FIRST DRAFT 3/4/17

*Rejecting or denying science does not eliminate the inevitability of its influence*

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Colonel Jason A. Kirk

District Commander and District Engineer

U.S. Army Corps of Engineers

701 San Marco Blvd.

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[Jason.A.Kirk@usacoe.army.mil](mailto:Jason.A.Kirk@usacoe.army.mil)

Re: Private Sector Assisted Programs for Removal, Recovery, and Product Marketing of Nutrients from Impaired Surface Waters in the Kissimmee-Okeechobee-Everglades Basin

Dear Colonel Kirk:

In January of this year we served together on a panel during the Everglades Coalition Conference at the Sanibel Harbour Resort in Lee County, which was moderated by Maggie Hurchalla. At that time I presented some ideas related to the use of Managed Aquatic Plant Systems (MAPS) for the recovery and effective reuse of nutrient pollutants within the Kissimmee-Okeechobee-Everglades (KOE) watershed. You may recall it was suggested that MAPS programs, and other recovery/reuse oriented technologies, with adequate support from both the private and public sectors, could develop into new Agri-Industries that would offer the unique opportunity to both reduce nutrient pollutants while also generating valuable products such as, but not limited to, soil amendments, livestock feeds, native plants for landscaping, biofuels, fiber products, and value added extracts. The advantages of such an Agri-Industry would be direct economic enhancement through job creation and resource recycling in combination with a reduction of nutrient management costs. The secondary benefits attendant with such an Agri-Industry would be improved water quality; greater efficiency of traditional agriculture; reduction of external nutrient loading; improved fisheries; protection of tourist related activities both within the KOE and the coastal estuaries and beaches; and extension of the life of existing and proposed Stormwater treatment Areas (STA).

Technologies, such as MAPS, by facilitating actual nutrient removal from the watershed, represent long term sustainable approaches for environmental restoration and protection, which would include removal and reduction of legacy stores of phosphorus and nitrogen. If these legacy stores are not removed, they will continue to endanger the water quality within much of Peninsular Florida—including the coastal regions. It was noted in a recent study by the University of Florida for example that the legacy phosphorus in the Lake Okeechobee watershed is about 110,000 tons of reactive (available) phosphorus, and that about 400-500 tons per year of additional phosphorus is being added to the watershed—well in excess of the TMDL of 136 tons/year.

It is understood that the USACOE has been assigned the primary responsibility of water quantity management, and are presently expediting the evaluation, planning and design of large water storage areas around Lake Okeechobee in an effort to avoid a repeat of this summer’s ecological disruptions associated with large releases to coastal waters. However, the issue of water quality strategically cannot be separated from water quantity, for the effectiveness of water storage and water releases is influenced significantly by water quality. For example, deep water storage areas, developed without pre-treatment or continual treatment, could become production facilities for cyanobacteria with the possible release of extensive loads of microcystin—a known toxin which can jeopardize the health of fish, wildlife, and humans. From a scientific perspective, water storage and water quality management should be jointly considered during system design and implementation.

While there are many potential applications for MAPS, there are two concepts which we believe are scientifically sound and institutionally feasible that could be effectively implemented if all parties cooperate.

* MAPS units could be established as “kidney” type systems around Lake Okeechobee to constantly treat water from the lake, pulling out phosphorus, nitrogen and suspended solids and biodegradable organics, while increasing the dissolved oxygen within the return water. Nutrients within the return water would be recharged in the lake with legacy phosphorus such that over time this legacy phosphorus would be reduced significantly through continual recirculation through these treatment “kidneys”. Using proven production models which have been developed for MAPS units, it is estimated that 12,000 acres of MAPS process area could remove over 500 tons of phosphorus each year. More acreage of course would be needed if greater annual removal is desired. This is about ¼ of the present area in STA’s. The phosphorus removal rate for these units would be expected to be 10-20 g m-2 yr-1, as compared to about 0.5-2 g m-2 yr-1 for STA’s. These removed nutrients would be recovered as plant biomass, which can be converted to saleable products. It is anticipated that financing could be done by private interests if an institutional program could be established that paid a unit price for each pound of phosphorus and nitrogen removed from the watershed, (but not for nutrients simply stored within the watershed, as such storage simply exacerbates the issue regarding build-up of legacy stores). If the buy-back unit pricing were less than the expected price associated with government supported treatment units (e.g. STA), then money would be saved, while promoting innovative business ventures. In other words it would be a win-win for all parties. Of course as product development expanded, then returns from product sales would increase, which would allow negotiated reduction of the unit price for nutrient removal. The concept therefore would mature, and become more efficient with time. To be successful, such a program would have to be long term, for the sizable capital investments required need to be amortized for at least 20 years. If the program is established as a short term commitment (<20 years), then the risks will likely be considered too great for most private investors. Note that this “kidney” concept could well be applied to water quality maintenance within the planned storage systems, as well as pre-treatment for downgradient STA units.
* One issue which has not received much attention, but which is clearly deleterious to long term quality of water within the KOE is the use of herbicides. If seen from a scientific perspective, herbicide use serves as an organic carbon pump, which ultimately degrades the aquatic ecology as fixed carbon is delivered via necrotic plant tissue on a regular basis to the sediments. In addition, the release of nutrients from this tissue serves to assure conditions remain optimal for the continued growth of aquatic plants. And of course, with the next spraying, another dump of organic carbon will go to the lake bottom. Herbicide spraying thus serves to accelerate lake succession towards senescence while destabilizing the lake’s ecology. While the spraying does support the suppliers of the chemicals and the jobs of the applicators, it is likely that a more sustainable and positive economic model could be established around mechanical harvesting and eventual processing of the harvested material. And of course this would result in a net removal of nutrients from the watershed. Considering much of the harvesting and processing equipment would be made in the United States, and that jobs would be created at many levels in order to implement the removal, processing, and marketing of the material, it is likely the economic benefits would far outweigh those associated with herbicide applications. And of course the environmental benefits would be far greater.

As mentioned during my panel presentation, Indian River County is presently using MAPS systems to remove and recover nutrients from impaired surface waters. They also remove aquatic plants from some of their drainage canals using automatic rakes, and are given nutrient removal credit for these removals. One system, known as the Egret Marsh Stormwater System, has been in operation over five years, and has been successfully removing significant phosphorus and nitrogen loads. The algae harvested from this system is composted and is presently being marketed by a private group as LagoonSaver™. Indian River County is presently in the planning and design phase for more MAPS systems as part of the TMDL compliance program. If you wish to learn more about Indian River County’s program please contact their Director of Stormwater Division, Keith McCully P.E. at 772-480-3952, or [kmccully@ircgov.com](mailto:kmccully@ircgov.com) .

Another MAPS which has had success is a technology known as BeeMats™ also known as Floating Treatment Wetlands. This technology involves the placement of native emergent wetland plants within a floating matrix, so they grow hydroponically. Periodically the plants are removed, and can either be composted, or sold as starter plants for native landscaping. Facilities are presently in place in Ft. Pierce, New Smyrna Beach and Titusville, as well as other locations.

Please note that this letter is co-signed by a group of engineers, scientists and entrepreneurs who have been involved in developing and implementing MAPS within Florida, and around the country. At your convenience this group would like to make a formal presentation to you, with other agencies such as the Water Management Districts and FDEP in attendance, if possible. A brief summary of the co-signers is noted as follows:

* Matthew Van Ert, PhD. Matt is a biochemist with extensive experience in applied microbiology. He has been working with algae and other aquatic autotrophs for well over a decade, and has worked extensively in developing products from these organisms. He has experience in the extraction of usable protein; development of paper and biodegradable plastics; and production and marketing of compost and soil enhancement products. Matt is presently working under contract with Indian River County to develop their next generation of full scale MAPS and to process and market the algae compost associated with the Egret Marsh facility. [Vanert\_associatesllc@yahoo.com](mailto:Vanert_associatesllc@yahoo.com) 321 368 3573
* Robinson Bazurto: Robinson is a graduate marine biologist with an MBA. He has worked for over twenty-five years in aquaculture, with nearly twenty of those years working with MAPS programs, both in operations and in planning and design. As part of this experience, Robinson directed the operations of several large scale MAPS, including performance monitoring and compost production. Robinson is presently assisting Matt in the further development of the Indian River MAPS program, while also working with Hydromentia Technologies LLC on projects throughout the United States. [buhocol@hotmail.com](mailto:buhocol@hotmail.com) 772 480 5667
* Steve Beeman: Steve has both a Bachelor and Master degree in Marine Zoology, and is the founder of Beemats LLC. He is also the founder of Beeman’s Nursery Inc, which is involved in the cultivation and sale of native plants for landscaping and ecological restoration. His Beemat MAPS technology is being well received by Stormwater Managers throughout the state, and there is real potential for its further development and application within large projects in the KOE. [beemats@gmail.com](mailto:beemats@gmail.com) 386 428 8578
* Mark Zivojnovich: Mark has a Bachelor degree in Zoology and a Master degree in Wildlife Ecology. He is presently President and CEO of Hydromentia Technologies LLC, and has been involved with MAPS programs for over thirty years. He has been instrumental in coordinating large scale projects and demonstrations with various governments and agencies throughout the United States, including the Florida Department of Environmental Protection, the Florida Department of Agriculture and Consumer Services, and the South Florida Water Management District. In addition to his science background, Mark has developed business skills that have allowed him to be an effective administrator and project manager. [mzivo@hdromentia.com](mailto:mzivo@hdromentia.com) 352 804 5126
* E. Allen Stewart III P.E.: Allen has a Bachelor degree in Zoology and a Master degree in Environmental Engineering and Environmental Studies. He is a registered Professional Engineer in Florida, and has been involved in the development of MAPS programs since 1976. He presently consults with Indian River County, and with the other signatories of this letter. [astewart24149@comcast.net](mailto:astewart24149@comcast.net) 352 615 7188

There is of course an abundance of technical information related to MAPS which we would share during a formal presentation. As would be expected, we continue to expand our understanding of MAPS both as scientists and as practitioners. The development of saleable products and the expansion of potential markets is still in the early stages of refinement, and as new and more valuable uses for the harvested plants are discovered, the MAPS approach will gain appeal from an economic, social, and environmental perspective. We look forward to meeting with your group. Please contact any of the signatories should you require additional information.

Sincerely,

E. Allen Stewart III P.E.

Mathew van Ert, PhD

Steve Beeman

Robinson Bazurto

Mark Zivojnovich