Project Background

Lake Tarpon

With a surface area of approximately four square miles and a watershed of approximately 52 square miles, Lake Tarpon, a Southwest Florida Water Management District (DISTRICT) Surface Water Improvement and Management (SWIM) Priority Waterbody, is the largest freshwater body in Pinellas County (COUNTY). The COUNTY and the DISTRICT have worked cooperatively in maintaining and improving the health of Lake Tarpon since the first Lake Tarpon SWIM Plan was developed in 1989. Because of its historically excellent water quality and rich fish and wildlife resources, the Lake has served as a regionally important recreational resource for many decades.

In recent years, however, Lake Tarpon and its associated natural resources have begun to exhibit signs of ecological stress. In 1998 the DISTRICT and COUNTY completed the cooperatively funded Lake Tarpon Drainage Basin Management Plan (PBS&J, 1998) and outlined a series of initiatives to protect the Lake from water quality degradation. Many initiatives from the Lake Tarpon Drainage Basin Management Plan (DBMP) have been implemented but the Lake continues to show declines in water quality, and the lake is now listed on the state’s verified impaired waters list for both Dissolved Oxygen and Nutrients (historic Trophic State Index). Additionally, the remaining capital improvements identified in the 1998 DBMP have been determined to be infeasible for implementation.

Characterization and Classification of Water Quality

Until 2013, FDEP utilized the Trophic State Index (TSI) for the determination of nutrient imbalances in lakes and estuaries in the State of Florida. Recently, the FDEP has developed lake-specific numeric nutrient concentration criteria (NNC) which was been subsequently approved by EPA. TSI was utilized by FDEP to determine nutrient impairment for lakes (including Lake Tarpon) and estuaries until the adoption of the NNC in 2012. TSI is calculated based on the calculated nutrient limitation (e.g., nitrogen, phosphorus or co-limited). In order to violate the TSI guidance criteria, a single year’s exceedance is needed. In regards to data sufficiency, a single sample is required from each quarter of the calendar. Specific to lakes, TSI targets were allocated based upon color classification. High color lakes (Color > 40 platinum-cobalt units (PCU)) had a TSI threshold of 60 TSI which roughly equates to “do not exceed” values for chlorophyll-a of 20 µg/L, TP of 0.07 mg/L and TN of 1.2 mg/L. A low color lake (color ≤ 20 PCU) had a TSI threshold of 40 TSI which roughly equates to do not exceed values for chlorophyll-a of 5.0 µg/L, TP of 0.02 mg/L and TN of 0.45 mg/L.

NNC was approved for classification purposes in 2013. Each lake must be characterized as a low or high color (Platinum Cobalt Units below or above 40 PCU, respectively) and then low color lakes are further classified as acidic (alkalinity ≤ 20 mg/L) or alkaline (alkalinity > 20 mg/L). The appropriate NNC criteria are assigned based upon the characterization and chlorophyll-a concentration on an annual basis, with criteria compared to the annual geometric mean for each parameter. Two exceedances of NNC criteria in any three year period denote an impaired waterbody, vs. the single year exceedance threshold of TSI.
Factors Influencing Water Quality

Lake eutrophication is a natural process of increasing nutrient enrichment and biological productivity that can be exacerbated by anthropogenic land uses. The accelerated eutrophication due to human activities is termed “cultural eutrophication”. Increased nutrients associated with eutrophication can give rise to algal blooms, which can give rise to decreased levels of dissolved oxygen (DO) in the early morning or on cloudy days. Should factors cause a rapid decline in algal biomass, DO levels can drop low enough to cause fish kills and/or odor problems.

However, factors other than nutrients alone can have strong influences on water quality. For example, water quality is strongly influenced by hydrology. In the City of Winter Haven, there are two main collections of lakes, the Chain of Lakes, and the Interior Lakes. The Chain of Lakes are connected to each other, and to large regional drainage channels; these lakes are, on average, 5 feet lower than historical levels. The Interior Lakes are not connected to each other or any regional drainage feature, and they are, on average, at the same elevation as they were 100 years ago. The lowered lake levels are thought to be the main reason why more than 70 percent of the lakes in the Chain of Lakes system are impaired, but less than 20 percent of the Interior Lakes are similarly impaired. In addition, over-zealous attempts to treat invasive species of submerged aquatic vegetation (e.g., Hydrilla) has been implicated as a factor involved in rapid deterioration of a number of lakes in Central Florida, including Lake Seminole.

Implications of NNC vs. TSI for Target-setting for Lake Management Plans

Lake Tarpon is undoubtedly a lake with problematic water quality, and it is in need of restoration projects aimed at improving its water quality. However, the nutrient load reduction strategies outlined in the DBMP (1998) and discussed in the latest SWIM Plan (2001) are based on the use of TSI, without first determining if the TSI values for nitrogen and phosphorus match up with their related TSI values for chlorophyll-a, for example. Management strategies to address external anthropogenic pollutant loadings, including stormwater treatment and installation of central sewer systems were identified based on modeling work that was done to meet a TSI goal for the lake of 55. A combination of projects focused on reducing external nutrient loads was found to be capable of decreasing TSI by 2.5 points, and therefore the DBMP highlighted the need for additional management actions to control the internal cycling of nutrient. PBS&J (1998) concluded that internal pollutant loads could be reduced by controlled harvesting of cattails and Hydrilla and by increased lake flushing and dilution. However, water quality improvements that could be achieved by macrophyte harvesting and modifications to lake levels and flushing rates were difficult to quantify, and further evaluation of their impacts was needed.

Project Goals and Approach

Atkins (CONSULTANT) will be responsible for the performance of this Scope of Work. The goals of this Water Quality Management Plan (WQMP) are to address the following questions:

- Are the nutrient targets for Lake Tarpon developed using TSI consistent with empirically-derived nutrient targets for Lake Tarpon?
- Are empirically-derived nutrient targets for Lake Tarpon consistent with NNC guidance?
- Are nutrient concentration reductions based on empirically-derived targets consistent with existing guidance on nutrient load reduction strategies?
- Are other factors, such as restoration of hydrologic functions, more likely to benefit water quality than stormwater retrofits alone?
- What projects will be most feasible and cost-effective in managing the water quality and natural resources of Lake Tarpon, within the constraints of compliance with NNC guidance?
- What are the estimated costs of these projects?

To address the above listed goals, this Scope of Work outlines a process through which water quality goals, and appropriate projects to meet the goals, will be develop. The approach will be consistent with current water quality standards. Rather than comparison of existing conditions to default state-wide TSI values, algal biomass (quantified as chlorophyll-a) will be compared not only to concurrent nutrient concentrations, but also to factors such as lake levels, water residence times, tannin concentrations, and acreage of SAV (treated or not treated). An updated hydrologic/hydrodynamic model for the Lake Tarpon watershed will be developed to provide the hydrologic framework for the WQMP, and to evaluate various lake management projects and scenarios. Deterministic models will be developed and applied in the development of appropriate and scientifically defensible water quality targets. Finally, best scientific and engineering literature and judgment will be used to develop a suite of projects and Best Management Practices (BMPs) that when implemented will lead to the attainment of the defined water quality targets.

**Project Tasks**

**Task 1 - Watershed and Water Quality Evaluation**

**Task 1.1**

The CONSULTANT will conduct a Surface Water Resource Assessment Inventory (both quantity and quality). The surface water resource assessment inventory will rely on data from the COUNTY’s current water quality monitoring program and other water quality data (e.g. STORET), as well as hydrologic and permit information available from the DISTRICT. The CONSULTANT will determine whether additional data collection is necessary to support the techniques (hydrologic models, empirically-derived water quality targets, etc.) that are to be developed for the WQMP.

**Task 1.2**

If additional data are needed, The CONSULTANT will present a summary of data gaps to the COUNTY. If the COUNTY agrees that additional data collection is needed, The CONSULTANT will prepare a Data Collection Plan that describes the proposed new data collection and study activities as well as the cost and schedule for those efforts. Funding and implementation of the Data Collection Plan will be dependent on both COUNTY and DISTRICT approval. If approved, this Scope of Work will be amended to accommodate this effort.

**Task 1.3**

Based on the findings of Task 1.1 the CONSULTANT will produce a Modeling Plan that describes the potential hydrologic and water quality models to be considered, the selection process used to evaluate their use, and if alternative modeling approaches are proposed, the justifications for such. A recommending modeling approach will be provided in the plan. Upon
approval of the *Modeling Plan* by the COUNTY and the DISTRICT, the CONSULTANT will develop, calibrate and validate watershed loading and hydrodynamic/water quality response models for Lake Tarpon and its watershed. The model(s) will consider variations and modifications in nutrient inputs, hydrologic inputs, and internal recycling processes; and will be used to assess the net water quality and/or biological response (e.g. algal abundance, dissolved oxygen conditions, FDEP derived numeric nutrient concentration criteria, and/or locally-appropriate water quality targets) to application of projects or Best Management Practices that will be used in Task 2.

**Task 1.4**

The CONSULTANT will prepare a *Draft Watershed and Water Quality Evaluation Report* that includes: a literature review and summary of prior applicable studies for Lake Tarpon; a review and compilation of existing water quality/quantity data, previous modeling efforts, and natural systems data for Lake Tarpon and surrounding watershed(s); identification and quantification of potential pollutant sources; identification of data gaps and additional data collection efforts conducted to fill those gaps; water quality protection goals for the lake and associated natural systems; and a calibrated existing conditions hydrologic/hydraulic computer model and inundation coverage to be used to analyze proposed project alternatives.

**Task 1.5**

The CONSULTANT will prepare a *Final Watershed and Water Quality Evaluation Report* incorporating review comments received on the draft from the COUNTY and the DISTRICT.

**Task 2 - Development of a Water Quality Management Plan**

**Task 2.1**

The CONSULTANT will conduct watershed and waterbody modeling of various management scenarios to be considered in the development of the WQMP.

**Task 2.2**

The CONSULTANT will use the information developed in Task 1 to develop a *Draft Water Quality Management Plan* (WQMP) that will summarize the existing conditions in the lake, provide the results of the watershed and water quality evaluations performed and use the models developed under Task 1 to identify, evaluate, and recommend several projects or Best Management Practices (BMPs) to improve water quality within the Lake and the tributaries to the Lake. These BMPs will include but not be limited to recommendations for reducing nutrient sources (sediment removal, stormwater treatment, etc.) in Lake Tarpon and its watershed. BMPs and potential restoration projects shall also address hydrologic and hydraulic issues identified within the watershed. Identified BMPs will include a conceptual design, project costs and removal rates.

**Task 2.3**

The CONSULTANT will prepare a *Final Water Quality Management Plan* incorporating review comments received on the draft from the COUNTY and the DISTRICT.
*Funds identified for Task 1.2 – Data Collection Plan are to be used only if significant data gaps are identified, and concurrence is reached between the CONSULTANT and the COUNTY that such gaps need to be addressed. If any and or all of the funds here designated are not needed, those funds would roll into later parts of the project, specifically the Task 2.2 – Draft Water Quality Management Plan.

Deliverable Requirements and Standards

The CONSULTANT will provide Pinellas County with 5 hardcopies of the final report, including all appendices. Otherwise, all other deliverables will be acceptable in electronic form.

The CONSULTANT will provide a database for any data collected under this agreement to Pinellas County within six (6) months of collection in a standardized electronic format from SWFWMD.

Horizontal Datum will be referenced to the Florida State Plane Coordinate System, West Zone (0902), Units US Survey Feet, North American Datum of 1983 (2007) including the most recent NSRS adjustment.

Vertical Datum will be referenced to the North American Vertical Datum of 1988 (NAVD 88), Units US Survey Feet, using the most recent geoid model to compute orthometric heights based on GPS derived ellipsoid heights.

Metadata will be provided for GIS deliverables and must be delivered in an ESRI ArcCatalog compatible XML format. Each data layer in the deliverable requires its own metadata XML file.

Metadata will be compliant with the Federal Geographic Data Committee's (FGDC) Content Standard for Spatial Metadata. All metadata must pass through the USGS metadata parser at http://geo-nsdi.er.usgs.gov/validation/ with no errors.