# Northern Everglades Chemical Treatment Pilot Project Parcel/Regional Level - Reservoirs

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| **Location:** | - |
| **Subwatershed:** | - |
| **Basin:** | - |
| **Purpose:** | To enhance reservoir phosphorus load reduction capacity |
| **Project Operation Start:** | 2010 - 2013 |
| **Considerations/Update:** | The Northern Everglades Chemical Treatment Pilot Project was proposed to review chemical treatment options to reduce phosphorus concentrations within the Northern Everglades watersheds and to evaluate the feasibility of large-scale implementation. Some limited implementation of chemical treatment systems as either a pilot study or on a limited scale treatment system have been implemented within the watershed, including the Hybrid Wetland Treatment Technology (HTTW-MM#10).<br><br>Additionally, a review of Alternative Treatment Technologies excluding Aluminum Sulphate chemical treatment was conducted as part of the SFWMD's New Alternative Technology Assessment (NATA) Program, completed in 2013. The objective of assessing the Alternative Treatment Technologies was to assess available technologies to reduce phosphorus from entering the watershed and contributing to eutrophication in the Lake due to excessive phosphorus inputs.<br><br>Consistent with the finding in Management Measure 10, the use of chemical treatments Aluminum Sulfate (ALUM) as part of the HTTW is an effective means to reduce phosphorus in the water column. The effectiveness of Alum is, however, dependent on the inflow phosphorus concentration. and, site-specific conditions, which also have an impact on the system operation cost. For example, elevated concentrations of dissolved organic matter and water pH/alkalinity outside of an optimum range tend to inhibit floc formation, reducing the effectiveness of the treatment.<br><br>Chemical treatment technology would provide the greatest opportunity for the treatment and removal of phosphorus in areas where background water quality parameters are optimal for ALUM coagulation or where the water quality can be efficiently amended. Utilizing chemical treatment for large scale application purpose poses a more complicated process. To effectively utilize chemical treatment on large scale, projects would require a review of site-specific conditions, a comprehensive design and an analysis of cost per pound removal of phosphorus. |

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| **Considerations/Update:** | **To ensure the cost effectiveness at systems proposed for treatment, the site-specific data review should include historical flow and phosphorus loading rates to determine the volume and frequency of Alum application, as well as water quality data (pH, alkalinity, color, turbidity) to determine any required amendments to the system water. Seasonal fluctuations in flowrates, phosphorus loading rates, and water quality should also be considered as these may require adjustments to ensure the HWTT effectiveness.**<br><br>**Potential Alternative Treatment technologies were vetted in 2010 through a Request for Proposal (RFP) process with a pre-determined set of criteria and evaluated by SFWMD scientific staff. The selection criteria were designed to provide a rapid and equitable method for the screening alternative nutrient removal technologies that might warrant further investigation by the SFWMD for demonstration projects. The review of alternative technology focuses on water quality in (1) waste streams from confined animal feeding operations; (2) ditch runoff from cattle ranching operations; (3) canal discharges into Lake Okeechobee; (4) Lake Okeechobee discharges and local watershed runoff into the east and west coast estuaries; and (5) water moving south from the Everglades Protection Area into the Water Conservation Areas and other portions of the traditional remnant Everglades. While no dedicated funding for the NATA (New Alternative Treatment Assessment) program was available, the SFWMD provided technical staff time for contractor coordination, reviewed proposed technologies alternatives, analyzed water samples, assisted with sites selections for field demonstrations, and reviewed study findings. All other direct and indirect costs associated with conducting NATA projects were borne by each vendor. The NATA Program was not intended, nor designed, to provide the data needed for the design of full-scale treatment facilities or to conduct a rigorous cross-comparison of candidate technologies. In addition to the NATA Program, the SFWMD evaluated a number of other technologies brought to its attention through avenues other than the NATA RFP process. Both the solicited and unsolicited technologies were evaluated.**<br><br>**The SFWMD responded to inquiries from 19 different technology vendors during the study period (and tested nine of these technologies in the laboratory and/or field. Six of the nine technologies (Aragonite, ElectroCoagulation™, Phoslock®, STI, ViroPhos™ and WP-1™) were part of the NATA Program. A seventh technology, Ferrate, was evaluated in conjunction with a field demonstration conducted by Highlands County. The eighth technology, AquaLutions™, was tested under a separate contract with the SFWMD, as was WP-1™ at one location (Blue Heron Pond). The ninth technology tested was Nclear®. A summary of the technologies and their testing is presented in the table below.** |

| Technology | Vendor | Technology Description | Action Taken |
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| AquaLutions™ | AquaFiber Technologies Corp. | A proprietary system that removes nutrients from surface water. | Vendor conducted field demonstration at two sites on the Caloosahatchee River (C-43 Canal). |
| Argonite | CaC03 Argonite Products, Inc. and Ocean Cay, Ltd. | Naturally occurring calcium carbonate mineral that precipitates directly from seawater. | SFWMD conducted jar test. |
| ElectroCoagulation ™ (EC/PW™) System | Powell Water Systems, Inc. and Gerber Pumps International, Inc. | Electric current generated across metal electrodes in a reactor vessel, generating free electrons and ions that neutralize the charge of other constituents causing them to coagulate. | Vendor conducted a bench-top test. |
| Ferrate Treatment | Ferrate Treatment Technologies LLC and WesPac Water LLC | Proprietary Technology that produces ferrate ($[FeO_4]^{2-}$; $Fe^{+6}$ oxidation state), a strong oxidizing agent, onsite at a commercial scale to treat water. | Vendor conducted field demonstration in Canal B of the Istokpoga Marsh Water Improvement SFWMD, Highlands County. |
| Nclear 11® | Nclear IP LLC | A mineral-based product that is a proprietary mixture of calcium silicate hydroxides. | SFWMD conducted jar test |
| Phoslock® | Phoslock Water Solutions, Ltd., AMEC and SePRO Corp. | A modified bentonite clay product that is amended with lanthanum, a rare earth metal, as the active ingredient. | SFWMD conducted jar test and vendor conducted a field demonstration at MacArthur Lake, Martin County. |
| STI (Simtec Triad Ionate) | TKW Consulting Engineers, Inc. and Michael Fitzsimmons | A proprietary mixture of mineral compounds described as calcium oxide-based powder or a calcified granite sodium pyrite-hydrochlorite. | SFWMD conducted two jar tests. |
| ViroPhos™ | EnviRemed and Virotech Global Solutions, Inc. | A mixture of hematite, hydrated alumina, sodalite, quartz, calcium minerals, magnesium minerals, and titanium oxides. | SFWMD conducted two jar tests and vendor conducted a field demonstration at the Turnpike Dairy pond, Martin County. |
| WP-1™ | North American Geochemical LLC and US Environmental Resource & Recovery Group LLC | A proprietary mixture of mineral compounds sold for use in phosphate stabilization. | SFWMD conducted a jar test and vendor conducted two field demonstrations at the STA-1W Test Cells and Blue Heron Pond, Miami-Dade County. |

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| **Considerations/Update:** | **It was the SFWMD's intention to conduct field demonstrations for all the technologies selected for evaluation, however, the Electro Coagulation™ apparatus was not suitable for use in the field and the SFWMD was unable to secure appropriate sites to test Aragonite, Nclear® and STI. All tests were of relatively short duration (days to weeks), of limited scope and, as noted above, must be regarded as preliminary efforts to characterize the treatment potential of each technology, i.e., can the technology reduce phosphorus or N concentrations in SFWMD surface waters.**<br><br>**Based on site condition availability, the actual initial phosphorus and nitrogen concentrations of waters tested varied considerably among technologies. The field demonstrations had no true control to compare against the application treatment(s), and results are from a combination of field and laboratory studies. These factors limited the comparisons that can made between different technologies. Therefore, the study findings provide only a simplified approach to cross-compare each technology's treatment performance, based on before- versus after-application changes in constituent levels.**<br><br>**In summary, all of the evaluated technologies demonstrated the potential to reduce total phosphorus concentrations in surface waters to some degree and many of them reduced total nitrogen levels as well. However, these studies were only initial assessments of treatment efficacy and considerable follow-on work would be needed to generate the data needed to conduct a feasibility analysis for a full- scale treatment system using any particular technology. In addition, the scope of the NATA Program was limited to those vendors who approached the SFWMD and consequently, the technologies evaluated represent only a small subsample of all available water treatment technologies. Additional RFPs were not issued due, in large measure, to the unavailability of sites suitable to conduct field demonstrations. Although there are no current plans to conduct additional laboratory or field tests.** |