4.17. Middle Lake Hamilton

Background

Physical and chemical characteristics specific to Middle Lake Hamilton are presented here in the context of relevant regulatory criteria and requirements (Table 4-34). Middle Lake Hamilton (WBID 15002), located in the WHCL Northern Chain, is hydrologically connected to lakes Hamilton and Little Lake Hamilton via constructed navigable canals (Photo 4-20, Figure 4-68). Middle Lake Hamilton has not been declared verified impaired; therefore, a TMDL is not required. However, the NNC are performance based, and an exceedance more than once every three years results in non-compliance. The annual geometric chlorophyll *a* and TN mean in 2005 through 2007 were above the NNC. Insufficient data were available to evaluate TP in comparison to the NNC target based on the EPA data requirements. The TN and chlorophyll *a* geometric mean for Middle Lake Hamilton for the period of 1997 to 2007 and corresponding EPA NNC water quality targets are listed in Table 4-34. To comply with the NNC, concentration reductions of 18 percent for TN and 33 percent for chlorophyll *a* are required.

A summary of water quality statistics for Middle Lake Hamilton is presented in Table 4-35. Median chlorophyll *a*, TN and TP concentrations exceed the NNC targets provided by EPA for Middle Lake Hamilton. Chlorophyll *a* concentrations in Lake Haines have fluctuated but have remained consistently elevated above 20 µg/L (Figure 4-69). A statistically significant trend in chlorophyll *a* concentrations from 1994 to 2007 was not observed (seasonal Kendall-Tau, $p > 0.10$). Lack of eradication projects in Middle Lake Hamilton suggest that *Hydrilla* infestations do not appear to be a problem. Middle Lake Hamilton is adjacent to a terminal lake, therefore, improvements in water quality of the lake would result in little benefits farther downstream.

The Middle Lake Hamilton watershed is 1,072 acres in size and includes 199 acres (19 percent) of developed lands compared to 873 acres (81 percent) of undeveloped lands. The 2000-2007 median color value (115 PCU) was above 40 PCU indicating the lake is a colored lake. Using the adopted EPA NNC for Florida lakes, characterization of alkalinity or acidity is not necessary based on the colored classification of Middle Lake Hamilton. The lake area, perimeter, water depth, and volume statistics are based on a water level elevation of 118 feet in February of 2010. Bathymetry data are available for Middle Lake Hamilton for the February 2010 water level elevation (Figure 4-70). Changes in overall surface area, water depth, and volume of the lake should be considered during the development and implementation of water quality restoration projects.

Water Quality Restoration Project Selection and Priorities

Based on Middle Lake Hamilton water quality and the surrounding watershed characteristics, five potential water quality restoration projects were identified using the WHCL WQMP decision key (Figure 4-71). The decision key presents the factors on which yes/no decisions were based and used to identify and select water quality improvement projects. Projects to address water quality, nutrient and sediment loading, and reduced lake levels are proposed. The projects are listed in order of priority, based on expected water quality improvements. A detailed discussion of the potential water quality restoration implications for each project can be found in Section 3.0.

- Project 1: Stormwater Infiltration Areas (SIAs)
- Project 2: Sediment Removal/Inactivation
- Project 3: Forested Wetland Rehydration
- Project 4: SAV Planting/Management or FTWs
- Project 5: EAV Planting/Management

Table 4-34. Physical, chemical, and regulatory characteristics of Middle Lake Hamilton.

Physical			
Location in chain	Northern	**High infiltration soils (acres)**	332 (31 percent)
Relation to other lakes	Adjacent to Terminal	**Developed land (acres)**	199 (19 percent)
Watershed area (acres)	1,072	**Undeveloped land (acres)**	873 (81 percent)
Lake area (acres)*	101	**Median water depth (feet)***	3.7
Perimeter (feet)*	10,932	**Maximum water depth (feet)***	5.7
Surface area: lake volume ratio*	0.28	**Volume (acre-feet)***	359
Watershed to surface area ratio*	10.61		
Water Chemistry			
Locally-derived: acidic or alkaline	NA	**Clear or colored**	Colored
Geometric mean chlorophyll *a* (µg/L)	30	**NNC chlorophyll *a* target (µg/L)**	20
Geometric mean TN (mg/L)	1.51	**NNC TN target (mg/L)**	1.23
Geometric mean TP (mg/L)	ID	**NNC TP target (mg/L)**	0.050
Regulatory Data			
Impaired	Yes	**TMDL status**	NA
Chlorophyll *a* trend	No trend**	**TP concentration reduction required**	ID

*at a water level elevation of 118 feet
**presented in section 5.0
NA- Not Applicable
ID- Insufficient Data

Photo 4-20. Fisherman on Middle Lake Hamilton.

Table 4-35. Middle Lake Hamilton water quality summary for 1997 to 2007.

Parameter	N	Minimum	Median	Maximum
Chlorophyll *a* (µg/L)	26	3	27	54
Color (PCU)	19	50	115	200
Conductivity (µmhos/cm)	19	169	204	271
Dissolved oxygen (mg/L)	19	4.98	7.5	9.46
pH	19	6.21	7.24	7.91
Secchi depth (feet)	26	1.1	2.1	3.0
Total nitrogen (mg/L)	26	1.05	1.56	2.46
Total phosphorus (mg/L)	21	0.043	0.070	0.167

Figure 4-68. Middle Lake Hamilton and associated watershed.

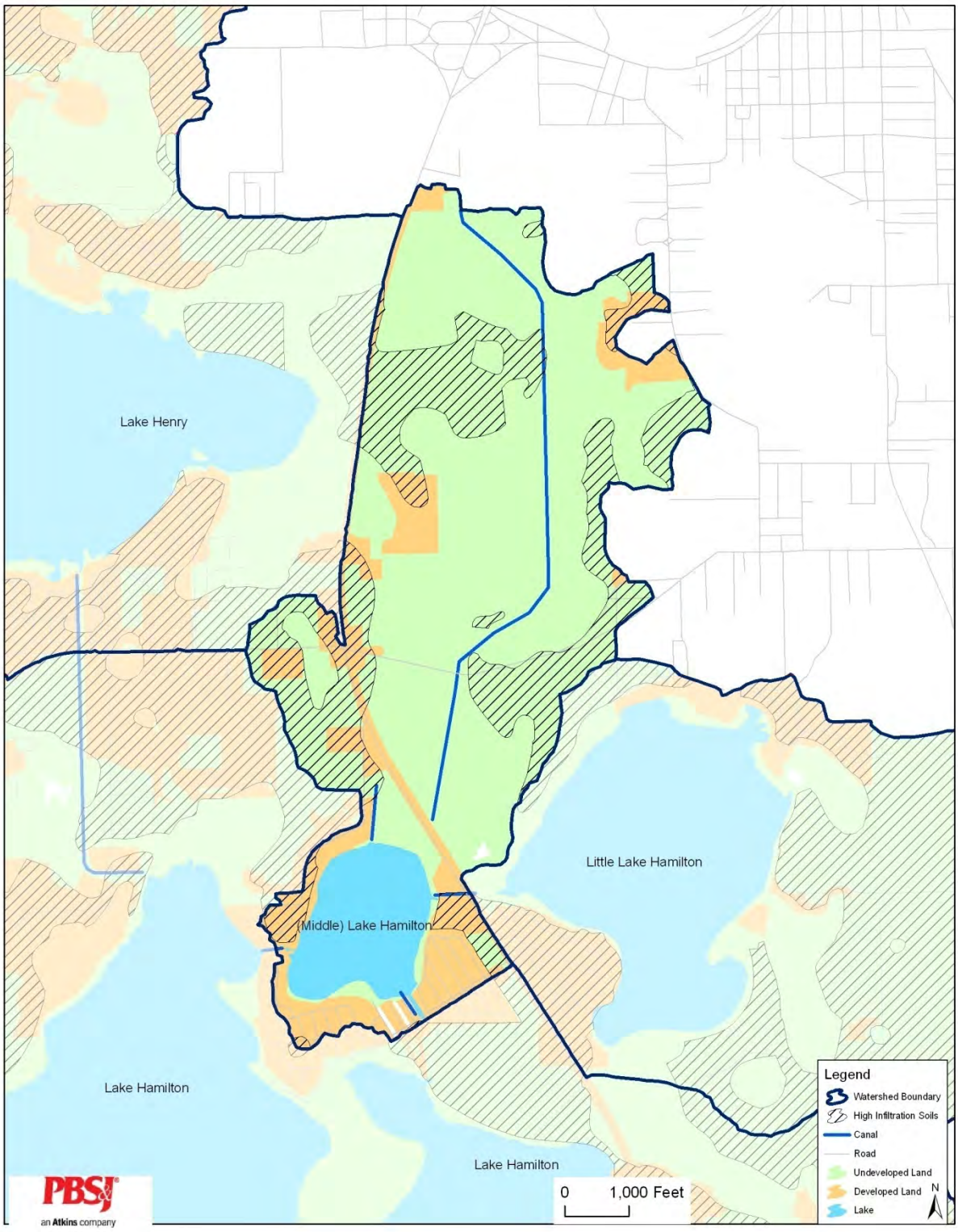


Figure 4-69. Middle Lake Hamilton chlorophyll *a* concentrations using available data from 1993 to 2007.

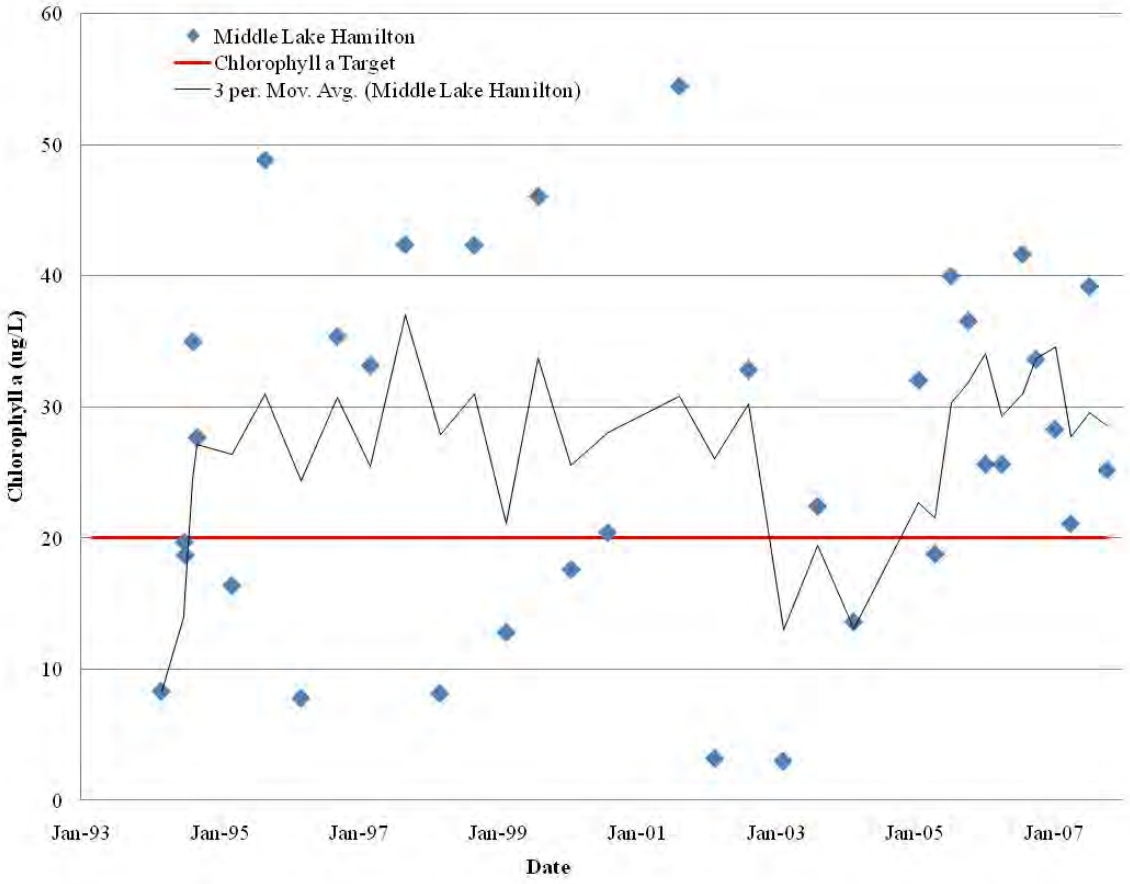
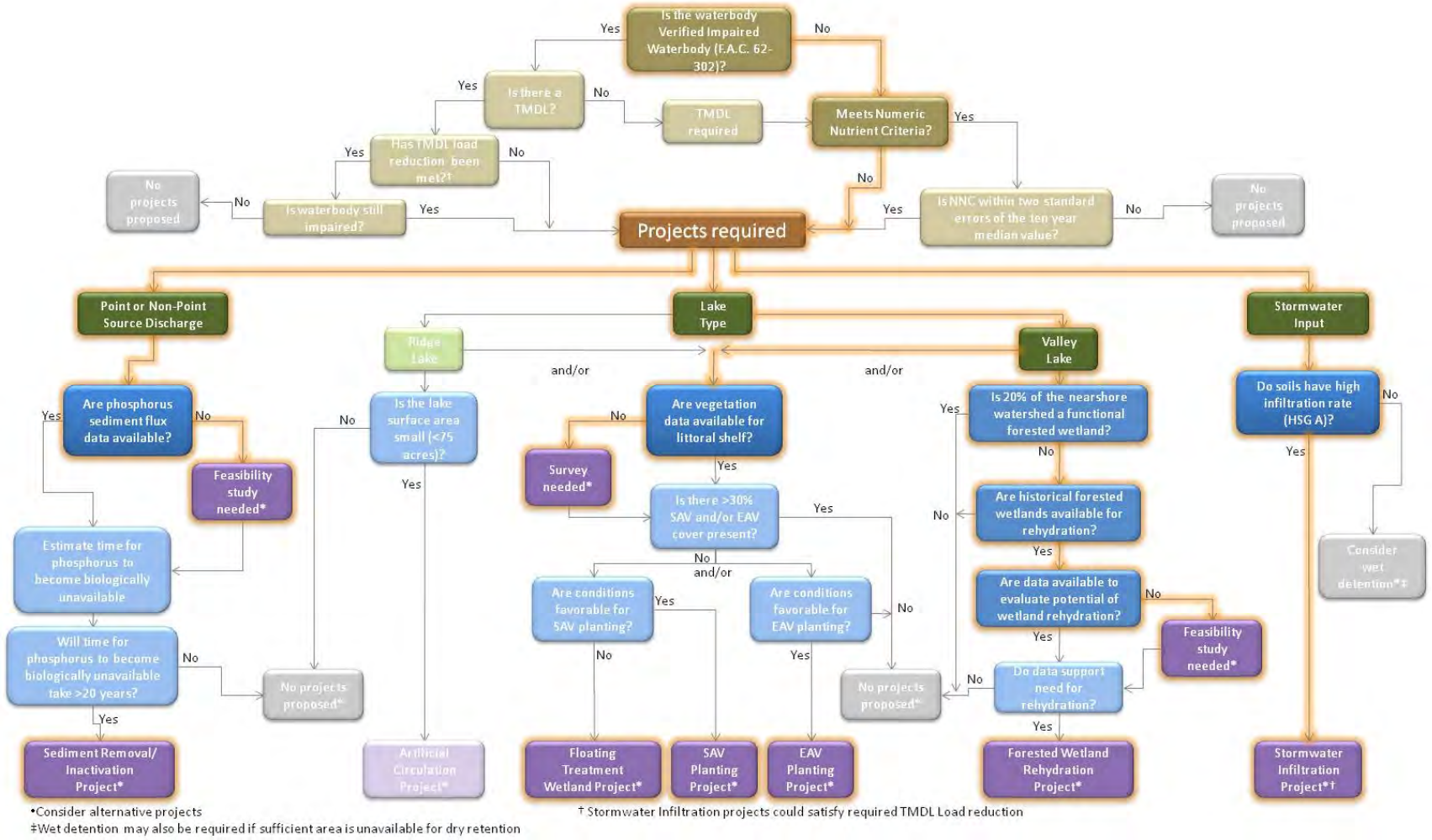


Figure 4-70. Middle Lake Hamilton bathymetry (February 2010) at water level elevation = 118 feet (Polk County Water Atlas).

Figure 4-71. Middle Lake Hamilton decision key: highlighted path shows decision process.



Project 1: Stormwater Infiltration Areas (SIAs)

The Middle Lake Hamilton watershed has approximately 332 acres (31 percent of the watershed) classified as high infiltration soils. A TMDL is not required for Middle Lake Hamilton and the Northern Chain was not included in the PLRG study (USF 2005), therefore data to estimate SIA acres for TP load reduction are not available at this time. The SIA design should be focused on recharging the surficial aquifer. SIA implementation could have a double benefit of increasing storage to supplement dry season lake levels and a reduction in stormwater loads that can be later applied to the required TMDL TP load reduction.

Project 2: Sediment Removal/Inactivation

Non-point source discharges to Middle Lake Hamilton may have resulted in substantial internal nutrient loads due to phosphorus release from sediments. Presently, sufficient data are not available to evaluate the internal phosphorus load and calculate the phosphorus decay rate and the time at which the phosphorus will ultimately become biologically unavailable in the lake sediments. A feasibility study is required to determine whether sediment removal/inactivation is necessary to reduce internal phosphorus loads to the lake.

Cost Estimate: $10,000.

Project 3: Forested Wetland Rehydration (and Restoration)

Approximately 19 percent of the land cover within the 500 foot buffer surrounding Middle Lake Hamilton is classified as wetlands using the 2006 FLUCS data. Forested wetlands encompass five percent of the total wetland area, which is not within the 10 to 20 percent recommended forested wetland cover required to maintain color levels above 50 PCU.

Middle Lake Hamilton has a watershed area of 1,072 acres draining into the 101-acre lake (watershed to lake ratio of 10.61). Also, a relatively large portion of the watershed is undeveloped (81 percent) and has low percolation soils (84 percent).

One proposed project is to rehydrate (restore) approximately 350 acres (Figure 4-72) of historically low lying lands that have been drained by the Haines City Drainage Canal. This project would treat stormwater runoff from a substantial portion of the watershed before it enters the lake and has been recommended by the Sustainable Water Resource Management Plan for re-creating lost storage in the watershed. A feasibility study is recommended to evaluate the proposed project area for inundation.

Feasibility study cost estimate: $100,000.

Project 4: SAV Planting or FTWs

SAV Planting

Middle Lake Hamilton does not have a history of *Hydrilla* infestations. A survey of existing SAV cover in Middle Lake Hamilton is recommended due to the lack of sufficient data to

calculate percent lake cover. Based on the results of the SAV survey, conclusions regarding SAV planting can be determined. If SAV cover is less than 30 percent, lake conditions should be evaluated to assess if additional SAV is viable based on the soil condition, water clarity and water depth.

SAV plants should not be planted in water depths greater than 2 feet based on the median secchi depth values (2.1 feet). The maximum planting effort for Middle Lake Hamilton cannot be calculated until the electronic bathymetry data are acquired.

Cost Estimate: A cost estimate will be generated upon receipt of the bathymetry data.

FTWs

If the feasibility study indicates that more than 30 percent of Middle Lake Hamilton has SAV cover, FTW may be considered. The installation of floating mats with appropriate aquatic vegetation would be expected to assimilate nutrients from the water column.

Project 5: EAV Planting

A survey of existing shoreline vegetation surrounding Middle Lake Hamilton is recommended due to the lack of sufficient data at this time. Based on the results of the shoreline survey, conclusions and recommendations regarding emergent aquatic or woody vegetation planting can be determined. If limited shoreline vegetation is present, shoreline conditions should be evaluated to assess if vegetation planting is viable based on the soil conditions, slope, water level and inundation frequency and wave disturbance.

Figure 4-72. Proposed forested wetland rehydration project area for Middle Lake Hamilton.