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Marco Island RFI Response

On October 7, 2022, the City of Marco Island issued a Request for Information (RFI) number #2023-001 as follows.

Request for Information (RFI) related to the best value technology methods to reduce nitrogen and phosphorus in the Marco Island Wastewater Treatment Plant (WWTP) reuse water.

Respondents should characterize projected performance benefits as well as economic parameters including capital and operating costs and other benefits and concerns associated with implementation of phosphorus removal technologies, as well as discussion of the fate of the removed phosphorus.

Applicants should submit their responses to Lina Upham, Purchasing & Risk Manager/Deputy City Clerk, City of Marco Island, 50 Bald Eagle, Marco Island, Florida, 34145, or via email to lupham@cityofmarcoisland.com. The deadline for submissions is December 6, 2022 at Noon.

Applicants should be aware that submittals in Florida become a matter of public record upon receipt.

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Marco Island Request For Information #2023-001
Phosphorus Free Water Solutions
December 6, 2022

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COMPANY BACKGROUND

Phosphorus Free Water Solutions ("PFWS") was formed in 2016 to commercialize patented technologies invented and developed at PFWS. PFWS's technology was initially demonstrated in 2017 during an 11 team "competition" at Lake Apopka for the St. John's River Water Management District ("SJRWMD"). PFWS prevailed as the successful team and in 2019 was awarded the first of several contracts by SJRWMD to clean nutrients from the waters of Lake Apopka. During 2018, PFWS was commissioned by the South Florida Water Management District ("SFWMD") to demonstrate its technology at 4 locations around Lake Okeechobee. PFWS successfully completed these demonstrations which resulted in the development and award to PFWS by SFWMD of the a nutrient removal project at the S-191 canal on the North end of Lake Okeechobee. . More recently, PFWS was selected as the water treatment contractor to respond to the Piney Point state of emergency resulting from a gypsum stack containment breach.. PFWS mobilized and within 17 days designed, constructed and commenced operations of an advanced water treatment process to remove toxic concentrations of ammonia and Phosphorus from the site.

CAPABILITIES

Since 2016, PFWS has engaged in advanced research and development directed to exploring and solving some of the most challenging water nutrient and contaminant issues confronting mankind across the globe. As result of its innovations, PFWS has been awarded numerous patents, most notably for electroless electrolytic removal of phosphorus. PFWS successfully deployed this technology at Piney Point, where we have maintained water quality effluent which meets or exceeds the FDEP discharge requirements for the site. Further, PFWS installed its patent pending proprietary electrolytic cell design for the removal of ammonia using only the native chlorides found in the water at Piney Point. This approach resulted in an unprecedented and efficient removal of ammonia as nitrogen gas. PFWS has been issued or has in process over one dozen patents directed to the efficient and effective removal of phosphorus and various forms of nitrogen from waste and surface waters.

PFWS research is not limited to the removal of nutrients from water. Indeed, PFWS is investing heavily in the research to find solutions to emerging contaminants of concern in our waters. These investments and efforts are beginning to demonstrate significant results in the safe and efficient oxidation and removal of the most pernicious of contaminates including the family of contaminants identified as the forever chemicals (polyfluorinated compounds) or PFAs for short.

PFWS maintains a staff of approximately 60 personnel ranging from site operations to our R&D staff of over 14 professionals including PhD scientists, chemical engineers and engineering technicians located at our Lakeland Facility. This group is led by Dr Carlos Borras who is cited in cutting edge research as a thought leader in the fundamentals of electrochemistry. Also in Lakeland, we have full fabrication capability where our equipment is built. This group contains our actual fabrication personnel, electricians and controls experts. Finally, we maintain a complete analytical laboratory with capability in acknowledged analytical methods.

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STRATEGIC RELATIONSHIPS

PFWS is first and foremost an advanced technology solution provider for the water treatment industry. Our solutions are delivered thru the deployment of our proprietary equipment and processes. As such, PFWS seeks to leverage established industry partners, when needed, for various standard engineering and construction capabilities necessary to complete a total solution delivery for each of its awarded projects. In order to procure these services at the most efficient cost and highest quality PFWS has established strategic relationships with local, regional and national engineering and construction firms. Notwithstanding the establishment of these relationships, PFWS maintains the freedom should a customer desire to work with the customers desired engineering teams who may hold certain beneficial site insights and experience.

CASE STUDIES

PFWS during its short history has conducted a number of pilot scale and full scale implementations of its process technology for nutrient removal. The individual case studies are attached or linked to online sources and include:

Martin County WWTP – Similar to Northside, this was a 90 day demonstration at the Tropical Farms WWTP as part of an Innovative Technology Grant application.

Tropical Farms
WWTP Demo Report

Apopka - 2017 - This is a full scale project (10 MGD) starting in 2019 with the contract execution for the removal of water column based phosphorus. https://phosphorusfree.com/results/ The most recent annual update follows. Final Report

Apopka Update .pdf

Okeechobee Demo 2019 – This was a 4 location, 90 day technology demonstration funded under a Governor's Executive Order to help reduce the intensity and duration of Harmful Algae blooms in and around Lake Okeechobee by the removal of phosphorus. https://phosphorusfree.com/results/ Final Report

Piney Point – This is an ongoing full scale project (1.5MGD) focused on Ammonia and Phosphorus Removal at the same location where we have maintained water quality meeting or exceeding the FDEP discharge requirements for the site.

Piney Point Brief.pdf

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PROPOSED PROJECT DESCRIPTION

PFWS directed this RFI response to the reuse water generated by the Reclaimed Water Production Facility in the center of Marco Island. Research indicates this water contains about 2.5 – 3 mg/l Total Phosphorus and about 6 mg/l Ammonia. The RFI requested information related to phosphorus and nitrogen removal capabilities. PFWS is uniquely positioned to address both phosphorus and ammonia (nitrogen) removal utilizing its technology portfolio that has been successfully deployed at Piney Point.

In order to mitigate any toxicity presented by the availability of excess nutrients it is necessary to address both species (nitrogen and phosphorus) in the case of Marco Island. The ammonia form of nitrogen at Marco Island is a readily available form of nitrogen capable of initiating and sustaining toxic Algae blooms. In Florida, most waters have a sufficient background of phosphorus to fuel these harmful Algae blooms if the other nutrient, nitrogen is present.

The nature of Algae is such that the average algal biomass contains about 17 parts nitrogen to 1 part phosphorus. As a result. it takes very little phosphorus to stimulate any background nitrogen and grow algae. The approach PFWS recommends is a 2 phased approach. First, phosphorus removal modules would be installed. This would be followed by an analysis of the beneficial necessity of a nitrogen removal stage. It is possible with the tidal nature of many of the island waterways that background phosphorus is very low and additional nitrogen from the reuse water would have little impact, yet additional phosphorus is like adding fertilizer to a fledgling algae bloom.

There are other ancillary benefits to the dual removal approach, most notably a significant reduction in the amount of chlorine needed for disinfection because the ammonia removal process generates its own bleach from the native chlorides in the water. This approach is particularly applicable to most coastal locations due to the unavoidable mixing of some salt water with the fresh water systems. As chloride, it just makes the water salty. In our process, as chlorine, it disinfects, decolorizes, deodorizes and produces a water incapable of sustaining algae growth. Coupled with phosphorus removal, the treated water is incapable of feeding the existing algal biomass.

FATE OF REMOVED PHOSPHORUS

Phosphorus will be removed from the water generally in the form of particulate Aluminum phosphate. This particulate will be dewatered in a combination of clarifiers and/or geotextile dewatering bags. If dewatered using clarifiers, the particulates can be added to the biosolids prior to final dewatering. The phosphate removed in this manner is recovered to the biosolids and increases the nutrient value of the biosolids themselves.

TREATED EFFLUENT WATER QUALITY TARGETS

The FDEP water quality standards for advanced water treatment are 5 mg/l TSS, 5 mg/l BOD, 3 mg/l Total Nitrogen, and 1 mg/l Total phosphorus. The standards should be viewed as a minimum acceptable limits. The phosphorus standard of 1 mg/l is approximately 200 times the threshold value (0.055 mg/l) to initiate or support an algae bloom. Moreover, the EPA target guidelines for phosphorus discharge at water treatment facilities is .075 mg/l. For clarity, 1 mg/l equals 1 part per million. The FDEP has designated the local canal waters as impaired for Nitrogen and offshore waters impaired for Nitrogen,

phosphorus and coliform. This impairment may drive the need for ammonia removal from the reuse water along with cost savings resulting from a reduced usage of bleach for disinfection.

The PFWS dual treatment process will produce reuse water significantly better than the AWT standards above. Using the same designations, the reuse water from the PFWS system will be 2 mg/l TSS, <3 mg/l BOD, 0.2 mg/l Total Nitrogen, and 0.10 mg/l Total Phosphorus. The PFWS system effluent forms an excellent foundation for a "One Water" system should that become a goal for this treated water.

APPROXIMATE COST ESTIMATES

CAPITAL

Range of Estimated Capital Cost –

PFWS Dual Treatment Capital – $3-$5 MM

PFWS Phosphorus Only Capital – $2- $3.5 MM

ANNUAL OPERATING –

Annual operating costs are approximately $640,000 for the dual treatment system most of which are offset by reduced costs in other areas.

ADDITIONAL COST OFFSETS

As a means of offsetting the capital required for this upgrade, there are several State Programs that provide grant money for a variety of purposes and specifically for WWTP upgrades – The innovative Technology Grant Program through the FDEP provides funds to implement new technology. While the PFWS Technology has been demonstrated at a variety of locations, Marco Island would be the first full scale implementation of the technology at a water Reuse Plant and thus eligible for the innovative grant funding. Grant funding is also available for WWTP upgrades which improve treatment capability to a minimum of the AWT standards. These grants do not require an innovative technology as a condition of award.

In addition, approximately 90% of the current bleach usage, the deep injection well power, a reduction in RO costs are estimated to approximately balance the projected operating costs. Intangible benefits like more reuse water available to sell, increased property values and associated tax revenues combine to make this a project with a net positive economic impact.