Large-Scale Muck Removal under the Save Our Lagoon Project Plan, Brevard County, Florida

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ABSTRACT: A thick layer of organic "muck" sediments cover much of the bottom of the Indian River Lagoon (IRL) in Brevard County, FL. These fine-grained nutrient-rich organic sediments with high water content, create shoreline water depths too shallow for boaters to navigate without disturbing the muck sediments.

Suspended muck sediments cause several undesirable consequences. These include the deterioration of water quality and the covering of seagrass beds and the creation of anoxic benthic conditions negatively impacting the IRL's infaunal communities and the basis of the aquatic ecosystem food chain. Due to both its hydrology and physiography, deeper portions of the IRL and areas near tributaries or estuaries often collect significant quantities of nutrient-rich, fine-grained, organic muck sediments. Within Brevard County, muck covers as much as 10% of the IRL bottom.

The IRL, once a sandy bottom estuary with a modest accumulation of organic detritus from the shoreline and aquatic vegetation loss, is now profoundly impacted by fine-grained nutrient-rich organic sediments with a high water content that has accumulated over years of excess sedimentation. Stormwater runoff from urban and agricultural areas, poorly treated wastewater treatment facility discharges, leaching from septic systems, and nutrification from excess fertilizer applications have all led to harmful levels of nutrients and sediments entering the IRL.

Figure 1. Entire Indian River Lagoon Map

These nutrient based pollutants also lead to muck accumulation on the IRL's bottom, which in turn fluxes nutrients and creates a lagoon bottom that is not conducive to seagrass, shellfish, or benthic invertebrate growth. The introduction of development in the area and the subsequent substantial nutrient loading has tipped the fragile balance of this delicate ecosystem, which has led to harmful impacts and a long history of impairment of the IRL.

The objective of the project, estimated at over $400,000,000 in construction costs and the handling of millions of cubic yards of sediments, is establishing a 10-year ½ cent sales tax-funded Save Our Lagoon Project Plan. Which in turn, funds local projects planned to meet water quality targets and improve the aesthetic appeal, health, productivity, and economic value of the IRL. Of particular note, Brevard County will use almost two-thirds of the total sales tax revenues (estimated at $400,000,000) for direct muck sediment removal through dredging.

INTRODUCTION

Figure 2. Brevard County Dredging

Recent systematic efforts were undertaken within the IRL in Brevard County, FL, which provide a valuable case study for large-scale restoration of muck impaired waterbodies.

Both the IRL Comprehensive Conservation and Management Plan (CCMP) and the IRL Surface Water Improvement and Management Plan (SWIM) recommend removal of these muck sediments as an efficient means to improve water quality and natural resources within the overall IRL. The Florida Department of Environmental Protection (FDEP) also endorses the removal of muck sediments under its Total Maximum Daily Loads (TMDL) program, which works to remove the legacy loads of nutrients and pollutants associated with re-suspended muck sediments into the water column and the transport of muck into the IRL, negatively affecting seagrasses. The St. Johns River Water Management District (SJRWMD) serves as a funding partner to several IRL dredging projects including the removal of 458,733 cubic meters (600,000 cubic yards) of muck sediments from the 63 km (3.9-mile) long Eau Gallie River, a tributary of the IRL in Brevard County.

As a remedy to the Brevard County IRL muck sedimentation problems, the Brevard County Commission authorized Ordinance 2016-15 establishing a 10-year ½ cent sales tax-funded Save Our Lagoon Project Plan. Which in turn, funds local projects planned to meet water quality targets and improve the aesthetic appeal, health, productivity, and economic value of the IRL. Of particular note, Brevard County will use almost two-thirds of the total sales tax revenues (estimated at $400,000,000) for direct muck sediment removal through dredging.

These proposed environmental restoration based dredging projects will specifically target ***removing*** muck sediments from the broad expanses of the IRL shallow-water ecosystems. Brevard County with further enhance the muck removal by ***reducing*** the generation of new muck sediments by working to eliminate excess fertilizer applications, curbing stormwater runoff, ameliorating failing septic systems, and eradicating wastewater treatment facility discharges. Subsequent endeavors will include ***restoring*** acres of new submerge aquatic vegetation and oyster reefs. Finally, the County proposes to document their citizen's return on its investment through a series of highly publicized academic ***reporting*** efforts.

Figure 3. Massive IRL Fish Kills; **Figure 4**. "Vote Yes" IRL Yard Sign; & **Figure 5**. IRL "Black Mayonnaise"

APPROACH/ACTIVITIES

The following types of projects will be included under this project:

1) ***Removing*** muck sediments from broad expanses of shallow-water ecosystems.
2) ***Reducing*** the generation of new muck sediments by working to eliminate excess fertilizer applications, curbing stormwater runoff, improving failing septic systems, and removing wastewater treatment facility discharges will further enhance the muck removal.
3) ***Restoring*** acres of submerged aquatic vegetation and oyster reefs.
4) ***Reporting*** efforts through which the County proposes to document their citizen's return on their investment through a series of educational endeavors.

REMOVING MUCK SEDIMENTS

Before the passage of the Save Our Lagoon Plan (November 2016) various municipalities, agencies, and Brevard County itself had historically removed roughly 4,000,000 cubic yards of muck sediments from the IRL, along with harmful chemicals like pesticides incorporated into the sediments. Overall, the Save Our Lagoon Plan calls for Brevard County to remove nearly 150% of the legacy pollution that is stored in roughly 6,000,000 cubic yards of accumulated muck sediments from the IRL. The Brevard County Board of County Commissioners is presently advertising for the Sykes Creek Muck Dredging Project, which will remove 640,000 cubic yards of muck as part of the Save Our Lagoon Plan to improve the health and water quality of the IRL.

Figure 6. Eau Gallie River and Elbow Creek Restoration Dredging Project (SJRWMD)

REDUCING MUCK SEDIMENTS

Brevard County will boost muck removal by reducing new muck sediments through eliminating excess fertilizer applications, curbing stormwater runoff, improving failing septic systems, and removing wastewater treatment facility discharges.

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treatment facility discharges, leaching from septic systems, and nutrification from excess fertilizer applications have all led to harmful levels of nutrients and sediments entering the IRL. These nutrient based pollutants also lead to muck accumulation on the IRL's bottom, which in turn fluxes nutrients and creates a lagoon bottom that is not conducive to seagrass, shellfish, or benthic invertebrate growth. The introduction of development in the area and the subsequent substantial nutrient loading has tipped the fragile balance of this delicate ecosystem, which has led to harmful impacts and a long history of impairment of the IRL.

Organic materials, sediments, and other fine particles carried in by tributaries, canals, and storm drains accumulate and break down on the bottom, forming a thick black liquid mud with the consistency of mayonnaise. This "black mayonnaise" builds up in channels and deep pockets where it has reached recorded depths of over 15 feet thick. These muck sediments are anoxic, store and release nutrients, and destroy natural benthic habitats.

RESTORING AND REPORTING

Because the IRL is characteristically shallow, like most other lagoons, it is strongly influenced by precipitation, evaporation, and tidal, and tributary flows, which results in fluctuating water temperature and salinity. Given the unique nature of the IRL, it is not surprising that this fragile ecosystem is highly susceptible to pollution and nutrient loading effects from municipal, industrial and agricultural runoff. Urbanization, excessive freshwater releases, contaminant loading, degradation of water quality, loss of seagrasses and mangrove habitat, a fisheries decline, and emerging diseases in marine mammals have all negatively affected the health of the IRL.

With the implementation of the Save Our Lagoon Project Plan, Brevard County continues conducting an aggressive restoration strategy for the IRL. While most of the funds for the plan focus on the reduction of excess nutrient inputs and the removal of the legacy loads of muck, success will be judged by the restoration of the IRL's natural filtration systems (oysters, clams, and wetlands), and ensuring sound research and reporting is the basis of each of these efforts.

CONCLUSIONS

It has taken at least five decades to reach this point of muck build-up in the IRL, and it is going to take us many years to clean it up and to restore the waterway to a fraction of its former productivity and health. The citizens of Brevard County, with the help of numerous local and state level agencies, have undertaken a bold plan to do just that. Since the restoration of the IRL depends on a reduction of nitrogen, phosphorus, and pollutants from sediments to the overlying water, it is no accident that the majority of the funds will be directed into restoration dredging efforts.

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