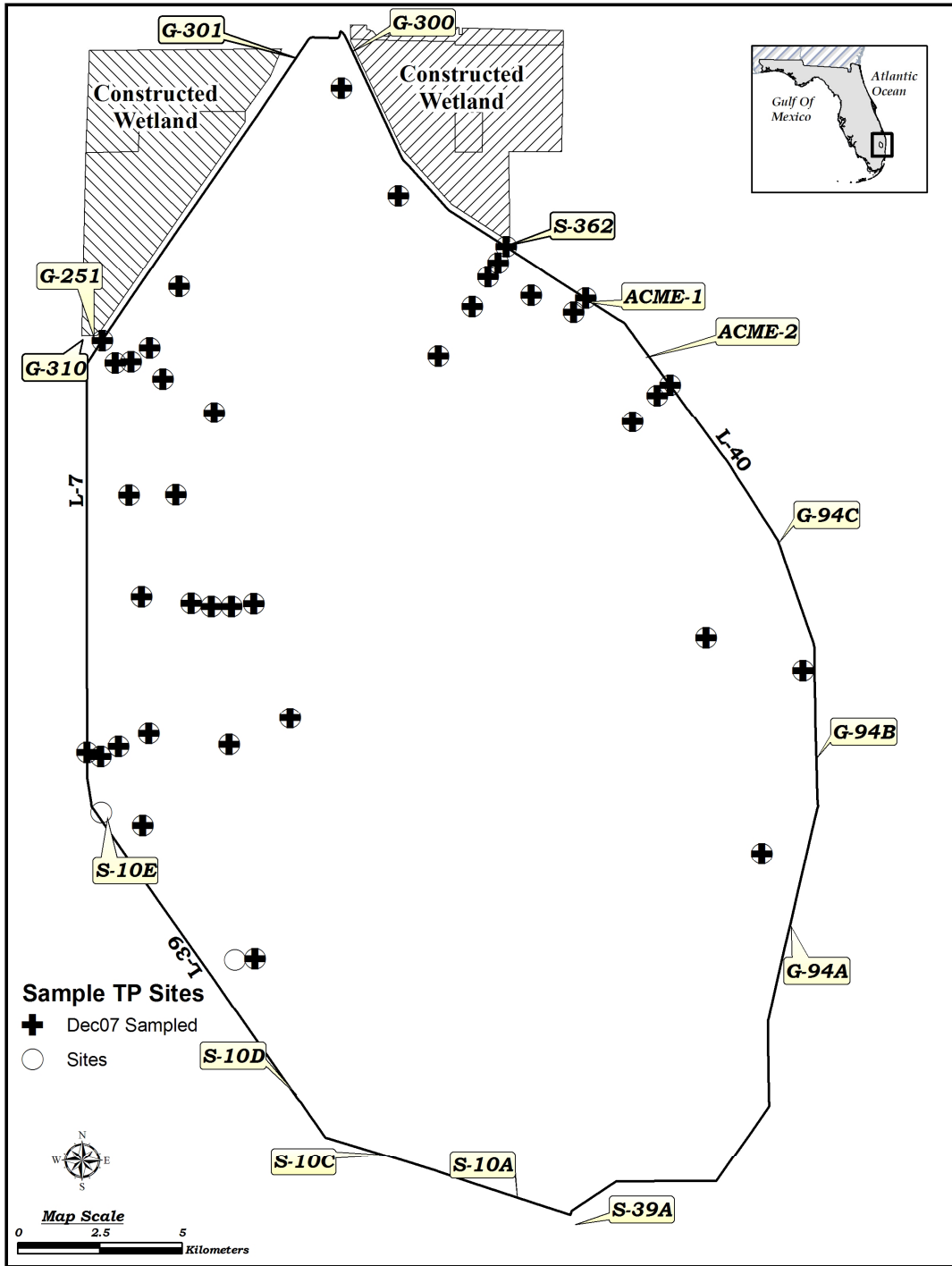


Figure 3. December 2007 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.