Remote Phosphorus Analysis Contributes to Water Quality Studies

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APPLICATIONS

The availability of near real-time total phosphorus (TP) data with high temporal resolution has provided opportunities for District scientists to better understand the transport and fate of P in various systems. Some applications include:

- STA performance and diagnostic evaluation
- Comparison of grab vs. composite sample collection
- Study of surge flows and storm event impacts
- Study of treatment technologies
- Documentation of diurnal effects

ABSTRACT

A remote phosphorus analyzer (RPA) system has been designed and optimized for the determination of TP and total reactive phosphorus (TRP). These analytical parameters were remotely monitored and the data were remotely processed. Several RPAs have been deployed at different STA locations during the past ten years and successfully provided near real-time TP and TRP data in support of Restoration Strategies Science Plan projects. The P concentration results and associated detection limits from these analyzers were comparable with standard laboratory analysis procedures. Conducting the same volume of analyses in a standard laboratory would have been cost-prohibitive.

BACKGROUND

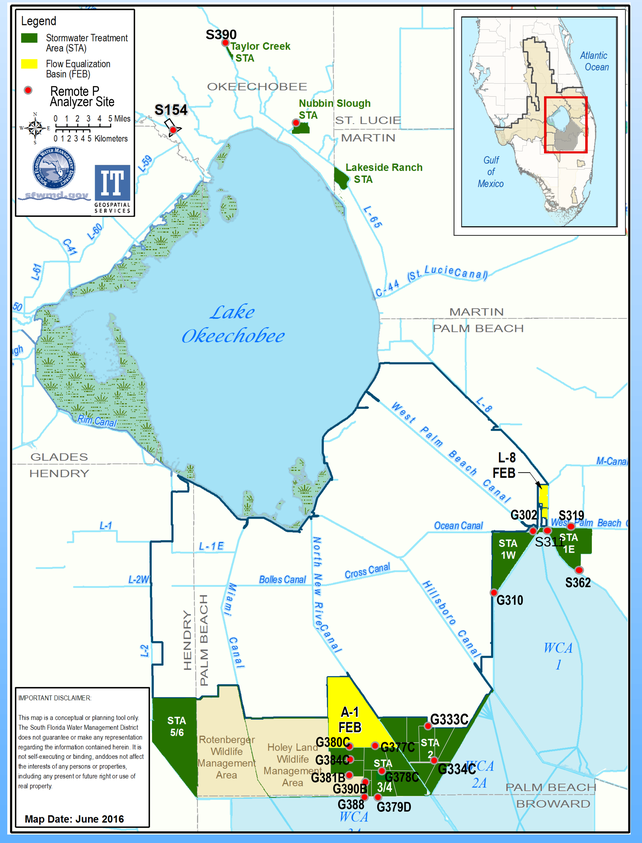
The traditional method of measuring P concentration in water involves field grab sampling with subsequent laboratory analysis. As more STAs are being constructed for protecting the ecosystem, the RPAs can obtain near real-time P concentration data for optimization of STA operation and P budget studies. Since 2007, RPAs have been deployed at 18 locations and have generated more than 103,000 results for TP and TRP with considerable cost savings compared to traditional sample collection and laboratory analysis.

TECHNOLOGY & COMMUNICATIONS

The instruments are self-contained, temperature controlled, precision analysis systems that are stocked with standards, reagents and waste capacity suitable for unattended operation for up to three months.

These instruments have been deployed inside small concrete buildings and in 5'x8' trailers. Deployment sites require electricity and close proximity to the target surface water source. Most deployments have been on the upstream side of a control structure.

Each RPA is equipped with a cell phone modem to allow for remote access through a secure link. On a weekly basis, the instruments are polled to verify normal operation and the raw data are downloaded. The data are reviewed for quality and consistency and then converted into site specific spreadsheet files that may be accessed by data users.



RPA Deployments - North

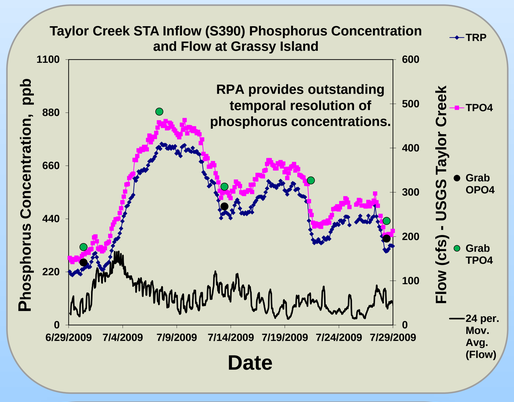
Area	Station	Dates	# Samples	Mean TP (µg/L)
Taylor Creek STA Inlet	S390	9/19/07-9/15/13	12684	384±193
Nubbin Slough STA Inlet	N/A	8/14/08-9/15/12	10238	319±225
S154 basin Kissimmee River	S154	8/15/08-1/26/12	7156	290±193
STA 1W Inlet	G302	2/24/07-5/7/10	7214	108±61
STA1W Outlet	G310	2/4/07-8/4/10	10550	36±49
STA1E Inlet Central Flow-way	S319	8/16/10-3/7/12	4108	78±32
STA1E Inlet Western Flow-way	S311	6/19/10-12/21/11	3342	102±31
STA1E Outlet	S362	6/23/10-6/19/12	5656	25±6

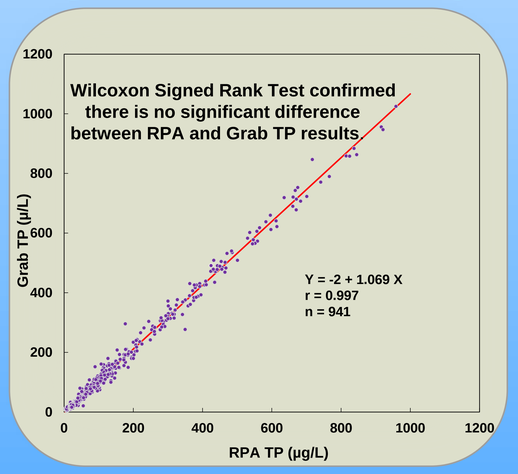
RPA Deployments - South

Area	Station	Dates	# Samples	Mean TP (µg/L)
STA2 Inlet Flow-way 3	G333C	6/3/13-10/10/13 7/8/16-Present	1281	84±48
STA2 Outlet Flow-way 3	G334C	5/3/13-12/3/13 5/24/16-Present	3954	22±7
STA3/4 Inlet Central Flow-way	G377C	5/19/14-1/9/15	2078	56±21
STA3/4 Mid-Levee Central Flow-way	G378C	6/10/14-1/16/15	1880	16.3±3
STA3/4 PSTA Cell Inlet	G390B	4/5/12-9/30/15	8493	20±11
STA3/4 PSTA Cell Outlet	G388	3/30/12-Present	8968	13±5
STA3/4 Outlet Central Flow-way	G379D	7/2/12-11/11/12 2/24/14-1/26/15	3067	25±13
STA3/4 Inlet Western Flow-way	G380C	11/14/12-3/15/13 1/23/15-Present	4646	57±28
STA3/4 Mid-Levee Western Flow-way	G384C	11/14/12-3/15/13 1/23/15-Present	2729	24±7
STA3/4Outlet Western Flow-way	G381B	7/5/12-8/4/15	5410	16±7

Current RPA Deployment Projects

Site	Location	Project	Functions
G380C	STA3/4 Inlet A1FEB Outlet	Operational Decisions (Modeling)	Assess operational decisions such as flow pattern and rate, and monitor A1FEB
G384C	STA3/4 Middle Levee		
G333C	STA2 Inlet	P Sources	Support Restoration Strategies Science Plan projects
G334	STA2 Outlet		
G388	STA3/4 PSTA Cell Outlet	PSTA	Evaluate PSTA performance at different water stage and flow





CONCLUSION

By 2010, the concept of high quality, high frequency, near real-time remote P analysis had proven to be a valuable tool for evaluation of P variance in many District applications. The technology is now broadly accepted by District scientists and RPA deployments have been requested in support of several Science Plan Projects. Current RPA deployment capacity stands at five active units as noted.