



Cooper Lake

LAKE HABITAT ASSESSMENT, LAKE VEGETATION INDEX, SUBMERGED
VEGETATION SURVEY AND WATER QUALITY

David Eilers, Karina Gonthier | USF Water Institute | June 22, 2023

Methods

STUDY AREA ANALYSIS

The watershed containing the Cooper Lake was analyzed using ESRI ArcGIS Pro. Using this software with 2022 ESRI Basemaps aerial, 2017 Land Use/ Land Cover (LULC), Landscape Development Intensity (LDI) Index values were calculated for the 100 meter buffer surrounding the lake following the procedures of FDEP

(<https://floridadep.gov/dear/bioassessment/content/bioassessment-ldi-hdg-bcg>). “The Landscape Development Intensity index (LDI) is an estimate of how much humans have altered an area of interest around a waterbody. Various land use types (low density residential, row crops, industrial, natural) are assigned coefficients of land use intensity based on estimates of the amount of human energy that is put into those land use types. The LDI is calculated by multiplying each land use coefficient by the percentage of the area of interest occupied by that land use, and then summing the results. The Florida Department of Environmental Protection (DEP) uses the LDI as a tool to estimate potential land use impacts on streams, lakes, and wetlands. For streams and rivers, DEP typically uses a LDI calculated for the 100 m buffer of the waterbody for 10 km upstream of the point of interest. For lakes and isolated wetlands, DEP typically uses a LDI calculated for the 100 m buffer around the waterbody. LDI values less than two (≤ 2) can be considered minimally disturbed.”

LAKE BATHYMETRY AND MORPHOLOGICAL CHARACTERISTICS ASSESSMENT

The **Bathymetric Map**¹ provides the lake’s morphologic parameters in various units. The bottom of the lake was mapped using a Lowrance Elite 7 Ti Wide Area Augmentation System (WAAS)² enabled Global Positioning System (GPS) with Totalscan transducer (bottom sounder) to determine the boat’s position, and bottom depth in a single measurement. The result is an estimate of the lake’s area, mean and maximum depths, and volume and the creation of a bottom contour map. Besides pointing out the deeper fishing holes in the lake, the morphologic data derived from this part of the assessment can be valuable to overall management of the lake vegetation as well as providing flood storage data for flood models.

¹ A bathymetric map is a map that accurately depicts all of the various depths of a water body. An accurate bathymetric map is important for effective herbicide application and can be an important tool when deciding which form of management is most appropriate for a water body. Lake volumes, hydraulic retention time and carrying capacity are important parts of lake management that require the use of a bathymetric map.

² WAAS is a form of differential GPS (DGPS) where data from 25 ground reference stations located in the United States receive GPS signals from GPS satellites in view and retransmit these data to a master control site and then to geostationary satellites. For more information, see end note 2.

LAKE VEGETATION INDEX ASSESSMENT

Hillsborough County requested the implementation of the Florida Department of Environmental Protection methods for Lake Vegetation Index (LVI 1000) (<http://www.dep.state.fl.us/water/sas/sop/sops.htm>) using forms FD 9000-03 (Physical/Chemical Characterization), FD 9000-06 (Lake Habitat Assessment) FD 9000-27 (LVI Field Sheet) and FD 9000-31 (Lake Observation Field Sheet).

The Lake Vegetation Index (LVI) is a rapid assessment protocol in which selected sections of a lake are assessed for the presence or absence of vegetation through visual observation and through the use of a submerged vegetation sampling tool called a Frodus. The assessment results provide a list of species presents and the dominant and where appropriate co-dominant species that are found in each segment. These results are then entered into a scoring table and a final LVI score is determined. LVI scores provide an estimate of the vegetative health of a lake. Our assessment team was trained and qualified by FDEP to conduct these assessment as an independent team and must prequalify each year prior to conducting additional assessments. The LVI method consists of dividing the lake into twelve pie-shaped segments (see diagram below) and selecting a set of four segments from the twelve to include in the LVI. The assessment team then travels across the segment and identifies all unique species of aquatic plant present in the segment. Additionally, a Frodus is thrown at several points on a single five-meter belt transect that is established in the center of the segment from a point along the shore to a point beyond the submerged vegetation zone. For scoring, the threshold score for impairment is 43.

Four metrics are utilized in the Lake Vegetation Index Survey; Dominant Coefficient of Conservatism (CoC), Percent Florida Exotic Pest Plant Council Type 1 (% FLEPPC), Percent Native Taxa, Percent Sensitive Taxa.

The Dominant Coefficient of Conservatism (CoC) metric for the dominant or co-dominate species in each section. The CoC applies a score of 0-10 to each species based on its ecological tolerances and fidelity to pre-settlement conditions. Species with higher scores show a high fidelity to native, undisturbed habitats and are typically sensitive to alterations. Available CoC scores can be obtained from LT 7000 from the Florida Department of Environmental Protection at: <http://www.dep.state.fl.us/water/sas/sop/sops.htm>.

The percent FLEPPC (Florida Exotic Pest Plant Council) Category 1 invasive exotic taxa in a single sampling unit (pie slice) by dividing the number of FLEPPC Category I taxa by the total number of taxa in that sampling unit. Multiply result times 100. Refer to Appendix LVI 1000-1 to determine which plants are on the FLEPPC Category 1 list. Note that not all exotic taxa should be included in this metric, only those listed in Appendix LVI 1000-1 as Category 1 FLEPPC. If the FLEPPC updates their list of Category 1 exotics, those updates shall not be reflected in this calculation until they are included in Appendix LVI 1000-1.

The percent native taxa in a single sampling unit (pie slice) is calculated by dividing the number of native taxa by the total number of taxa in that sampling unit. Multiply result times 100. Nativity status is determined by the Plant Atlas from the Institute for Systematic Botany, and is listed in Appendix LVI 1000-1. For informational purposes, visit the website

<http://www.florida.plantatlas.usf.edu/>. Taxa that are native according to the Plant Atlas from the Institute for Systematic Botany but are not on the list in Appendix LVI 1000-1 may be included in this metric calculation, but inclusion of these additional taxa is not required.

The percent sensitive taxa in a single sampling unit by summing the number of taxa with a C of C (Coefficient of Conservatism) score ≥ 7 and then dividing by the total number of taxa in that sampling unit. Multiply result times 100. Refer to Appendix LVI 1000-1 for a list of C of C scores.

The collected bathymetric data is analyzed for submerged aquatic vegetation (SAV) calculations including the percentage of the surface area of the lake inhabited by SAV as well as an estimate of the percent volume of the lake inhabited by SAV. SAV is an important component to a lakes nutrient cycling as well as chlorophyll concentrations due to the SAV and phytoplankton competing for available nutrients in the water column. In addition SAV serves a vital role as habitat for many species of macroinvertebrates and fish as well as substrate for epiphytic algae.

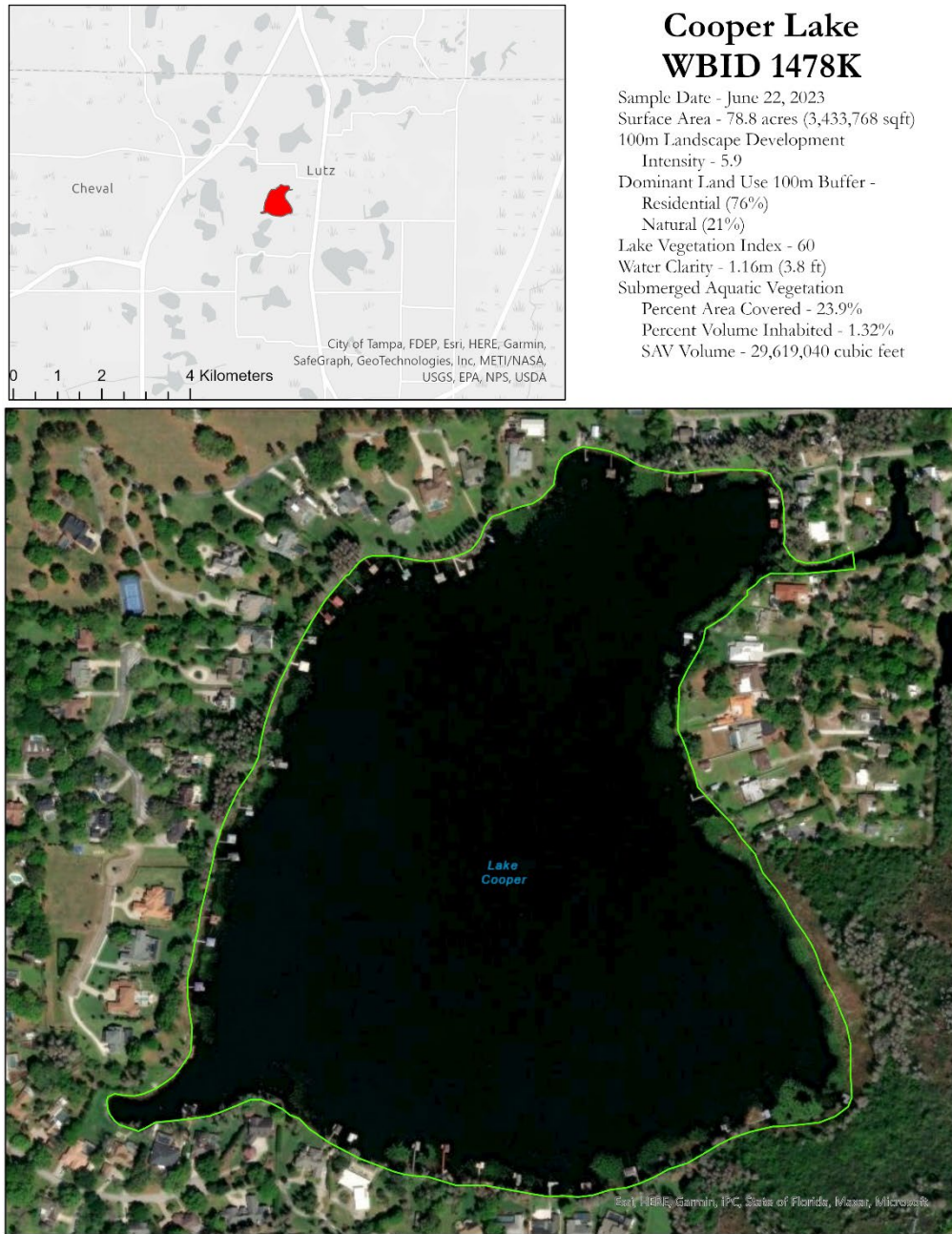
WATER QUALITY ASSESSMENT

Physical water quality samples were taken using a Eureka Manta Sub-2 multiprobe pre and post calibrated on the day of the assessment. Measurements taken with this device include: depth, conductivity, pH, Dissolved Oxygen (mg/l and % Saturation) and salinity. Chemical water parameters were collected and preserved on ice by USF Water Institute staff and analyzed at the Hillsborough County Public Utilities Laboratory Analysis include; Chlorophyll (a, b, c, t and corrected), Alkalinity, Color, EColi, Enterococci, Ammonia, Nitrates/Nitrites, Total Phosphorous, Kjeldahl Nitrogen and Total Nitrogen. The results of the water quality sampling effort will be discussed in the framework of the FDEP Numeric Nutrient Criteria

Study Area

Cooper Lake is located in the Coastal Old Tampa Bay Watershed in north-western Hillsborough County, Florida. The Landscape Development Intensity Index of the 100 meter buffer around Cooper Lake is dominated by residential (76%) and natural (21%) land uses. The resulting LDI value for the 100 meter buffer around Cooper Lake is 5.9.

FIGURE 1: 2023 COOPER LAKE ASSESSMENT STUDY AREA MAP



Lake Bathymetry and Morphological Characterization

At the time of the assessment, Cooper Lake was experiencing normal water levels (57.96 feet NAVD88 on staff gauge) resulting in a 78.8 acre water body. Cooper Lake at the time of the assessment had a mean water depth of 8.6 feet and a maximum observed depth of 19.73 feet. The volume at this time was approximately 221,567,337 gallons. Figure 2 shows the resulting bathymetric contour map for Cooper Lake from data collected on June 22, 2023. The collected data has been overlain the 2022 ESRI Basemap aerials.

Table 1: Morphological Calculations for Cooper Lake

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	3,433,768	319,005	78.8		
Mean Depth	8.6	2.63			
Maximum Depth	19.73	6.01			
Volume (cubic)	29,619,040	838,710		680.0	221,567,337
Gauge (NAVD 88)	57.96	17.67			

Figure 2: 2023 2-Foot Bathymetric Contour Map for Cooper Lake

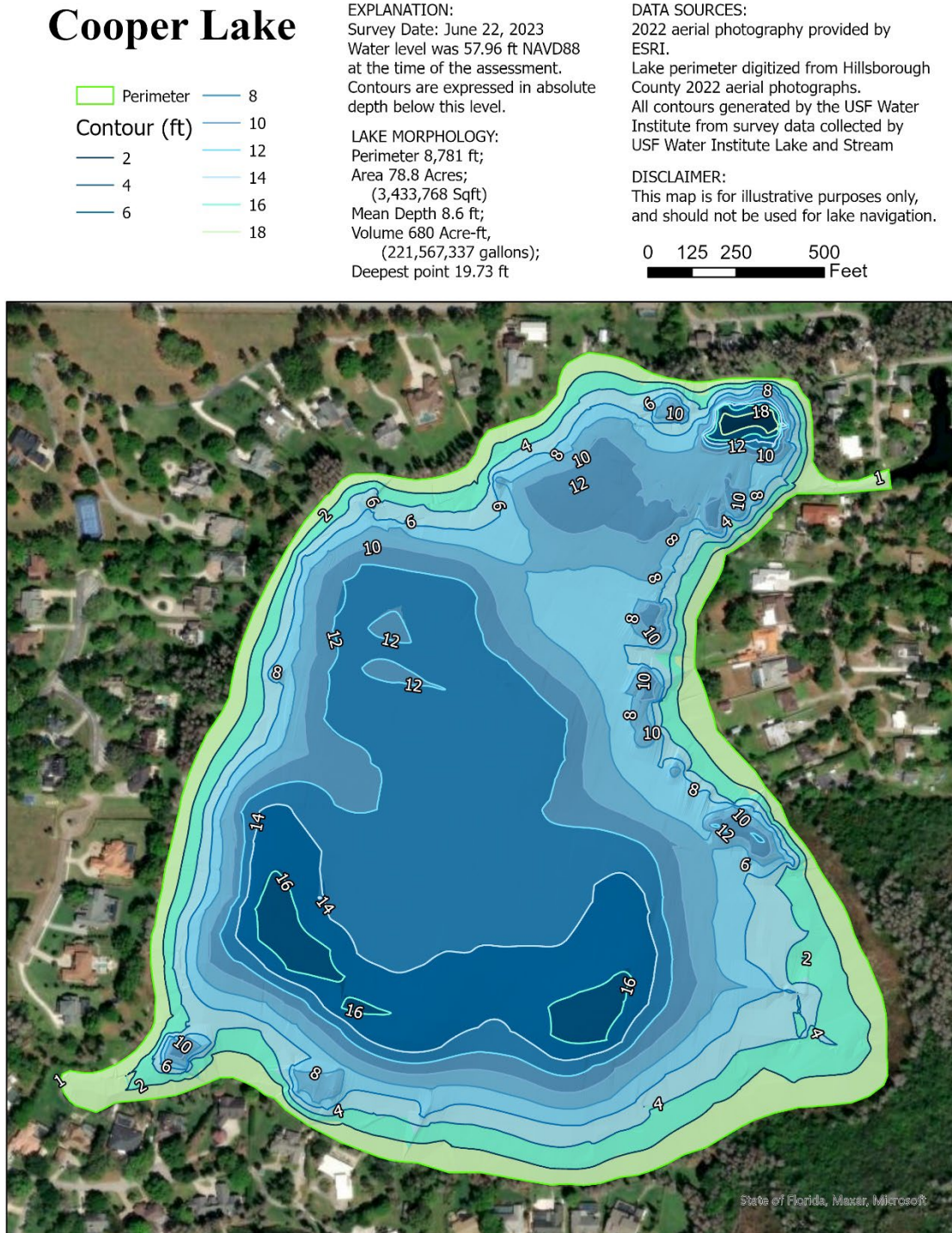




Figure 3 Overview photograph of Cooper Lake showing the typical residential portion of shoreline along region 2 of the Lake Vegetation Index.

Lake Habitat and Lake Vegetation Index Assessment

The lake assessment for Cooper Lake was conducted on June 22, 2023. The water in Cooper Lake was characterized as tannic with high turbidity. The secchi disk depth was 1.16 meters allowing for a moderate submerged aquatic vegetation community. The vegetation quality of the plants in and buffering Cooper Lake are predominantly native species with moderate growths of non-native invasive species such as *Alternanthera philoxeroides* and *Panicum repens*. The percentage of non-native FLEPPC 1 species ranged from 0% (region 5) to 14% (regions 2 and 8). Stormwater reaches the lake predominately via sheet flow from surrounding residential land cover. The development along the shoreline has been maintained primarily for turf grasses, however many residents have maintained a narrow buffer of emergent vegetation immediately adjacent to the water as shown in Figure 3. The bottom substrate quality was dominated by sand with coarse particulate organic matter near shore and submersed vegetation.



Figure 4 Utricularia inflata was co-dominant in region 8 and dominant in regions 5 and 11 of the Lake Vegetation Index

The Lake Vegetation Index identified 45 species of wetland vegetation growing in the four selected sections along Cooper Lake. The majority of these species (37) are native species. The remaining 8 species (*shown in **bold** in Table 2*) are non- native or invasive to this region. The vegetation community along the shorelines of Cooper Lake has been altered by lawn maintenance activities leaving a *Taxodium* canopy with a sparse shrub and ground cover community. The edges of the lake are dominated by *Pontederia cordata* and species able to rapidly colonize following the frequent disturbance of mowing, such as *Panicum repens* and *Ludwigia octovalis*. At the time of the assessment the water transparency was 1.16 m (3.8 ft). Eight species of submersed aquatic vegetation were observed during the lake vegetation index. *Utricularia inflata*, *Ceratophyllum demersum* and *Najas guadalupensis* were dominant or co-dominant species in the assessed LVI regions. The floating leaved vegetation community had 5 species observed with both *Nymphaea odorata* being co-dominant in region 2 of the LVI.

By analyzing the collected sonar chart, submerged aquatic vegetation potentially covered approximately 23.94% of the surface area of Cooper Lake. This submerged vegetation inhabits an estimated 1.32% of the water volume in Cooper Lake. Figure 5 shows the results of the SAV analysis indicating the location and height of SAV estimated from collected sonar readings.

The calculated LVI score for Cooper Lake was 60, above the impairment threshold of 43 indicating the vegetation community is showing evidence of being “Healthy”. Figure 6 shows the map of Cooper Lake detailing the LVI regions used for the assessment (Regions 2, 5, 8, 11). Table 2 details the species list results of the Lake Vegetation Index. Table 3 details the scoring result for the Lake Vegetation Index.

Cooper Lake

Cooper Perimeter

Cooper Perimeter

Height of SAV (ft)

4 - 4.5
3.5 - 4
3 - 3.5

2.5 - 3
2 - 2.5
1.5 - 2
1 - 1.5
0.5 - 1
0.25 - 0.5
0 - 0.25

0 125 250 500
Feet

EXPLANATION:

Survey Date: June 22, 2023
Water level was 57.96 ft
at the time of the assessment.
Submerged Aquatic Vegetation was
analyzed from collected sonar data.
The height of the SAV where present
is shown in 0.5 foot increments.

DATA SOURCES:

2022 aerial photography provided by
ESRI.
Lake perimeter digitized from Hillsborough
County 2022 aerial photographs.
All contours generated by the USF Water
Institute from survey data collected by
USF Water Institute Lake and Stream
Assessment Program

SAV STATISTICS:

Area 822,039 square ft; 18.9 Acres;
(23.94% of Lake Surface Area)
Mean SAV Height 0.5 ft;
Volume 390,357 Cubic ft, (2,920,095
gallons);
(1.32% of Lakes Volume)



Water Institute

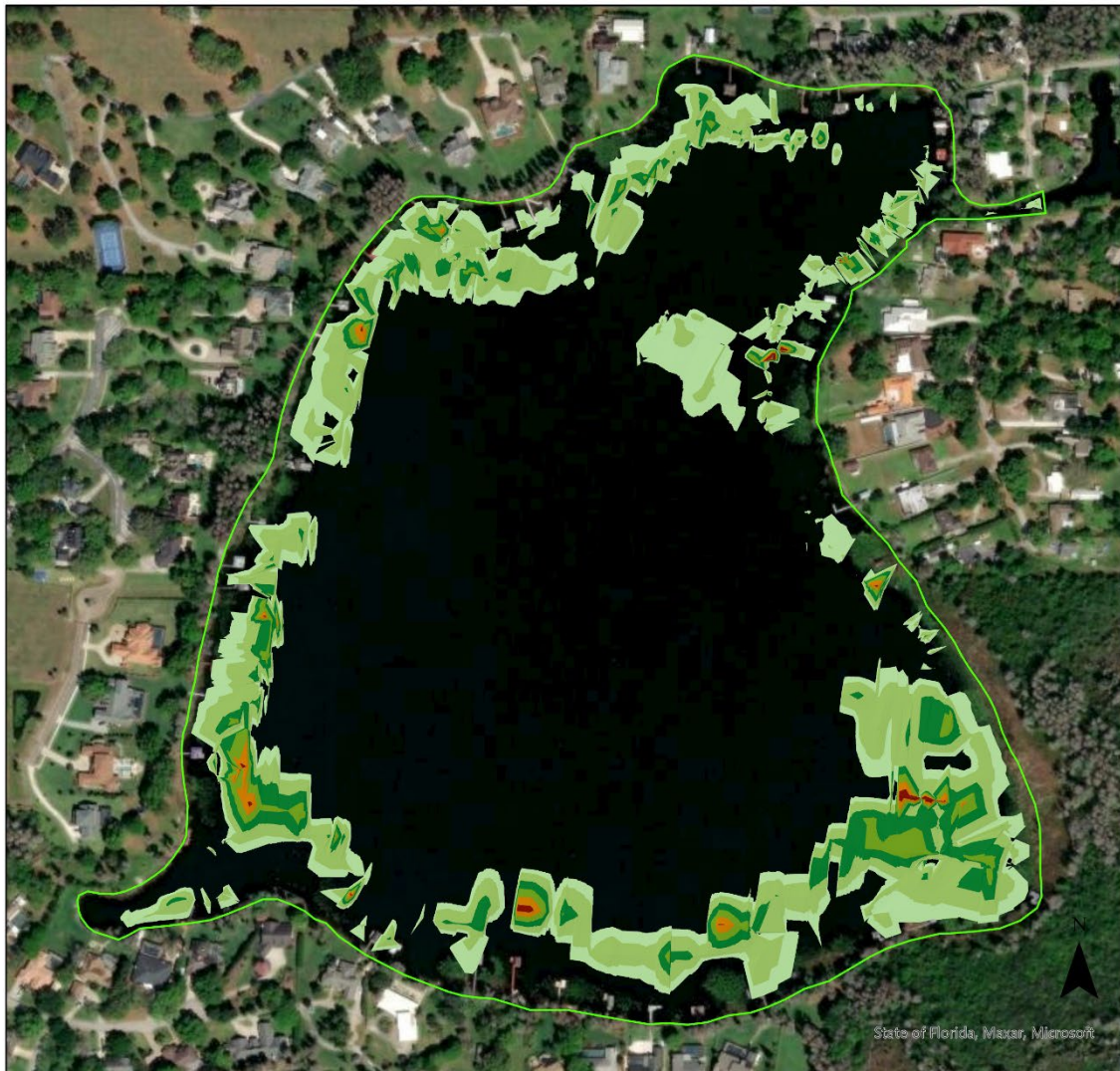


Figure 5 Cooper Lake Submerged Aquatic Vegetation Assessment Results

Cooper Lake WBID 1478K

Sample Date - June 22, 2023
Regions Assessed - 2, 5, 8, 11
Dominant Species per Region -
2 - *Najas guadalupensis*,
Nymphaea odorata
5 - *Utricularia inflata*
8 - *Chara*,
Utricularia inflata
11 - *Utricularia inflata*

Lake Description
Water Clarity - 1.2 m (3.8 ft)
Color - Turbid, Tannic
Sediment Types - Sandy, CPOM,
Vegetated
Lake Vegetation Index - 60

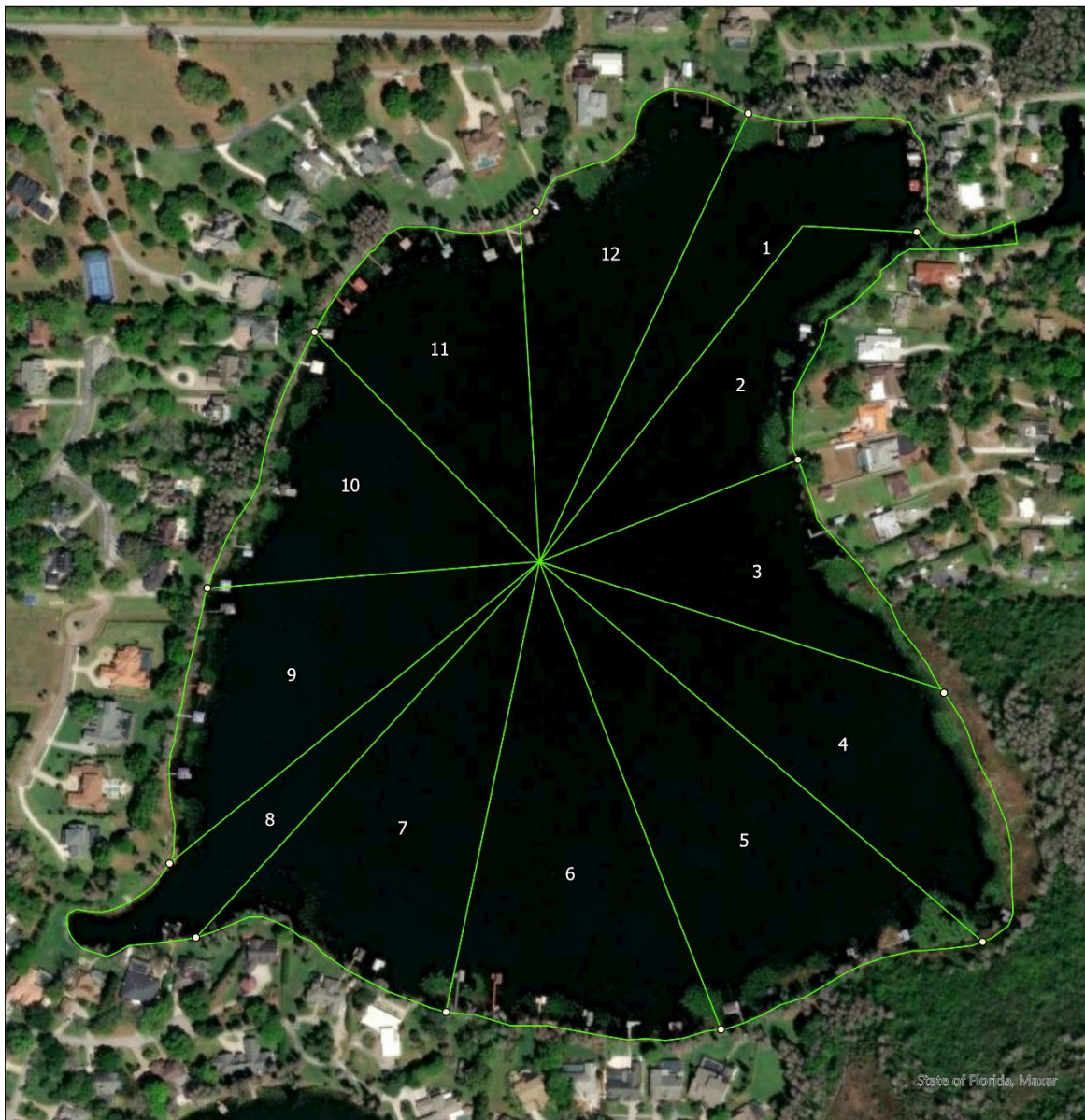
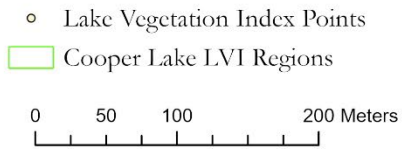


Figure 6: Lake Vegetation Index region map for Cooper Lake

Table 2: Lake Vegetation Index results for Cooper Lake June 22, 2023. In this table, “p” represents the taxa was present in the region while “c” and “d” denotes the taxa as being co-dominant or dominant in the vegetation region.

Taxon	CofC Score	FLEPPC Status	Wetland Status	Nativity	Region				Occurrence
					2	5	8	11	
<i>Acer rubrum</i>	4.65	-	FACW	Native	p	p	p	p	4
<i>Alternanthera philoxeroides</i>	0.00	Category 2	OBL	Exotic	p	p	p	p	4
<i>Ludwigia octovalvis</i>	2.00	-	OBL	Native	p	p	p	p	4
<i>Najas guadalupensis</i>	5.07	-	OBL	Native	c	p	p	p	4
<i>Nuphar</i>	3.50	-	OBL	Native	p	p	p	p	4
<i>Nymphaea odorata</i>	5.00	-	OBL	Native	c	p	p	p	4
<i>Pontederia cordata</i>	5.38	-	OBL	Native	p	p	p	p	4
<i>Taxodium</i>	7.00	-	OBL	Native	p	p	p	p	4
<i>Utricularia inflata</i>	5.85	-	OBL	Native	p	d	c	d	4
<i>Cyperus polystachyos</i>	1.56	-	FACW	Native	p	-	p	p	3
<i>Eclipta prostrata</i>	2.00	-	FACW	Native	p	-	p	p	3
<i>Eleocharis baldwinii</i>	2.82	-	OBL	Native	p	-	p	p	3
<i>Hydrocotyle</i>	2.00	-	FACW	Native	p	-	p	p	3
<i>Ludwigia leptocarpa</i>	3.00	-	OBL	Native	-	p	p	p	3
<i>Mikania scandens</i>	1.95	-	-	Native	-	p	p	p	3
<i>Panicum repens</i>	0.00	Category 1	FACW	Exotic	p	-	p	p	3
<i>Sagittaria lancifolia</i>	3.00	-	OBL	Native	p	p	p	-	3
<i>Typha</i>	1.00	-	OBL	Native	p	p	p	-	3
<i>Cephalanthus occidentalis</i>	5.00	-	OBL	Native	-	p	p	-	2
<i>Ceratophyllum demersum</i>	4.16	-	OBL	Native	p	-	c	-	2
<i>Cyperus blepharoleptos</i>	0.00	-	OBL	Exotic	-	p	p	-	2
<i>Cyperus odoratus</i>	3.00	-	FACW	Native	p	-	p	-	2
<i>Eichhornia crassipes</i>	0.00	Category 1	OBL	Exotic	p	-	p	-	2
<i>Ludwigia peruviana</i>	0.00	Category 1	OBL	Exotic	p	-	p	-	2
<i>Salix caroliniana</i>	2.95	-	OBL	Native	-	p	p	-	2
<i>Schoenoplectus tabernaemontani</i>	5.55	-	OBL	Native	p	-	p	-	2
<i>Thelypteris palustris pubescens</i>	5.31	-	FACW	Native	-	p	p	-	2
<i>Utricularia gibba</i>	6.37	-	OBL	Native	-	p	p	-	2

Taxon	CofC Score	FLEPPC Status	Wetland Status	Nativity	Region				Occurrence
					2	5	8	11	
<i>Commelina</i>	2.00	-	-	-	p	-	-	-	1
<i>Cyperus surinamensis</i>	2.03	-	FACW	Native	-	-	p	-	1
<i>Echinochloa walteri</i>	2.50	-	FACW	Native	-	-	p	-	1
<i>Erechtites hieraciifolius</i>	1.00	-	FAC	Native	-	-	p	-	1
<i>Eupatorium capillifolium</i>	0.83	-	FAC	Native	p	-	-	-	1
<i>Fuirena breviseta</i>	3.50	-	OBL	Native	-	-	p	-	1
<i>Hydrilla verticillata</i>	0.00	Category 1	OBL	Exotic	p	-	-	-	1
<i>Ilex cassine</i>	6.00	-	OBL	Native	-	p	-	-	1
<i>Lemna</i>	1.00	-	OBL	Native	-	-	p	-	1
<i>Ludwigia (unknown nativity)</i>		-	OBL	-	-	-	p	-	1
<i>Ludwigia arcuata</i>	3.50	-	OBL	Native	p	-	-	-	1
<i>Micranthemum glomeratum</i>	5.85	-	OBL	Native	p	-	-	-	1
<i>Myrica cerifera</i>	2.00	-	FAC	Native	-	p	-	-	1
<i>Nitella</i>	6.00	-	OBL	Native	p	-	-	-	1
<i>Salvinia minima</i>	0.00	Category 1	OBL	Exotic	-	-	p	-	1
<i>Sapium sebiferum</i>	0.00	Category 1	FAC	Exotic	-	-	p	-	1
<i>Vallisneria americana</i>	7.00	-	OBL	Native	p	-	-	-	1

Table 3: Scoring Summary for the Lake Vegetation Index

LVI Sample Result: 60				
Region South				
Metric / Section	2	5	8	11
Total # Taxa	28	20	36	16
% Native Taxa	79%	90%	78%	88%
% FLEPPC 1 Taxa	14%	0%	14%	6%
% Sensitive Taxa	7%	5%	3%	6%
Dom Taxa Count	2	1	2	1
CofC Dom Taxa	5.04	5.85	5.01	5.85
Section LVI	51	75	45	69

Water Quality Assessment

Long-term water quality data is available for Cooper Lake. The available data was collected by Lakewatch, Southwest Florida Water Management District, Florida Department of Environmental Protection and Hillsborough County Environmental Services. Table 4 provides a summary of the Physical/Chemical conditions recorded at the middle of the Cooper Lake during the assessment in 2023.

Table 4: Cooper Lake Water Quality 6/22/2023 (Field)

Meter Readings:	Depth (M)	Temp (°C)	pH (SU)	D.O (MG/L)	D.O Sat. (%)	Cond. (UMHO/CM)	Salinity (PPT)
Top:	0.16	28.7	7.2	6.28	81	170	0.08
Mid-Depth:	2.84	28.5	7.15	5.04	64.8	170	0.08
Bottom:	3.99	27.4	7.03	0.4	5.1	188	0.09

The chemical water quality analysis for Cooper Lake is shown in Table 5 for the samples taken on 6/22/23 and 7/13/23. Table 6 includes this data in the numeric nutrient criteria framework using the data from this assessment. The long term color data have a geometric mean value of 33.56 PCU, classifying it as a clear water lake (greater than or equal to 40 PCU). Total Alkalinity period of record geometric mean value is 21.9 mg/L but has insufficient data to use for classification. Conductivity can be used as a proxy for alkalinity with approximately 200 µmho/cm being equivalent to an alkalinity of 20 mg/L CaCO₃. The long term mean value for conductivity is 197.7, classifying Cooper Lake as acidic. The NNC thresholds for a clear, acidic lake with insufficient data to calculate NNC (Previous three years with at least 4 samples per year in separate seasons) are 6 µg/L for Chlorophyll-a Corrected for Phaeophytin, 0.01 mg/L for Total Phosphorous and 0.51 mg/L for Total Nitrogen. For years with sufficient data, the thresholds are 0.03 mg/L Total Phosphorous and 0.93 mg/L Total Nitrogen.

Geometric mean Chlorophyll-a corrected values for the past three years are above the threshold with annual geometric means with no data in 2021, 17.86 µg/L (2022) and 8.96 µg/L (2023). Total Phosphorous geometric mean values for the most recent data were above the nutrient threshold for clear, acidic lakes in the peninsula region with insufficient data with a value of no data in 2021, 0.027 mg/L (2022) and below the threshold for clear acidic lakes with sufficient data in 2023 with 0.023 mg/L. Total Nitrogen values were above the nutrient threshold for clear, acidic lakes with insufficient data with a value of no data in 2021 and 0.989 mg/L (2022) and below the threshold for lakes with sufficient data with a value of 0.801 mg/L (2023).

Bacteria testing showed low levels of E. Coli (20.3 colonies/100ml) and Enterococci (48.8 colonies/100ml) below the rules set forth in FDEP 62-302.530 (<https://www.flrules.org/gateway/RuleNo.asp?title=SURFACE%20WATER%20QUALITY%20STANDARDS&ID=62-302.500>) “Most Probable Number (MPN) or Membrane Filter (MF) counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period.”

Table 5: Cooper Lake 2023 Hillsborough County Environmental Services Water Quality Results (Laboratory)

Parameter	6/22/2023	7/13/2023	POR Mean Value	Units
Alkalinity	33.3	32.4	32.89	mg/LCaCO3
Color			33.56	PCU
E Coli	20.3	9.2	6.06	#/100ml
Enterococci	48.8	4.1	4.47	#/100 ml
Chlorophyll a	15	20	12.35	ug/L
Chlorophyll b	2.5	2.5		ug/L
Chlorophyll c	2.5	2.5		ug/L
Chlorophyll a Corrected	14.0	16.0	12.82	ug/L
Ammonia	0.073	0.073	0.018	mg/L
Nitrates/Nitrites	0.043	0.043	0.013	mg/L
Kjeldahl Nitrogen	0.043	0.043	0.295	mg/L
Total Nitrogen	1.230	1.16	0.907	mg/L
Total Phosphorus	0.068	0.068	0.023	mg/L

Table 6: Numeric Nutrient Criteria Framework

Parameter	Value
Geometric Mean Color (pcu)	33.56
Number of Samples	26
Geometric Mean Alkalinity (mg/L CaCO ₃)	21.89
Number of Samples	5 (insufficient)
Geometric Mean Conductivity (µmho/cm)	197.73
Number of Samples	32
Lake Type	Clear - acidic

Year (# of Samples)	Geomean Chla Corrected (µg/L)	Chlorophyll a Criteria (µg/L)	Geomean Total Phosphorous (mg/L)	Total Phosphorous Criteria (mg/L)	Geomean Total Nitrogen (mg/L)	Total Nitrogen Criteria (mg/L)
2021 (2)	3.98	< 6	No data	< 0.01	No data	< 0.51
2022 (3)	17.78	< 6	0.027	< 0.01	0.989	< 0.51
2023 (4)	8.96	< 6	0.023	< 0.03	0.801	< 0.93

Conclusion

Cooper Lake is a predominately residential lake in the Coastal Old Tampa Bay Watershed of Hillsborough County, Florida. The results of the assessment of Cooper Lake shows an impaired lake based on Chlorophyll-a, Total Nitrogen and Total Phosphorous concentrations according to the FDEP numeric nutrient criteria using a combination of Lakewatch, Southwest Florida Water Management District and Hillsborough County Environmental Services datasets. It should be noted that insufficient data is a major issue with Cooper Lake with no nutrient data available for 2021 and insufficient color data to make a proper determination of lake type, potentially changing the lake to a different set of thresholds.

The system does show health in the vegetation communities according to the Lake Vegetation Index with few invasive species (8) and an overall LVI score of 60. The assessment also revealed a submerged aquatic vegetation community comprising 8 species occupying 23.94% of the surface area and 1.32% of the volume of Cooper Lake.