Hybrid Wetlands Treatment Technology (HWTT)

Location:	**Northern Everglades**
Subwatershed:	**Taylor Creek/Nubbin Slough**
Basin:	**S-191 and S-133**
Purpose:	**Reduce phosphorus exports to Lake Okeechobee in the four priority basins (S-65D, S-65E, S-154, and S-191).**
Project Operation Start:	**2008**
Considerations/Update:	**This Management Measure includes the design, construction and operation of Hybrid Wetland Treatment Technology (HWTT) facilities at six facilities within the Northern Everglades Watershed. These locations include Nubbin Slough, Mosquito Creek, Lemkin Creek, Ideal Groves (outside the Lake Okeechobee Watershed), Grassy Island and Wolf Ditch. HWTT represents a combination of wetland and chemical treatment approaches to improve water quality. Chemical coagulants are added, either continuously or intermittently, to the front end of the wetland treatment system, which contains one or more deep water zones to capture the resulting floc material. A fundamental concept of HWTT is that the floc resulting from coagulant addition generally remains active and has the capability of additional phosphorus (P) sorption. Both passive and active reuse of floc material is utilized in HWTT. The goals of HWTT systems are:** **1. Improve the effectiveness and reliability of chemical treatment systems for P removal.** **2. Utilize existing wetland vegetation to the maximum extent possible to minimize chemical amendment use.** **3. Eliminate the need for off-site disposal of residual floc materials.** **4. Facilitate the removal of nitrogen (N) species (Implementation of Hybrid Wetlands Treatment Technology in the Northern Everglades Watershed, 2018)** **In coordination with FDEP and FDACS, the District has completed a review of the HWTT system, which included an evaluation of its effectiveness for the removal of P, system cost, and potential toxicity of treated discharges to receiving waters. The application of Aluminum Sulfate (ALUM) is a principal component of the HWTT process and is a relatively non-toxic material commonly used for water clarification. DB Laboratories conducted toxicant analysis to assess potential ecological risk posed by the application of ALUM to the surface water at HWTT facilities. Based on the review of the toxicant analysis submitted to FDEP, no obvious ecological or contaminate risk or impairment to the ecological system is posed by the current application of ALUM as part of the HWTT systems.**

Considerations/Update:	Findings:

a. **Site-specific water quality parameters (i.e., pH, alkalinity and turbidity) can modify the effectiveness of ALUM as a water quality coagulating agent. Additionally, since these systems are partially dependent on the addition of chemical coagulants, the amount of ALUM required for the HTTW system increases as flow rates increase. Therefore, ensuring the accurate dosing rate of ALUM within a system is critical to achieving a cost-effective system.**
b. **The HWTT effectively removed P and improved water quality at each of the six systems, and the effectiveness of ALUM as a coagulating agent is dependent on inflow water quality parameters. Elevated concentrations of dissolved organic matter and water pH/alkalinity outside of an optimum range inhibit floc formation, reducing the effectiveness of the treatment. To improve system effectiveness, Watershed Technologies has deployed lime rock beds to provide buffering prior to alum additions and to further buffer (increase pH and alkalinity) system effluent at outflow regions.**
c. **The actual P removal cost from operating systems ranged from $53 to $301 per pound of P removed, as summarized below for partial (Table 1) and from $19 to $179 at full capacity (Table 2).**
d. **HWTT systems can effectively reduce P and the utilization of combined floating and submerged vegetation can also reduce nitrogen concentrations within the surface water column. The cost effectiveness of these systems is variable and dependent on accurately determining the flow, P concentrations and background water quality.**
e. **The use of HWTT technology is well suited for the treatment of point sources where high nutrient concentrations and flows can be predicted to mitigate elevated concentrations prior to discharge to an off-site water body. Based on the data collected from the existing HWTT treatment system, additional treatment systems could be readily designed and implemented to mitigate point sources in strategic areas.**
f. **Utilizing HWTT for large-scale application proposes a more complicated process, and would require a review of site-specific conditions, a comprehensive design, and an analysis of the cost per pound of P removed. The site-specific data review should include historical flow rates and P loading rates to determine the volume and frequency of ALUM application, as well as water quality data (pH, alkalinity, color, turbidity) to determine if any required amendments should be added to the source water. Seasonal fluctuations in flow rate, P loading rates, and water quality should also be considered, as these may require adjustments to ensure the HWTT effectiveness. Application of HTTW to systems with elevated P loading due to high flowrates and/or concentrations would provide the greatest opportunity for the treatment and removal of P.**

Table 1. Actual P Removal and Cost at Partial Capacity				
Project Name	# of Days On-Line	Lbs. of TP Removed per day	Actual P Removal and. Cost at Partial Capacity- $/lb. P per Day	Total lbs. of P Removed per year
Nubbin Slough	360	8.91	$53	3,209
Mosquito Creek	357	6.07	$107	2,167
Lemkin Creek	353	1.76	$301	621
Wolff Ditch	355	3.72	$173	1,321
Grassy Island	358	19.79	$110	7,084

Table 2. Actual P Removal and Cost at Full Capacity				
Project Name	Projected Lbs. of TP Removed per Day	Projected Cost at Full Capacity - $/lb. P per Day	Total lbs. of P Removed per Year	Total Cost at Full Capacity - $/P Yr. (lbs.)
Nubbin Slough	43.59	$19	15,692	$298,148
Mosquito Creek	16.86	$61	6,019	$367,159
Lemkin Creek	4.14	$179	1,461	$261,519
Wolff Ditch	8.77	$105	3,113	$326,865
Grassy Island	63.16	$61	22,611	$1,379,271

References

Environmental, D. (2018). Lab Work. Rockledge, Florida.

Watershed Technologies, W. (2018). *Implementation of Hybrid Wetlands Treatment Technology in the Northern Everglades Watershed.* Satellite Beach, FL: Watershed Technologies.