SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Lake Trafford
Management Plan

October 2018

Contents

Executive Summary

Lake Trafford is a shallow, 1,500-acre lake and is Florida's largest lake south of Lake Okeechobee. It is the headwaters of several important ecosystems, including Corkscrew Swamp, and is seasonally connected to the Corkscrew Regional Ecosystem Watershed (CREW) lands and Camp Keais Strand. Over time, the lake has experienced a decline in the overall viability of the lake ecosystem. This decline has affected fisheries and tourism on the lake.

Lake Trafford was once sandy bottomed. Over time, nutrients in runoff from the watershed and the introduction of the invasive exotic plant species, *Hydrilla verticillata* (hydrilla), have shifted the lake's native aquatic vegetation to dense mats of hydrilla. Herbicides were used to control the hydrilla and dead plant material accumulated on the bottom of the lake, releasing additional nutrients. This triggered harmful algal blooms (HABs) and degraded prime spawning habitat for native fish. The blooms also contributed to reductions in the lake's dissolved oxygen levels, resulting in periodic fish kills.

With the cooperation of the U.S. Army Corps of Engineers and the South Florida Water Management District (SFWMD), the Florida Fish and Wildlife Conservation Commission (FWC), Collier County Tourism, and the SFWMD Big Cypress Basin spent over $22 million to dredge the lake, removing over 6 million cubic yards of muck, and restocked the lake with native fish and planted native vegetation. This removal of the muck and planting of native vegetation were only the beginning of restoration of the lake.

Stakeholders soon realized that ongoing management of Lake Trafford needs to be both coordinated and adaptive, and the multiple organizations working on the lake created the Lake Trafford Management Team, bringing organizations together to enhance coordination, decrease duplication of efforts, and leverage resources.

The SFWMD has been actively involved in the restoration of Lake Trafford since it was identified as a Critical Restoration Project in 2004. This plan is being written as a means to stay engaged in multi-agency restoration efforts and to continue positive momentum with lake improvements. The purpose of this document is to detail issues affecting Lake Trafford and provide a series of action plans that can be used to address those issues.

In coordination with the management team, this Lake Trafford Management Plan was developed to provide guidance on the long-term management of the lake and to document specific action plans that will achieve the goals of improving water and sediment quality, restoring and enhancing habitat, controlling invasive vegetation, and improving public use and outreach. The action plans also identify potential costs, funding sources, and potential restoration and stormwater projects that are envisioned to achieve these goals.

Introduction

Lake Trafford is a shallow 1,500-acre sub-tropical lake located in Immokalee, Florida. It is the headwaters of the Corkscrew Swamp and is seasonally connected to Corkscrew Regional Ecosystem Watershed (CREW) lands, Camp Keais, and other regional waterways. Ann Olesky park and boat ramp are on the northeast shore of the lake. Pepper Ranch Preserve abuts the northern littoral area of the lake. A forested slough flows into the eastern cove of the lake. An expansive marsh exists south of the lake and comprises the southern half of the lake shoreline. The western shore of the lake is largely undeveloped wetlands, however a few single-family lots abut the lake shore, as do a few single-family lots on the east side.

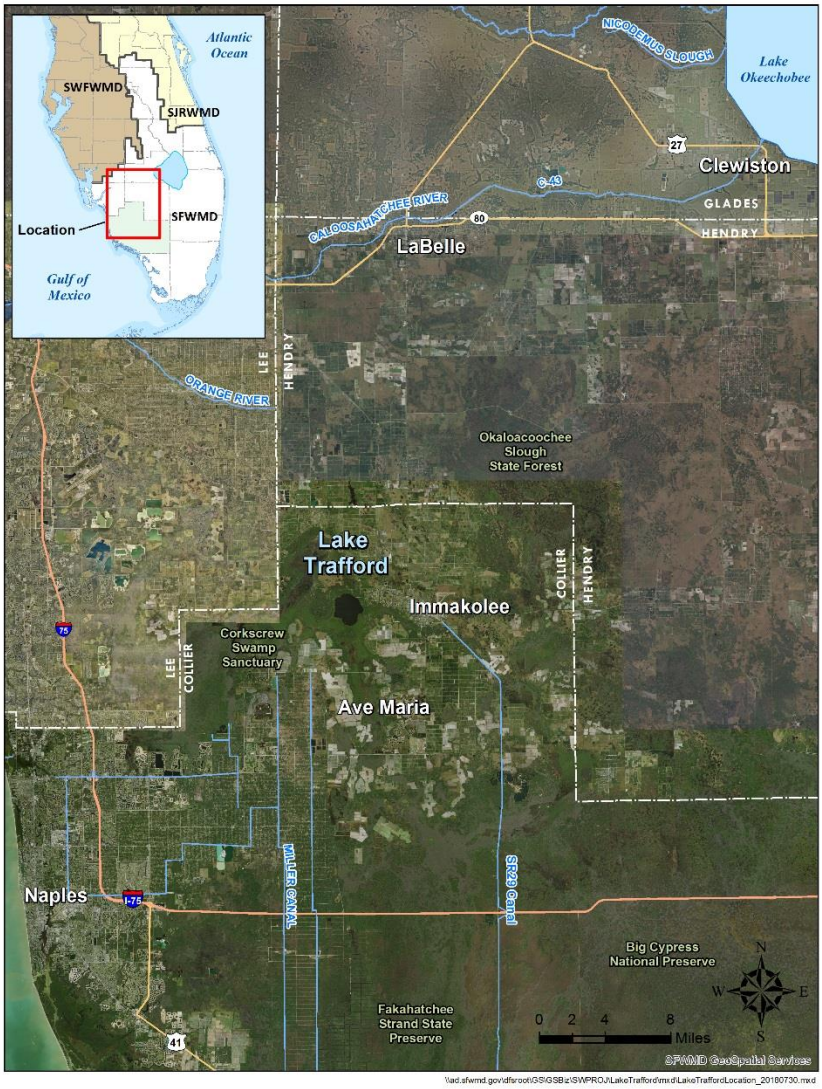


Figure 1. Location of Lake Trafford

An extensive build-up of organic sediments (muck) on the lake bottom resulted in the need to dredge the lake. As a result, the Lake Trafford Critical Restoration Project was initiated in 2006 to remove the muck build-up from the lake bottom and littoral areas. The dredging project occurred in three phases and was completed in 2010. The goal was to restore the lake bottom back to a sand/sand-marl substrate. The project resulted in the removal of over 6 million cubic yards of

organic sediments from the lake bottom. Native vegetation was subsequently planted to supplement the existing population and promote habitat for fish and wildlife.

Stakeholders soon realized that the ongoing management of Lake Trafford needed to be both coordinated and adaptive, and the multiple organizations working on the lake created the Lake Trafford Management Team, bringing parties together to enhance coordination, decrease duplication of efforts, and leverage resources. The team members are comprised of staff from the following organizations:

- Big Cypress Basin/SFWMD
- Florida Fish and Wildlife Conservation Commission
- Florida Department of Environmental Protection
- Collier County
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- Florida Gulf Coast University
- University of Florida
- The Nature Conservancy
- Corkscrew Audubon
- Natural Ecosystems
- Peninsula Engineering, Inc.

Below is a list of activities performed by various agencies:

- Removal of over 6 million cubic yards of organic sediments through the completion of a hydraulic dredging project
- Invasive exotic and nuisance vegetation control through ongoing seasonal treatment events
- Increase coverage of native herbaceous vegetation through installation of supplemental plantings
- Reduction of the coverage of *Hydrilla verticillata* (hydrilla) in the lake boundary to less than 2%
- Completion of a Lake Management Action Plan by Florida Gulf Coast University
- Completion of a Lake Trafford Watershed Delineation
- Mapping of the coverage and species of submerged aquatic vegetation (SAV) within the lake
- Reduction of the coverage of invasive exotic SAV through successful release of triploid grass carp
- Development of a water and nutrient budget for the lake
- Water quality trend assessments
- Post-dredging sediment profile assessment

Issues that continue to affect Lake Trafford are as follows:

- Nutrient loading
- Harmful Algal blooms
- Sediment resuspension and turbidity
- Exotic/nuisance species recruitment
- Recurrent fish kills
- Water quality impairments
- Management of adjacent lands

The goal of the Lake Trafford Management Plan is to improve water and sediment quality, restore and enhance habitat, control invasive vegetation, and improve public use and outreach to return the lake to a healthy, macrophyte-dominated ecosystem with diverse native plant and animal communities.

Watershed Delineation

A two-year watershed delineation project was completed in 2017 through an agreement with the Big Cypress Basin (BCB) and the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS). The delineation focused on surface water and surface flow patterns and resulted in a revised watershed boundary of approximately 16,182 acres (Appendix C). The study revealed that rainfall spatial variability, constricted flow pathways and other factors are shown to result in temporary seasonal shifts in the watershed boundary (Shukla 2017). The study was also crucial to understanding Lake Trafford, and it provides a focus area for the restoration strategies within this management plan.

State of Lake Trafford

This section details the status of water and sediment quality, aquatic vegetation, fisheries, invasive vegetation, and public use. Restoration efforts to date include dredging, fish stocking, exotic vegetation removal, and supplemental planting with native vegetation species. The lake has responded positively to the activities; however, continued restoration efforts are necessary to keep the lake on track for ecological balance and improved water quality.

Water and Sediment Quality Status and Trends

Water quality monitoring has occurred on a regular basis since 1996. Water quality samples are collected monthly in the spring, summer, and fall and bimonthly in the winter at three locations within Lake Trafford (LKTRAF1, LKTRAF4 and LKTRAF8; see Figure 2). Parameters include alkalinity, biochemical oxygen demand (BOD), ammonium (NH4), Chlorophyll-a, color, nitrate/nitrite (NOx), orthophosphorus, phaeophytin, silica, total phosphorus, total nitrogen, total organic carbon, total suspended solids, turbidity, dissolved oxygen, specific conductance, temperature, pH, and depth.

Lake Trafford is classified as impaired for nutrients, dissolved oxygen, and unionized ammonia. Additionally, its Trophic State Index (TSI), which is based on concentrations of total phosphorus, total nitrogen, and Chlorophyll a, indicates it is hypereutrophic (FDEP 2008). Trend analyses of various parameters are performed periodically to analyze the influences on water quality in the lake. A previous trend analysis revealed that external nutrient loading is a primary factor in Lake Trafford water quality (Iricanin & Hill 2016).

Current water quality data indicate the following trends for the period of January 1997 through December 2017:

- Total suspended solids exhibited an increasing trend
- Chlorophyll-a decreased until 2010, but increased after 2010
- Turbidity decreased until 2006, but increased after 2006
- Although not statistically significant, total phosphorus, soluble reactive phosphorus, total nitrogen, and particulate phosphorus exhibited decreasing trends during the period of record

Overall, it appears that the dredging activities contributed to improved water quality with respect to nutrients. The total suspended solid to turbidity ratio increased through 2009, suggesting a shift from algal dominance to autochthonous (soil like) particles. The ratios decreased after 2009, suggesting that the system may be returning to an algal-dominated system (Iricanin 2018).

Stormwater systems that drain into Lake Trafford are primarily from areas within the town of Immokalee. Additional surface waters that drain into the lake are from urban lands, agriculture lands, and natural areas. Wastewater systems within the watershed include residential septic tanks and two wastewater treatment plants.

A recent study of the water and nutrient budget of the lake revealed that most of the phosphorus enters the lake from surface water while most of the nitrogen enters the lake from groundwater. Most of the surface water comes from the east slough, while the majority of the groundwater enters near the central portion of the lake (Thomas 2016), though the source of the groundwater remains to be investigated.

Continued efforts are needed to improve water and sediment quality. These can be accomplished through the strategic implementation of water and sediment quality projects within the lake and watershed. Additionally, water quality sampling should continue as a means to document the success of the projects.

Figure 2. Surface water quality sampling locations

Aquatic Vegetation Status and Trends

Healthy SAV and emergent aquatic vegetative (EAV) communities are important to the ecological viability and water quality of the lake. They provide habitat cover for aquatic fauna and fish nurseries, uptake nutrients, mitigate wave action and turbidity, and provide food for various species of fauna. Currently, the percent coverage of SAV and EAV species is less than 20% of the lake area, with the most recent estimates of SAV at 10.6% coverage (Thomas 2015).

However, informal sampling in 2018 showed little to no SAV in the lake. The management goal for aquatic vegetation coverage in the lake is 30% (Ceilley 2013).

Previously, the invasive exotic submerged species, *Hydrilla verticillata* was highly abundant throughout the lake. The monocultures of hydrilla coincided with an overall decline in native fish and wildlife populations, demonstrating a need to control the species and promote diversity. Targeted control using aquatic herbicides and two releases of triploid grass carp have reduced the coverage to less than 2% based on the informal sampling in 2018. *Cyperus blepharoleptos* (Cuban bulrush) is a non-native emergent species that has recently encroached into the lake from the adjacent canals and slough. Although the coverage is low, maintenance efforts have begun in order to control the population and prevent further spread into the lake.

Currently, the most abundant SAV species is *Vallisneria americana* (American eelgrass). The most abundant EAV species include *Typha sp.* (cattails), *Schoenoplectus sp.* (giant bulrush), and *Paspalidium geminatum* (Egyptian paspalidium). Other species common on the lake include *Panicum hemotomon* (maidencane), *Pontederia cordata* (pickerelweed), *Thalia geniculata* (fire flag), *Eleocharis sp.* (spikerush), *Pistia stratiotes* (water-lettuce), and *Nelumbo lutea* (American lotus). A comprehensive table of species observed on the lake in 2017-2018 is provided in Appendix D.

The benefits of incorporating native SAV, EAV, and floating vegetation into habitat restoration projects are numerous. Ecological improvements have been observed from the planting work that has been done to date, but the coverages of native aquatic vegetation have not yet reached the targeted goals. Because of this, continued enhancements of native aquatic vegetation communities are necessary for the ecological integrity of Lake Trafford.

Fisheries Status and Trends

In 1996 and 1997, two major fish kills occurred in Lake Trafford as a result of nutrient-driven algal blooms. Additionally, the thick layer of muck on the bottom effectively eliminated large areas of spawning sites required by largemouth bass. Without any hard-bottom spawning sites available, largemouth bass were not successful in establishing juvenile fish populations. Additional fish kills occurred in 2004 and 2005 that essentially removed all of the remaining adult largemouth bass from the lake. Bluegill and red-ear sunfish were affected by a similar lack of spawning sites, but not to the extent that all adults were removed from the lake. Some forage species such as golden shiner and threadfin shad were significantly impacted by the fish kills as well.

Black crappie continued to be successful because of a spawning strategy that utilized the abundant vegetation on the edge of the lake as spawning habitat. This allowed crappie to become the dominant sport fish in Lake Trafford and provided anglers with at least one species to pursue in the years following the 2004 and 2005 fish kills.

Following the completion of the muck removal project in 2010, FWC stocked Lake Trafford with approximately 500,000 Florida largemouth bass from the Florida Bass Conservation Center in Richloam in 2010 and 2011. This successful stocking led to the re-establishment of the largemouth bass fishery.

As of Fall 2017, both black crappie and largemouth bass, the two dominant sportfish species in Lake Trafford, are doing well. Crappie trawl samples are producing catch rates of 20 to 30 fish per minute, which is in the range of historical sample rates, and angler catch rates are near historical norms of 2 to 3 crappie per hour. Electrofish samples of largemouth bass can vary with

sample conditions in the lake, but show that the bass fishery is at, or very close to, full recovery, with numerous fish collected in the 8 to 10 pound category and a condition factor (a measure of robustness that uses a weight to length ratio) exceeding 1.0. A condition factor of 1.0 is one of the higher readings for lakes in Florida and indicates that the available forage base provides bass with adequate resources to thrive. Other species such as bluegill and red-ear sunfish have also rebounded in recent years, with creel surveys showing higher catch rates by anglers for both species.

A number of non-native fish species are also found in Lake Trafford. They include blue tilapia, Mayan cichlid, oscar, walking catfish, sailfin catfish, and brown hoplo. FWC biologists have not found any substantial impacts to native fish at this time, however, monitoring for potential negative impacts is ongoing. All of the non-native species are impacted by cold temperatures during winter months and could suffer cold related kills if temperatures drop below 50 degrees Fahrenheit for several days. Additionally, large numbers of sailfin catfish were killed by toxins produced during an algal bloom in Fall 2017. Other species of fish were not impacted to the degree observed in sailfin catfish. Individuals are strongly encouraged to remove non-native aquarium species in a responsible manner and not to release them into Florida lakes or water bodies.

The fishery in Lake Trafford is highly dependent on a diverse and quality forage base. This forage base has shown signs of improvement over the past few years and will continue to benefit from the focus on improvements to the vegetation habitat in the lake. The habitat restoration work will provide benefits to the fishery for years to come.

Invasive Vegetation Status and Trends

Invasive vegetation are those species that tend to outcompete other species in terms of coverage and form dense monocultures. They can be native or exotic and are often indicative of an imbalance in the system. The control of submerged and floating exotic aquatic vegetation promotes the re-establishment of a diversity of native aquatic vegetation in the lake, which is critical to lake restoration objectives. In addition, the control of native EAV, such as cattail monocultures, along the shoreline improves habitat for fish, wading birds, waterfowl, and other species that depend on shallow-water habitat for one or all of their life stages.

Invasive vegetation management is primarily conducted by FWC and is achieved through herbicide treatments, installation of native vegetation, and the release of grass carp. FWC focuses on the control of submergent, floating, and emergent exotic and invasive native vegetation. These species have included Cuban bulrush, cattail, hydrilla, primrose willow, water hyacinth, and water lettuce. Currently, invasive vegetation comprises approximately 5% coverage of the lake. Continued management of invasive species is necessary to ensure the success of restoration goals and to protect the integrity and viability of the lake ecosystem.

Public Use and Outreach Status and Trends

Public access to Lake Trafford is provided through Ann Olesky Park, Pepper Ranch Preserve, and the Lake Trafford Marina. Ann Olesky Park contains a public boat ramp, dock, and fishing pier. Pepper Ranch Preserve has a boardwalk with an overlook to Lake Trafford. The Marina contains a public boat ramp.

Lake Trafford is a popular fishing and boating destination. From October 2016 through September 2017, 6,262 vehicles visited Lake Trafford through Ann Olesky Park alone. The completion of the

dredging project, improvements in fish populations, and reconstruction of the fishing pier in 2017 have encouraged continued tourism on the lake.

Lake Trafford has been featured in news articles and magazines for its resurgence, particularly in angling opportunities. Despite the articles and editorials, no official outlet for public outreach exists. Because of the uniqueness, ongoing restoration efforts, and popularity of Lake Trafford, an outreach program is recommended as a means to promote stakeholder awareness.

Interagency Planning and Coordination

Interagency planning and coordination are vital to the success of the management strategies at Lake Trafford. Coordination promotes the leveraging of resources and prevents duplication of efforts.

Funding

Potential sources of funding will be identified by the partners and team members.

Action Plans

Action plans are detailed guides that describe specific actions that can be taken to achieve various goals for Lake Trafford. This Management Plan contains fifteen action plans organized into four categories: Water and Sediment Quality, Habitat Restoration and Monitoring, Invasive Vegetation Management, and Public Use and Outreach. The action plans within each category are listed below. The action plan categories are described in further detail ahead of the action plans. For specific metrics, reference can be made to the 2013 Lake Trafford Management Action Plan.

Water and Sediment Quality

Water quality improvement is essential to the restoration of Lake Trafford. Post-dredging management efforts include reducing the amount of nutrients entering the lake and reducing and/or mitigating the nutrients still in the lake. New or existing stormwater systems in the watershed should be designed to include water quality treatment components including stormwater treatment ponds, grassy swales, and baffle boxes. Stakeholders will be encouraged to implement nutrient reduction best management practices (BMPs) to keep nutrients from entering the lake.

Water quality targets for nutrient levels in the lake should meet the existing Total Maximum Daily Load (TMDL) established for the lake in 2008 by the Florida Department of Environmental Protection (FDEP). The TMDL document established a target for the Trophic State Index (TSI) of 56 based on the background conditions for the lake. This target TSI equates to an average chlorophyll-a (Chla) concentration of 19.04 micrograms per liter (µg/l), total nitrogen (TN) concentration of 1.09 milligrams per liter (mg/l), total phosphorus (TP) concentration of 0.025 mg/l and a TN/TP ratio of 44 (Table 1). These targets are lower than the required state water quality standards (FAC 62-302), but when coupled with significant reductions in TN and TP loading of 60% and 77% respectively, these targets are expected to achieve the Class III surface water designation for Lake Trafford.

In addition to reduction of nutrients, lake restoration should include sediment management. Build-up of nutrient rich sediments will occur through in-lake processes and stormwater runoff. Suspended solids in the water column can shade out native aquatic plants that are vital to fisheries

and sediment stabilization. Projects that encourage lake bottom stabilization, reduced sediment transport, or further sediment buildup will be encouraged. Mazzotti et. al (2008)[1] indicates that total suspended solids should be no higher than 15 mg/L for proper light penetration for native aquatic plant growth, specifically for *Vallisneria americana*. In addition, this publication also indicates that chlorophyll-a should be no higher than 15 µg/L for adequate light penetration.

Restoration efforts should strive to meet or exceed the targets for water quality provided in Table 1, depending on the restoration goal. Sediment depth is a parameter that should also be included once a target depth is determined (see Action Plan WQ-3).

Table 1. Water Quality Targets for Lake Trafford

Parameter	TMDL	State Standard (FAC 62-302)	Mazzotti 2008
Chlorophyll-a (µg/L)	19.04	20	15
Total Nitrogen (mg/L)	1.09	1.27	--
Total Phosphorus (mg/L)	0.025	0.05	--
Trophic State Index	56	--	--
TN/TP ratio	44	--	--
Total Suspended Solids (mg/L)	--	--	15
Secchi Depth (m)	--	--	0.85 - 1.1

[1]Mazzotti, F. J., L. G. Pearlstine, R. H. Chamberlain, M. J. Hunt, T. Barnes, K. Chartier, D. DeAngelis. 2008. Stressor Response Model for Tape Grass (*Vallisneria americana*). CIR 1524. University of Florida/ Institute of Food and Agricultural Sciences. Available at http://edis.ifas.ufl.edu/uw281

WQ-1 Water Quality Monitoring

ACTION:
Monitor surface and groundwater quality in Lake Trafford and surrounding watershed.

BACKGROUND:
Lake Trafford is a hyper-eutrophic lake that experiences frequent algal blooms and fish kills. The lake has been identified as impaired, meaning it does not meet the Class III Freshwater State Standards for water quality. The lake currently has a Total Maximum Daily Load for dissolved oxygen, nutrients, and unionized ammonia. Continued water quality monitoring is essential to determine water quality trends.

STRATEGY:
Continue with the collection and analysis of water quality samples within the lake and watershed. Conduct trend analyses every two years to document changes in water quality within the lake and watershed. Re-evaluate the monitoring strategy as water quality improvement projects are implemented or additional information becomes available. Potential Partners: Collier County and Big Cypress Basin (BCB).

SCHEDULE:
Monthly samples are collected at three sites in Lake Trafford (LKTRAF1, LKTRAF4, LKTRAF8) and at two sites (IMKSLGH, IMKFSHCK) in the watershed (see Figure 1). Semi-annual samples are collected in the two Water Table wells (C-00532, C-1078).

COST:
Current cost of sample collection and analysis is $24,300 for Lake Trafford; $5,400 for two surface water sites and two groundwater sites in the watershed annually.

EXPECTED BENEFITS:
Continued monitoring will measure the water quality trends over time and determine the viability of implemented water quality improvement projects.

MONITORING ENVIRONMENTAL RESPONSES:
Samples will be collected and analyzed for:

Dissolved oxygen	Total Organic Carbon	Nitrite
Temperature	Biochemical Oxygen Demand	Nitrate
pH	Ammonia	Total Kjeldahl Nitrogen
Specific conductivity	Total phosphorus	Silica
Total suspended solids	Ortho-phosphate	Phaeophytin
Turbidity	Chlorophyll-a	

REGULATORY NEEDS:
None anticipated.

FUNDING:
Collier County and BCB currently contribute funding to the water quality monitoring. Additional funding/sources may be required if changes are made to the program.

WQ-2 Nutrient Reduction Best Management Practices

ACTION:
Encourage stakeholders in the Lake Trafford Watershed to follow Best Management Practices (BMPs) at residential, commercial and agricultural properties.

BACKGROUND:
Lake Trafford is a hyper-eutrophic, nutrient-rich waterbody. The nutrients feed algal blooms and kill fish. Keeping nutrients out of the lake is a top priority. It is more cost effective to prevent nutrients from entering the watershed than to remove them once they are present.

STRATEGY:
First, ensure compliance with the Collier County Fertilizer Ordinance. All residential and commercial properties must comply with Ordinance #11-24. Enforcement of the Collier County Fertilizer Ordinance is typically done on a complaint basis. If someone reports a violation of the ordinance, Collier County Code Enforcement will investigate and issue a citation, if warranted. Second, there are specific agricultural BMPs for each type of agricultural operation. Compliance with agricultural BMPs is currently voluntary unless the watershed has an adopted Basin Management Action Plan (BMAP). Potential Partners: Collier County, Florida Department of Agriculture and Consumers Services, Florida Department of Environmental Protection, South Florida Water Management District, University of Florida Institute of Food and Agricultural Sciences.

SCHEDULE:
Enforcement of the Fertilizer Ordinance is ongoing.

COST:
To Be Determined (TBD)

EXPECTED BENEFITS:
Reduction of nutrients to the watershed and lake.

MONITORING ENVIRONMENTAL RESPONSES:
Reduction of nutrients to the watershed and lake would be captured in the existing water quality monitoring efforts; however, reduction of nutrients in the lake may not be seen for some time due to in-lake nutrient cycling.

REGULATORY NEEDS:
Permits are not required to implement this plan.

FUNDING:
TBD

WQ-3 Nutrient Reduction Strategies for Wastewater and Septic Systems

ACTION:
Develop and implement strategies to reduce potential nutrient inputs from wastewater and septic systems in the lake Trafford watershed.

BACKGROUND:
Lake Trafford is a hyper-eutrophic, nutrient-rich waterbody. The nutrients feed algal blooms and kill fish. Keeping nutrients out of the lake is a top priority. It is more cost effective to prevent nutrients from entering the watershed than to remove them once they are present.

STRATEGY:
Establish a wastewater Best Management Practice (BMP) plan to reduce nutrient inputs from wastewater systems within the watershed. Evaluate the feasibility of alternatives to spray field application of biosolids, if appropriate. Other wastewater BMPs could include those for septic tanks that exist in the watershed. The Florida Department of Health is currently charged with conducting surveys and inventorying all septic tanks in Florida. Outreach during this inventory to septic tank owners to encourage BMPs may help reduce subsurface nutrient loads to groundwater. Potential Partners: Immokalee Water and Sewer District, Collier County, Florida Department of Environmental Protection (FDEP), Florida Department of Health, South Florida Water Management District.

SCHEDULE:
FDEP is currently working with wastewater treatment plants in the watershed to reduce nutrient loads in the watershed. The wastewater BMP plan is anticipated to take one year to create once approved. An implementation schedule is to be determined.

COST:
TBD

EXPECTED BENEFITS:
Reduction of nutrients to the watershed and lake.

MONITORING ENVIRONMENTAL RESPONSES:
Reduction of nutrients to the watershed and lake would be captured in the existing water quality monitoring efforts; however, reduction of nutrients in the lake may not be seen for some time due to in-lake nutrient cycling.

REGULATORY NEEDS:
Permits are not required to implement this plan.

FUNDING:
TBD

WQ-4 Manage Sediments in Lake Trafford

ACTION:
Monitor sediment thickness in Lake Trafford and develop a series of projects to reduce sedimentation and sediment suspension.

BACKGROUND:
Lake sediments build up over time, which causes nutrient cycling in the lake. Resuspension of the sediment also shades out native submergent aquatic vegetation. Between 2006 and 2010, approximately 6.3 million cubic yards of sediment were dredged from the bottom of Lake Trafford to reduce the in-lake nutrient supply that was causing algal blooms and fish kills and improve water clarity.

STRATEGY:
Monitor the thickness of the sediment and develop a target thickness of sediment acceptable at various locations in the lake. Determine sediment accrual rates. Create wind breaks to reduce sediment resuspension near critical fisheries habitat. Look for ways to reduce sedimentation such as mechanical harvesting of aquatic vegetation and removal of suspended solids from stormwater inputs and implement the activities. Determine additional steps as needed to ensure sediments are maintained within the target thickness. Potential Partners: Collier County, Big Cypress Basin, South Florida Water Management District, Florida Department of Environmental Protection and Florida Fish and Wildlife Conservation Commission.

SCHEDULE:
Monitor sediment thickness annually unless information demonstrates a need for a change in the frequency. Create the wind breaks during spring time when water levels are at the lowest for the year. The investigative portion of the strategy is to be implemented as soon as possible, with further implementation as funding is available.

COST:
TBD

EXPECTED BENEFITS:
Sediment management will reduce nutrients in the lake, improve habitat for aquatic flora and fauna, improve water clarity, and reduce the frequency of dredging.

MONITORING ENVIRONMENTAL RESPONSES:
Monitoring water clarity and other associated parameters is already being done with existing water quality monitoring.

REGULATORY NEEDS: Potential permitting requirements for stormwater retrofits and additional steps.

FUNDING:
TBD

WQ-5 Stormwater Projects

ACTION:
Identify and increase the number of stormwater retrofit projects and new projects to benefit the water quality of Lake Trafford by reducing the nutrients and total suspended solids.

BACKGROUND:
Much of the urban and agricultural areas surrounding the lake were developed and/or farmed prior to the 1970s and before implementation of stormwater treatment standards and best management practices (BMPs). As a result, untreated stormwater from these areas discharges into Lake Trafford through the east slough. The Big Cypress Basin (BCB) commissioned the Immokalee Stormwater Master Plan that was completed in 2005. Review of this plan indicated that untreated stormwater was being conveyed to the lake. The Collier County Stormwater Management Section is identifying projects through an update to the Stormwater Master Plan to provide water quality treatment of stormwater prior to discharging into Lake Trafford.

STRATEGY:
Identify and collect Immokalee stormwater outfall information regarding discharges to Lake Trafford or receiving water bodies in the watershed and integrate with the existing watershed delineation. Then, develop spatial coverage of areas that lack stormwater treatment and produce maps depicting outfalls with natural resource coverage and land use. With that, prioritize stormwater sub-basins in need of retrofits or new facilities based on the size of the drainage basin, loading, proximity to Lake Trafford, potential for pollutant reduction, cost, impacts to natural resources, and other factors. Then, identify and provide funding mechanisms and grant opportunities to implement retrofits in high-priority locations. Allocate funds to the targeted stormwater retrofits and new projects in high-priority locations. Potential Partners: Collier County and BCB.

SCHEDULE:
TBD

COST:
Identifying and collecting stormwater information and project prioritization will be accomplished with existing staff resources. The potential cost of constructing stormwater retrofits and new treatment facilities is approximately $17.4 million. (See Table X in Appendix B)

EXPECTED BENEFITS
Improved water quality; reduction in nutrients and total suspended solids.

MONITORING ENVIRONMENTAL RESPONSES:
Data will be collected, analyzed, and integrated with the existing water quality monitoring program.

REGULATORY NEEDS:
Permits are required by the South Florida Water Management District (SFWMD) and other state, federal, and local agencies.

FUNDING:
TBD

Habitat Restoration and Monitoring

Habitat restoration is critical to the management efforts of Lake Trafford and is an important component to the success of other management strategies. Improvements in the coverage of native aquatic vegetation, biodiversity, water quality, and fish populations are linked to the health and viability of the habitat. In addition, damages from invasive species warrant the need for restoration efforts in order to preserve the integrity of the system.

Past restoration efforts, including the removal of extensive hydrilla monocultures within the lake and the subsequent dredging project, resulted in a vast decline in emergent aquatic vegetation (EAV) and submergent aquatic vegetation (SAV) to a coverage of near zero percent. This was an expected result of these important and necessary efforts; therefore, re-establishment of EAV and SAV has been incorporated into the restoration strategies. Planting EAV and SAV in conjunction with other habitat restoration strategies, at the right timing, can result in substantial improvements to the ecosystem and biodiversity of the lake.

Turbidity and low water clarity are issues that affect the integrity of the habitat. They reduce light penetration in the water column, which contributes to a decline in (SAV). Turbidity in Lake Trafford appears to be largely driven by the suspension of particles in the water column from wind/wave action, with some potential to also be exacerbated by boat traffic. Increased coverages of EAV and SAV in littoral areas will help stabilize the lake bottom, reduce wave friction on the shoreline, improve water quality, and provide habitat and nursery areas for fish.

Lake Trafford contains a variety of native and exotic fish species. Healthy, naturally reproducing populations of native fish species demonstrate a viable and sustainable habitat. Because of this, regular monitoring of fish populations is necessary to document changes in species and densities that may provide clues to the health of the habitat.

A key component of many habitat restoration projects is the monitoring of the environmental response. Monitoring allows for the documentation of the changes over time and provides valuable information regarding the success of the restoration efforts. In addition, monitoring reveals when a target or goal is met. Monitoring also allows for the triggering of new restoration efforts based on information that demonstrates a need, such as the establishment of a new invasive species or a reduction in populations below a minimum target level.

Following are several key action plans for habitat restoration and monitoring at Lake Trafford. These plans include increasing native aquatic vegetation (EAV and SAV), improving water quality, enhancing fish habitat, and monitoring exotic apple snail populations. These plans should be updated or additional plans should be added based on new information or the achievement of success goals.

HR-1 Create Wind Breaks and Living Shorelines

ACTION:
Develop a series of small projects using vegetation to create wind breaks and living shorelines throughout the system to help reduce sediment suspension in Lake Trafford while concurrently improving visibility and submergent aquatic vegetation (SAV) densities with expanded light penetration. Once each project has been constructed, vegetation and turbidity levels in the lake will be monitored.

BACKGROUND:
It has been established through various studies and research that Lake Trafford turbidity is largely the result of wind-driven suspension. In addition to natural sources, commercial airboat tours, which provide an economic staple for the area, also further fuel sediment suspension from boat wash along exposed shorelines. In an effort to minimize natural and man-made sediment impacts on the lake, establishing strategic wind breaks and living shorelines would be a beneficial first step to improving light penetration needed to boost existing lake planting densities. In addition to establishing these new planting zones, careful maintenance and monitoring of the plantings would be required to ensure their success.

STRATEGY:
Select locations where the natural shoreline has been compromised and would benefit from stabilization measures and select the most effective wind break locations. Once selected, plant/create the chosen locations as a project by project basis, followed by monitoring of each. Potential Partners: TBD.

SCHEDULE:
Select project locations within first year of implementation. Select stabilization methods and plant palettes within the second year of implementation. Design, permitting, construction, monitoring, etc. to be implemented as budgets allow on a project-by-project basis.

COSTS:
- Construction plans – $3,500.00 (private sector cost).
- Physical construction of each project – TBD
- Permitting (possibly required for various projects) – permitting fees could range from $1,500 to $3,000.00 (private sector cost).
- Monitoring of projects – TBD.

EXPECTED BENEFITS:
Shoreline stabilization, reduced turbidity, and increased native plant densities. Additional wildlife habitat will also result with the success of these projects.

MONITORING ENVIRONMENTAL RESPONSES:
Monitoring will be implemented by a source chosen either by the Lake Trafford Management Team or by a bid process if the funding source dictates.

REGULATORY NEEDS:
Permits will be required for fill needed to create wind breaks.

FUNDING:
TBD

HR-2 Utilize Lake Trafford Sediment Disposal Site as a Circulating Filter Marsh

ACTION:
Explore the feasibility of creating a circulatory water filtration system for Lake Trafford by reactivating the previously permitted dredge-spoil deposition site and associated filter marshes, potentially using renewable energy sources.

BACKGROUND:
Excessive nutrient loading and suspended particulate matter in Lake Trafford have contributed to lower than ideal water quality and water clarity. A large impounded area close to the lake was once used to provide a deposition site for muck and sediment removed from the lake during the dredging project. The Lake Trafford Management Team has repeatedly discussed the concept of converting this site into an ex-situ filter marsh by planting it with a suite of native, aquatic plants and reimplementing a system to move water from the lake into the filter marsh, allowing the filtered water to circulate back into the lake.

STRATEGY:
Explore options to power a pump system to circulate water from the lake to the filter marsh and back to the lake. Design the system and calculate costs of construction, operation, monitoring, and maintenance. Renewable energy sources, such as solar and wind generated energy, may be considered. Pursue organizational support and funding through official and grant funding sources. Potential Partners: South Florida Water Management District, Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, United States Army Corps of Engineers, United States Fish and Wildlife Service, Florida Gulf Coast University, University of Florida, Johnson Engineering, Ocean Arks, Inc.

SCHEDULE:
TBD

COST:
TBD

EXPECTED BENEFITS:
Improved system resiliency, enhanced water quality and clarity, better conditions in the lake for desirable vegetation, and an increase in the value of the lake's habitat for fish and wildlife.

MONITORING ENVIRONMENTAL RESPONSES:
The Lake Trafford Management Team partners will develop water quality objectives and targets. A schedule to sample the water and analyze the indices of water quality will be developed and included in the proposal.

REGULATORY NEEDS:
The permitting necessary to implement this system will be determined; however, it is anticipated that the permitting process will be similar to the process followed to acquire the permits granted to implement the muck and sediment dredging operation in the past. There may be opportunities to renew the U. S. Army Corps of Engineers and State of Florida permits that already exist.

FUNDING:
TBD

HR-3 Develop Aquatic Vegetation Restoration Targets and Restore Habitat

ACTION:
Develop submergent aquatic vegetation (SAV) and emergent aquatic vegetation (EAV) restoration targets that incorporate restoration of lake sediments and elevations, as well as water quality improvements to promote subsequent increases in areal extent of SAV and EAV. Increase habitat within Lake Trafford through implementation of restoration projects. Monitor the increase in vegetation to refine target.

BACKGROUND:
Historical nutrient loading, herbicide treatment of invasive aquatic plants, and the disruption of lake bottom associated with dredging virtually eliminated SAV and EAV with the exception of parts of the littoral zone. Re-establishment of a diverse native plant community is critical to the long-term health of the lake. In addition, establishment of diverse native aquatic communities will require ongoing control of invasive plants, which can become dominant in the initial rapidly changing, unstable conditions of the recovering lake.

STRATEGY:
Develop a target elevation and acreage for SAV/EAV restoration based on existing information and share the target with federal, state, and local governments and stakeholders. Identify sites within the lake for restoration/creation, using the agreed upon target and develop a conceptual design for each of the priority habitat restoration projects identified. As necessary, establish interlocal agreements with parties to restore and create habitat within their jurisdiction and protect the habitat through education. Obtain permits for priority habitat restoration projects identified in Appendix C-1. Develop and implement project-specific monitoring programs to document a real increase in habitat as result of restoration projects. Continue long-term monitoring programs to document spatial and temporal changes in vegetation cover and correlate trends with water quality and sediment parameters. Potential Partners: Florida Fish and Wildlife Conservation Commission & South Florida Water Management District.

SCHEDULE:
TBD

COST:
Construction of up to 90 acres of SAV/EAV habitat over the next five years is estimated at $735,075. The estimated cost for the SAV/EAV monitoring program is $25,000 annually.

EXPECTED BENEFITS:
Improved water quality and critical habitat; stabilized sediments and improved water clarity.

MONITORING ENVIRONMENTAL RESPONSES:
Progress will be monitored by assessments of submergent and emergent vegetation. Monitoring may include project-specific monitoring and long-term monitoring programs.

REGULATORY NEEDS:
State and federal permits for construction are required. Some of the habitat restoration/ enhancement projects may qualify for the U.S. Army Corps of Engineers Nationwide Permit.

FUNDING:
TBD

HR-4 Enhance Fish Habitat and Monitor Fish Populations

ACTION:
Plant native submergent aquatic vegetation (SAV) and emergent aquatic vegetation (EAV) in strategic areas to improve fish habitat, and monitor fish populations on a regular basis

BACKGROUND:
Many of the fishery management goals that were established in 2009 have been met. However, moving forward, lake monitoring must continue to ensure that unfinished goals are met and that past successes do not begin to regress. The need for continued monitoring and work was highlighted by the fish kill observed in late 2017 and early 2018. Although not related to low dissolved oxygen this time, the fish kill was related to a harmful algal bloom that produced toxins and was the first since the restoration work began. Fish monitoring is currently being funded and conducted by FWC's (Florida Fish and Wildlife Conservation Commission) Fisheries Division.

STRATEGY:
Periodically review the Lake Trafford fishery goals for angler catch rates, electrofishing catch per unit effort (CPUE), and presence of young of year (YOY). Review and update the fishery monitoring plan adopted in the FWC Long-Term Monitoring (LTM) protocols and monitor according to the plan. Improve habitat and maintain fish populations within the goals and plans. Potential Partners: FWC.

SCHEDULE:
The implementation schedule is ongoing and occurs on a regular basis. Habitat improvement efforts will be implemented when the monitoring efforts demonstrate the fishery goals are not being met.

COST:
Costs are currently internal staff costs within FWC. Additional costs may occur for planting and/or fish stocking or other implementation measures associated with this Action Plan.

EXPECTED BENEFITS:
Improved habitat for fish and other aquatic wildlife, ecosystem improvements, enhanced recreational activities.

MONITORING ENVIRONMENTAL RESPONSES:
Monitoring should continue on a regular basis to document the status of the fishery. Diversity and abundance of native and exotic fish, as well as the health of the fish, should be monitored.

REGULATORY NEEDS:
No permitting is necessary for this action plan.

FUNDING:
TBD

HR-5 Develop and Implement an Apple Snail Monitoring and Maintenance Plan

ACTION:
Establish the locations and estimated apple snail (*Pomacea*) populations along the banks of Lake Trafford. Develop a monitoring protocol to identify and map the encroachment of non-native invasive apple snail species.

BACKGROUND:
One species of apple snail is native to Florida, the Florida apple snail (*Pomacea paludosa*). However, there are an estimated four exotic species also found within the state. Of these, two species are extremely invasive and destructive: the island apple snail (*Pomacea insularum*) and channeled apple snail (*Pomacea maculata*). These snails have been seen in small numbers on Lake Trafford and could in larger quantities alter the native vegetative habitats. Monitoring their proliferation on the lake will be important as time and money is spent on various lake improvement projects that could be affected by their presence.

STRATEGY:
Create a series of transects to be surveyed based on previous observations made by Lake Trafford Management Team members over time. Conduct a site visit to survey the areas targeted for population and identification studies. Compile a list of species seen or identification of species by egg masses, their counts, and their locations. If a control method for invasive exotic apple snail species is ever identified, then the method will be discussed among members of the Lake Management Team; and, if the team feels its use will not compromise other desirable adjacent floral or faunal species, then a control implementation plan will be developed. Potential Partners: TBD

SCHEDULE:
Develop the program and begin monitoring within two years of implementation. Monitoring will be ongoing, with frequency determined during the program development process.

COST:
Biennial monitoring of snail populations – Estimated between $1,000 and $1,700 per survey.

EXPECTED BENEFITS:
Improved restoration planning; document potential benefits to avian species, such as the snail kite (*Rostrhamus sociabilis*), that consume native and exotic apple snails; correlate plant loss resulting from invasive apple snails.

MONITORING ENVIRONMENTAL RESPONSES:
Monitoring will include identification of observed snail species, numbers and locations, and egg masses by species and location. As apple snail populations increase at the lake, bird foraging activities and species of birds seen will also be recorded during each event. If controls are found for invasive exotic species in the future, then the need for control implementation and the system's response to the control will be added to the monitoring protocol.

REGULATORY NEEDS:
Permits may be required to implement biological control measures one is found in the future.

FUNDING:
TBD

HR-6 Monitor Zooplankton and Phytoplankton Populations

ACTION:
Develop and implement a zooplankton and phytoplankton monitoring program.

BACKGROUND:
Zooplankton and phytoplankton are the basis of the aquatic food web and are important components of the lake ecosystem. Healthy zooplankton and phytoplankton communities support fish populations and promote water quality. Correlations between planktonic communities and water quality, particularly nutrients, have been documented. Understanding their population dynamics is important for ensuring that the Lake Trafford restoration goals are met. An over-abundance of phytoplankton can lead to algal blooms, which are common on Lake Trafford. Harmful algal blooms (HABs) are those that cause fish kills or other negative effects to the biota. Several HABs have occurred in Lake Trafford in recent history, most notably in October and November 2017. Currently, no program is in place to regularly monitor zooplankton and phytoplankton.

STRATEGY:
Determine the agency or group responsible for planktonic monitoring. Develop a zooplankton and phytoplankton monitoring program, determine the tools necessary for the monitoring, and determine a budget. Procure any needed materials if conducting in-house. Conduct monitoring at the planned frequency and document the results. Conduct periodic trend analyses of the planktonic communities using the information gathered and present the information to the Lake Trafford Management Team. Potential Partners: Florida Gulf Coast University (FGCU), Florida Fish and Wildlife Conservation Commission (FWC), Big Cypress Basin (BCB), South Florida Water Management District (SFWMD), University of Florida Institute of Food & Agricultural Services (UF/IFAS).

SCHEDULE:
Develop the program and begin monitoring within two years of implementation. Monitoring will be ongoing, with frequency determined during the program development process.

COST:
Seek to absorb cost internally using expertise of staff on the Lake Trafford Management Team. Otherwise, explore the cost for an external contractor.

EXPECTED BENEFITS:
Improved understanding of lake ecology for decision makers to utilize for restoration strategies and to determine success measures.

MONITORING ENVIRONMENTAL RESPONSES:
Zooplankton and phytoplankton monitoring results can be evaluated in conjunction with other monitoring parameters, including water quality, submergent aquatic vegetation, emergent aquatic vegetation, fish, etc. to gain a holistic understanding of the lake processes and responses to those processes.

REGULATORY NEEDS:
No permits are required.

FUNDING:
TBD

HR-7 Develop a Lake Resiliency Plan

ACTION:
Develop a comprehensive plan to improve resiliency from external stressors.

BACKGROUND:
External stressors, such as changes in hydrology, water quality, climate, land use, invasive species, and other parameters can affect the lake ecosystem and its ability to withstand or recover quickly. Negative effects that cause the lake to rebound slowly or not rebound at all are particularly threatening to restoration efforts. Improving the lake resiliency to these external stressors is an important step in ensuring the long-term viability of the lake.

In recent years, land managers have recognized a need to incorporate resiliency in their management plans, particularly in coastal areas or areas that are susceptible to deleterious effects of climate change, sea level rise, and other stressors. Resiliency plans can help decision makers identify vulnerabilities in the system and strategically improve those areas, so the system can withstand and quickly recover from the stressor. Currently, a lake resiliency plan does not exist for Lake Trafford.

STRATEGY:
Determine the lead agency or work group to write the resiliency plan and conduct research. Develop a budget if needed. Write the plan and submit for peer review as needed. Then, submit the plan to management for implementation. Potential Partners: Lake Trafford Management Team.

SCHEDULE:
It is anticipated that this action plan can be completed within two years.

COST:
No cost is required to develop the plan. However, costs may be required to implement the plan. The costs to implement the plan will be determined at a later date as those implementation measures are developed.

EXPECTED BENEFITS:
Improved resilience from external stressors, identification of ecological vulnerabilities, improved strategic planning, long-term viability of the lake.

MONITORING ENVIRONMENTAL RESPONSES:
Monitoring is not required for the plan; however, it may be incorporated into the plan as a means to document responses to the implementation of the plan.

REGULATORY NEEDS:
No permits are required.

FUNDING:
TBD

Invasive Vegetation Management

Invasive vegetation management involves using an integrated approach, including a combination of chemicals, supplemental planting, bio-controls, and mechanical removal. In addition, regularly scheduled vegetative monitoring events are necessary to document changes in populations over time. This documentation can then be used in vegetation management planning throughout each year.

Management efforts on the lake often range between maintaining, controlling, or eradicating target populations. Maintaining is the method of managing a population so that its coverage does not increase. Controlling is a method of managing a population within a determined coverage range. Eradication is a method that includes the full removal of a population.

Most of the invasive vegetation management efforts on Lake Trafford have been geared toward control; however, eradication of small, isolated populations of invasive species have been successfully accomplished. Additionally, the removal of the vast, dense hydrilla monoculture was a success. Although the hydrilla was not completely eradicated from the lake, very little evidence of hydrilla has been found over the last year.

Currently, ten exotic species and three native invasive species are known to inhabit Lake Trafford. The exotic species include torpedo grass, para grass, hydrilla, primrose willow, *Lygodium*, climbing cassia, water lettuce, water hyacinth, Cuban bulrush, and Brazilian pepper. The native invasive species include cattails, fire flag, and common reed. Most of these species comprise a very low percentage of the overall coverage of vegetation due to timely, targeted management efforts.

Cattails are a known problem, and their success may be attributed to the abundance of nutrients in the lake. Cattail monocultures are common around the littoral zones of the lake. Small assemblages of cattails have shown to provide habitat for wetland-dependent species. In addition, they also act as wind breaks for the shoreline. Because of this, management efforts are targeted at control rather than eradication.

Below is an action plan for invasive vegetation management within Lake Trafford. This plan involves developing targets for invasive species and maintaining within those targets. The plan should be updated, or additional plans should be added based on new information or the achievement of success goals.

IVM-1 Develop and Maintain Targets for Invasive Vegetation

ACTION:
Create an Integrated Pest Management (IPM) plan to maintain invasive and exotic vegetation within the targeted coverage.

BACKGROUND:
Because of their ability to spread quickly with little competition from native vegetation or natural predators, invasive species have the capacity to reduce biodiversity, disrupt hydrology, worsen the effects of fire, and reduce suitability for wildlife and have negative effects on ecotourism, recreation, and aesthetics. It is important to determine the coverage of invasive species that will cause harmful disruptions, and then manage the species below that coverage. A multifaceted approach, also called Integrated Pest Management (IPM), is currently the best method to control invasive exotics. This approach uses mechanical, chemical, biological, and cultural means to reduce and control invasive species. In addition, early detection rapid response (or EDRR) is a viable defense against early colonizers. Invasive species management is currently conducted by FWC's Invasive Plant Management section.

STRATEGY:
Based on the habitat type, determine a maximum percent coverage of invasive species for Lake Trafford and the surrounding marshes. Develop an IPM plan to address invasive vegetative species. Conduct regularly scheduled vegetative surveys to document the coverage of invasive vegetation, locations, and species. Conduct regularly scheduled maintenance events to target the invasive species based on the IPM plan. Potential Partners: Florida Fish and Wildlife Conservation Commission (FWC), Collier County, South Florida Water Management District.

SCHEDULE:
Develop an adaptive IPM plan within three months of determining maximum percent coverages. Conduct yearly vegetative surveys. Conduct regularly scheduled maintenance events based on targets. Revisit the IPM plan and adjust as needed based on monitoring results.

COST:
TBD

EXPECTED BENEFITS:
Improved habitat and biodiversity, sustainability of restoration plantings, improved overall productivity of the lake, increased aesthetic and recreational value.

MONITORING ENVIRONMENTAL RESPONSES:
Vegetative monitoring will be conducted annually to document the coverages of vegetative species within and adjacent to the lake. The monitoring events will record the species and percent coverages at each sampling location along fixed transects.

REGULATORY NEEDS:
No regulatory permits are needed for invasive plant management. However, applicators should have a pesticide applicator license in aquatics and natural areas or conduct this work under the direct supervision of someone who does.

FUNDING:
TBD

Public Use and Outreach

Ann Olesky Park, Lake Trafford Marina, and Pepper Ranch Preserve provide public access to Lake Trafford. Ann Olesky Park contains a public boat ramp, dock, and fishing pier. Lake Trafford Marina contains a public boat ramp and provides airboat tours. Pepper Ranch Preserve has a boardwalk to the lake.

Most people visit Lake Trafford for fishing, boating, wildlife viewing, and enjoyment of the outdoors. Because Lake Trafford is a tourist destination, public outreach is an important component of the management strategies. Public outreach allows land managers to educate the public about various issues that affect the lake, the management activities that are in-progress, and the successes of those activities. This, in turn, empowers the public to aid in restoration efforts through “ownership” of taxpayers associated with being informed.

Currently, there is no one source for public outreach materials for Lake Trafford. In addition, there is no outlet for the dissemination of outreach materials at Ann Olesky Park. Most public outreach occurs in news releases from the corresponding agencies or from articles and segments published by local reporters.

Below are action plans for public use and outreach for Lake Trafford. These plans include the development of a Lake Trafford logo, developing and executing an outreach program, and installing an informational kiosk at Ann Olesky Park. The plans should be updated, or additional plans should be added based on new information or the achievement of success goals.

PO-1 Develop and Implement a Public Use and Outreach Program

ACTION:
Develop a public use and outreach program that will educate the public about Lake Trafford and the various restoration activities associated with the lake. Identify items for different age groups and audiences and develop appropriate means to disseminate the information.

BACKGROUND:
Lake Trafford is a local tourist destination for fishing, boating, bird watching, and wildlife viewing. Airboat tours occur year-round, and Ann Olesky park provides public access to the lake via a public boat ramp and boardwalk/pier. Public outreach is an important tool for educating the community on the current condition of the lake and for sharing potential solutions to the issues that impact the lake. In addition, it can be an outlet for sharing key restoration activities that are occurring on the lake.

STRATEGY:
Develop a list of outreach items, including the goals and target audiences for each item, and create a Lake Trafford Logo to use on all outreach materials. Develop additional program activities for implementation. Determine the appropriate team members/agencies that will implement the program. Implement the program by creating the materials (flyers, pamphlets, fact sheets, etc.) and compiling them into an outreach document or “tool box.” Develop a Lake Trafford website and social media (Facebook and Twitter, YouTube) to highlight project benefits and recreational activities. Contact local agencies and schools to make them aware of the available outreach information and disseminate as appropriate. Potential Partners: Lake Trafford Management Team.

SCHEDULE:
It is anticipated that the program can be drafted within a year. The outreach will be conducted as needed.

COST:
Cost of developing the program depends on the partners involved and whether internal creative services or staff time can be used. Additional costs (TBD) may occur during implementation of the plan components.

EXPECTED BENEFITS:
Stakeholder buy-in for restoration strategies, community awareness of lake issues, empowerment through education.

MONITORING ENVIRONMENTAL RESPONSES:
Monitoring will not be necessary for the development of the plan. Monitoring during implementation of the plan may include surveys to be filled out by participants during outreach events.

REGULATORY NEEDS:
No regulatory needs are expected for the development of an outreach program.

FUNDING:
TBD

PO-2 Install an Information Kiosk at Ann Olesky Park

ACTION:
Place an information kiosk at Ann Olesky Park to post bulletins, flyers, and information about Lake Trafford.

BACKGROUND:
Information kiosks are simple and effective tools to disseminate information. In natural settings such as parks, information kiosks often include maps, brochures, and other information pertinent to the location. They are effective visual aids for telling the story of the location. When planned properly, kiosks provide opportunities to educate and communicate a variety of information, including management and restoration activities, as well as watch out situations. Ann Olesky Park at Lake Trafford is a local tourist destination for fishing, boating, bird watching, and wildlife viewing. At this location, a kiosk could be used to describe past and current restoration activities, highlight fisheries information (including fish kills), provide information about wildlife in and around the lake, describe invasive plants, and more.

STRATEGY:
Determine the most appropriate type of information kiosk for Lake Trafford and where it would be placed in the park. Contact local vendors for pricing and place the order. Install the kiosk and print appropriate outreach materials to place into the kiosk as needed. Maintain the kiosk as needed to keep it in good repair. Potential Partners: Collier County, Lake Trafford Management Team.

SCHEDULE:
It will likely take 3 months to choose a kiosk and have it installed (longer if a permit is needed).

COST:
Approximately $5,000.

EXPECTED BENEFITS:
Simple and effective means to share information about the lake.

MONITORING ENVIRONMENTAL RESPONSES:
No monitoring will be necessary.

REGULATORY NEEDS:
Potential permit may be needed.

FUNDING:
TBD

References

Ceilley, D.W., S. Thomas and E.M. Everham III. 2013. Lake Trafford Management Action Plan. Prepared for South Florida Water Management District, West Palm Beach. FL.

FDEP. Water Quality Assessment for the State of Florida, Section 305(b) Main Report. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2008. TMDL Report: Nutrient, Un-ionized Ammonia, and DO TMDLs for Lake Trafford (WBID 3259W). Florida Department of Environmental Protection, Tallahassee, FL.

Iricanin, N. and S.D. Hill. 2016. Water Quality Trends and Effects of Sediment Removal in Lake Trafford. South Florida Water Management District.

Iricanin, N. 2018. Overview of Water Quality Data Management and Analyses for Lake Trafford: (1997-2017). South Florida Water Management District.

Mazzotti, F.J., L.G. Pearlstine, R.H. Chamberlain, M.J. Hunt, T. Barnes, K. Chartier, and D. DeAngelis. 2008. Stressor Response Model for Tape Grass (*Vallisneria americana*). CIR 1524. University of Florida/Institute of Food and Agricultural Sciences.

Shukla, S. and M. Wallace. 2017. Identifying the Drainage Area of Lake Trafford: Topographic and Hydrologic Analyses. Prepared for South Florida Water Management District, West Palm Beach, FL.

Thomas, S., E.M. Everham III, D.W. Ceilley, and M. Lucius. 2015. Lake Trafford Aquatic Vegetation Monitoring and Mapping Final Report. Prepared for South Florida Water Management District, West Palm Beach, FL.

Thomas, S., J.Y. Kim, and M. Lucius. 2017. Developing a Water and Nutrient Budget for Lake Trafford, Florida, U.S.A. (Draft), Prepared for Florida Department of Environmental Protection, Tallahassee, FL.

Tschirky, P.A. 2000. Waves and Wetlands: An investigation of wave attenuation by emergent, freshwater, wetland vegetation (Doctoral dissertation). Queen's University, Kingston, Ontario, Canada.

Appendix A: Potential Restoration Projects

Habitat Mosaic Project
Create a habitat mosaic of vegetative communities within the shallow zone through supplemental planting of native vegetation (emergent, submergent and floating)

East Bay Restoration
Create a wind break and a protected cove in the eastern bay where the slough discharges into the lake. Follow up with supplemental plantings to filter water and uptake nutrients.

Mechanical Harvesting of Cattail Monocultures and Organic Sediments
Physical removal of cattails and organic substrate within the area of the northern and western lake shore and supplemental planting of native vegetation; particularly a 10± acre area on the north end.

Shoreline Enhancement
Enhance eroded shorelines through re-grading and supplemental planting with native vegetation and the creation of living shorelines

Fish Nurseries
Create fish nurseries through planting native vegetation and installing artificial “reefs” and strategically placed gravel beds

Pepper Ranch Weir Project
Hydrological enhancement of Pepper Ranch and improvements to Lake Trafford water quality through the strategic placement of a weir at the outflow of Pepper Ranch to the northern ditch that connects with Lake Trafford. The primary objectives of this project are to restore water depth and duration on the southern side of Pepper Ranch appropriate for the target wetland communities, to recharge local aquifers, and to filter out pollutants from ground water before it flows into Lake Trafford.

Appendix B: Potential Stormwater Projects

Nutrients in Surface and Ground Waters
Identify the pathways into the lake and determine nutrient contributions from those pathways.

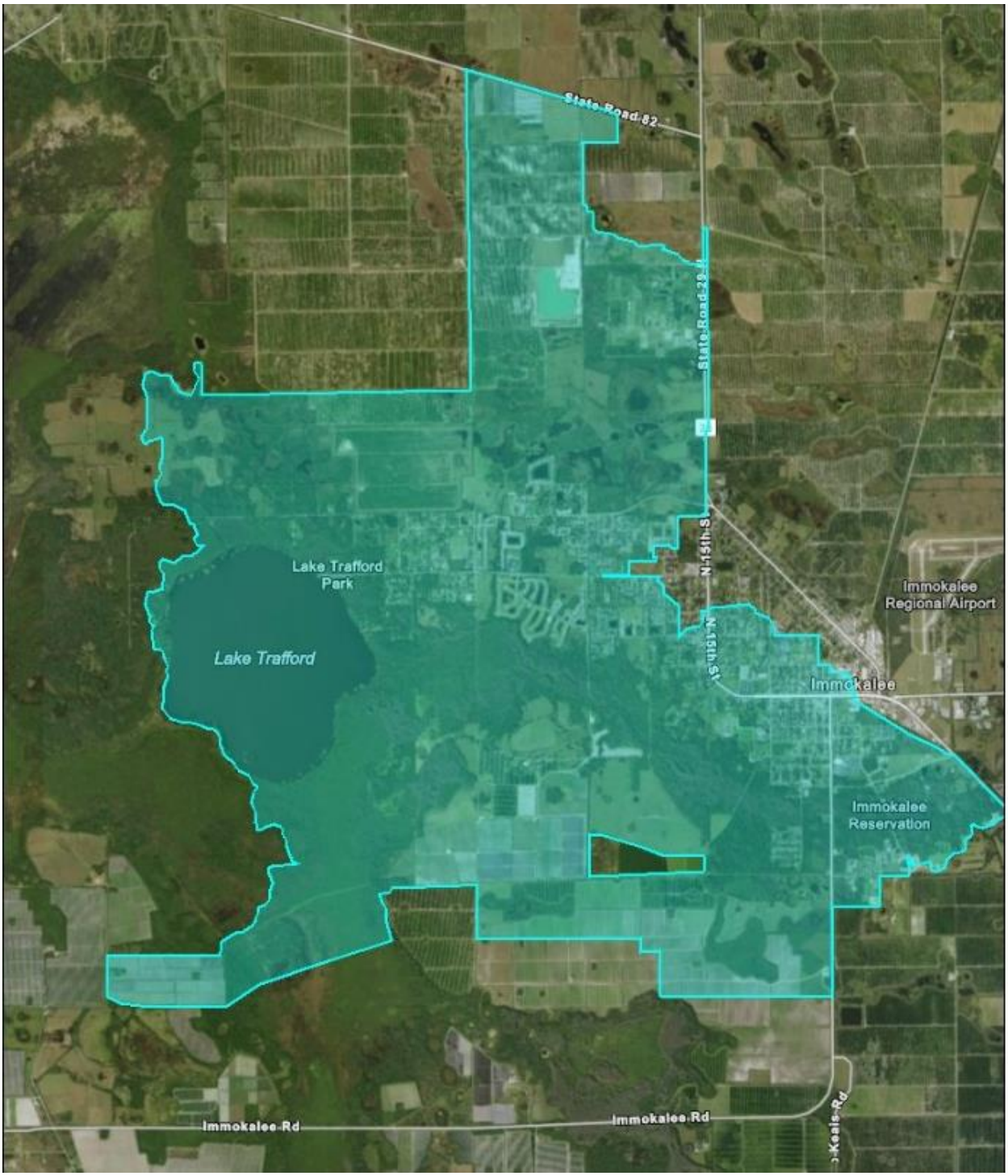
Stormwater Treatment Area (STA)
Creation of an STA to help treat water prior to entering the lake.

Filter Marshes
Creation of filter marshes to treat water prior to entering the lake.

Immokalee Stormwater System Retrofits
Installation of stormwater retrofits or new appurtenances designed to treat stormwater and reduce flooding.

Eastern Slough Improvements
Installation of water quality BMPs to reduce sediment and nutrient inputs into the eastern slough.

Appendix C: Lake Trafford Watershed Boundary



Source: Shukla and Wallace 2017

Appendix D: Vegetation Observed in Lake Trafford 2017-2018

Scientific Name	Common Name	Type	Status
Acer rubrum	Red Maple	Woody	Native
Amaranthus sp.	Amaranth	Emergent	
Annona glabra	Pond apple	Woody	Native
Bacopa sp.	Bacopa	Emergent	Native
Blechnum serrulatum	Swamp Fern	Emergent	Native
Cassytha filiformis	Love vine	Vine	Native
Cephalanthus occidentalis	Buttonbush	Woody	Native
Cyperus blepharoleptos	Cuban bulrush	Emergent	Exotic
Eichhornia crassipes	Water hyacinth	Floating	Exotic
Eleocharis sp.	Spikerush	Emergent	Native
Hydrilla verticillata	Hydrilla	Submergent	Exotic
Hydrocotyle sp.	Marsh pennywort	Emergent	Native
Ipomoea alba	Morning glory	Vine	Native
Limnobium spongia	Frog's bit	Emergent	Native
Ludwigia leptocarpa	Anglestem primrosewillow	Woody	Native
Ludwigia octovalvis	Mexican primrosewillow	Woody	Native
Ludwigia repens	Red ludwigia	Emergent	Native
Mikania scandens	Climbing hempvine	Vine	Native
Myrica cerifera	Wax myrtle	Woody	Native
Najas guadalupensis	Southern naiad	Submergent	Native
Nelumbo lutea	American lotus	Floating	Native
Panicum hemotomon	Maidencane	Emergent	Native
Panicum repens	Torpedo grass	Emergent	Exotic
Paspalidium geminatum	Kissimmeegrass	Emergent	Native
Persicaria sp.	Smartweed	Emergent	
Phragmites sp.	Common reed	Emergent	
Pistia stratiotes	Water lettuce	Floating	Exotic
Pontederia cordata	Pickerelweed	Emergent	Native
Potamogeton illinoensis	Illinois pond weed	Submergent	Native
Sabal palmetto	Sabal palm	Woody	Native
Sacciolepis striata	American cupscale	Emergent	Native
Sagittaria lancifolia	Narrowleaf arrowhead	Emergent	Native
Sagittaria latifolia	Duck potato	Emergent	Native
Salix caroliniana	Carolina willow	Woody	Native
Sambucus nigra subsp. canadensis	Elderberry	Woody	Native
Schinus terebinthifolia	Brazilian pepper	Woody	Exotic
Schoenoplectus sp.	Giant Bulrush	Emergent	Native
Thalia geniculata	Alligator flag	Emergent	Native
Typha sp.	Cattails	Emergent	Native
Vallisneria americana	American eelgrass	Submergent	Native

Appendix E: Stormwater Treatment Conceptual Project Identification

Project	Project Scope	Estimated Cost[1]	Potential Partners [2]	Status
Lake Trafford Road	Ditch and culvert upgrades along Lake Trafford Rd., west of Little League Road. Water quality pond located at the downstream end of culvert upgrades west of Tippens Terrace	$2.4 Million	Collier Co., *CRA/MSTU, BCB/SFWMD, and Grants	To Be Implemented
Fish Creek & West End of Westclox Street	Improvements to Fish Creek, creating a bypass swale system, capacity improvements for the west end of Westclox, and two 5.00-acre water quality treatment ponds	$4.9 Million	Collier Co., *CRA/MSTU, BCB/SFWMD, and Grants	To Be Implemented
Immokalee Drive/Carson Road Stormwater Treatment Facility & Eden Park Area	Culvert improvements along Carson Rd., Lake Trafford Rd., local improvements to the Eden Park area, and two water quality treatment ponds with outfall into the slough	$7.7 Million	Collier Co., *CRA/MSTU, BCB/SFWMD, and Grants	To Be Implemented
East Delaware Avenue Area	Local culvert and swale improvements, 2.26-acre water quality treatment pond, and new outfall to the south. (Project is located north and south of East Delaware Avenue)	$1 Million	Collier Co., *CRA/MSTU, BCB/SFWMD, and Grants	To Be Implemented
Roberts Avenue West	A 1.59-acre water quality treatment pond with swales entering and exiting pond. (Project is located south of Roberts Avenue West)	$450,000	Collier Co., *CRA/MSTU, BCB/SFWMD, and Grants	To Be Implemented
5th Street South Pond	A 1.21-acre water quality treatment pond with dual 48” RCP entering and exiting pond (Project is located west of South 5th St.)	$530,000	Collier Co., *CRA/MSTU, BCB/SFWMD, and Grants	To Be Implemented

Notes:
1 - Land and environmental mitigation costs are not Included in the estimated costs.
2 - Potential partners listed have not committed funds and are subject to their budget approvals.

*CRA/MSTU (Collier County/Immokalee Community Redevelopment Agency/Municipal Services Taxing Unit)

Appendix F: Letters of Support (Attached)

Collier County Growth Management Department; Capital Project Planning, Impact Fees and Program Management Division

Florida Department of Agriculture and Consumer Services; Office of Agricultural Water Policy

Florida Department of Environment Protection; Environmental Assessment and Restoration

Florida Fish and Wildlife Conservation Commission; South Region

Florida Gulf Coast University; College of Arts and Sciences

Collier County
Growth Management Department
Capital Project Planning, Impact Fees & Program Management Division

September 10, 2018

Eva Velez, P.E.
Division Director, Everglades Policy and Coordination
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

Subject: Letter of Support for the Lake Trafford Management Plan

Dear Ms. Velez:

Collier County writes to express our support for the Lake Trafford Management Plan (Plan) recently completed by the South Florida Water Management District (District). This multi-agency management team effort will provide long-term guidance and action plans for adaptive management of Lake Trafford and its surrounding ecosystem.

Lake Trafford (Lake) is a vital part of ecosystems such as Corkscrew Swamp, the Corkscrew Regional Ecosystem Watershed (CREW) lands and Camp Keais Strand. Over time, nutrient rich runoff and invasive exotic species have changed the composition of the Lake leaving it subject to increased algal blooms and degraded habitat. This Plan will improve water and sediment quality, restore and enhance habitat, control invasive vegetation and improve public use and outreach. Through the effort of State and local agencies as well as stakeholders, communication of Lake Trafford management has increased. An important effort, this coordination among stakeholders will decrease duplication of efforts and leverage individual resources.

Collier County is grateful for the effort put forth in development of the Plan and supports its implementation. We appreciate the continued efforts and leadership of the SFWMD in restoring this regional resource. We look forward to seeing the restoration progress of Lake Trafford and its surrounding ecosystem in the coming years. You may continue to count on our support and assistance in implementation of the Lake Trafford Management Plan.

Sincerely,

Amy Patterson

Amy Patterson
Director, Capital Project Planning, Impact Fees & Program Management

Office of Agricultural Water Policy
(850) 617-1700

The Mayo Building
407 South Calhoun Street
Tallahassee, Florida 32399-0800

Florida Department of Agriculture and Consumer Services
Commissioner Adam H. Putnam

September 17, 2018

Eva Velez, P.E.
Division Director, Everglades Policy and Coordination
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

Subject: Letter of Support for the Lake Trafford Management Plan

Dear Ms. Velez:

The Florida Department of Agriculture and Consumer Services' (FDACS) Office of Agricultural Water Policy (OAWP) writes to express our support for the Lake Trafford Management Plan (Plan) recently completed by the South Florida Water Management District. This multi-agency management team effort will provide long-term guidance and action plans for adaptive management of Lake Trafford and its surrounding ecosystem.

Lake Trafford is a vital part of ecosystems such as Corkscrew Swamp, the Corkscrew Regional Ecosystem Watershed lands, and Camp Keais Strand. Over time, nutrient rich runoff and invasive exotic species have changed the composition of the Lake leaving it subject to increased algal blooms and degraded habitat. This Plan will improve water and sediment quality, restore and enhance habitat, control invasive vegetation and improve public use and outreach. Through the efforts of State and local agencies as well as other stakeholders, communication of Lake Trafford management has increased. This coordination among stakeholders will decrease duplication of efforts and leverage individual resources.

The FDACS OAWP is grateful for the efforts put forth in development of the Plan and supports its implementation. We look forward to seeing the restoration progress of Lake Trafford and its surrounding ecosystem in the coming years. You may continue to count on our support and assistance in implementation of the Lake Trafford Management Plan.

Sincerely,

Bonnie Wolff Pelaez

Bonnie Wolff Pelaez
Program Planning Coordinator
Office of Agricultural Water Policy
Florida Department of Agriculture and Consumer Services

FLORIDA DEPARTMENT OF
Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Noah Valenstein
Secretary

September 12, 2018

Eva B. Velez, P.E.
Division Director, Everglades Policy and Coordination
South Florida Water Management District

Dear Ms. Velez,

Thank you for providing a copy of the Draft Lake Trafford Management Plan for our review. The department greatly applauds the South Florida Water Management District (WMD) for developing this draft plan and setting a starting point for restoration efforts. The department has been a part of the Lake Trafford research and restoration efforts for many years, and we greatly appreciate the opportunity to be a part of continued and new efforts moving forward.

The fifteen action plans detailed in the plan present a well-rounded approach to addressing the multitude of challenges facing the lake. A number of the proposed strategies look to be promising and will strengthen the future work to manage and restore Lake Trafford both in the short and the long-term. As efforts move forward, and the plan moves from draft to final, we request that the WMD maintain this proactive approach to communicating the status of the plan efforts and please do not hesitate to provide questions on any restoration aspects where the department may be able to provide guidance.

Sincerely,

Thomas Frick, Director
Environmental Assessment and Restoration
Florida Department of Environmental Protection

Florida Fish and Wildlife Conservation Commission

Commissioners
Bo Rivard
Chairman
Panama City

Robert A. Spottswood
Vice Chairman
Key West

Gary Nicklaus
Jupiter

Joshua Kellam
Palm Beach Gardens

Michael W. Sole
Tequesta

Gary Lester
Oxford

Sonya Rood
St. Augustine

Executive Staff
Eric Sutton
Executive Director

Thomas H. Eason, Ph.D.
Assistant Executive Director

Jennifer Fitzwater
Chief of Staff

Dr. Thomas Reinert
Regional Director
South Region

561-625-5122
561-625-5129 FAX

Managing fish and wildlife resources for their long-term well-being and the benefit of people.

8535 Northlake Boulevard
West Palm Beach, FL
33412-3303

Hearing/speech-impaired:
800-955-8771 (T)
800-955-8770 (V)

MyFWC.com

September 5, 2018

Eva Velez, P.E.
Division Director, Everglades Policy and Coordination
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
evelezto@sfwmd.com

RE: Letter of Support for the Lake Trafford Management Plan

Dear Ms. Velez:

The Florida Fish and Wildlife Conservation Commission (FWC) writes to express support for the Lake Trafford Management Plan completed by the Lake Trafford Management Team. This multi-agency effort will provide long-term guidance and action plans for adaptive management of Lake Trafford and its surrounding ecosystem.

Lake Trafford is an important resource locally and is a vital part of ecosystems such as Corkscrew Swamp, the Corkscrew Regional Ecosystem Watershed (CREW) lands, and Camp Keais Strand. The Plan will improve water and sediment quality, restore and enhance habitat, control invasive vegetation, and improve outreach and public use. Through the effort of state and local agencies, as well as stakeholders, communication of Lake Trafford management has increased. The outreach efforts in the Plan are a good step toward including public participation in management efforts on Lake Trafford, and FWC staff is supportive of additional public involvement in the future.

Managing fish and wildlife resources for their long-term well-being and the benefit of people is the mission of the FWC. We are proud of our role in the lake restoration process, and in the creation of the Lake Trafford Management Plan. We look forward to the continued collaboration on restoration of Lake Trafford and its surrounding ecosystem and will continue to fully support implementation of the Lake Trafford Management Plan. Please continue to coordinate directly with Barron Moody at (561) 882-5724 or by email at barron.moody@MyFWC.com for implementation assistance.

Sincerely,

Thomas R. Reinert, Ph.D.
Regional Director

Cc: Matt Morrison, South Florida Water Management District, mjmorris@sfwmd.gov
James Erskine, FWC, James.Erskine@MyFWC.com

FLORIDA GULF COAST UNIVERSITY College of Arts and Sciences

Serge Thomas, Ph.D.
Associate Professor
10501 FGCU Blvd. S.
Fort Myers, FL-33965
Ph. 239-204-0920
Email: sethomas@fgcu.edu

Friday, September 21, 2018

To:
Eva Velez, P.E.
Division Director, Everglades Policy and Coordination
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

Subject: Letter of Support for the Lake Trafford Management Plan

Dear Ms. Velez:

I have reviewed the Lake Trafford Management Plan (LTMP). Since I, Dr. Everham from FGCU and other entities initially drafted it and because I have worked on Lake Trafford (LT), I am well aware of the issues this lake and its watershed are facing. Older versions of this LTMP have in the past improved the coordination/communication of the joint efforts of State and local agencies as well as stakeholders.

LT is a vital part of ecosystems such as Corkscrew Swamp, the Corkscrew Regional Ecosystem Watershed (CREW) lands and Camp Keais Strand. Over time, nutrient rich runoff and invasive exotic species have changed the nutrient status and biodiversity of the Lake which led to a dystrophic turbid state plagued with recurrent algal blooms and a degraded natural habitat.

The task is immense and will require drastic changes in the management of the watershed and LT will have to undergo through substantial remediation implementations to make it switch to a better trophic state. This shift cannot happen unless the water quality has improved to a threshold higher than what it required to shift LT to its current turbid state. This hysteresis is indeed documented in many lake remediation programs and, as such, thorough long-term monitoring in addition to the current monitoring should take place. Such a monitoring will allow to gauge and document the changes in LT subsequent to various implementations that took or will take place.

Although I feel that although the LTMP still has room for improvement and additional items, it will, under its current state be instrumental in improving LT water quality and its surrounding watershed. The natural habitat should be improved to the detriment of encroaching invasive vegetation which should have repercussions to the rest of the food web as well as improve public use and overall the LT image.

This LTMP will undeniably continue to be essential in coordinating multi-agency restoration efforts led on LT and its watershed as well as decrease duplication of such efforts. It will additionally provide long-term guidance and action plans for adaptive management of Lake Trafford and its surrounding ecosystem.

It is thus my professional educated opinion that I am supporting the LTMP received on 0912/2018 from the South Florida Water Management District (District).

I am grateful for the effort put forth in the development of such a LTMP and support its implementation. I look forward to seeing the restoration progress of Lake Trafford and its surrounding ecosystem in the coming years. You may continue to count on my support and assistance in the implementation of the LTMP.

Yours sincerely,

Dr. Serge Thomas

South Florida Water Management District
3301 Gun Club Road • West Palm Beach, Florida 33406
561-686-8800 • 800-432-2045 • www.sfwmd.gov

sfwmd.gov