5.4.5.5 Internal Lake Load

Internal recycling loads represent fluxes from benthic substrate that build up from the deposition of ongoing or legacy loads coming into a waterbody. Additionally, build up can also occur through the accumulation of organic material which settles following algal blooms. These algal blooms occur due to excess nutrient loading to the water column which results in a positive feedback loop of benthic nutrient releases followed by algal blooms. Nutrients are bound into the benthic substrate and, under different conditions (depending upon the nature of the nutrients in the sediments), can be released into the water column. In many lakes within Florida, benthic flux, or internal recycling, can be a significant portion of the nutrient budget. While naturally occurring flux does occur, it is the portion caused by the excessive historic and/or ongoing anthropogenic impacts that would require remediation.

In the qualitative assessment of potential pollutant loads to the Lafayette Chain of Lakes (**Section 5.4.4.4**) an assessment was made relative to the potential for anthropogenically driven internal loading to play a significant role in the nutrient balance of each of the waterbodies within the Lafayette Chain of Lakes. The determination was made that internal loading was not a significant nutrient load to any of the lakes.

5.4.5.6 Atmospheric Deposition

In order to calculate the atmospheric deposition loading for nutrients to the Lafayette Chain of Lakes, the data from the Quincy Station (FL14), identified in earlier sections and shown on **Figure 5-35**, were utilized. The National Atmospheric Deposition Program (NADP) provides a clearinghouse for deposition data. The NADP sites collect nitrogen data but not phosphorus, as such, only TN is available. **Table 5-11** presents the annual TN loads per acre from 2010 to 2020. No data were available at the Quincy station for 2020 so the value from the next nearest station (Sumatra – FL23) was utilized. Averaging the annual load per acre over the 10-year period gives a value of 2.56 lb/acre/yr. Multiplying the 2.56 lb/acre/yr TN load by the acreages for Upper Lake Lafayette, Piney Z Lake, Lower Lake Lafayette, and Alford Arm gives the TN atmospheric loads. **Table 5-12** presents the calculated loads for each of the lakes in the chain.

Table 5-11: Annual Atmospheric Total Nitrogen Load per Acre from Quincy Station

Year	TN (lb/acre)
2010	2.19
2011	2.31
2012	2.20
2013	2.57
2014	4.95
2015	2.57
2016	2.47
2017	2.31
2018	2.40
2019	1.97
2020*	2.16*

*Data from NADP Website Sumatra Station

Table 5-12: Atmospheric Total Nitrogen Loads to Lafayette Chain of Lakes

Waterbody	Acreage	TN Load (lb/yr)
Upper Lake Lafayette	373	955
Piney Z Lake	238	609
Lower Lake Lafayette	1067	2,732
Alford Arm	367	940

5.4.5.7 Summary of Calculated Loads

Nutrient loads to the Lafayette Chain of Lakes were calculated for stormwater runoff, septic systems, interconnected flow (where data allowed), and atmospheric deposition. **Table 5-13** presents the calculated total loads to the lake for TN and TP. For septic systems and atmospheric deposition only TN loads were calculated (see **Section 5.4.5.2** and **Section 5.4.5.6** respectively for explanation). A significant load that was not able to be calculated is the load from Alford Arm into Lower Lake Lafayette, which is due to a lack of recent data in Alford Arm.

Table 5-13: Summary of Calculated Loads to the Lafayette Chain of Lakes

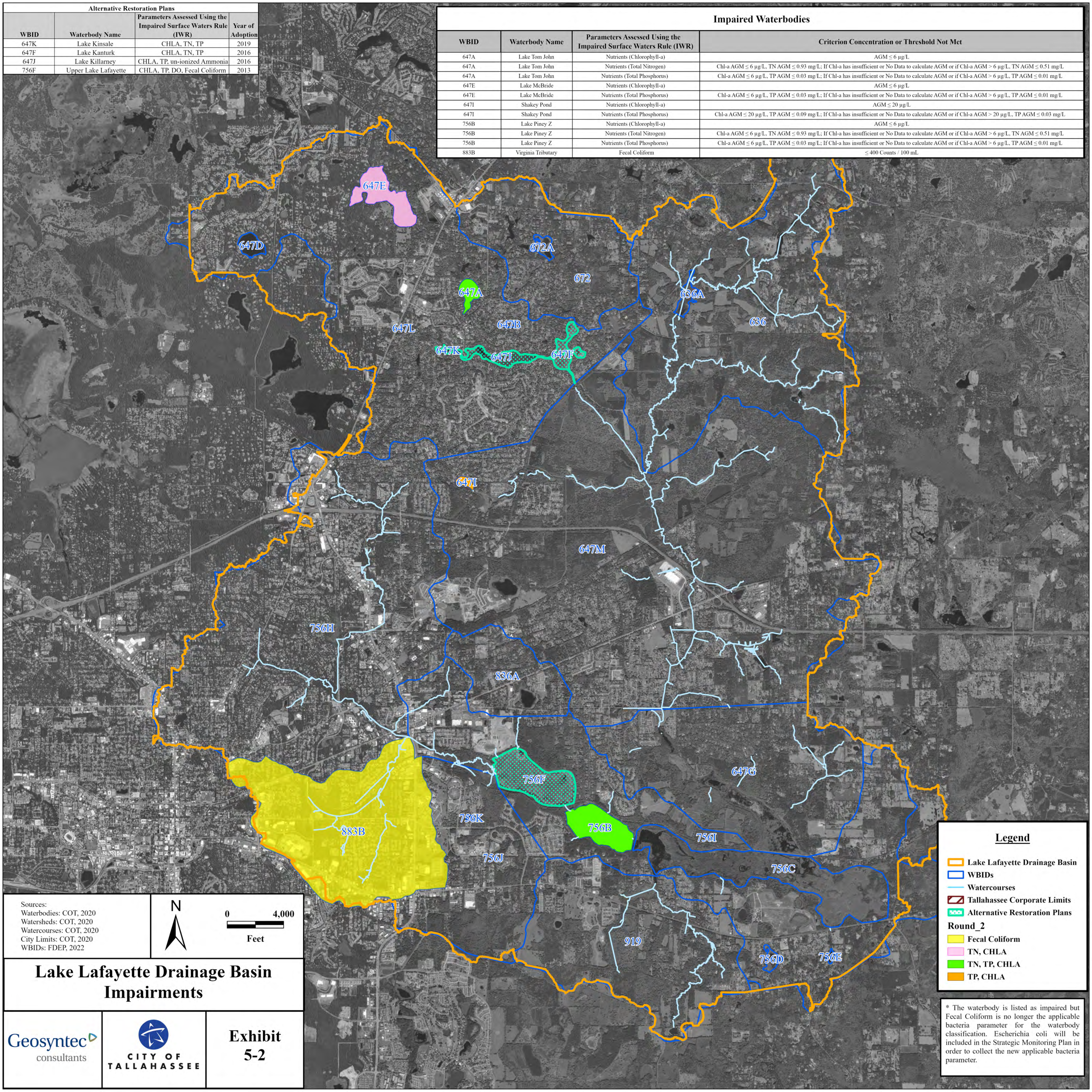
Source	Upper Lake Lafayette		Piney Z Lake		Lower Lake Lafayette		Alford Arm	
	TN (lb/yr)	TP (lb/yr)	TN (lb/yr)	TP (lb/yr)	TN (lb/yr)	TP (lb/yr)	TN (lb/yr)	TP (lb/yr)
Stormwater Runoff	19,863	2,843	1,626	361	9,019	1,571	26,793	5,292
Septic Systems	1,168	ND	65	ND	2,011	ND	6,327	ND
Lake Inflow	648	48	0	0	ND	ND	20,549	2,079
Atmospheric Deposition	955	ND	609	ND	2,732	ND	940	ND

ND – No data available to calculate, NA – Load calculation not applicable

Alternative Restoration Plans			
WBID	Waterbody Name	Parameters Assessed Using the Impaired Surface Waters Rule (IWR)	Year of Adoption
647K	Lake Kinsale	CHLA, TN, TP	2019
647F	Lake Kanturk	CHLA, TN, TP	2016
647J	Lake Killarney	CHLA, TP, un-ionized Ammonia	2016
756F	Upper Lake Lafayette	CHLA, TP, DO, Fecal Coliform	2013

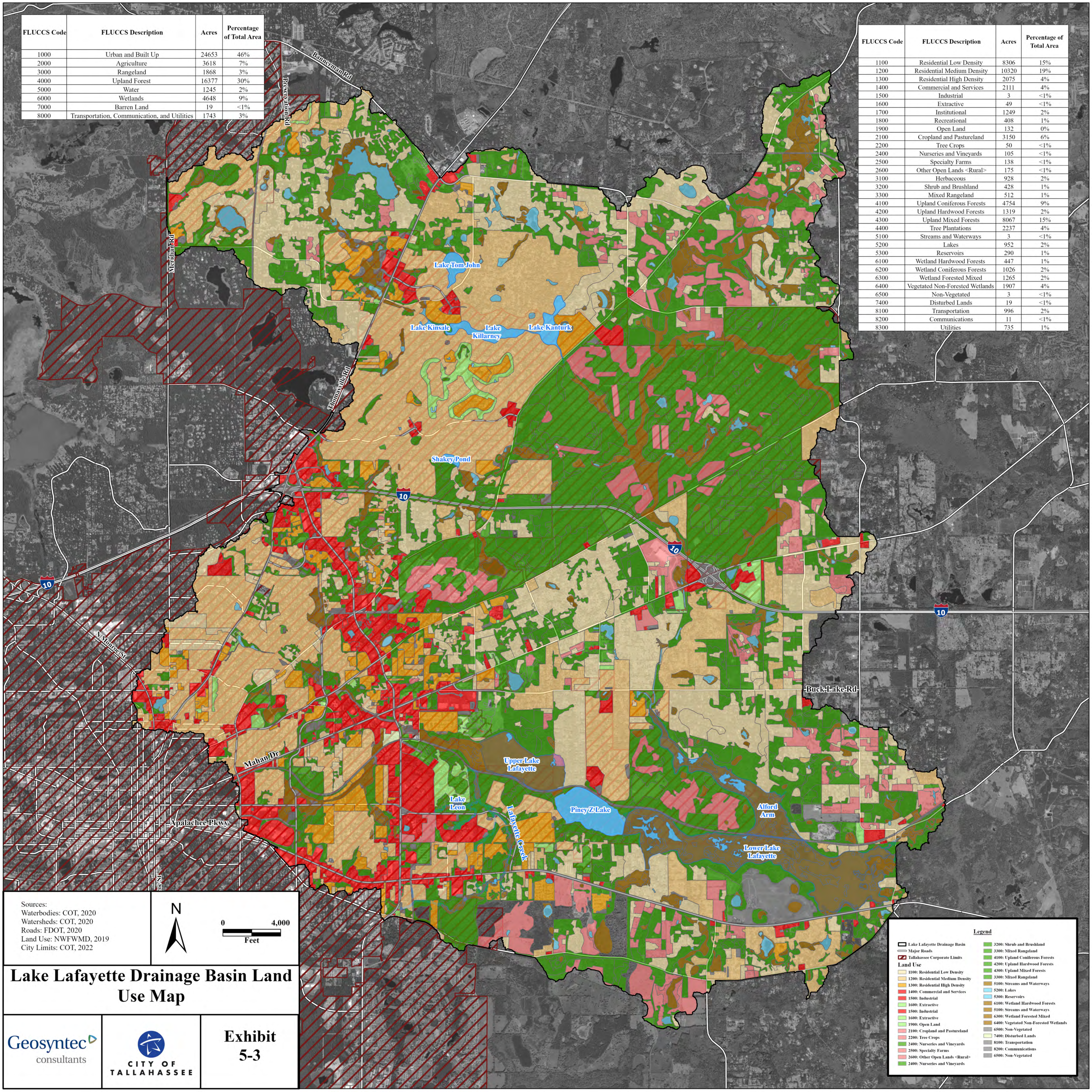
Impaired Waterbodies

WBID	Waterbody Name	Parameters Assessed Using the Impaired Surface Waters Rule (IWR)	Criterion Concentration or Threshold Not Met
647A	Lake Tom John	Nutrients (Chlorophyll-a)	AGM ≤ 6 µg/L
647A	Lake Tom John	Nutrients (Total Nitrogen)	Chl-a AGM ≤ 6 µg/L, TN AGM ≤ 0.93 mg/L; If Chl-a has insufficient or No Data to calculate AGM or if Chl-a AGM > 6 µg/L, TN AGM ≤ 0.51 mg/L
647A	Lake Tom John	Nutrients (Total Phosphorus)	Chl-a AGM ≤ 6 µg/L, TP AGM ≤ 0.03 mg/L; If Chl-a has insufficient or No Data to calculate AGM or if Chl-a AGM > 6 µg/L, TP AGM ≤ 0.01 mg/L
647E	Lake McBride	Nutrients (Chlorophyll-a)	AGM ≤ 6 µg/L
647E	Lake McBride	Nutrients (Total Phosphorus)	Chl-a AGM ≤ 6 µg/L, TP AGM ≤ 0.03 mg/L; If Chl-a has insufficient or No Data to calculate AGM or if Chl-a AGM > 6 µg/L, TP AGM ≤ 0.01 mg/L
647I	Shakey Pond	Nutrients (Chlorophyll-a)	AGM ≤ 20 µg/L
647I	Shakey Pond	Nutrients (Total Phosphorus)	Chl-a AGM ≤ 20 µg/L, TP AGM ≤ 0.09 mg/L; If Chl-a has insufficient or No Data to calculate AGM or if Chl-a AGM > 20 µg/L, TP AGM ≤ 0.03 mg/L
756B	Lake Piney Z	Nutrients (Chlorophyll-a)	AGM ≤ 6 µg/L
756B	Lake Piney Z	Nutrients (Total Nitrogen)	Chl-a AGM ≤ 6 µg/L, TN AGM ≤ 0.93 mg/L; If Chl-a has insufficient or No Data to calculate AGM or if Chl-a AGM > 6 µg/L, TN AGM ≤ 0.51 mg/L
756B	Lake Piney Z	Nutrients (Total Phosphorus)	Chl-a AGM ≤ 6 µg/L, TP AGM ≤ 0.03 mg/L; If Chl-a has insufficient or No Data to calculate AGM or if Chl-a AGM > 6 µg/L, TP AGM ≤ 0.01 mg/L
883B	Virginia Tributary	Fecal Coliform	≤ 400 Counts / 100 mL



Lake Lafayette Drainage Basin Impairments

Exhibit 5-2



FLUCCS Code	FLUCCS Description	Acres	Percentage of Total Area
1000	Urban and Built Up	24653	46%
2000	Agriculture	3618	7%
3000	Rangeland	1868	3%
4000	Upland Forest	16377	30%
5000	Water	1245	2%
6000	Wetlands	4648	9%
7000	Barren Land	19	<1%
8000	Transportation, Communication, and Utilities	1743	3%

FLUCCS Code	FLUCCS Description	Acres	Percentage of Total Area
1100	Residential Low Density	8306	15%
1200	Residential Medium Density	10320	19%
1300	Residential High Density	2075	4%
1400	Commercial and Services	2111	4%
1500	Industrial	3	<1%
1600	Extractive	49	<1%
1700	Institutional	1249	2%
1800	Recreational	408	1%
1900	Open Land	132	0%
2100	Cropland and Pastureland	3150	6%
2200	Tree Crops	50	<1%
2400	Nurseries and Vineyards	105	<1%
2500	Specialty Farms	138	<1%
2600	Other Open Lands <Rural>	175	<1%
3100	Herbaceous	928	2%
3200	Shrub and Brushland	428	1%
3300	Mixed Rangeland	512	1%
4100	Upland Coniferous Forests	4754	9%
4200	Upland Hardwood Forests	1319	2%
4300	Upland Mixed Forests	8067	15%
4400	Tree Plantations	2237	4%
5100	Streams and Waterways	3	<1%
5200	Lakes	952	2%
5300	Reservoirs	290	1%
6100	Wetland Hardwood Forests	447	1%
6200	Wetland Coniferous Forests	1026	2%
6300	Wetland Forested Mixed	1265	2%
6400	Vegetated Non-Forested Wetlands	1907	4%
6500	Non-Vegetated	3	<1%
7400	Disturbed Lands	19	<1%
8100	Transportation	996	2%
8200	Communications	11	<1%
8300	Utilities	735	1%

Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Land Use: NWFWMD, 2019
City Limits: COT, 2022

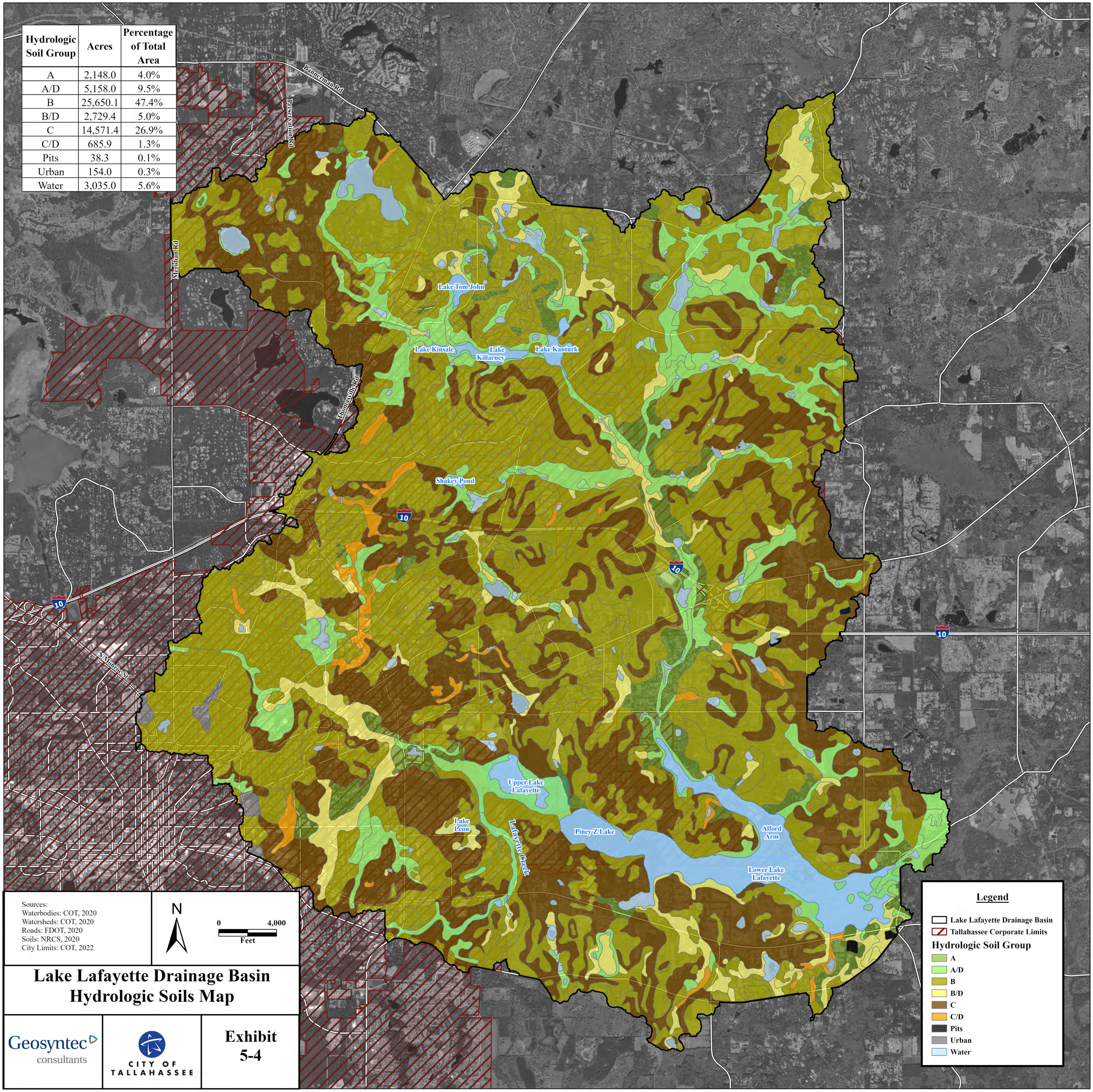
Lake Lafayette Drainage Basin Land Use Map

Geosyntec consultants

CITY OF TALLAHASSEE

Exhibit 5-3

Hydrologic Soil Group	Acres	Percentage of Total Area
A	2,148.0	4.0%
A/D	5,158.0	9.5%
B	25,650.1	47.4%
B/D	2,729.4	5.0%
C	14,571.4	26.9%
C/D	685.9	1.3%
Pits	38.3	0.1%
Urban	154.0	0.3%
Water	3,035.0	5.6%



Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Soils: NRCS, 2020
City Limits: COT, 2022

Lake Lafayette Drainage Basin Hydrologic Soils Map

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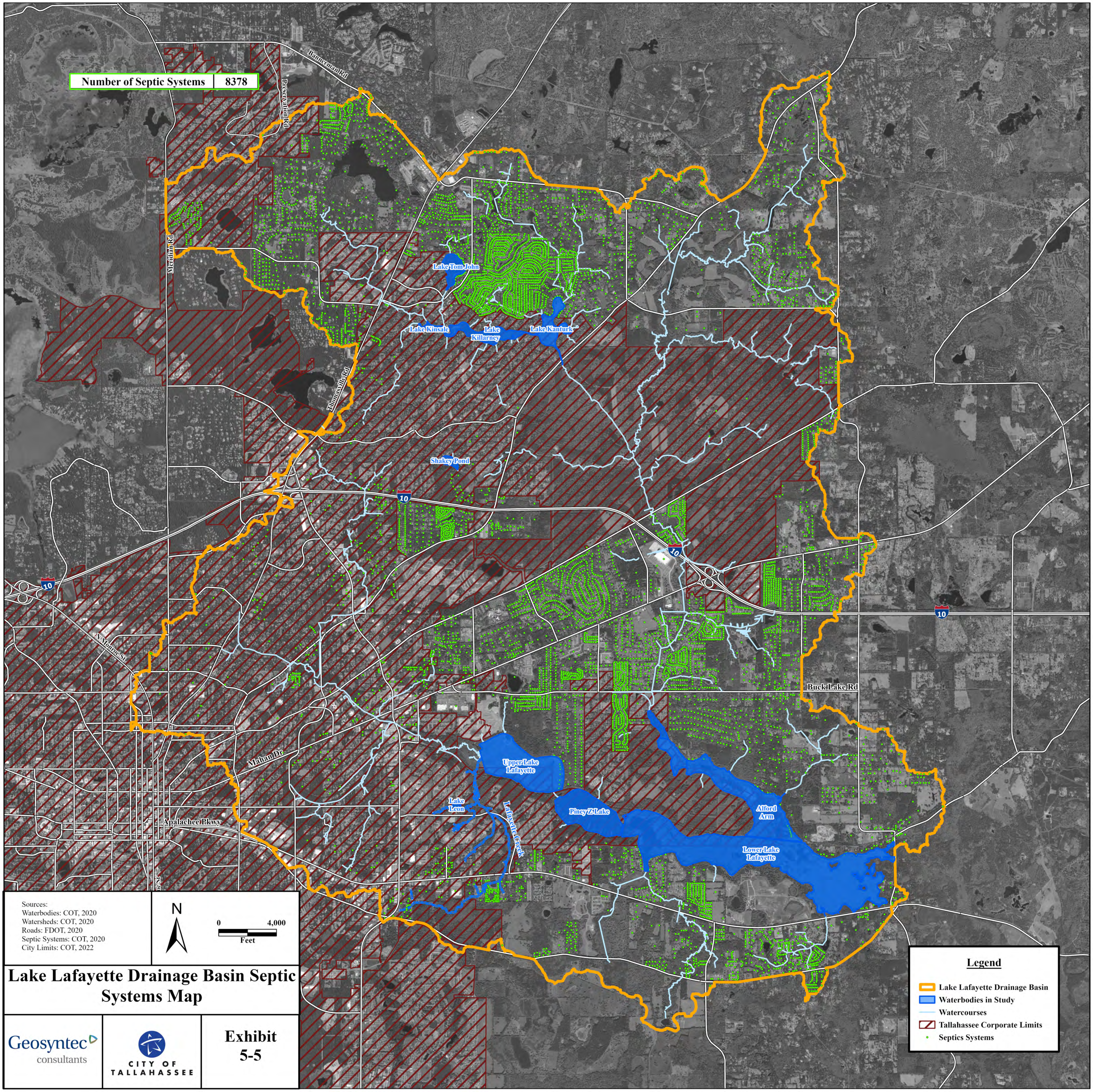
Exhibit 5-4


Number of Septic Systems 8378
Bannerman Rd
Preservation Rd
Meridian Rd
Thomasville Rd
Lake Tom John
Lake Kinsale
Lake Killarney
Lake Kanturk
Shakey Pond
10
N Monroe St
Mahan Dr
Apalachee Pkwy
Buck Lake Rd
Upper Lake Lafayette
Lake Leon
Lafayette Creek
Piney Z Lake
Alford Arm
Lower Lake Lafayette
Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Septic Systems: COT, 2020
City Limits: COT, 2022
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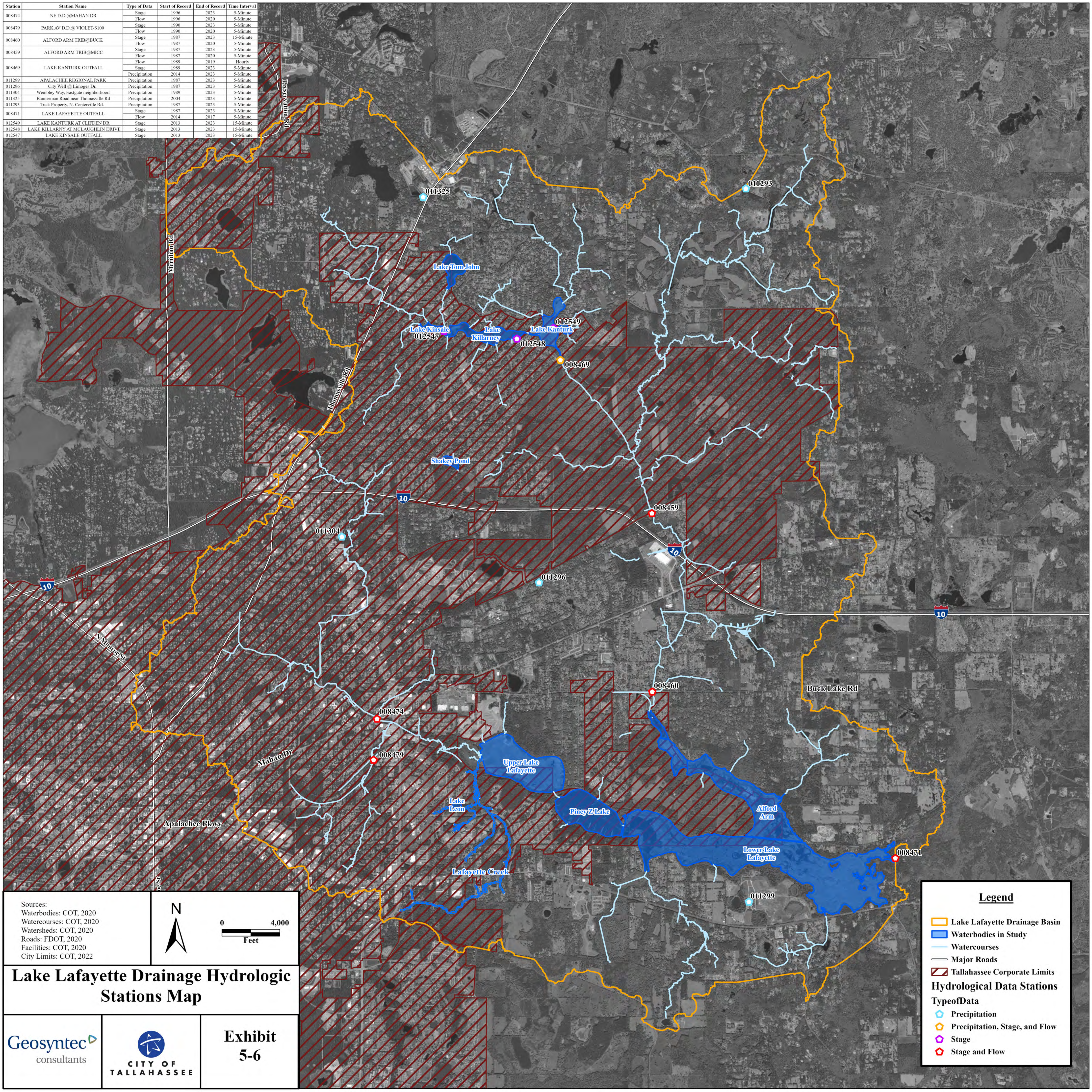
Feet
Legend
Lake Lafayette Drainage Basin
Waterbodies in Study
Watercourses
Tallahassee Corporate Limits
Septics Systems
Lake Lafayette Drainage Basin Septic Systems Map
Geosyntec consultants
CITY OF TALLAHASSEE
Exhibit 5-5

Station	Station Name	Type of Data	Start of Record	End of Record	Time Interval
008474	NE D.D.@MAHAN DR	Stage	1996	2023	5-Minute
		Flow	1996	2020	5-Minute
008479	PARK AV D.D.@ VIOLET-S100	Stage	1990	2023	5-Minute
		Flow	1990	2020	5-Minute
008460	ALFORD ARM TRIB@BUCK	Stage	1987	2023	15-Minute
		Flow	1987	2020	5-Minute
008459	ALFORD ARM TRIB@MICC	Stage	1987	2023	5-Minute
		Flow	1987	2020	5-Minute
008469	LAKE KANTURK OUTFALL	Flow	1989	2019	Hourly
		Stage	1989	2023	5-Minute
		Precipitation	2014	2023	5-Minute
011299	APALACHEE REGIONAL PARK	Precipitation	1987	2023	5-Minute
011296	City Well @ Limoges Dr.	Precipitation	1987	2023	5-Minute
011304	Wembley Way, Eastgate neighborhood	Precipitation	1989	2023	5-Minute
011325	Bannerman Road near Thomasville Rd	Precipitation	2004	2023	5-Minute
011293	Tuck Property, N. Centerville Rd.	Precipitation	1987	2023	5-Minute
008471	LAKE LAFAYETTE OUTFALL	Stage	1987	2023	5-Minute
		Flow	2014	2017	5-Minute
012549	LAKE KANTURK AT CLIFDEN DR	Stage	2013	2023	15-Minute
012548	LAKE KILLARNY AT MCLAUGHLIN DRIVE	Stage	2013	2023	15-Minute
012547	LAKE KINSALE OUTFALL	Stage	2013	2023	15-Minute



Lake Lafayette Drainage Hydrologic Stations Map

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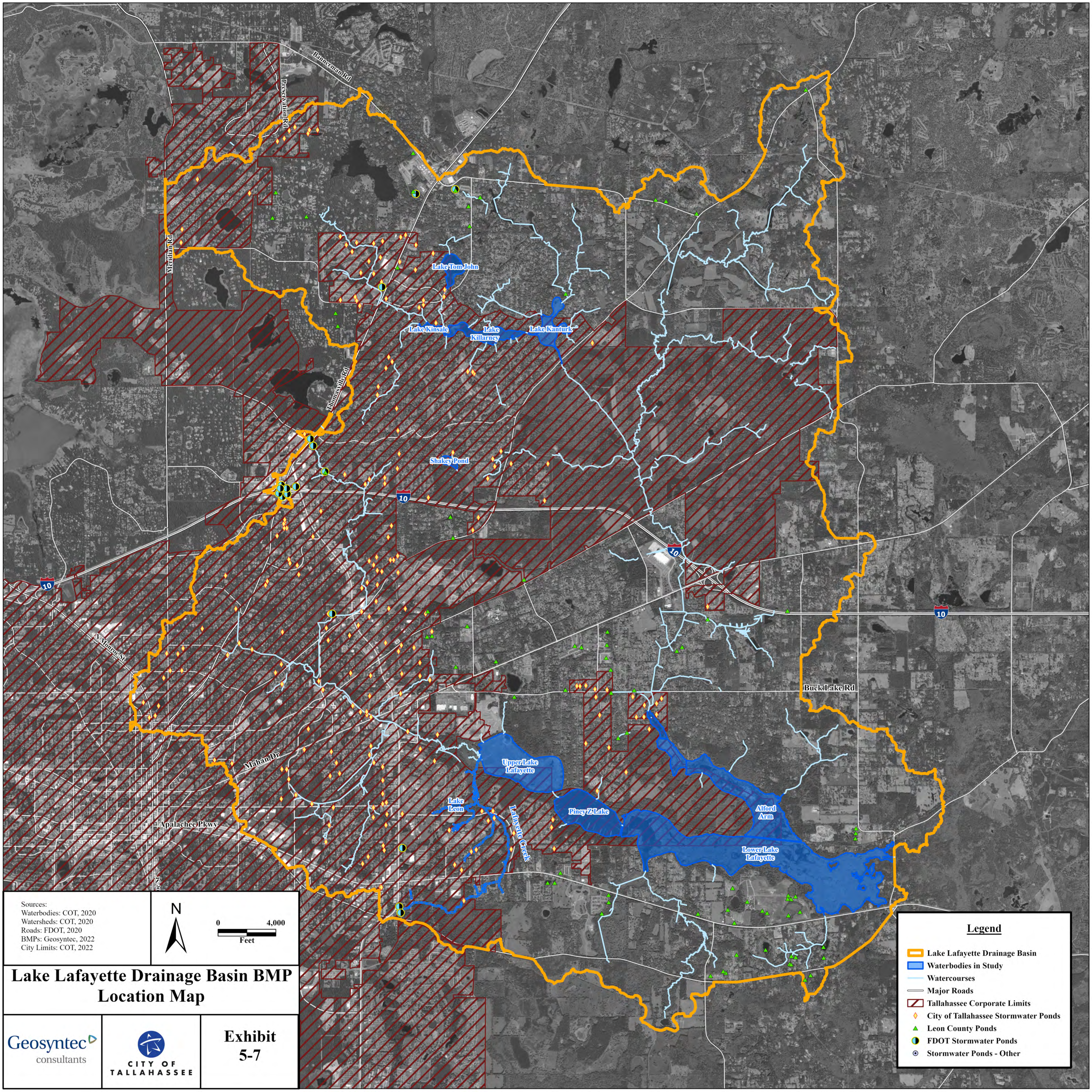
Exhibit 5-6



Lake Lafayette Drainage Basin BMP Location Map

Exhibit 5-7

5.5 Killearn Chain of Lakes

This section presents the results from Tasks 1 through 3 for the Killearn Chain of Lakes (Lake Kinsale, Lake Killarney, and Lake Kanturk), which includes an overview and history of the lakes and basin; present impairment status; an overview of available data; a qualitative assessment of potential pollutant sources; and calculation of potential pollutant loads.

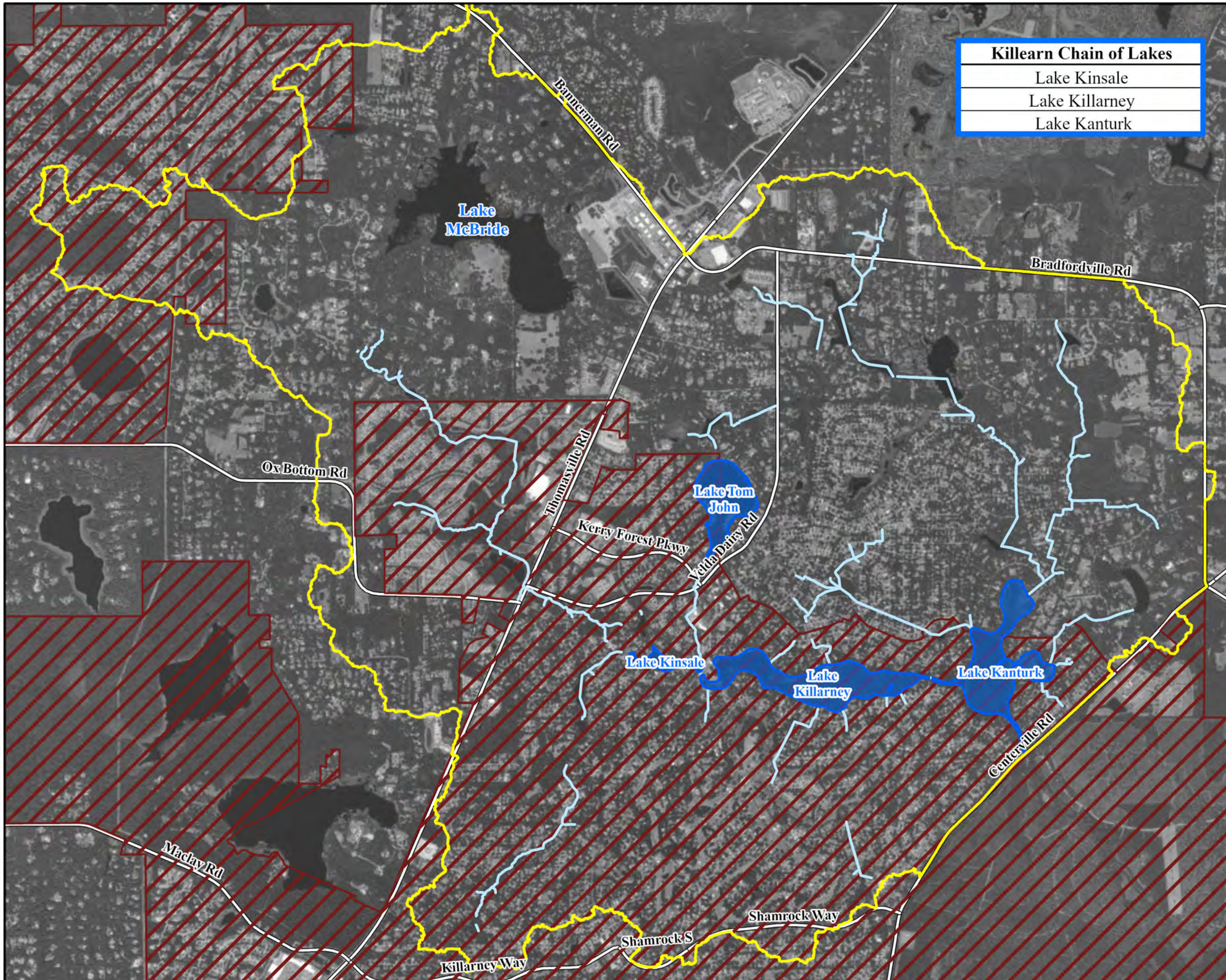
5.5.1 Overview and History

The Killearn Chain of Lakes include Lake Kinsale, Lake Killarney and Lake Kanturk located in the upstream portion of the Lake Lafayette Drainage Basin (**Figure 5-55**). Flows from the upstream most waterbody in the system (Lake McBride) flow south to a crossing at Thomasville Road and then into the western end of Lake Kinsale. Additional flows from Lake Tom John (another target waterbody in this study) enter Lake Kinsale at its eastern end. Flows then proceed through Lake Killarney and Lake Kanturk, discharge across Centerville Road, and eventually to Alford Arm and Lower Lake Lafayette.

Based on early maps from the 1800s, the area where Lake Killarney is located was called Long Pond. This area appears to be best described as a wetland prairie system that was also a floodplain for the drainage out of Lake McBride as it flowed down to Lake Lafayette. **Photo 5-30** through **Photo 5-37** present aerial views of the system from 1937 through 2020. In the early photos (**Photo 5-30** and **Photo 5-31**) the general shapes of the lakes can be seen as open water floodplain areas. Agricultural activities from the 1940s to the 1960s resulted in excavation of drainage ditches and a pond in the area of Lake Killarney. In the 1970s permits were obtained for development of the area into lots for residential housing including a golf course located to the south of the lakes. The three lakes, as they exist today, were constructed in the historic floodplain primarily as aesthetic features for the development. **Photo 5-32** through **Photo 5-34** show the transition from the agricultural area in the 1950s to the developed condition in the 1980s. By 1996 (**Photo 5-35**) the area around the lakes is almost completely built-out residential development.

The drainage basin for the Killearn Chain of Lakes covers an area of 8,843 acres and includes Lake McBride in the upstream reaches and Lake Tom John that drains across Velda Dairy Road into Lake Kinsale (**Figure 5-55**). The Killearn Chain receives discharge from multiple neighborhoods including Killearn Acres, Killearn Estates, Royal Oaks, Foxcroft, Lake Carolyn Estates, Highlands and portions of Ox Bottom Manor and Summerbrooke. Additionally, the basin includes numerous commercial areas along Thomasville Road and Kerry Forest Parkway.

Water levels in each of the lakes are controlled by structures that provide interconnection between the waterbodies. A weir structure is located at the downstream end of Lake Kinsale (**Photo 5-38**) at an elevation of 74.8 ft-NAVD88. A culvert with an invert elevation of 70.5 ft-NAVD88 connects Lake Killarney with Lake Kanturk. Finally, a sump with an overflow elevation of 73.9 ft-NAVD88 at Centerville Road controls outflow from Lake Kanturk (**Photo 5-39**). The outflow from Lake Kanturk has been significantly stabilized to prevent erosion (**Photo 5-40**).



CITY OF TALLAHASSEE

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Miles

Legend

- Killearn Chain of Lakes Drainage Basin
- Waterbodies in Study
- Watercourses
- Tallahassee Corporate Limits

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Facilities: COT, 2020
City Limits: COT, 2022

Figure 5-55:
Killearn Chain of Lakes Basin Overview Map

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

Photo 5-30: Killearn Chain of Lakes Basin Area Aerial (1937)

Photo 5-31: Killearn Chain of Lakes Basin Area Aerial (1949)

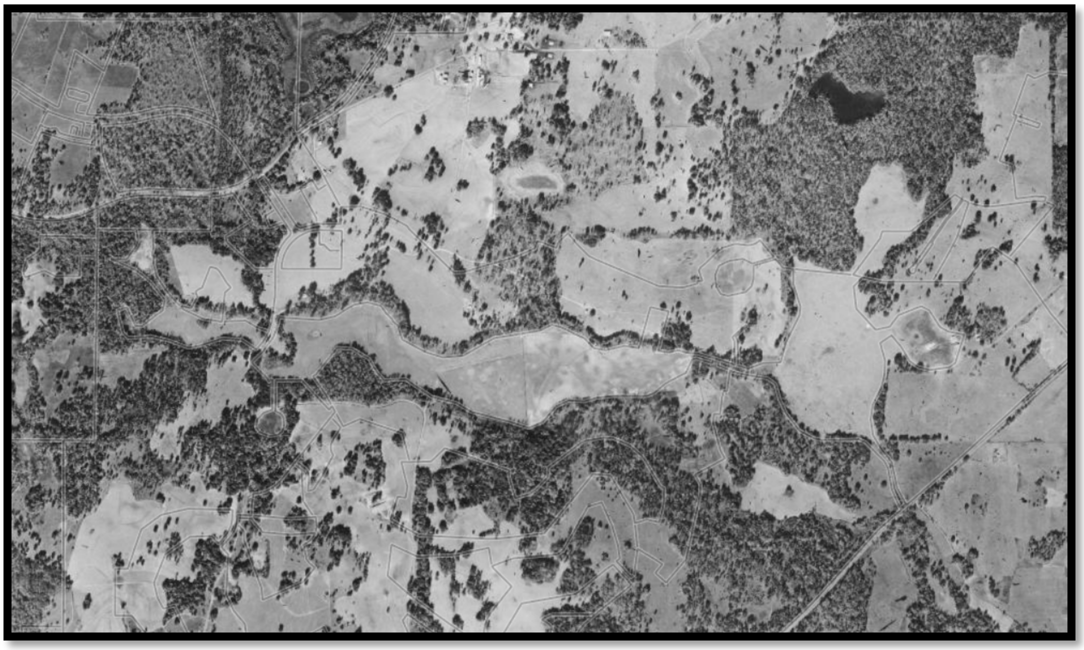


Photo 5-32: Killearn Chain of Lakes Basin Area Aerial (1954)

Photo 5-33: Killearn Chain of Lakes Basin Area Aerial (1970)

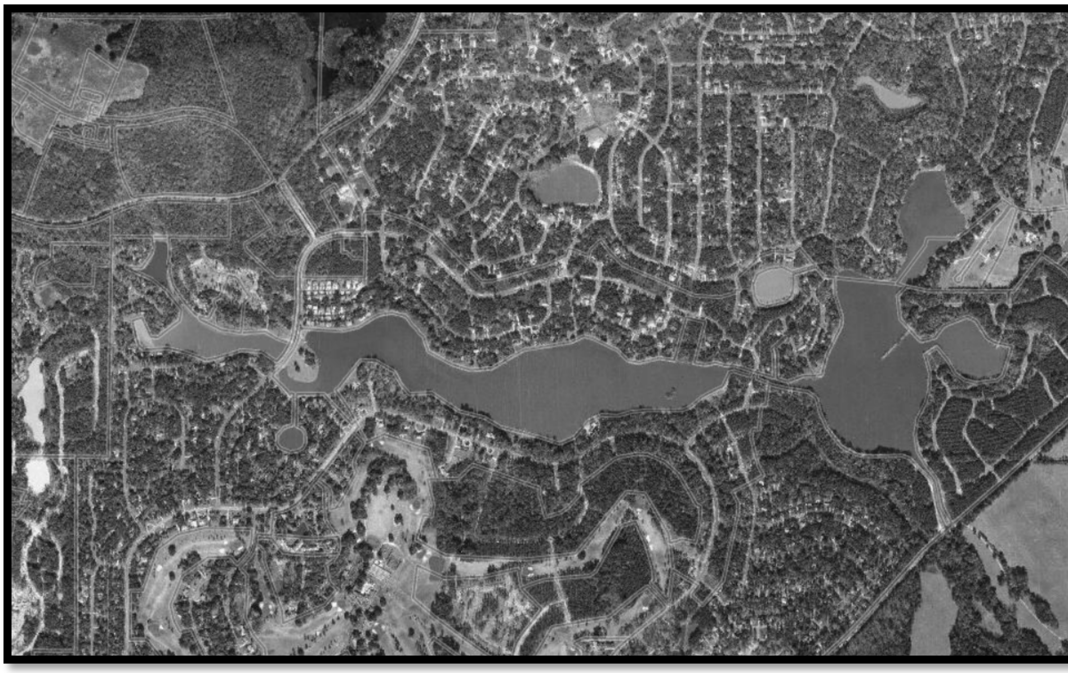


Photo 5-34: Killearn Chain of Lakes Basin Area Aerial (1983)

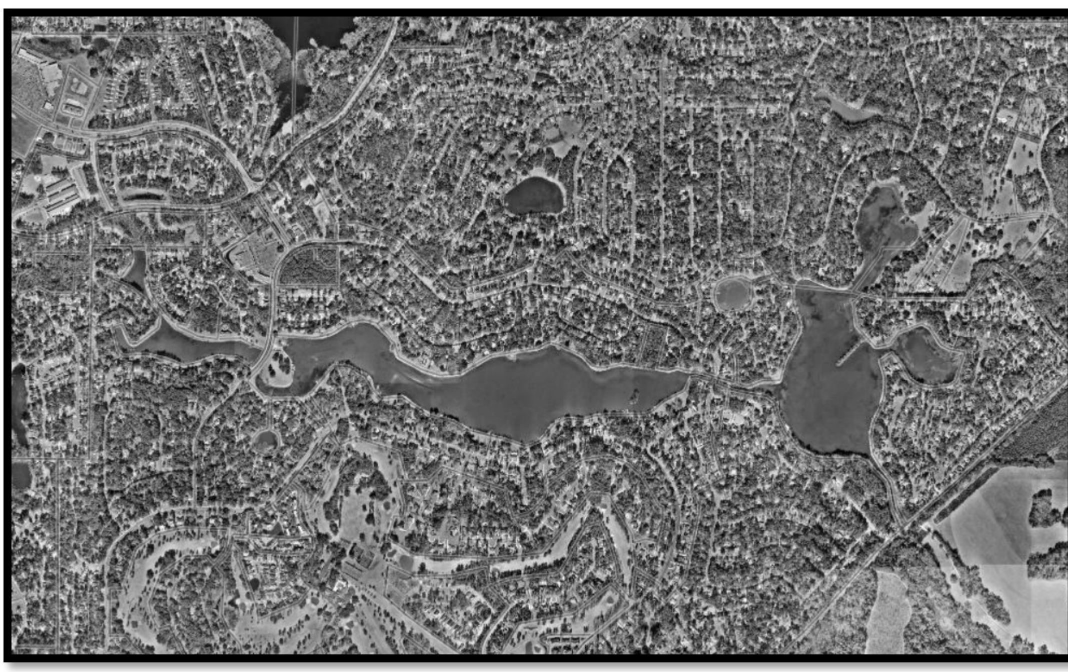


Photo 5-35: Killearn Chain of Lakes Basin Area Aerial (1996)

Photo 5-36: Killearn Chain of Lakes Basin Area Aerial (2007)

Photo 5-37: Killearn Chain of Lakes Basin Area Aerial (2020)

Photo 5-38: Weir Structure on Lake Kinsale

Photo 5-39: Sump Wall Overflow on Eastern End of Lake Kanturk

Photo 5-40: Outflow Channel from Killearn Chain of Lakes at Centerville Road

When the lakes were constructed in the 1970s, in order to maintain water levels, groundwater pumping was required due to insufficient hydrologic inputs. This pumping supplemented inflows and helped to maintain water levels throughout the system. Due to costs, pumping was discontinued circa 1990. Following the elimination of pumping, the lakes experienced significant fluctuation in water levels with periods of dry-down which exposed the lake bottom for extended periods of time.

Examination of the aerial photos shows these fluctuations. In the 1983 aerial (**Photo 5-34**) all three lakes are clearly full. In the 1996 aerial (**Photo 5-35**) some bottom exposure can be seen. In the 2007 and 2020 aerial photos (**Photo 5-36** and **Photo 5-37**) extensive exposed bottom can be seen in both Lake Killarney and Lake Kanturk. Due to the weir at the downstream end of Lake Kinsale, along with the larger watershed which drains directly to Lake Kinsale, water levels remain higher in comparison to the other two lakes. To illustrate the impacts of the variations in water level, photos of Lake Killarney are provided under different conditions. **Photo 5-41** presents a near full condition following extended rainfall. **Photo 5-42** presents a more average condition. **Photo 5-43** presents a low water condition during winter. **Photo 5-44** presents a low water condition after an extended dry period to allow vegetative growth. As these photos illustrate, the impacts to the lakes from the exposure of the lake bottom (and associated vegetation) to frequent dry spells creates conditions where upon refilling, decomposing material leads to an influx of nutrients to the system with resulting algal response.

Photo 5-41: Western End of Lake Killarney High Condition (April 2017)

Photo 5-42: Western End of Lake Killarney Average Condition (May 2011)

Photo 5-43: Western End of Lake Low Condition (January 2020)

Photo 5-44: Western End of Lake Low Condition (July 2011)

Between 2014 to 2018 numerous studies were undertaken by the City and others to evaluate conditions in the lakes and identify an appropriate path forward for the waterbody designations and restoration. The studies included,

- A 2014 Evaluation of Sediment Impacts on Water Quality by ERD that evaluated sediments in the lake and their potential contribution to nutrient loading,
- A 2014 study by the City and the University of Florida that provided an assessment of the soil characteristics in the basin and their impacts on water quality,
- A 2015 study by Applied Technology and Management (ATM) that provided an assessment of storm event loading data and other data relative to the waterbody designations, and
- Studies by ATM and Frydenborg Ecologic in 2016 and 2017 that evaluated the effects of the water level fluctuations on water quality and guidance for performing sampling within the three lakes.

The lake sediment study (conducted in 2014) calculated the internal nutrient loads under typical conditions and under conditions following rewetting of the lake bottoms. Analyses were performed on cores taken from two sites in Lake Kinsale, three sites in Lake Killarney, and three sites in Lake Kanturk. The calculated loads are presented in **Section 5.5.4.4**. The study concluded that nutrient recycling from bottom sediments is minimal and that nutrient release from sediments following reflooding is not a significant source.

The overriding finding from the other studies is that the water level fluctuations create extended periods where conditions are not appropriate for assessment against criteria established for lakes under the NNC and lakes in general. As such, management recommendations need to center around solutions to maintain water levels in the lakes or provide for management as a more standard wetland prairie system. The study findings are discussed in greater detail in sections to follow.

5.5.2 Regulatory Status

Exhibit 5-2 presented the verified impaired waters within the overall Lake Lafayette basin. In the Cycle 3/Group 1 assessment, Lakes Killarney/Kinsale (WBID 647C) were verified impaired for nutrients (TSI) and un-ionized ammonia based on data from 2007 to 2014. During that same cycle Lake Kanturk (WBID 647F) was verified impaired for nutrients (TSI) based on data from 2008 to 2014. In 2016, the City submitted a document entitled *Documentation in Support of Category 4e for WBIDs 647C and 647F: Killarney and Kanturk* requesting the two WBIDs (containing all three lakes) be moved into Category 4e. Category 4e (as outlined in **Section 5.4.2**) indicates that *the waterbody is impaired, but ongoing or recently completed restoration activities are underway to restore designated uses, so a TMDL calculation is not necessary*. In 2019 WBID 647C was subdivided so that in the present IWR database there are two WBIDs, one for Lake Kinsale (WBID 647K) and one for Lake Killarney (WBID 647J). The 4e designation carried forward to the two new WBIDs. Presently all three lakes remain in the 4e category. A key finding as part of the 4e assessment was that without supplemental hydraulic augmentation the waterbodies will continue to be impaired.

5.5.3 Waterbody Data Review and Summary

This section presents an overview of available data and data sources for the Killearn Chain of Lakes including bathymetry, land use, soils, septic systems, hydrologic measurements, surface water quality, groundwater quality, biological, stormwater treatment facilities, and atmospheric deposition.

5.5.3.1 Bathymetry

No bathymetric data was available. Based on available reports and other information the average depths in the lakes (when full) are approximately 4 ft, 6 ft, and 5 ft for Lake Kinsale, Lake Killarney, and Lake Kanturk, respectively.

5.5.3.2 Land Use

Figure 5-56 presents a map of the Level 2 land uses within the Killearn Chain of Lakes basin. A table is provided to show the overall acreages and percent cover for the various levels. Tables are provided for both the Level 2 and grouped Level 1 land uses. The largest land use type by far within the Killearn Chain of Lakes drainage basin per the grouped Level 1 categories is Urban and Built Up (67 percent) with the bulk of that being Medium Density Residential. The areas are spread throughout the basin. The next highest category is Upland Forest (20 percent) located primarily in the northwestern most upstream reaches of the basin.

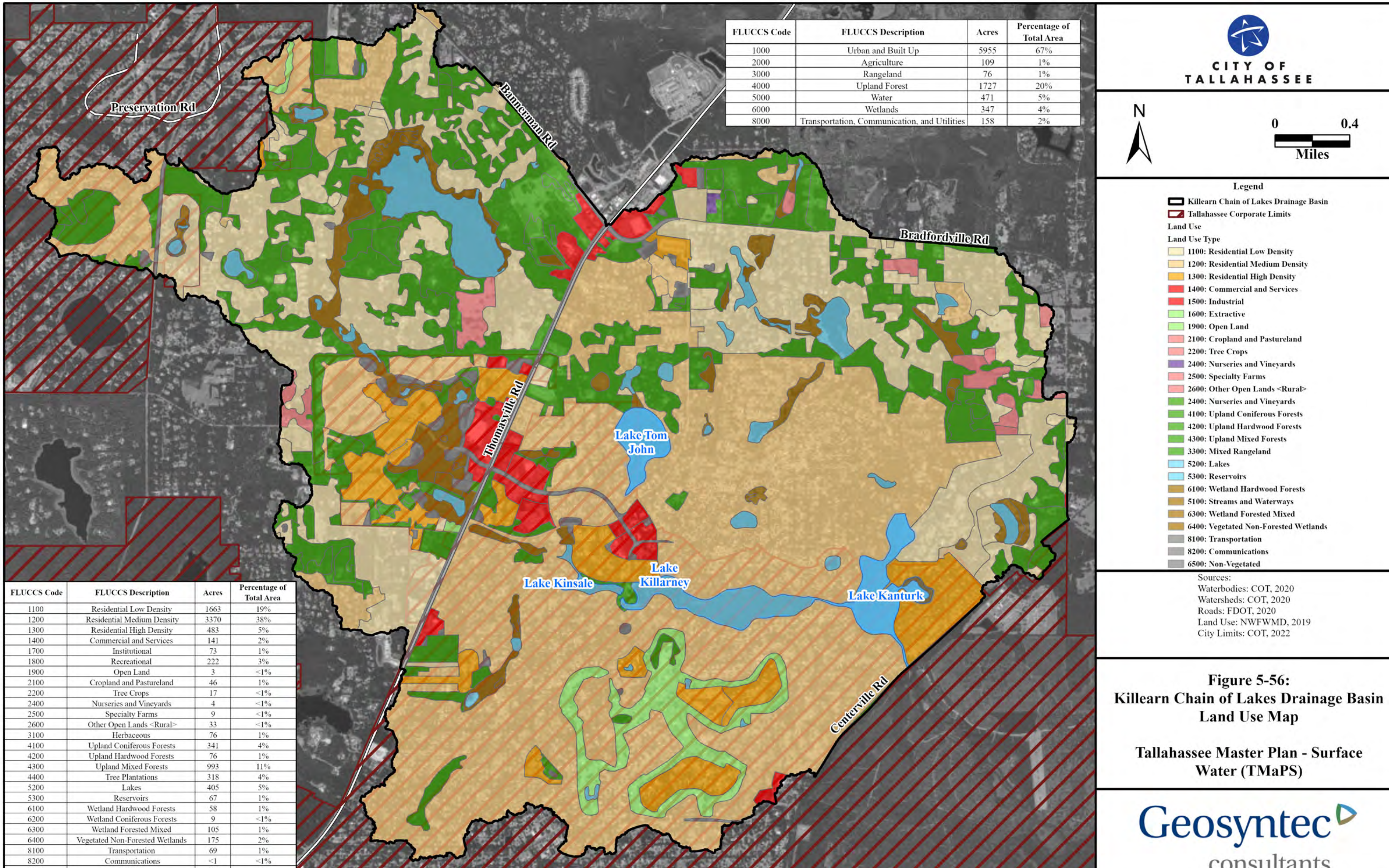
5.5.3.3 Soils

The most prevalent soil group in the Killearn Chain of Lakes basin is Group B (56 percent) (**Figure 5-57**). Group B soils are considered to have moderate rates of infiltration. The second highest soil group coverage is Group C (20 percent), which has low rates of infiltration and high runoff potential. The majority of the remaining soil groups (B/D and A/D) throughout the basin are generally in areas with high water tables so they also would not drain well and have large runoff potentials.

5.5.3.4 Septic Systems

An estimated 2,675 septic systems are within the boundaries of the Killearn Chain of Lakes drainage basin, based on the FDOH septic tank layer (**Figure 5-58**). The systems are located throughout the northern and upstream portions of the basin. The highest density is in neighborhoods to the north of the Killearn Chain of Lakes along tributaries that drain to Lake Kanturk.

Effluent from septic tanks that are in good condition should be comparable to secondarily treated wastewater effluent from sewage treatment plants. However, septic systems can be a source of pollutants, pathogens, and nutrients and are identified by FDEP as a potential source of bacteria and nutrients to waterbodies in its assessment processes.



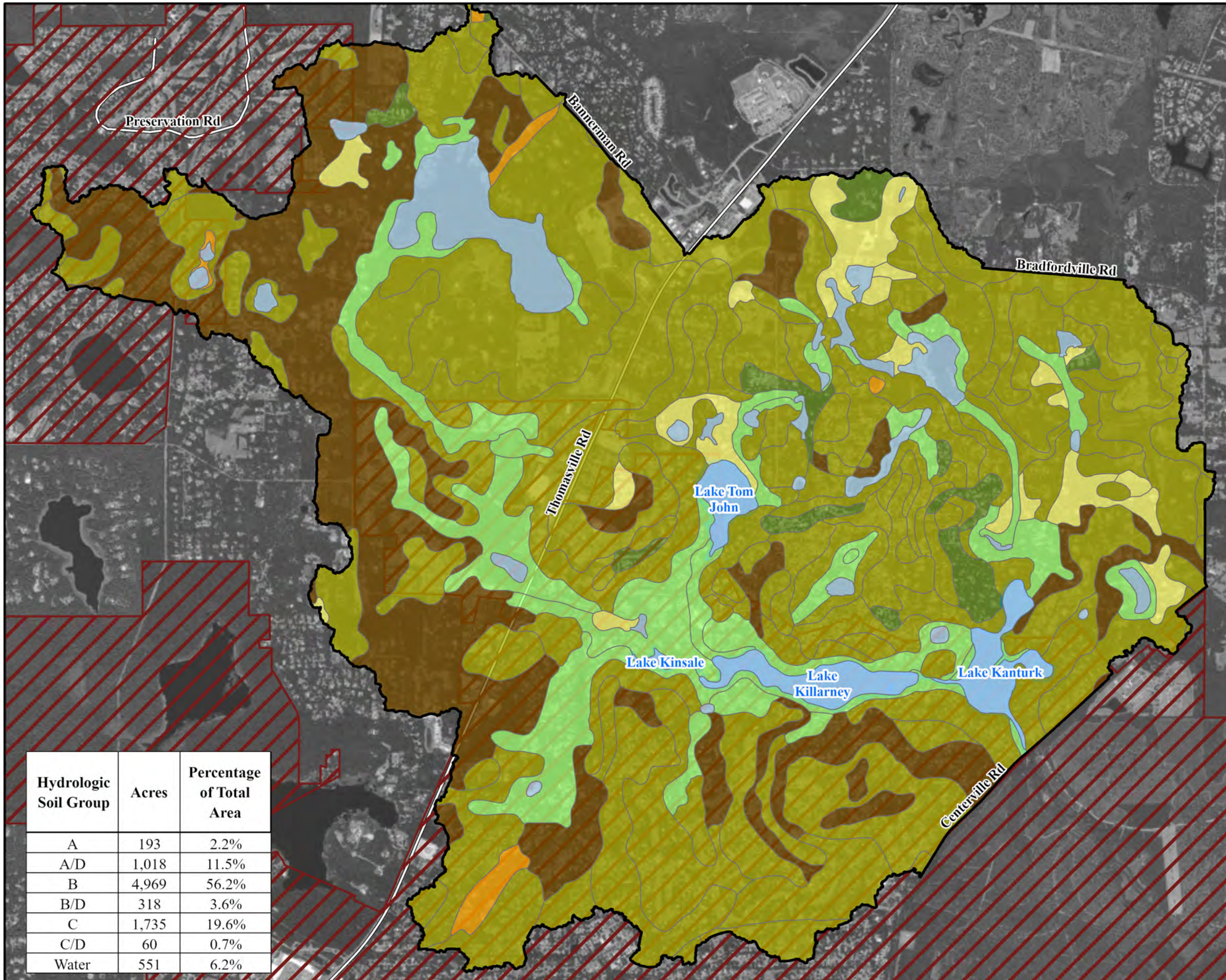
FLUCCS Code	FLUCCS Description	Acres	Percentage of Total Area
1000	Urban and Built Up	5955	67%
2000	Agriculture	109	1%
3000	Rangeland	76	1%
4000	Upland Forest	1727	20%
5000	Water	471	5%
6000	Wetlands	347	4%
8000	Transportation, Communication, and Utilities	158	2%

FLUCCS Code	FLUCCS Description	Acres	Percentage of Total Area
1100	Residential Low Density	1663	19%
1200	Residential Medium Density	3370	38%
1300	Residential High Density	483	5%
1400	Commercial and Services	141	2%
1700	Institutional	73	1%
1800	Recreational	222	3%
1900	Open Land	3	<1%
2100	Cropland and Pastureland	46	1%
2200	Tree Crops	17	<1%
2400	Nurseries and Vineyards	4	<1%
2500	Specialty Farms	9	<1%
2600	Other Open Lands <Rural>	33	<1%
3100	Herbaceous	76	1%
4100	Upland Coniferous Forests	341	4%
4200	Upland Hardwood Forests	76	1%
4300	Upland Mixed Forests	993	11%
4400	Tree Plantations	318	4%
5200	Lakes	405	5%
5300	Reservoirs	67	1%
6100	Wetland Hardwood Forests	58	1%
6200	Wetland Coniferous Forests	9	<1%
6300	Wetland Forested Mixed	105	1%
6400	Vegetated Non-Forested Wetlands	175	2%
8100	Transportation	69	1%
8200	Communications	<1	<1%
8300	Utilities	89	1%

Figure 5-56: Killearn Chain of Lakes Drainage Basin Land Use Map

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



Hydrologic Soil Group	Acres	Percentage of Total Area
A	193	2.2%
A/D	1,018	11.5%
B	4,969	56.2%
B/D	318	3.6%
C	1,735	19.6%
C/D	60	0.7%
Water	551	6.2%

CITY OF TALLAHASSEE

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Legend

- Killearn Chain of Lakes Drainage Basin
- Tallahassee Corporate Limits

Hydrologic Soil Group

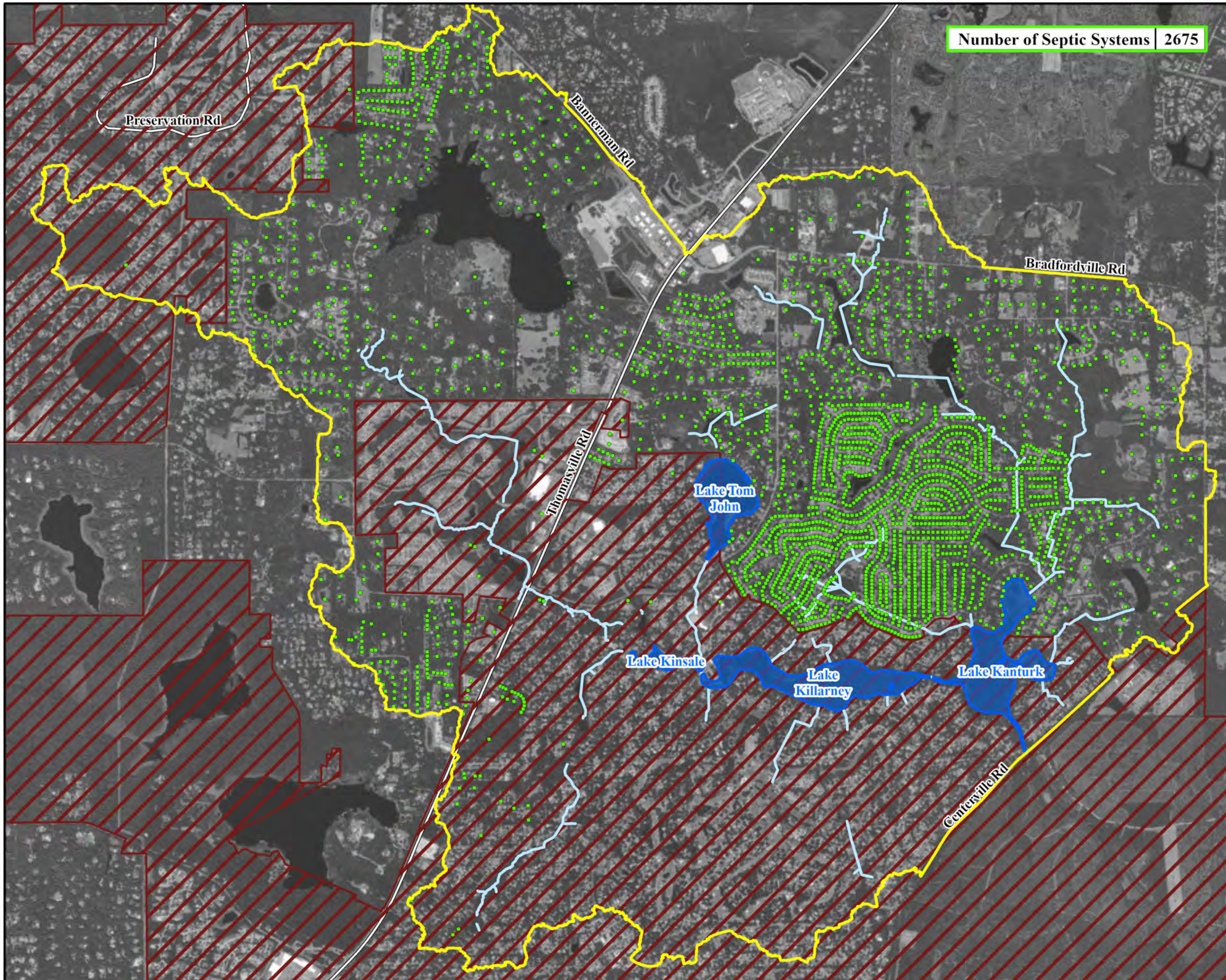
- A
- A/D
- B
- B/D
- C
- C/D
- Water

Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Soils: NRCS, 2020
City Limits: COT, 2022

Figure 5-57:
Killearn Chain of Lakes Drainage Basin Soils Map

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



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Miles

Legend

- Waterbodies in Study
- Watercourses
- Tallahassee Corporate Limits
- Septic Systems

Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Septic Systems: COT, 2020
City Limits: COT, 2022

Figure 5-58:
Killearn Chain of Lakes Drainage Basin Septic Systems Map

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

5.5.3.5 Hydrologic Data

Exhibit 5-6 presented the locations of hydrologic data stations within the Lake Lafayette basin. As the map shows, there are water level stations located in each of the three lakes (Stations 012547, 012548, and 012549). Data from these stations was obtained from 2013 to 2021. **Figure 5-59** presents a plot of the measured water levels relative to NAVD88 for the period of the available data. The data for each of the lakes are plotted together to show how the lake levels vary relative to one another. The data show the variations between the lakes. The stage in Kinsale stays higher for longer periods and does not drop down to the levels seen in the other waterbodies. Killarney and Kanturk drop to levels around 4 ft lower than Kinsale for extended periods representing dry out conditions.

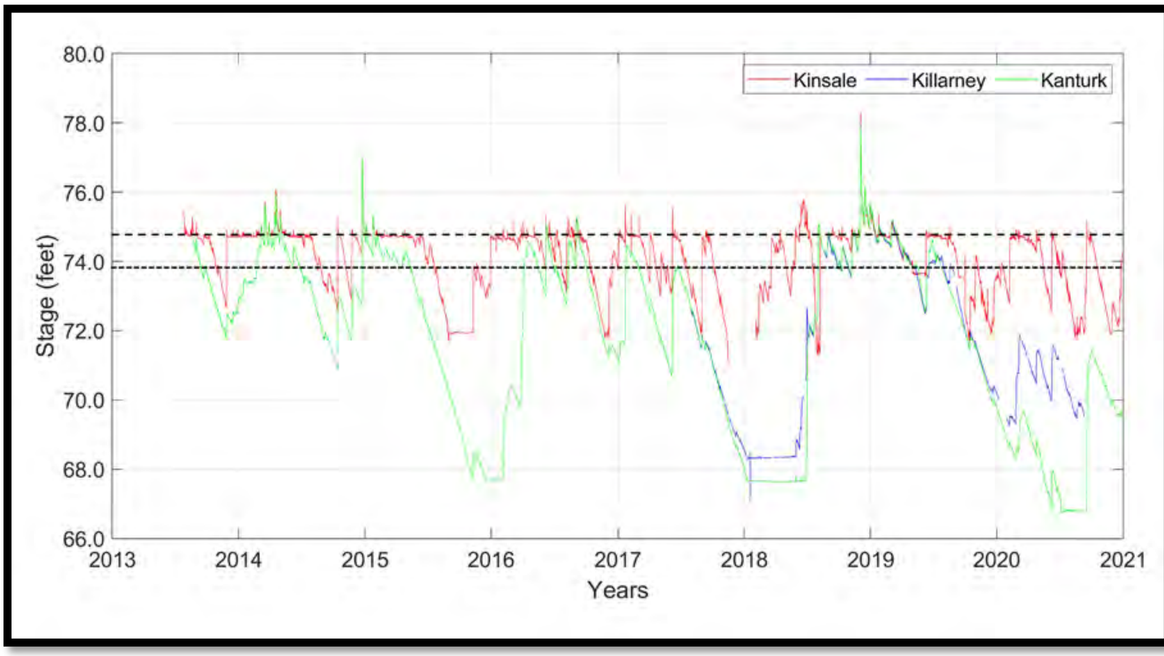


Figure 5-59: Water Levels in Lake Kinsale, Lake Killarney, and Lake Kanturk with Control Elevations (Kinsale/Killarney – long dash, Killarney/Kanturk – short dash)

A flow measurement station is located downstream of Lake Kanturk where the discharge channel crosses Centerville Road (**Exhibit 5-6**). These data reflect the flow out of the system. **Figure 5-60** presents a plot of the daily average flows from 1990 through 2020. The flow rates vary from 0 up to over 200 cfs. Discharge out of the Killearn Chain of Lakes is highly intermittent with long periods when discharge is at 0.

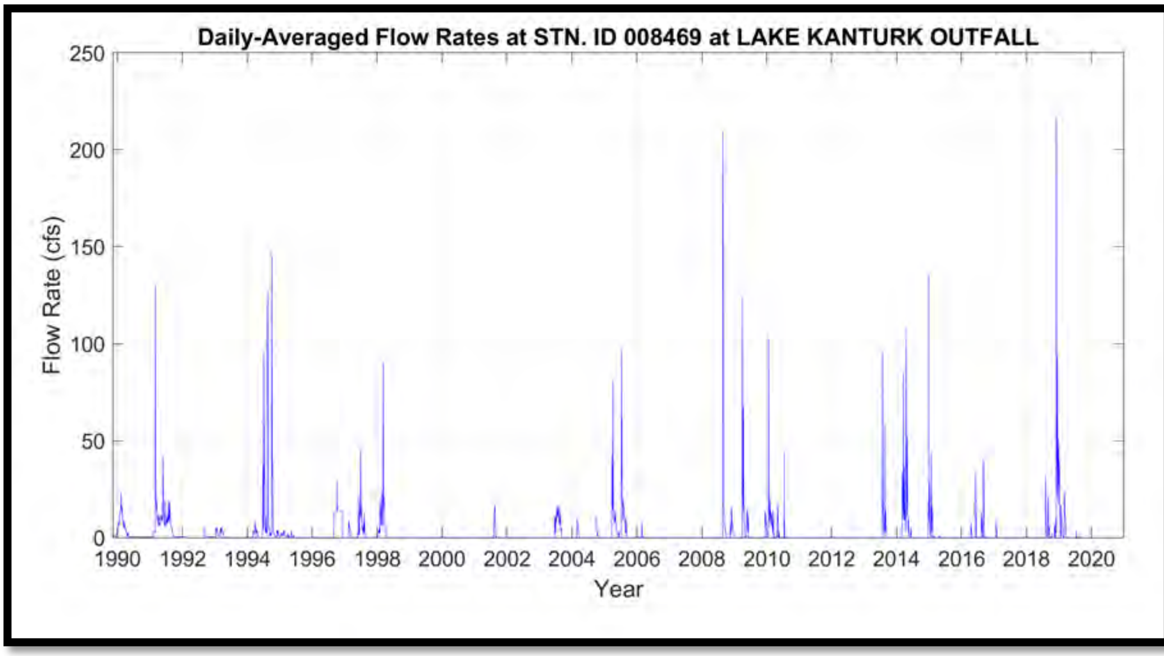


Figure 5-60: Flow Out of Lake Kanturk

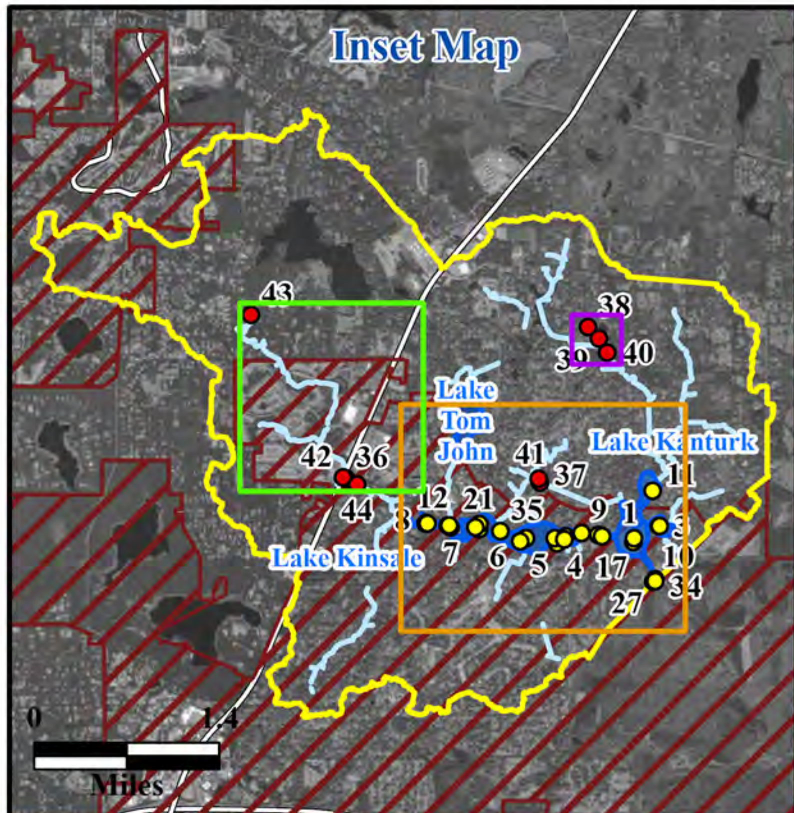
5.5.3.6 Surface Water Quality Data

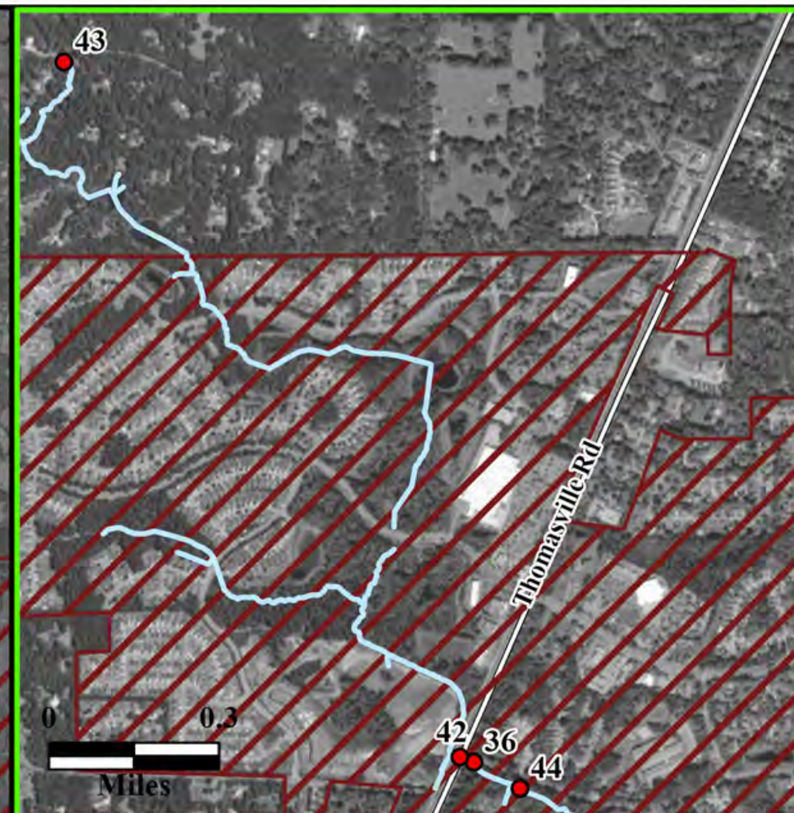
The available data from the Killearn Chain of Lakes span from 1999 to the present. Data were provided by local and state agencies (City, Leon County, FDEP, and USGS) as well as private sector firms (McGlynn Lab).

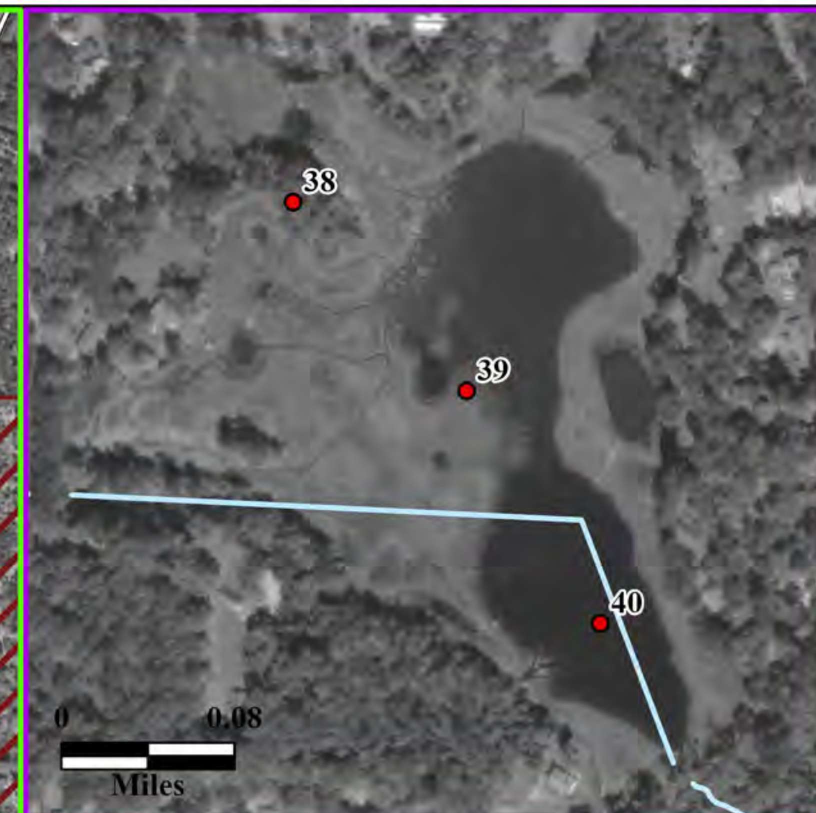
Figure 5-61 presents the locations of in-lake water quality monitoring stations for the Killearn Chain of Lakes (yellow) along with stations that provide water quality data within tributaries that drain into Lake Kinsale and Lake Kanturk (red). A table is provided in **Figure 5-61** that shows the station ID, station name, period of record, and if the station represents in-lake or inflowing tributary data. Based on the number of stations and the length of the station IDs, station IDs were not included on the figure, rather each of the stations is given a number and the numbers correspond to stations in the table.

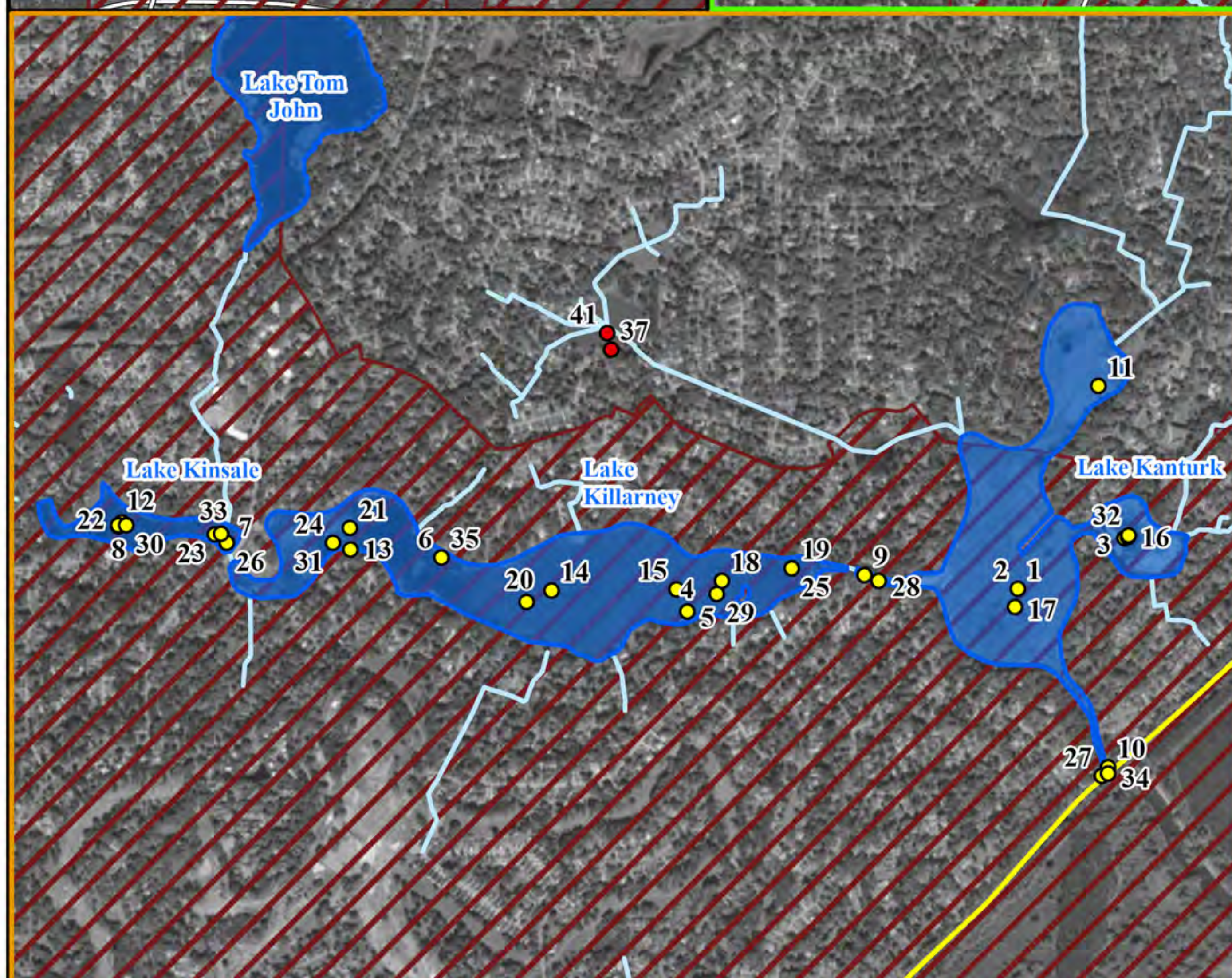
Figure 5-61 shows that water quality monitoring stations have been spread throughout the three lakes for the period of record. Relative to more recent data (after 2010) there are numerous stations throughout the system.

Some initial plots of the available data in the lakes are provided in this section. As nutrients are the primary constituent of interest relative to water quality conditions in the Killearn Chain of Lakes, plots are provided for the key parameters related to potential nutrient impairment. These include TN, TP, Chl-a, and TSI. Additionally, based on interest relative to septic systems and other sources, FIB, specifically *E. coli* are included. Additional data plots and analyses are provided as part of the qualitative assessment of sources in **Section 5.5.4**.









Number	Station ID	Station Name	Start of Record	End of Record	Position
1	21FLCOT KANTURK	KANTURK	2008	2022	In-Lake
2	21FLCOT KANTURK - SUPPL	Kanturk - Supplemental	2013	2014	In-Lake
3	21FLCOT KANTURK N - SUP	Kanturk North - Supplemental	2013	2014	In-Lake
4	21FLCOT KILLARN E - SUP	Killarney East - Supplemental	2013	2014	In-Lake
5	21FLCOT KILLARNEY EAST	KILLARNEY EAST	2007	2022	In-Lake
6	21FLCOT KILLARNEY WEST	KILLARNEY WEST	2008	2022	In-Lake
7	21FLCOT KINSALE	Kinsale	2017	2022	In-Lake
8	21FLCOT KINSALE - SUPPL	Kinsale - Supplemental	2013	2014	In-Lake
9	21FLCOT STA - 16	STA - 16	2014	2014	In-Lake
10	21FLCOT STA-12	STA-12	2014	2014	In-Lake
11	21FLGW 45419	Z1-LL-8003 UNNAMED LARGE LAKE	2014	2014	In-Lake
12	21FLGW 54310	Z1-SL-12030 LAKE KINSALE	2018	2018	In-Lake
13	21FLKWATLEO-KILLARNEY-1	LEO-KILLARNEY-1	1999	2009	In-Lake
14	21FLKWATLEO-KILLARNEY-2	LEO-KILLARNEY-2	1999	2009	In-Lake
15	21FLKWATLEO-KILLARNEY-3	LEO-KILLARNEY-3	1999	2009	In-Lake
16	21FLMCGLKANTURK1	Lake Kanturk, first station	2008	2019	In-Lake
17	21FLMCGLKANTURK3	Lake Kanturk, third station	2008	2021	In-Lake
18	21FLMCGLKILLEARNY1	Lake Killearny, station 1	2008	2021	In-Lake
19	21FLMCGLKILLEARNY1A	Lake Killearny, station 1A	2009	2009	In-Lake
20	21FLMCGLKILLEARNY2	Lake Killearny, station 2	2008	2021	In-Lake
21	21FLMCGLKILLEARNY3	Lake Killearny, station 3	2008	2021	In-Lake
22	21FLMCGLKINSAIL1	Lake Kinsail, station 1	2008	2021	In-Lake
23	21FLMCGLKINSAIL2	Lake Kinsail, station 2	2008	2021	In-Lake
24	21FLPNS 132UL	Lake Killearny Near Center (also 21FLWQSP)	2011	2011	In-Lake
25	21FLPNS KILLEARNY1A	Lake Killearny East (also 21FLMCGL)	2011	2011	In-Lake
26	21FLTLHRG1TLHR0148	Lake Kinsale	2021	2022	In-Lake
27	21FLWQA 303135908411272	Alford Arm Trib at Centerville Rd (Lake Kanturk outlet)	2006	2006	In-Lake
28	21FLWQA BLOOM515	Canal Between Kanturk and Killarney	2017	2017	In-Lake
29	21FLWQA BLOOM516	Killarney Mid	2017	2017	In-Lake
30	21FLWQA BLOOM517	Kinsail Mid	2017	2017	In-Lake
31	21FLWQSPLEO132UL	Lake Killarney near center (WBID 647C)	2005	2005	In-Lake
32	21FLWQSPLEO136UL	Lake Kanturk near center (WBID 647)	2005	2005	In-Lake
33	21FLWQA G1WA0079	Lake Kinsail	2017	2017	In-Lake
34	21FLCOT LLB04	LLB04	2015	2019	In-Lake
35	21FLCOT KILLARN W - SUP	Killarney West - Supplemental	2013	2014	Upstream
36	21FLCOT STA-11	STA-11	2013	2014	Upstream
37	21FLGW 7045	NWA-SL-1005 LAKE SHEELIN	2000	2000	Upstream
38	21FLKWATLEO-JEAN-1	LEO-JEAN-1	1999	1999	Upstream
39	21FLKWATLEO-JEAN-2	LEO-JEAN-2	1999	1999	Upstream
40	21FLKWATLEO-JEAN-3	LEO-JEAN-3	1999	1999	Upstream
41	21FLKWATLEO-SHEELIN-2	LEO-SHEELIN-2	1999	1999	Upstream
42	21FLWQA 303217408413489	Alford Arm Trib at Thomasville Rd	2006	2006	Upstream
43	21FLWQA 303321508414309	Alford Arm Trib at Rd north Two Pond Lane	2006	2006	Upstream
44	21FLWQA G1WA0015	Killearn Chain of Lake Outlet at Velda Dairy Rd. across from	2016	2017	Upstream

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Legend

Killearn Chain of Lakes Drainage Basin
Waterbodies in Study
Watercourses
Tallahassee Corporate Limits
Water Quality Stations
Position
In-Lake
Upstream of Lake

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
City Limits: COT, 2022
WQ Stations: FDEP, 2022

Figure 5-61:
Killearn Chain of Lakes Basin Water Quality Station Location Map

Tallahassee Master Plan - Surface Water (TMaPS)

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Below are plots of the measured TN, TP, and Chl-a data from 2010 to 2020 for Lake Kinsale, Lake Killarney, and Lake Kanturk. For Lake Kinsale (**Figure 5-62** through **Figure 5-64**) all three constituents show significant variation with TN and Chl-a showing slight upward trends, while TP concentrations appear consistent over the 10-year period. Three concentrations higher than 120 μg/L (not shown on the graph) were measured in Lake Kinsale in 2017 between May and August, with one measurement at 380 μg/L. For Lake Killarney **(Figure 5-65** through **Figure 5-67**), all three parameters show significant variation with lower overall concentrations after 2015. Finally, Lake Kanturk (**Figure 5-68** through **Figure 5-70**) shows similar concentration ranges to those seen in the other lakes but with more bunched data at lower concentrations with fewer higher values.

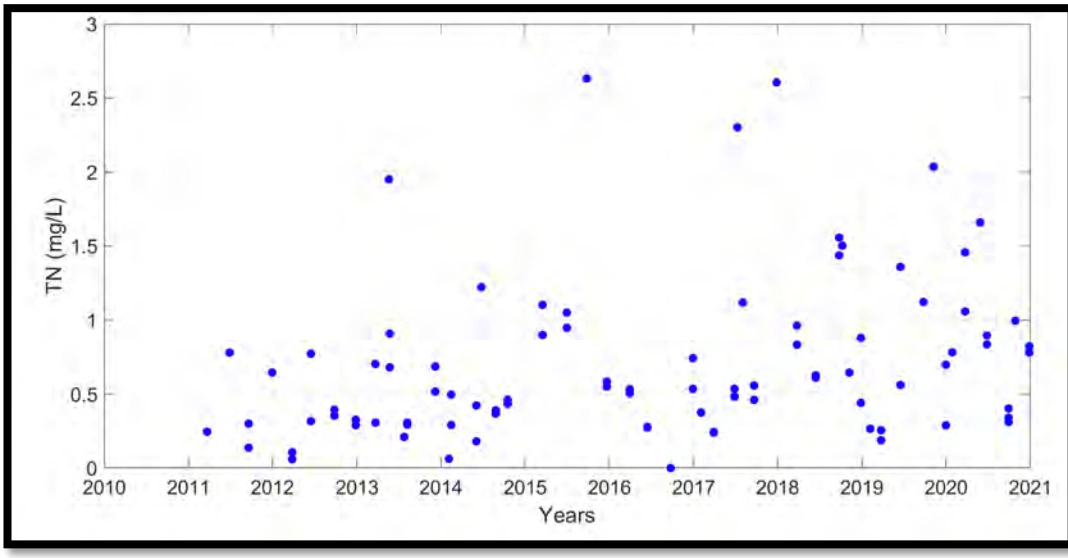

Figure 5-62: Plot of Measured TN Concentrations in Lake Kinsale (2010 to 2020)

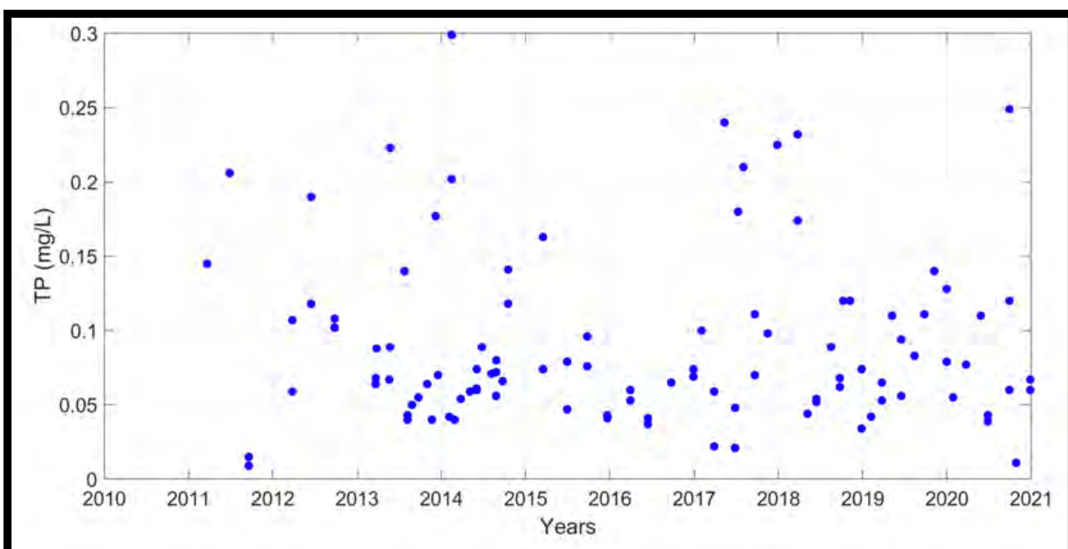

Figure 5-63: Plot of Measured TP Concentrations in Lake Kinsale (2010 to 2020)

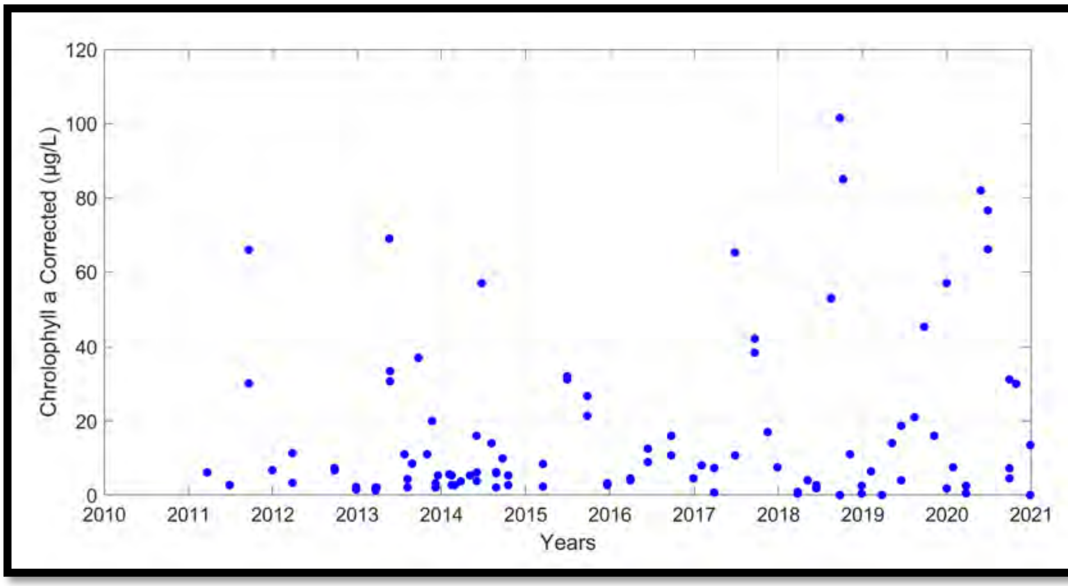

Figure 5-64: Plot of Measured Chl-a Concentrations in Lake Kinsale (2010 to 2020)

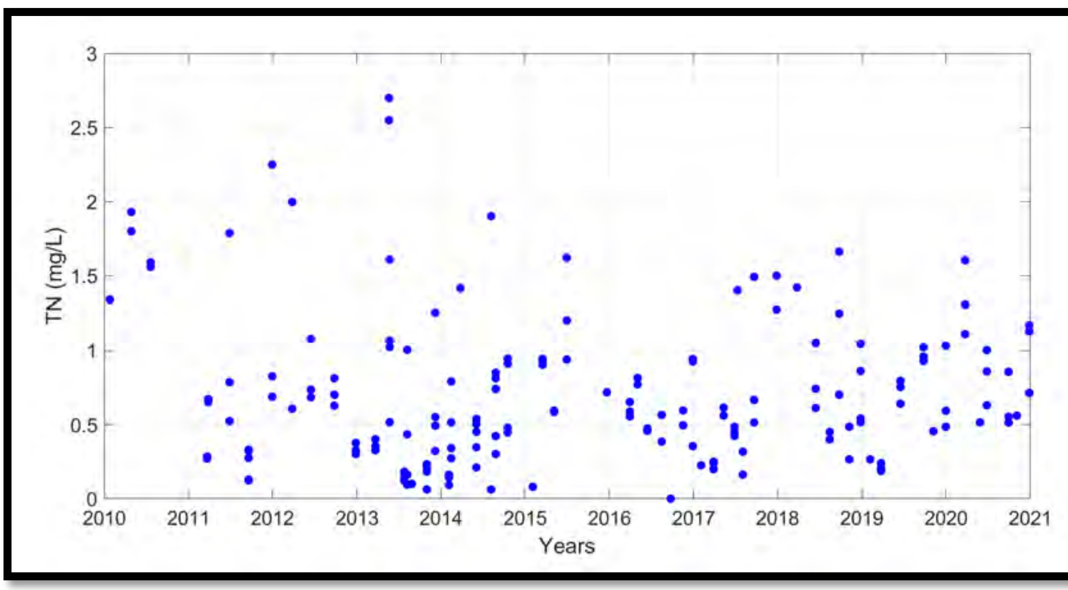

Figure 5-65: Plot of Measured TN Concentrations in Lake Killarney (2010 to 2020)

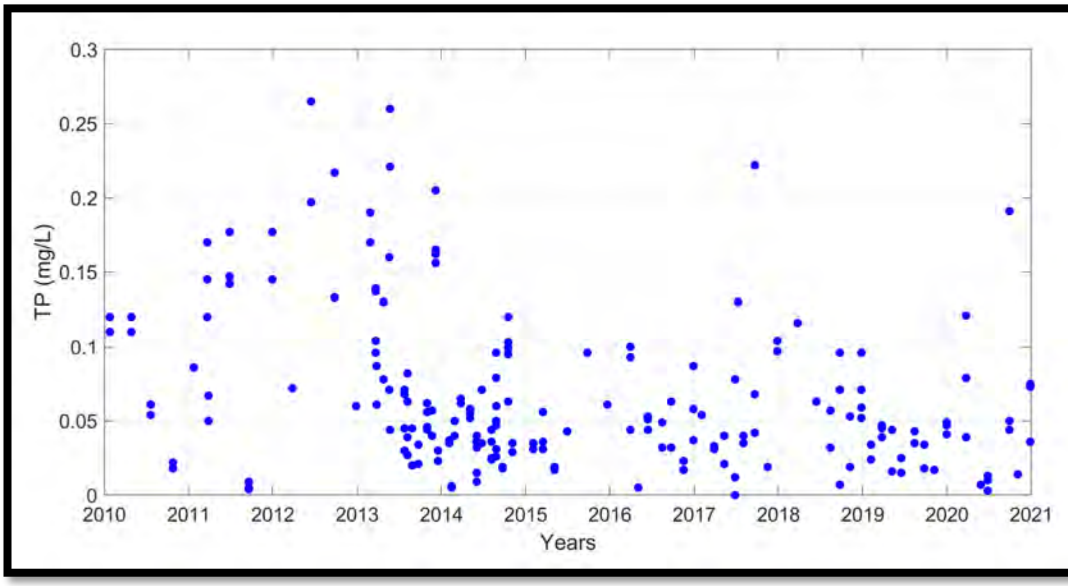

Figure 5-66: Plot of Measured TP Concentrations in Lake Killarney (2010 to 2020)

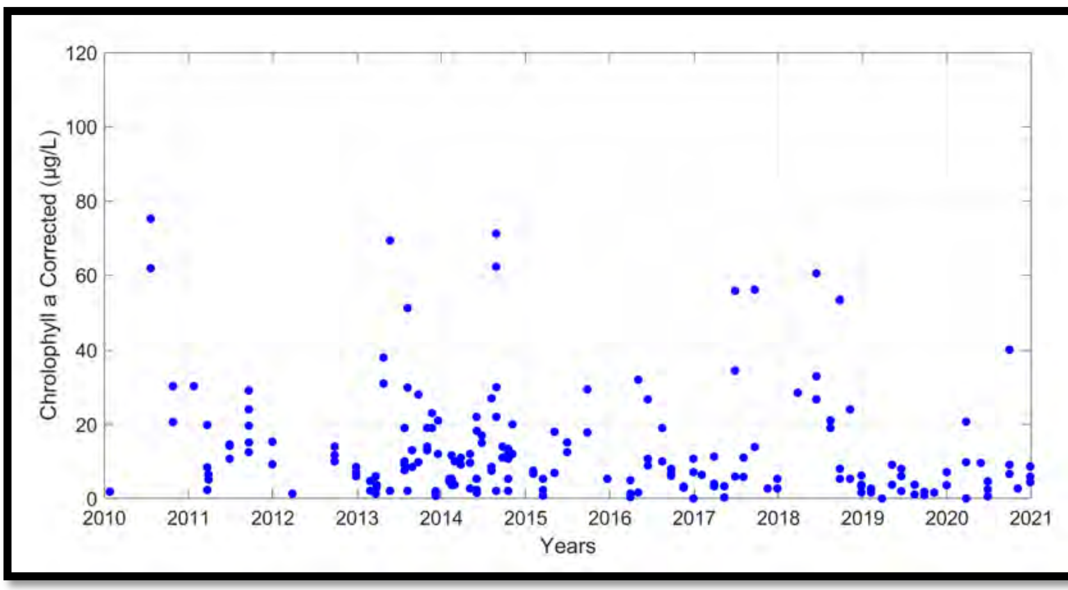

Figure 5-67: Plot of Measured Chl-a Concentrations in Lake Killarney (2010 to 2020)

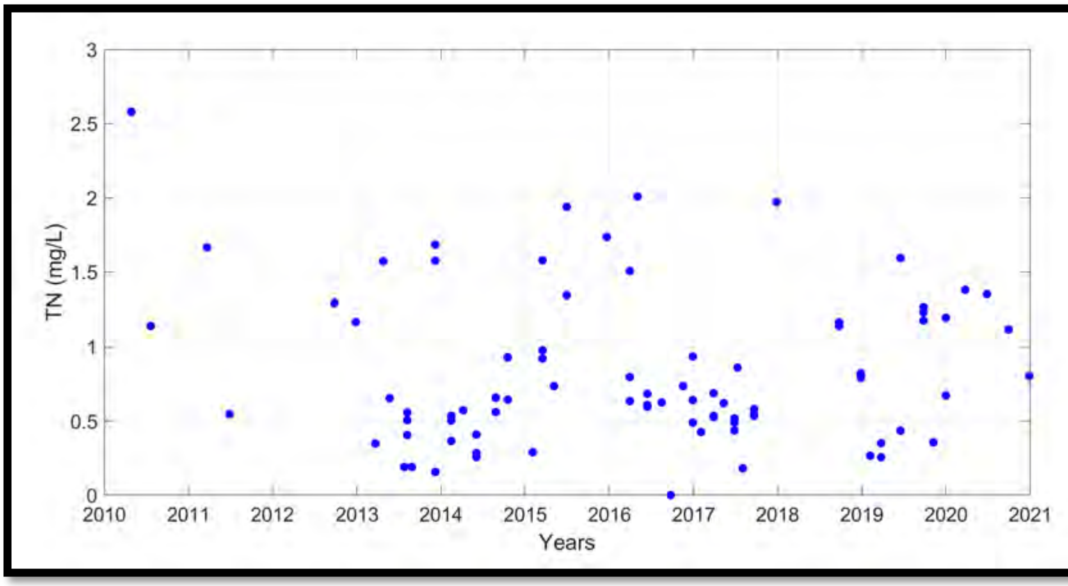

Figure 5-68: Plot of Measured TN Concentrations in Lake Kanturk (2010 to 2020)

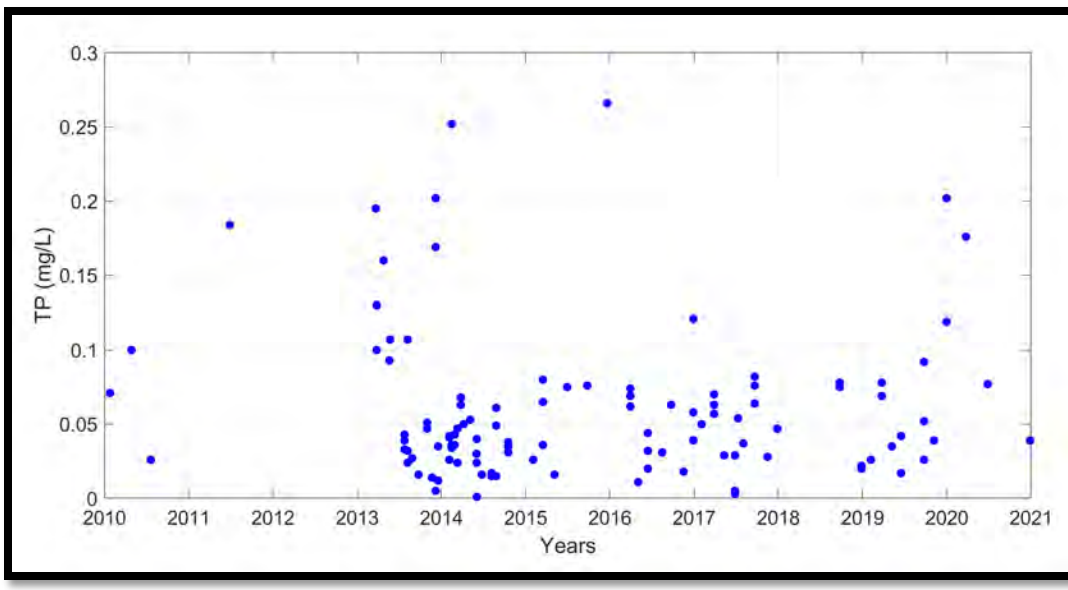

Figure 5-69: Plot of Measured TP Concentrations in Lake Kanturk (2010 to 2020)

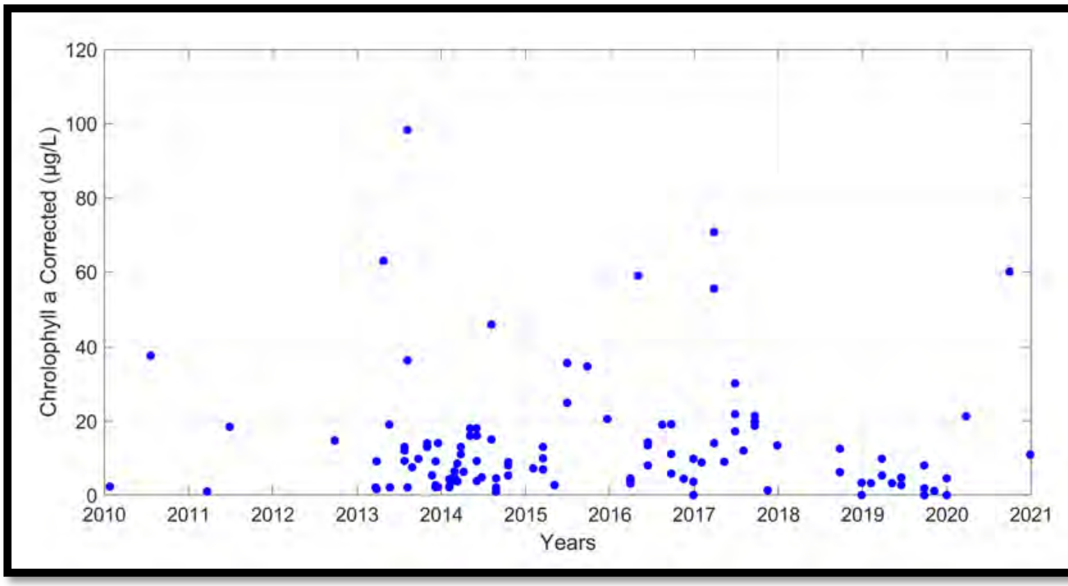

Figure 5-70: Plot of Measured Chl-a Concentrations in Lake Kanturk (2010 to 2020)

Under FDEP's NNC, the Killearn Chain of Lakes are all defined as low color, low alkalinity waterbodies. Based on this designation, the AGM threshold for Chl-a is 6 µg/L. For TN and TP, a range of concentrations are allowable, based on maintaining Chl-a levels in the lake below 6 µg/L. For TN, the range is 0.51 mg/L to 0.93 mg/L. For TP, the range is 0.01 mg/L to 0.03 mg/L. Based on the constructed nature and use of these waterbodies (as stormwater facilities) the City has identified through numerous studies that the targets outlined above may not be appropriate. For *E. coli*, the criteria are monthly geometric means below 126 colonies per 100 mL of water and less than 10 percent of samples above 410 colonies per 100 mL of water in any 30-day period.

TN, TP, and Chl-a AGMs are plotted below for each of the lakes as these define the status relative to nutrient impairments. Where sufficient data are available to assess the AGMs, the levels are provided from 2010 through 2020. For Chl-a, only data with corrected Chl-a are provided. The Chl-a threshold and the minimum and maximum thresholds for TN and TP relative to the NNC are provided on each of the graphs as pink dashed lines. Plots of calculated TSI values in the lake are also provided. While TSI is no longer utilized for the determination of impairment, it does serve as an indicator of lake health. Based on TSI definitions, levels below 60 are deemed good condition, levels between 60 and 70 indicate fair condition, while levels above 70 indicate poor condition. Finally, *E. coli* data for each of the lakes, for the available period of record, are presented against the 410 colonies per 100 mL threshold.

Examination of the TN plots (**Figure 5-71**, **Figure 5-74**, and **Figure 5-77**) shows that between 2010 and 2020 the TN AGMs for the three lakes varied significantly with some values below the minimum, some between the minimum and maximum and some above the maximum. Only Lake Kanturk did not have values below the minimum and overall had higher TN AGMs. TP AGM levels (**Figure 5-72**, **Figure 5-75**, and **Figure 5-78**) for the three lakes were all at or above the maximum threshold with Lake Kinsale having the highest values, and Lake Killarney and Lake Kanturk having similar values. **Figure 5-73**, **Figure 5-76**, and **Figure 5-79**, present the Chl-a

AGMs from 2010 through 2020. The majority of the Chl-a AGMs for the three lakes were above the 6 µg/L threshold with Lake Kanturk having the highest overall values and Lake Killarney showing a downward trend.

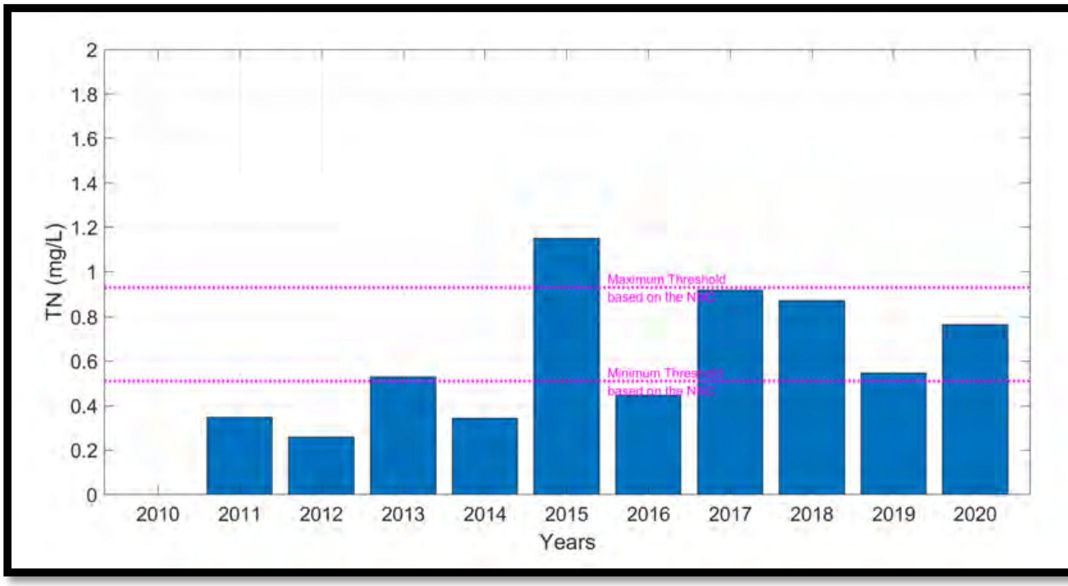

Figure 5-71: Plot of AGM for TN with NNC Criteria for Lake Kinsale

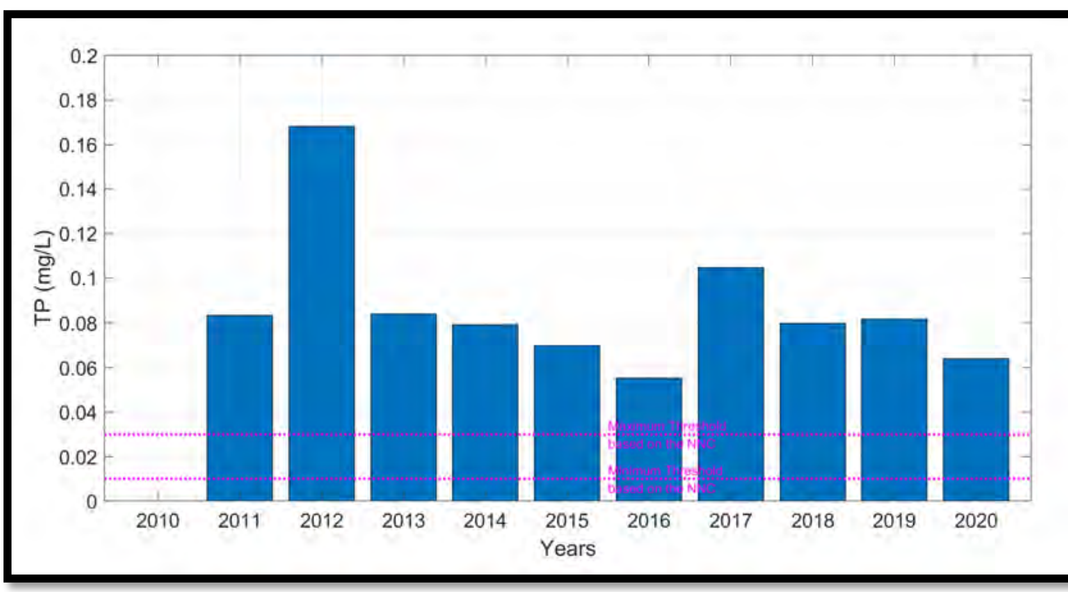

Figure 5-72: Plot of AGM for TP with NNC Criteria for Lake Kinsale

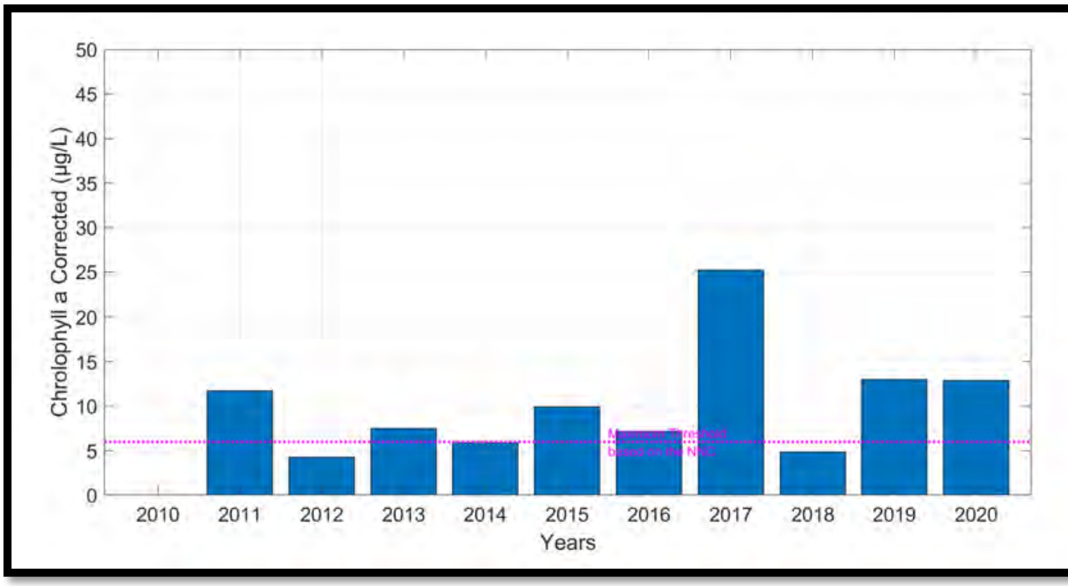

Figure 5-73: Plot of AGM for Chl-a with NNC Criteria for Lake Kinsale

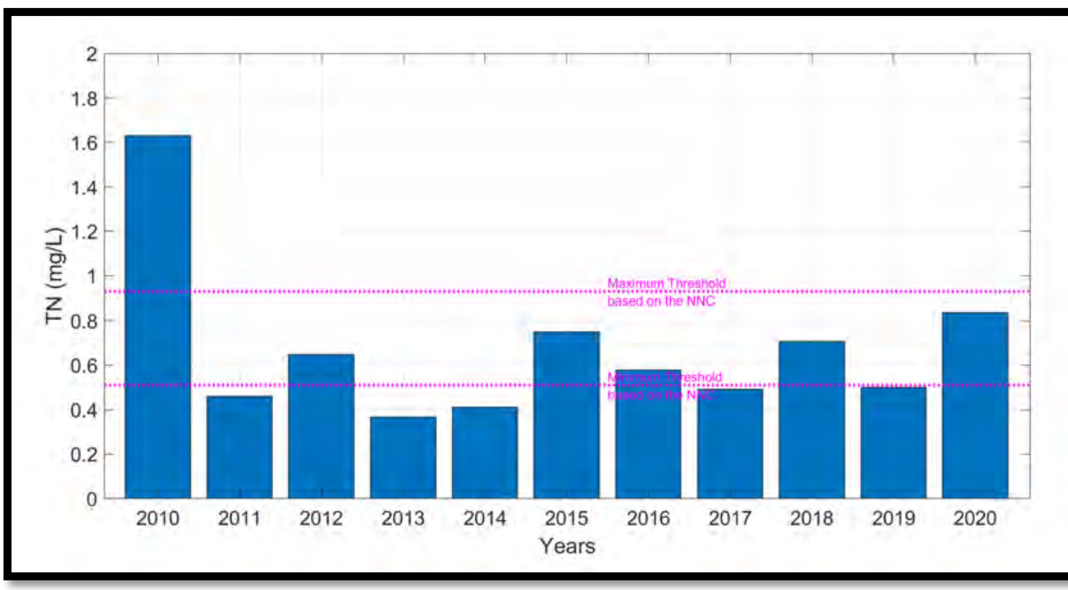

Figure 5-74: Plot of AGM for TN with NNC Criteria for Lake Killarney

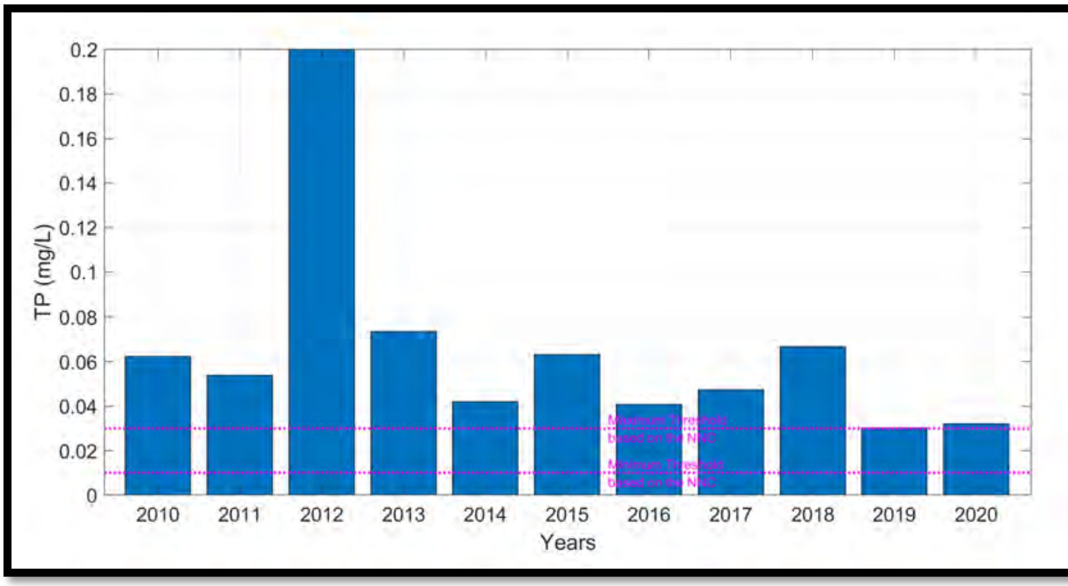

Figure 5-75: Plot of AGM for TP with NNC Criteria for Lake Killarney

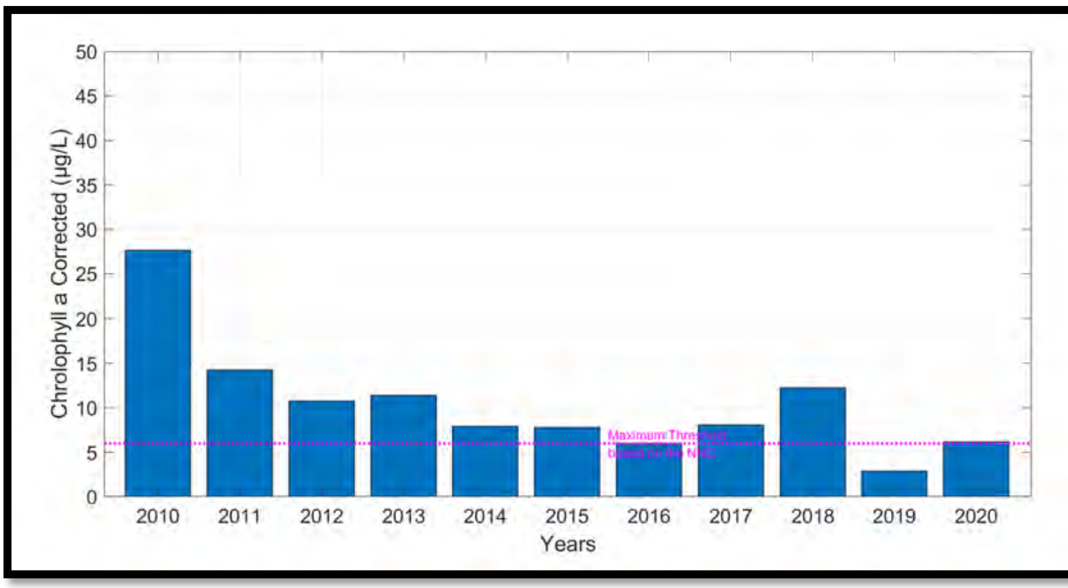

Figure 5-76: Plot of AGM for Chl-a with NNC Criteria for Lake Killarney

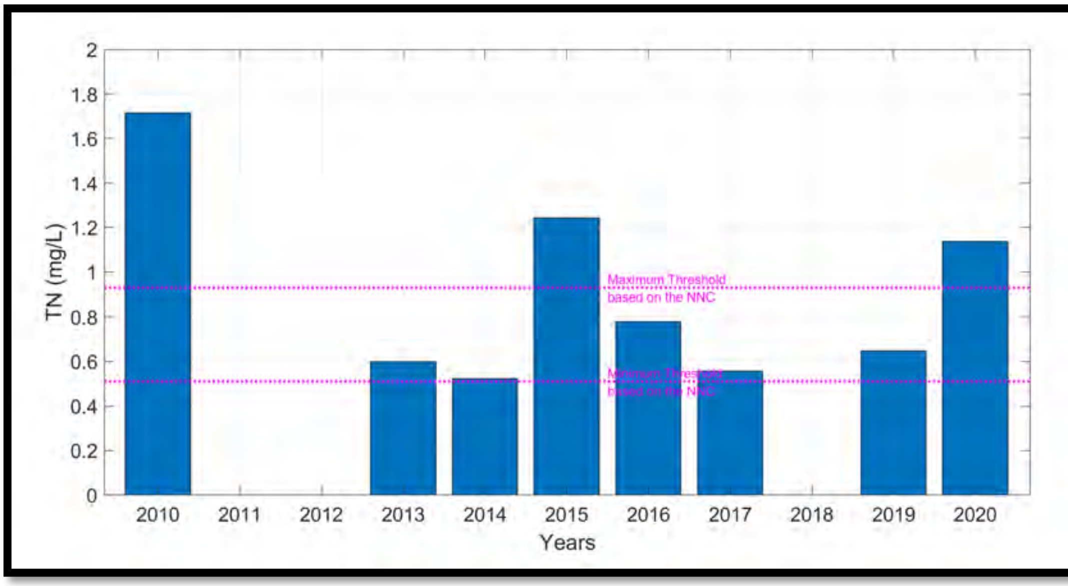

Figure 5-77: Plot of AGM for TN with NNC Criteria for Lake Kanturk

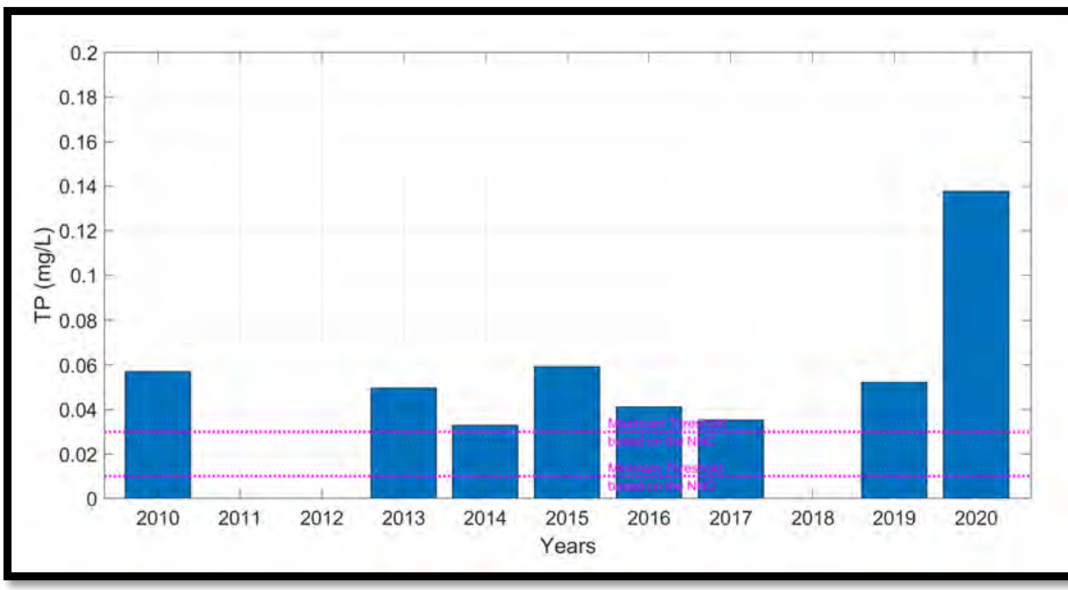

Figure 5-78: Plot of AGM for TP with NNC Criteria for Lake Kanturk

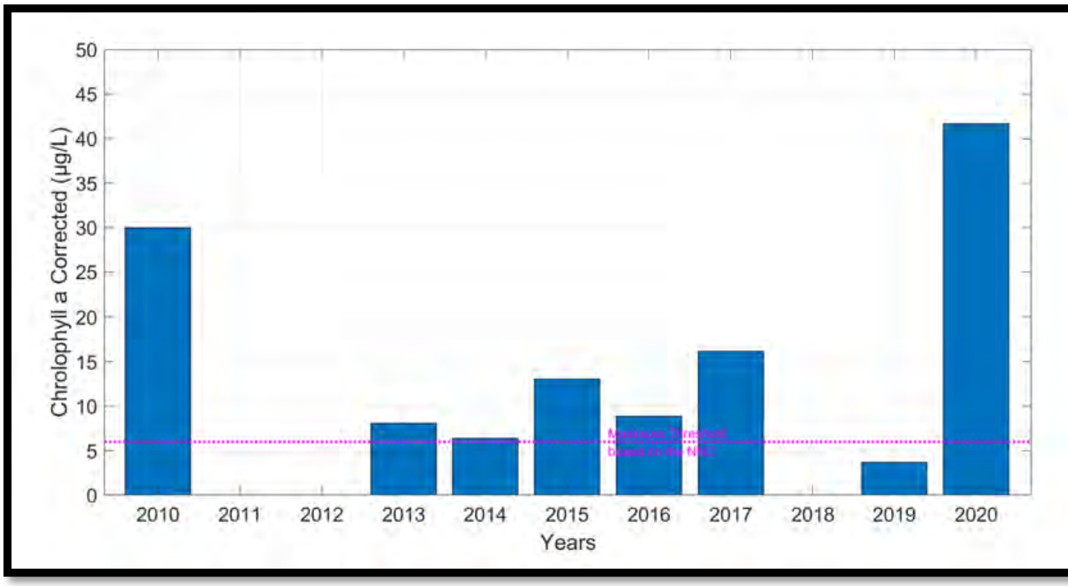

Figure 5-79: Plot of AGM for Chl-a with NNC Criteria for Lake Kanturk

Examination of the TSI plots **Figure 5-80**, **Figure 5-81**, and **Figure 5-82**) show that each of the lakes has values in the good range (below 60), the fair range and values in the poor range (above 70). The bulk of the values are in the good range for each of the lakes. All three lakes switch between nitrogen limited to nutrient balanced with some periods of time showing phosphorus limitation.

Figure 5-83, **Figure 5-84**, and **Figure 5-85** present plots of measured *E. coli* levels in the lakes from 2016 through 2020. The concentrations are generally low with no measurements showing values above the 410 MPN/100 mL threshold.

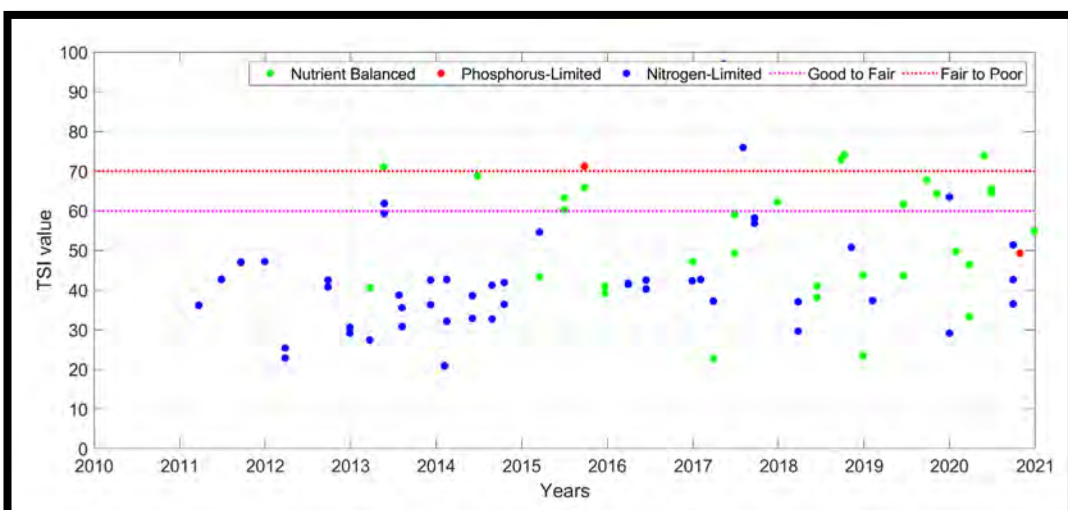

Figure 5-80: Plot of TSI for Lake Kinsale

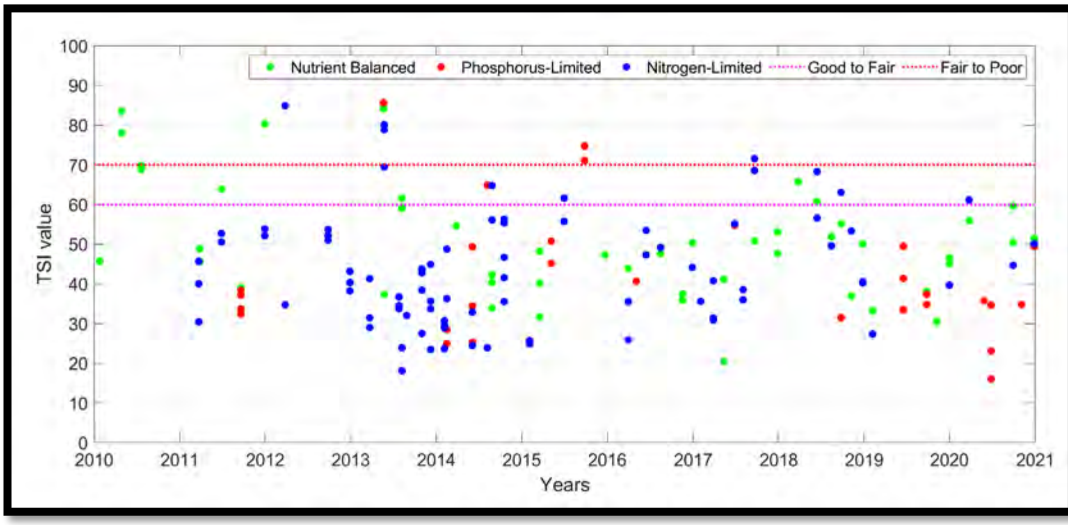

Figure 5-81: Plot of TSI for Lake Killarney

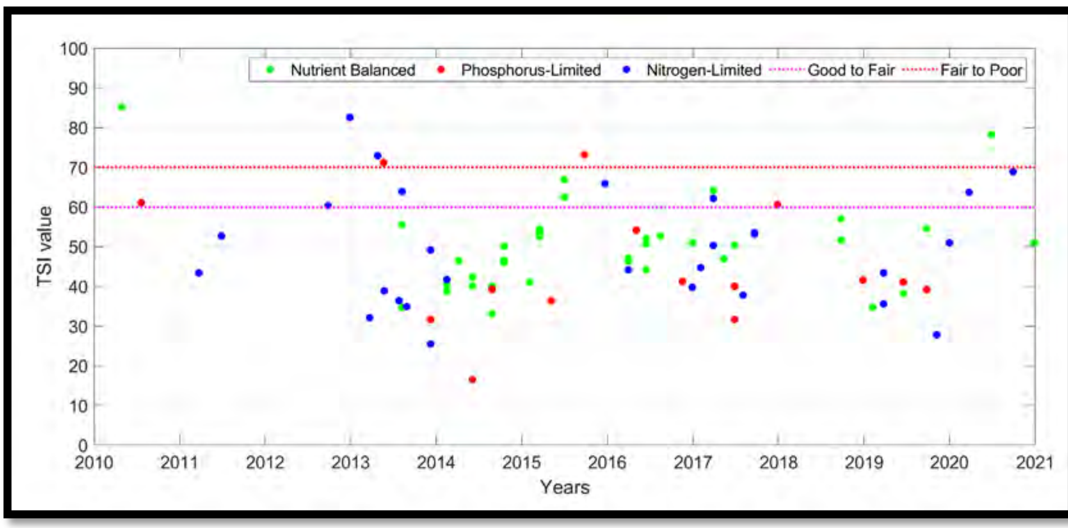

Figure 5-82: Plot of TSI for Lake Kanturk

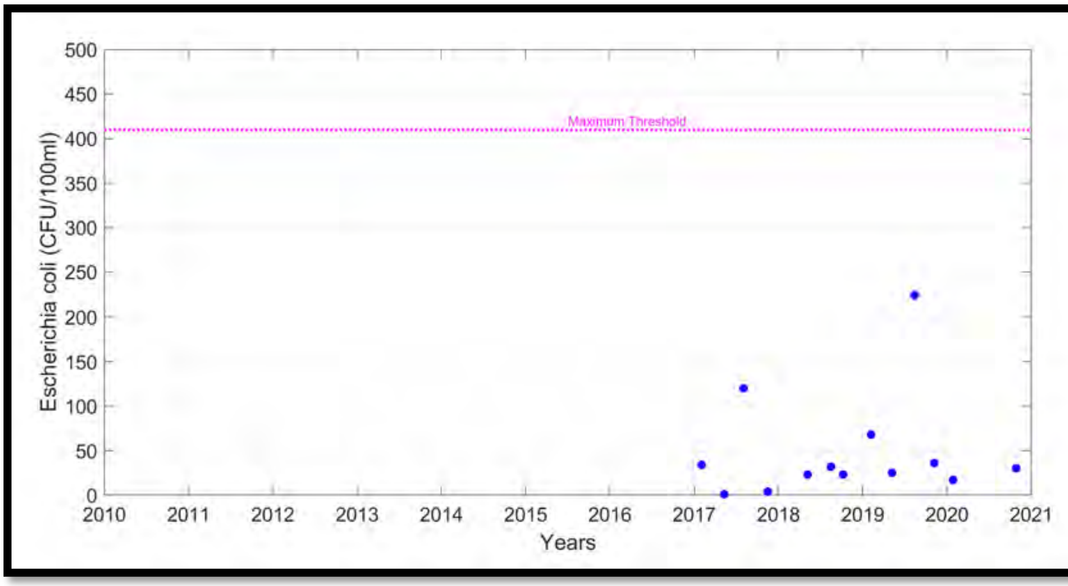

Figure 5-83: Plot of *E. coli* for Lake Kinsale

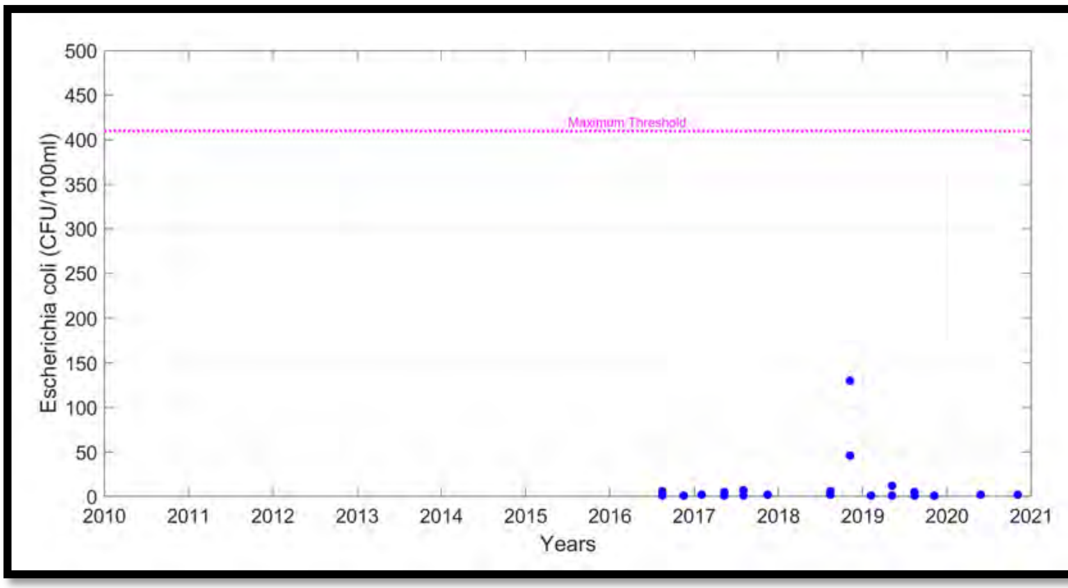

Figure 5-84: Plot of *E. coli* for Lake Killarney

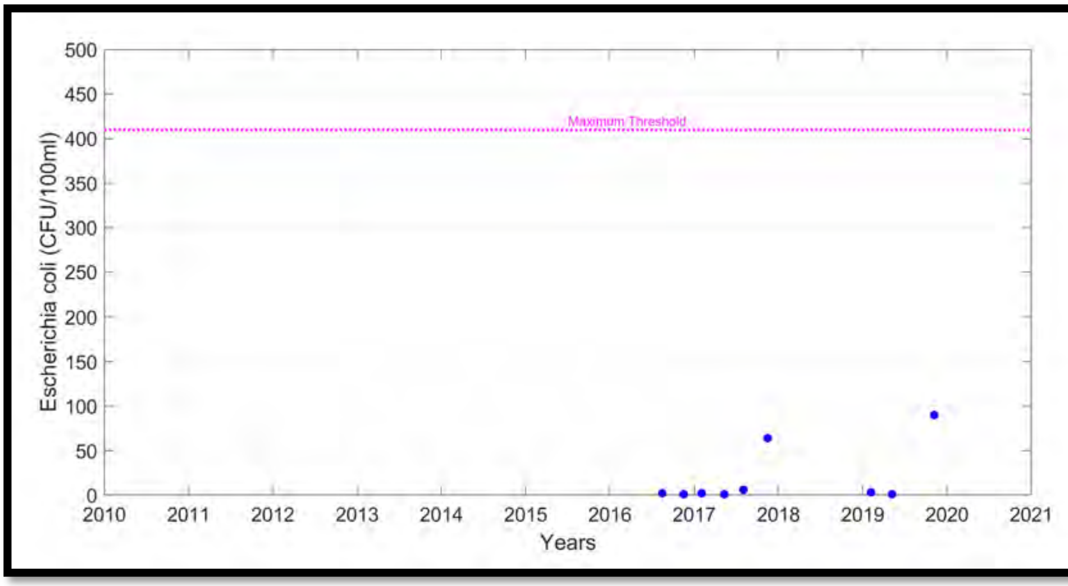

Figure 5-85: Plot of *E. coli* for Lake Kanturk

5.5.3.7 Groundwater Data

Presently, there are no surficial groundwater monitoring wells within the Killearn Chain of Lakes basin.

5.5.3.8 Biological Data

Table 5-14 and **Table 5-15** present LVI data collected by the City in Lake Killarney and Lake Kanturk since 2010. Data are only available for two years in that timeframe, 2010 and 2013. The data for both lakes showed impaired conditions relative to biology. No data during that same time period was available for Lake Kinsale. A 2009 sampling had a value of 35 which also indicates impaired conditions relative to the biology. The primary factor limiting the ability to perform LVI determinations are the low water levels and the repeated wetting and drying of the lake beds.

Table 5-14: Summary of LVI Data for Lake Killarney

Date	Station ID	LVI	Aquatic Life Use Category
6/10/2010	21FLCOT COTLVI005	28	Impaired
10/21/2013	21FLCOT COTLVI005	32	Impaired

Table 5-15: Summary of LVI Data for Lake Kanturk

Date	Station ID	LVI	Aquatic Life Use Category
6/10/2010	21FLCOT COTLVI004	24	Impaired
10/21/2013	21FLCOT COTLVI004	38	Impaired

5.5.3.9 Stormwater Treatment Facilities

In assessing potential sources of pollutants to the Killearn Chain of Lakes, and ultimately for targeting loads and reductions, it is important to identify treatment facilities adjacent to and along tributaries flowing into the three lakes. **Figure 5-86** presents a map showing the locations of stormwater treatment facilities throughout the Killearn Chain of Lakes basin. Multiple City ponds are located in the tributaries that drain into Lake Kinsale across Thomasville Road and downstream of Lake Tom John as well as the smaller tributary that drains to Lake Killarney. Leon County facilities are located in the tributaries that drain into the northern side of Lake Kanturk and scattered throughout the unincorporated areas that drain to Lake Kinsale.

5.5.3.10 Atmospheric Deposition Data

Section 5.4.3.11 presented the location of the nearest atmospheric deposition station to the Lake Lafayette basin. The data from this station will be utilized to calculate atmospheric deposition to the Killearn Chain of Lakes.

5.5.3.11 Data Summary

For the purposes of the qualitative analysis of sources of pollutants to the Killearn Chain of Lakes (**Section 5.5.4)** the available data are sufficient. There are sufficient active surface water quality stations within the lakes and within key tributaries entering the lakes. There are continuous water level measurements in each of the three lakes along with continuous flow at the outfall. Additionally, measured internal nutrient flux data are available for each of the lakes based on conditions in 2014. The following outlines limitations in the available data. Specific recommendations on additional data collection efforts are provided in **Section 5.10**.

- There is no flow data for the tributaries flowing into Lake Kinsale.
- There are limited water quality data at the inflow points to Lake Kinsale from the upstream tributaries. Only two years of data are available along the creek crossing Thomasville Road.
- There are limited data to evaluate the potential for seepage of pollutants to the lake from the surficial aquifer, i.e., surficial groundwater sampling stations around the lakes.

5.5.4 Qualitative Assessment of Sources

As outlined in previous sections, prior to performing loading calculations and other analyses to quantify existing pollutant sources to the Killearn Chain of Lakes, it is important to analyze available data and summarize findings from historical studies to support identification and magnitude of likely sources.

For the Killearn Chain of Lakes, the sources to be evaluated include the following:

- Stormwater runoff
- Septic systems
- Internal recycling and seepage

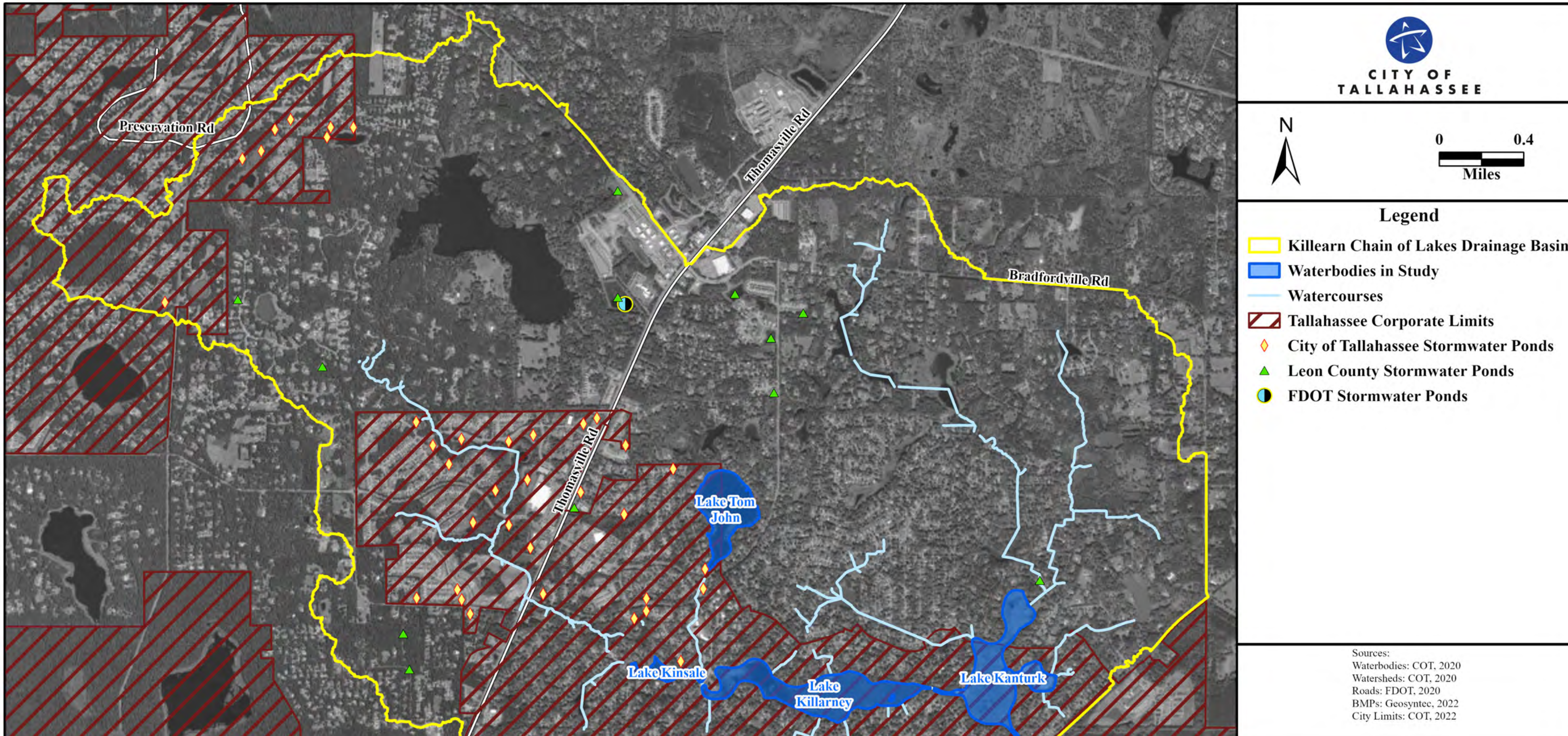

Figure 5-86:
Killearn Chain of Lakes Basin BMP Location Map

Tallahassee Master Plan - Surface Water (TMaPS)

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- Wastewater
- Atmospheric deposition
- Interconnected flows

An overview of analyses and findings for each source listed above is provided in the following sections. Prior to the discussions of each of the potential sources, an in-lake analysis is provided to build on the information presented in **Section 5.5.3**. Following the discussions for each source type, a summary of findings for the qualitative assessment is provided.

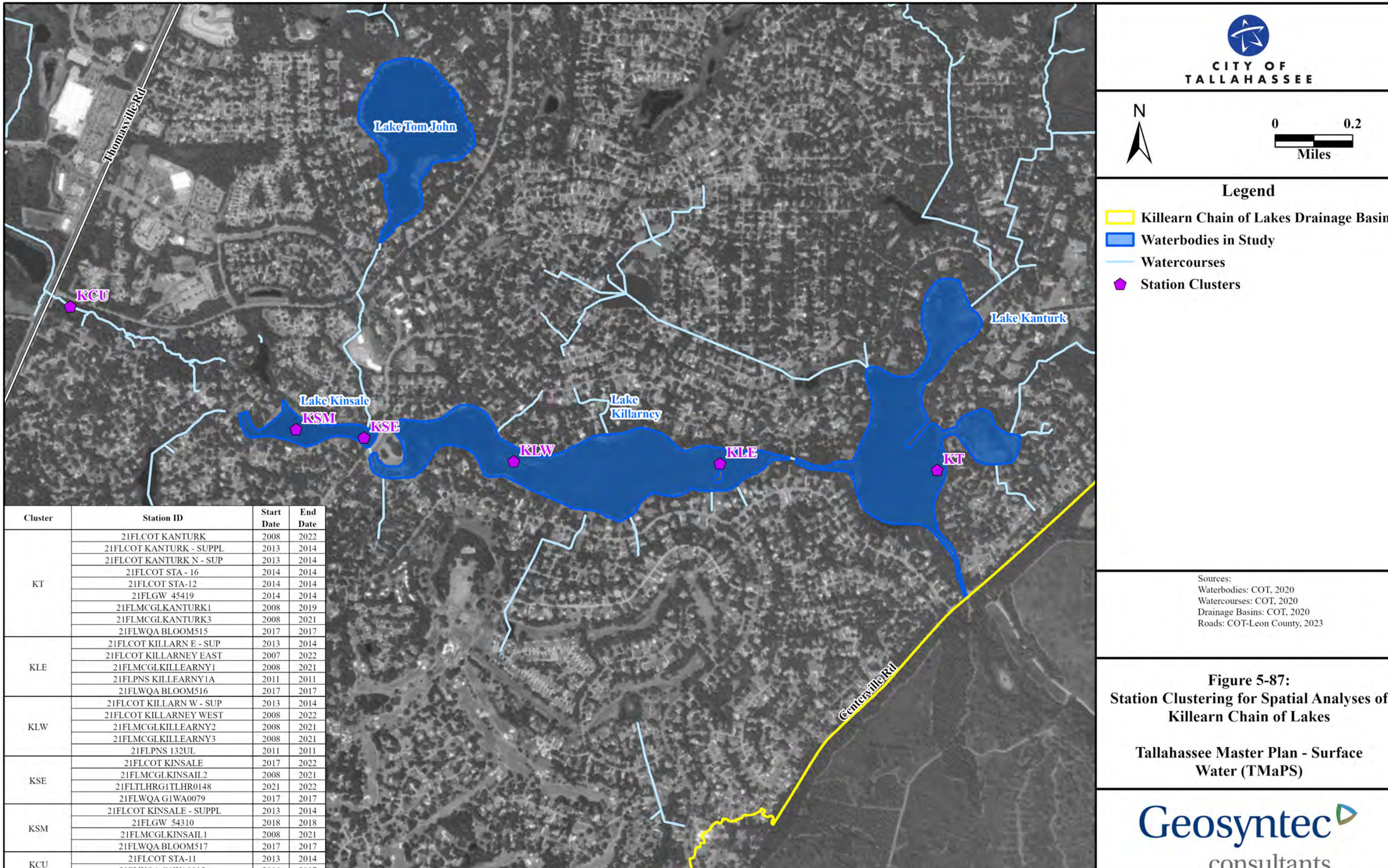
5.5.4.1 In-Stream Water Quality

Following the methodology utilized for the Lafayette Chain of Lakes in **Section 5.4.4.1**, analyses were conducted on the available in-lake data for the three lakes from 2010 to 2020, which provide an evaluation of the baseline water quality conditions as well as the spatial variation through the system of lakes. The parameters analyzed for the Killearn Chain of Lakes include color, alkalinity, TP, TN, Chl-a, TSI, and *E. coli*.

As was done for the Lafayette Chain of Lakes (**Section 5.4.4.1**) stations were clustered where they represent conditions within a specific area and all stations with data after 2010 were assigned to a specific cluster. The clustered data from 2010 to 2020 were analyzed to provide the average of the annual geomeans or the 90th percentile, depending upon the parameter. The results are presented on a map, with colors representing the results. The levels associated with the colors are reflective of water quality thresholds as outlined in 62-302 Florida Administrative Code (F.A.C) and are discussed and presented in **Section 5.4.4.1**. For the Killearn Chain of Lakes the nutrient thresholds are based on the lakes' classification as low color, low alkalinity waterbodies.

Figure 5-87 presents the data clustering used for the analyses and associated stations. For the Killearn Chain of Lakes, data since 2010 were available at multiple locations throughout the chain and at one location along the tributary draining the western portions of the basin. Within Lake Kanturk there was one cluster, near the outfall of the lake (KT). Within Lake Killarney there are two clusters one at the eastern end of the lake prior to discharging to Lake Kanturk (KLE) and one toward the western end of the lake (KLW). Finally, within Lake Kinsale there are two clusters, one at the eastern end of the lake just upstream of the weir (KSE) and the other around the middle of the lake (KSM). The final cluster is located along the tributary that drains into the western end of Lake Kinsale just downstream from the crossing at Thomasville Road (KCU). These stations, viewed together, present the spatial variation as water passes through the chain.

Figure 5-88 presents the color. For color, the scales were set such that values of 40 PCU and above were red with the remaining colors (orange down to blue) divided into 10 PCU segments, which shows how the lakes vary spatially relative to the low color threshold of 40 PCU. Moving from Lake Kinsale down to Lake Kanturk the color averages are relatively consistent with values between 10 PCU and 30 PCU. (KSM=29.2 PCU, KSE=26.1 PCU, KLW=22.5 PCU, KLE=16.8 PCU, KT=23.3 PCU).



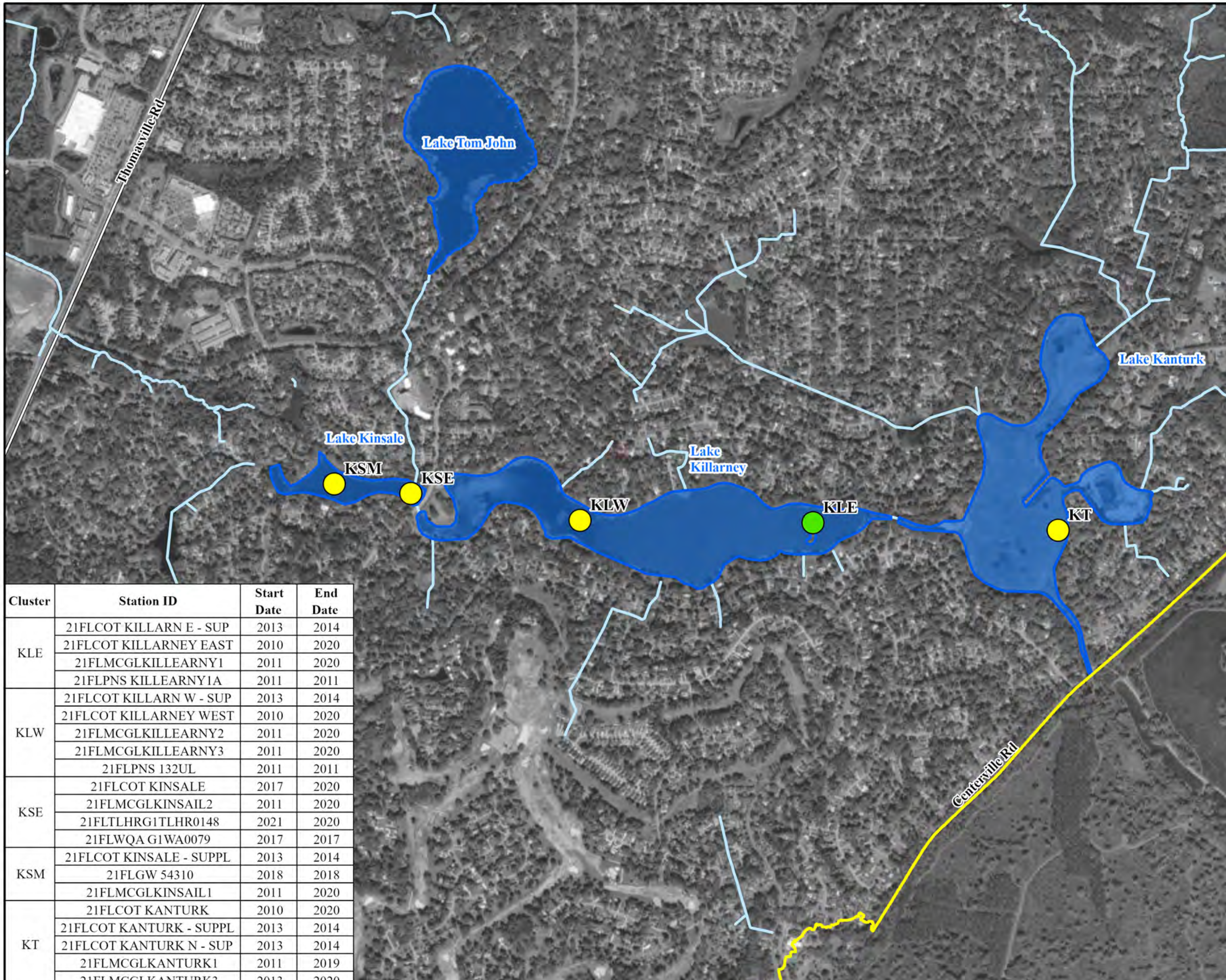
Cluster	Station ID	Start Date	End Date
KT	21FLCOT KANTURK	2008	2022
	21FLCOT KANTURK - SUPPL	2013	2014
	21FLCOT KANTURK N - SUP	2013	2014
	21FLCOT STA - 16	2014	2014
	21FLCOT STA-12	2014	2014
	21FLGW 45419	2014	2014
	21FLMCGLKANTURK1	2008	2019
	21FLMCGLKANTURK3	2008	2021
	21FLWQA BLOOM515	2017	2017
KLE	21FLCOT KILLARN E - SUP	2013	2014
	21FLCOT KILLARNEY EAST	2007	2022
	21FLMCGLKILLEARNY1	2008	2021
	21FLPNS KILLEARNY1A	2011	2011
	21FLWQA BLOOM516	2017	2017
KLW	21FLCOT KILLARN W - SUP	2013	2014
	21FLCOT KILLARNEY WEST	2008	2022
	21FLMCGLKILLEARNY2	2008	2021
	21FLMCGLKILLEARNY3	2008	2021
	21FLPNS 132UL	2011	2011
KSE	21FLCOT KINSALE	2017	2022
	21FLMCGLKINSAIL2	2008	2021
	21FLTLHRG1TLHR0148	2021	2022
	21FLWQA G1WA0079	2017	2017
KSM	21FLCOT KINSALE - SUPPL	2013	2014
	21FLGW 54310	2018	2018
	21FLMCGLKINSAIL1	2008	2021
	21FLWQA BLOOM517	2017	2017
KCU	21FLCOT STA-11	2013	2014
	21FLWQA G1WA0015	2016	2017

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023

**Figure 5-87:
Station Clustering for Spatial Analyses of Killearn Chain of Lakes**

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



Cluster	Station ID	Start Date	End Date
KLE	21FLCOT KILLARN E - SUP	2013	2014
	21FLCOT KILLARNEY EAST	2010	2020
	21FLMCGLKILLEARNY1	2011	2020
	21FLPNS KILLEARNY1A	2011	2011
KLW	21FLCOT KILLARN W - SUP	2013	2014
	21FLCOT KILLARNEY WEST	2010	2020
	21FLMCGLKILLEARNY2	2011	2020
	21FLMCGLKILLEARNY3	2011	2020
	21FLPNS 132UL	2011	2011
KSE	21FLCOT KINSALE	2017	2020
	21FLMCGLKINSAIL2	2011	2020
	21FLTLHRG1TLHR0148	2021	2020
	21FLWQA G1WA0079	2017	2017
KSM	21FLCOT KINSALE - SUPPL	2013	2014
	21FLGW 54310	2018	2018
	21FLMCGLKINSAIL1	2011	2020
KT	21FLCOT KANTURK	2010	2020
	21FLCOT KANTURK - SUPPL	2013	2014
	21FLCOT KANTURK N - SUP	2013	2014
	21FLMCGLKANTURK1	2011	2019
	21FLMCGLKANTURK3	2013	2020

CITY OF TALLAHASSEE

Legend

- Killearn Chain of Lakes Drainage Basin
- Waterbodies in Study
- Watercourses

Color Average 2010-2020

PCU

- 0-10
- 10-20
- 20-30
- 30-40
- >40

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 5-88:
Spatial Assessment of Color in Killearn Chain of Lakes

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

Figure 5-89 presents the alkalinity. The scales were set such that values above 20 mg/L were red, based on the NNC cutoff for low alkalinity lakes, with the remaining colors (orange down to blue) in 5 mg/L segments. Moving from Lake Kinsale down to Lake Killarney, alkalinity levels are relatively constant with the clusters between 15 mg/L and 20 mg/L (KSM=17.8 mg/L, KSE=17.6 mg/L, KLW=17.9 mg/L, KLE=18.0 mg/L, KT=14.4 mg/L). The Kanturk station has lower values between 10 mg/L and 15 mg/L.

Figure 5-90 and **Figure 5-91** present the TN and TP. The ranges for the lakes were set the same way as described for the Piney Z Lake with blue lower than the minimum NNC thresholds (TN=0.51 mg/L, TP=0.01 mg/L) and red higher than the maximum (TN=0.93 mg/L, TP=0.03 mg/L). For the tributary cluster (KCU) values above the designated stream criteria (TN=1.03 mg/L, TP=0.18 mg/L) are red while the remaining colors (orange down to blue) in even segments.

The TN map (**Figure 5-90**) shows all lake cluster averages just below or just above the minimum threshold (KSM=0.59 mg/L, KSE=0.55 mg/L, KLW=0.47 mg/L, KLE=0.52 mg/L, KT=0.71 mg/L) with limited spatial variation between the lakes. The one cluster with higher TN levels was KT within Lake Kanturk. Based on the limited data cluster KCU is well below the stream threshold (KCU=0.35 mg/L).

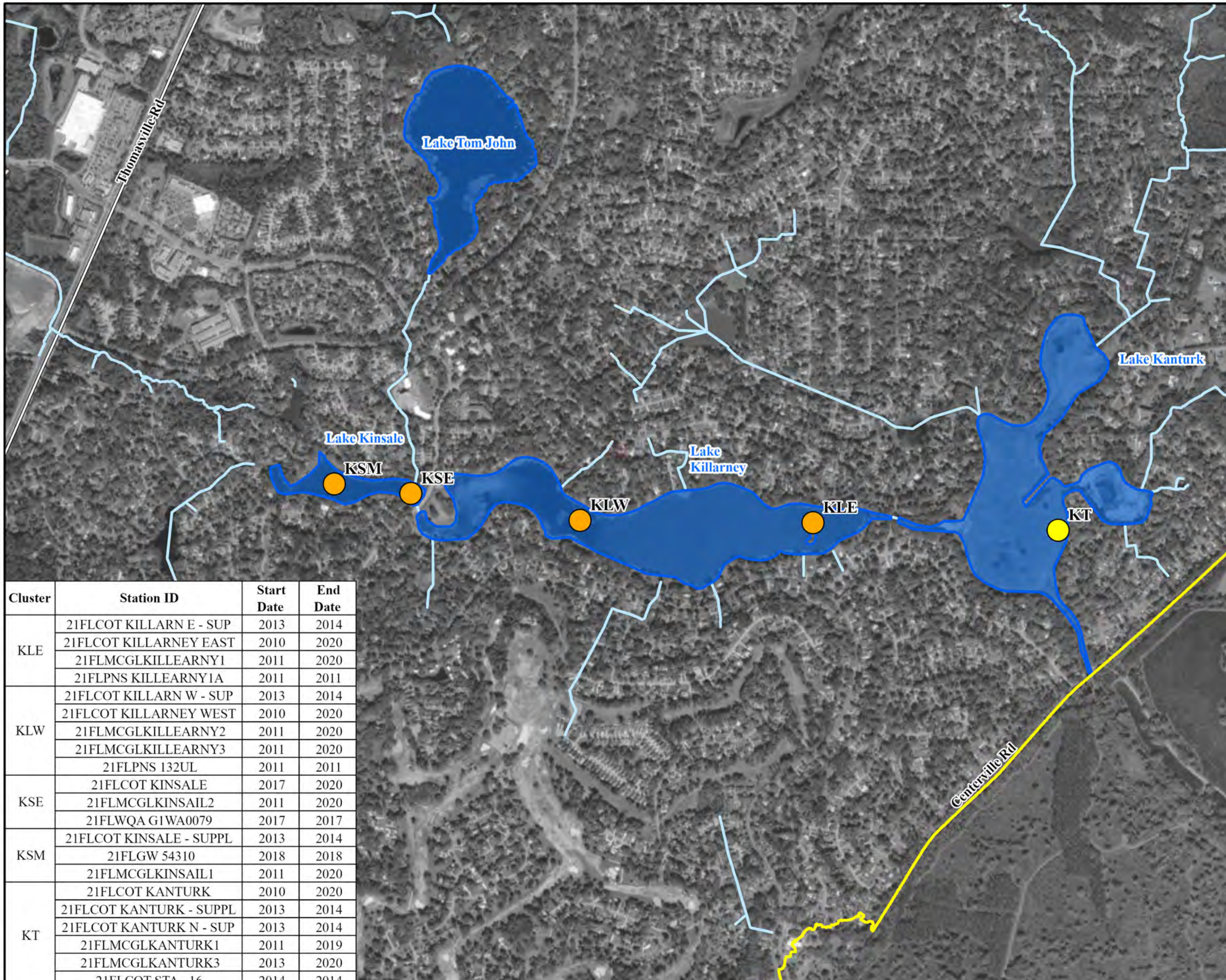
The TP map (**Figure 5-91**) shows all lake cluster averages above the maximum threshold (KSM=0.078 mg/L, KSE=0.085 mg/L, KLW=0.057 mg/L, KLE=0.050 mg/L, KT=0.043 mg/L). The tributary cluster TP level lower than the stream criteria but has levels well above the criteria within the lakes (KCU=0.088 mg/L).

Figure 5-92 and **Figure 5-93** present the Chl-a and TSI. The ranges for the lakes were set the same way as described for the Piney Z Lake with red higher than the NNC threshold of 6 μg/L for Chl-a and 60 for TSI. The Chl-a map (**Figure 5-92**) shows all lake cluster averages above the maximum threshold (KSM=11.0 μg/L, KSE=9.0 μg/L, KLW=8.4 μg/L, KLE=8.5 μg/L, KT=7.1 μg/L). The TSI map (**Figure 5-93**) shows all lake cluster averages below the 60 threshold (KSM=50.3, KSE=48.7, KLW=46.3, KLE=49.0, KT=47.4).

Figure 5-94 presents a map of the *E. coli* levels. The data analyzed are from 2016 through 2020 and the data were analyzed to provide the 90^{th} percentile to compare against the 410 MPN/100 mL criteria per the FDEP approach in the IWR analyses. The map shows that all lake clusters have 90^{th} percentile values well below the 410 MPN/100 mL threshold, with all stations below 100 MPN/100 mL (KSM=23 MPN/100 mL, KSE=46 MPN/100 mL, KLW=6 MPN/100 mL, KLE=2 MPN/100 mL, KT=4 MPN/100 mL).

5.5.4.2 Stormwater Runoff

Data for the tributary inflow station across Thomasville Road (which drains the upper portions of the watershed) indicate elevated TP concentrations in comparison to the in-lake TP thresholds. Average concentrations are above 0.09 mg/L compared to the in-lake range of allowable concentrations between 0.01 mg/L and 0.03 mg/L. Stormwater sampling at this same location conducted in 2013 to 2014, showed similar concentrations (average around 0.08 mg/L). While these levels are elevated in relation to the in-lake thresholds, they are well below the stream NNC for this region (0.18 mg/L).



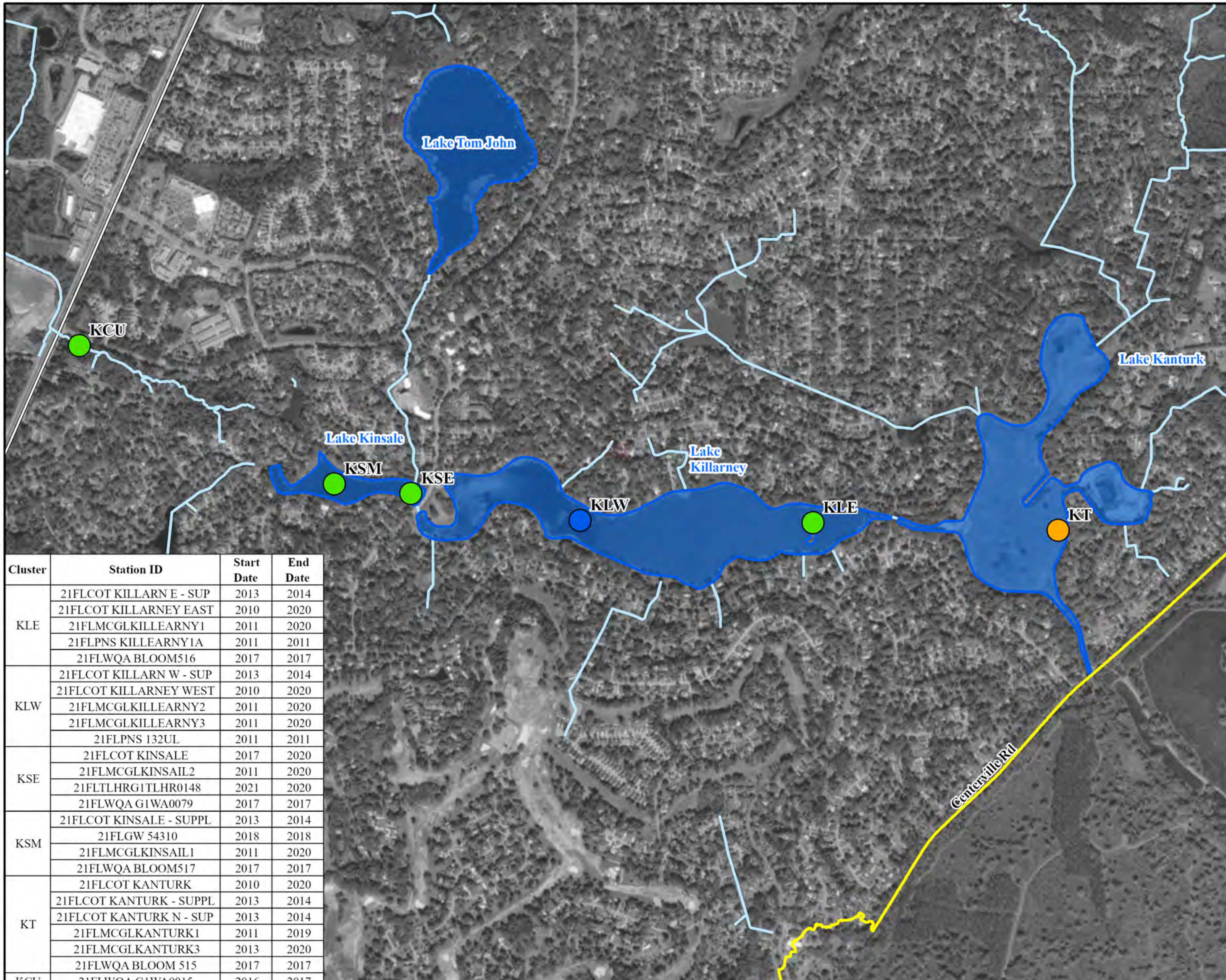
Cluster	Station ID	Start Date	End Date
KLE	21FLCOT KILLARN E - SUP	2013	2014
	21FLCOT KILLARNEY EAST	2010	2020
	21FLMCGLKILLEARNY1	2011	2020
	21FLPNS KILLEARNY1A	2011	2011
KLW	21FLCOT KILLARN W - SUP	2013	2014
	21FLCOT KILLARNEY WEST	2010	2020
	21FLMCGLKILLEARNY2	2011	2020
	21FLMCGLKILLEARNY3	2011	2020
	21FLPNS 132UL	2011	2011
KSE	21FLCOT KINSALE	2017	2020
	21FLMCGLKINSAIL2	2011	2020
	21FLWQA G1WA0079	2017	2017
KSM	21FLCOT KINSALE - SUPPL	2013	2014
	21FLGW 54310	2018	2018
	21FLMCGLKINSAIL1	2011	2020
KT	21FLCOT KANTURK	2010	2020
	21FLCOT KANTURK - SUPPL	2013	2014
	21FLCOT KANTURK N - SUP	2013	2014
	21FLMCGLKANTURK1	2011	2019
	21FLMCGLKANTURK3	2013	2020
	21FLCOT STA - 16	2014	2014

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 5-89:
Spatial Assessment of Alkalinity in Killearn Chain of Lakes

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



Cluster	Station ID	Start Date	End Date
KLE	21FLCOT KILLARN E - SUP	2013	2014
	21FLCOT KILLARNEY EAST	2010	2020
	21FLMCGLKILLEARNY1	2011	2020
	21FLPNS KILLEARNY1A	2011	2011
	21FLWQA BLOOM516	2017	2017
KLW	21FLCOT KILLARN W - SUP	2013	2014
	21FLCOT KILLARNEY WEST	2010	2020
	21FLMCGLKILLEARNY2	2011	2020
	21FLMCGLKILLEARNY3	2011	2020
	21FLPNS 132UL	2011	2011
KSE	21FLCOT KINSALE	2017	2020
	21FLMCGLKINSAIL2	2011	2020
	21FLTLHRG1TLHR0148	2021	2020
	21FLWQA G1WA0079	2017	2017
KSM	21FLCOT KINSALE - SUPPL	2013	2014
	21FLGW 54310	2018	2018
	21FLMCGLKINSAIL1	2011	2020
	21FLWQA BLOOM517	2017	2017
KT	21FLCOT KANTURK	2010	2020
	21FLCOT KANTURK - SUPPL	2013	2014
	21FLCOT KANTURK N - SUP	2013	2014
	21FLMCGLKANTURK1	2011	2019
	21FLMCGLKANTURK3	2013	2020
	21FLWQA BLOOM 515	2017	2017
KCU	21FLWQA G1WA0015	2016	2017

CITY OF TALLAHASSEE

N

0 0.2
Miles

Legend

- Killearn Chain of Lakes Drainage Basin
- Waterbodies in Study
- Watercourses

In-Lake TN Average 2010-2020
mg/L

- 0-0.51
- 0.51-0.65
- 0.65-0.79
- 0.79-0..93
- >0.93

Stream TN Average 2010-2020
mg/L

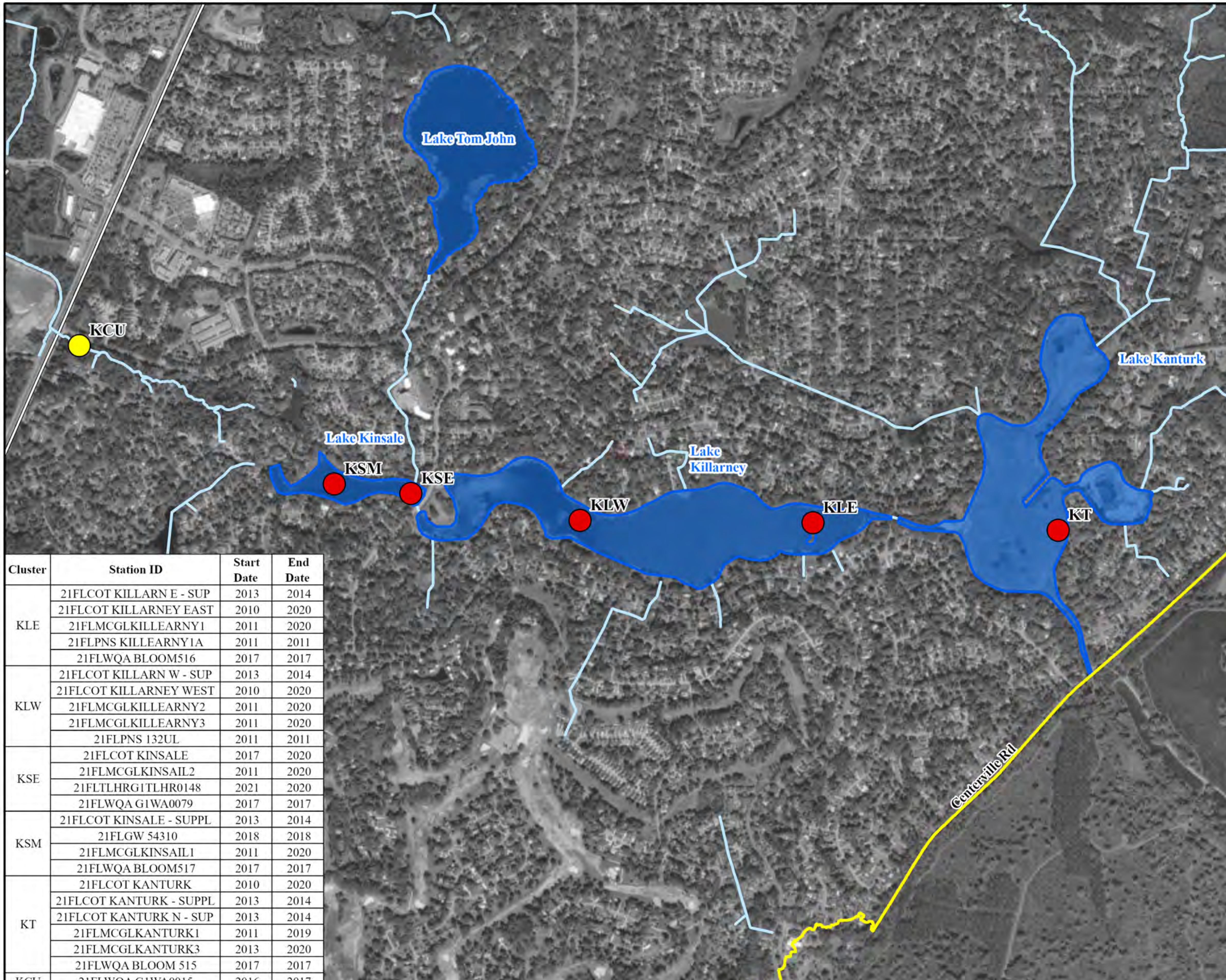
- 0-0.25
- 0.25-0.50
- 0.50-0.75
- 0.75-1.03
- >1.03

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 5-90:
Spatial Assessment of TN in Killearn Chain of Lakes and Tributaries

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



Cluster	Station ID	Start Date	End Date
KLE	21FLCOT KILLARN E - SUP	2013	2014
	21FLCOT KILLARNEY EAST	2010	2020
	21FLMCGLKILLEARNY1	2011	2020
	21FLPNS KILLEARNY1A	2011	2011
	21FLWQA BLOOM516	2017	2017
KLW	21FLCOT KILLARN W - SUP	2013	2014
	21FLCOT KILLARNEY WEST	2010	2020
	21FLMCGLKILLEARNY2	2011	2020
	21FLMCGLKILLEARNY3	2011	2020
	21FLPNS 132UL	2011	2011
KSE	21FLCOT KINSALE	2017	2020
	21FLMCGLKINSAIL2	2011	2020
	21FLTLHRG1TLHR0148	2021	2020
	21FLWQA G1WA0079	2017	2017
KSM	21FLCOT KINSALE - SUPPL	2013	2014
	21FLGW 54310	2018	2018
	21FLMCGLKINSAIL1	2011	2020
	21FLWQA BLOOM517	2017	2017
KT	21FLCOT KANTURK	2010	2020
	21FLCOT KANTURK - SUPPL	2013	2014
	21FLCOT KANTURK N - SUP	2013	2014
	21FLMCGLKANTURK1	2011	2019
	21FLMCGLKANTURK3	2013	2020
	21FLWQA BLOOM 515	2017	2017
KCU	21FLWQA G1WA0015	2016	2017

CITY OF TALLAHASSEE

N

0 0.2
Miles

Legend

- Killearn Chain of Lakes Drainage Basin
- Waterbodies in Study
- Watercourses

TP Average 2010-2020
mg/L

- 0-0.010
- 0.010-0.017
- 0.017-0.024
- 0.024-0.030
- >0.03

Stream TP Average 2010-2020
mg/L

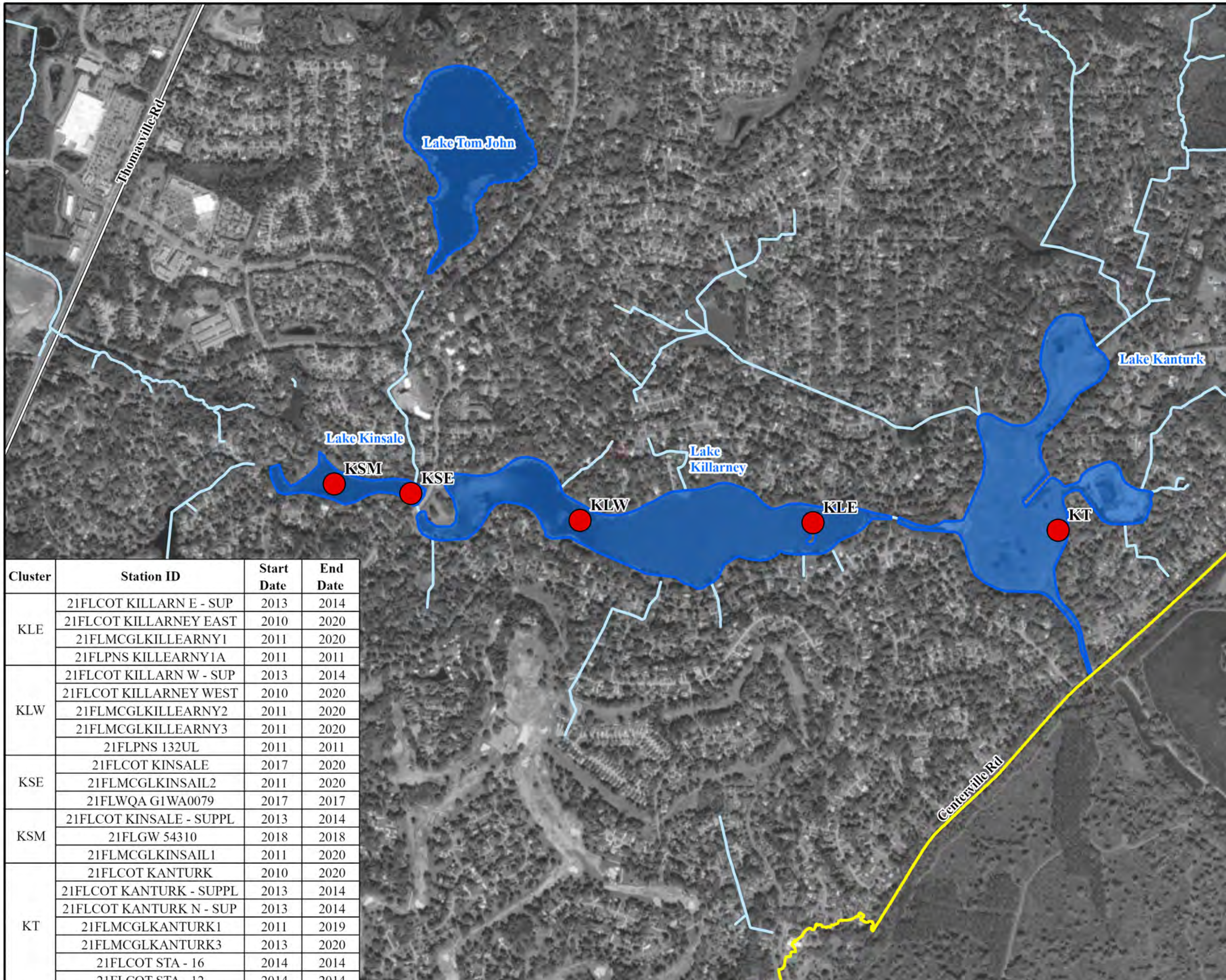
- 0-0.045
- 0.045-0.09
- 0.09-0.135
- 0.135-0.18
- >0.18

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

**Figure 5-91:
Spatial Assessment of TP in Killearn Chain of Lakes and Tributaries**

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



Cluster	Station ID	Start Date	End Date
KLE	21FLCOT KILLARN E - SUP	2013	2014
	21FLCOT KILLARNEY EAST	2010	2020
	21FLMCGLKILLEARNY1	2011	2020
	21FLPNS KILLEARNY1A	2011	2011
KLW	21FLCOT KILLARN W - SUP	2013	2014
	21FLCOT KILLARNEY WEST	2010	2020
	21FLMCGLKILLEARNY2	2011	2020
	21FLMCGLKILLEARNY3	2011	2020
	21FLPNS 132UL	2011	2011
KSE	21FLCOT KINSALE	2017	2020
	21FLMCGLKINSAIL2	2011	2020
	21FLWQA G1WA0079	2017	2017
KSM	21FLCOT KINSALE - SUPPL	2013	2014
	21FLGW 54310	2018	2018
	21FLMCGLKINSAIL1	2011	2020
KT	21FLCOT KANTURK	2010	2020
	21FLCOT KANTURK - SUPPL	2013	2014
	21FLCOT KANTURK N - SUP	2013	2014
	21FLMCGLKANTURK1	2011	2019
	21FLMCGLKANTURK3	2013	2020
	21FLCOT STA - 16	2014	2014
	21FLCOT STA - 12	2014	2014

CITY OF TALLAHASSEE

N

0 0.2 Miles

Legend

- Killearn Chain of Lakes Drainage Basin
- Waterbodies in Study
- Watercourses

Chl a Average 2010-2020

µg/L

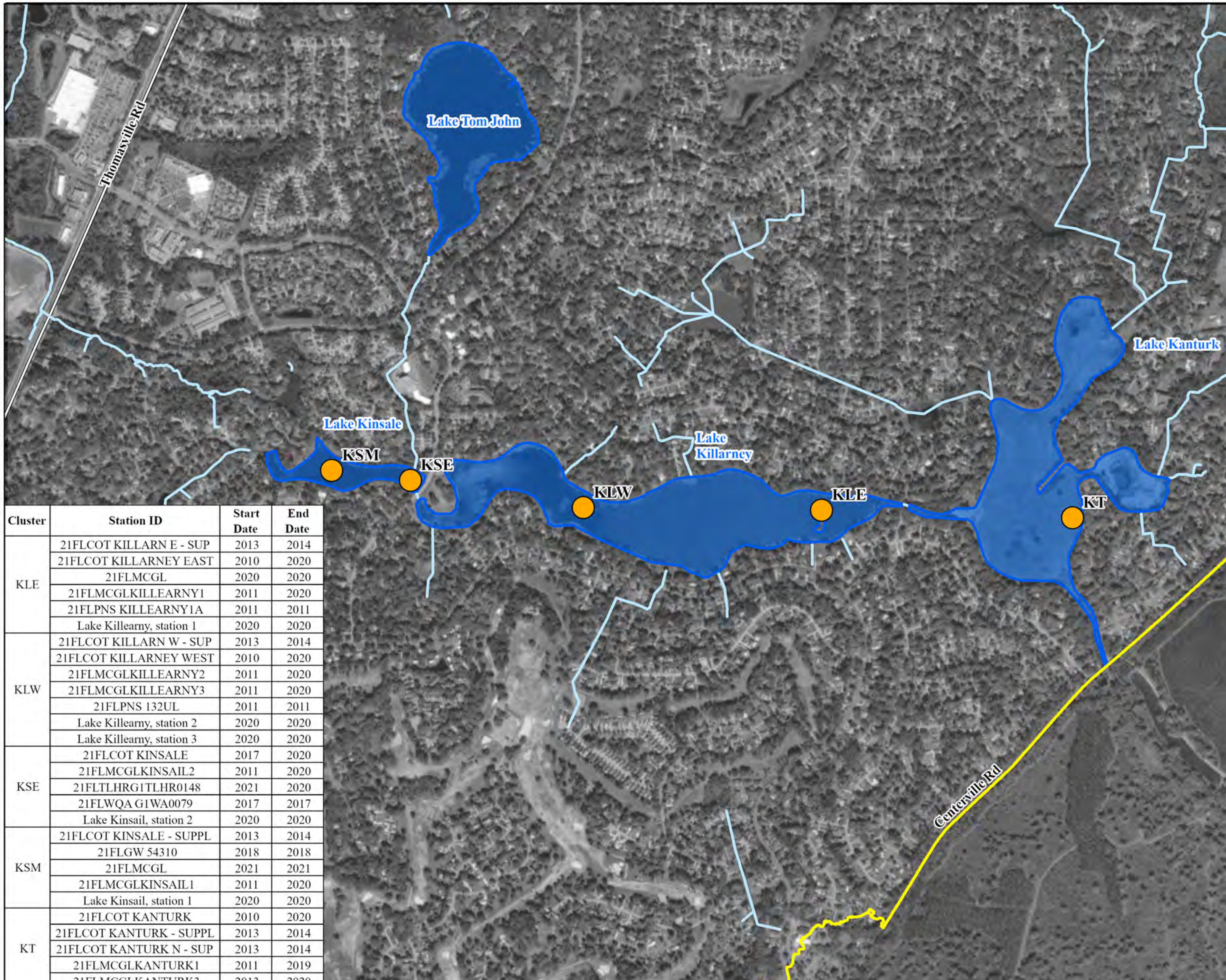
- 0-1.5
- 1.5-3
- 3-4.5
- 4.5-6
- >6

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 5-92:
Spatial Assessment for Chl a in Killearn Chain of Lakes

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



Cluster	Station ID	Start Date	End Date
KLE	21FLCOT KILLARN E - SUP	2013	2014
	21FLCOT KILLARNEY EAST	2010	2020
	21FLMCGL	2020	2020
	21FLMCGLKILLEARNY1	2011	2020
	21FLPNS KILLEARNY1A	2011	2011
	Lake Killearny, station 1	2020	2020
KLW	21FLCOT KILLARN W - SUP	2013	2014
	21FLCOT KILLARNEY WEST	2010	2020
	21FLMCGLKILLEARNY2	2011	2020
	21FLMCGLKILLEARNY3	2011	2020
	21FLPNS 132UL	2011	2011
	Lake Killearny, station 2	2020	2020
	Lake Killearny, station 3	2020	2020
KSE	21FLCOT KINSALE	2017	2020
	21FLMCGLKINSAIL2	2011	2020
	21FLTLHRG1TLHR0148	2021	2020
	21FLWQA G1WA0079	2017	2017
	Lake Kinsail, station 2	2020	2020
KSM	21FLCOT KINSALE - SUPPL	2013	2014
	21FLGW 54310	2018	2018
	21FLMCGL	2021	2021
	21FLMCGLKINSAIL1	2011	2020
	Lake Kinsail, station 1	2020	2020
KT	21FLCOT KANTURK	2010	2020
	21FLCOT KANTURK - SUPPL	2013	2014
	21FLCOT KANTURK N - SUP	2013	2014
	21FLMCGLKANTURK1	2011	2019
	21FLMCGLKANTURK3	2013	2020

CITY OF TALLAHASSEE

N

0 0.2
Miles

Legend

- Waterbodies in Study
- Watercourses
- Killearn Chain of Lakes Drainage Basin

TSI Average 2010-2020

TSI Score

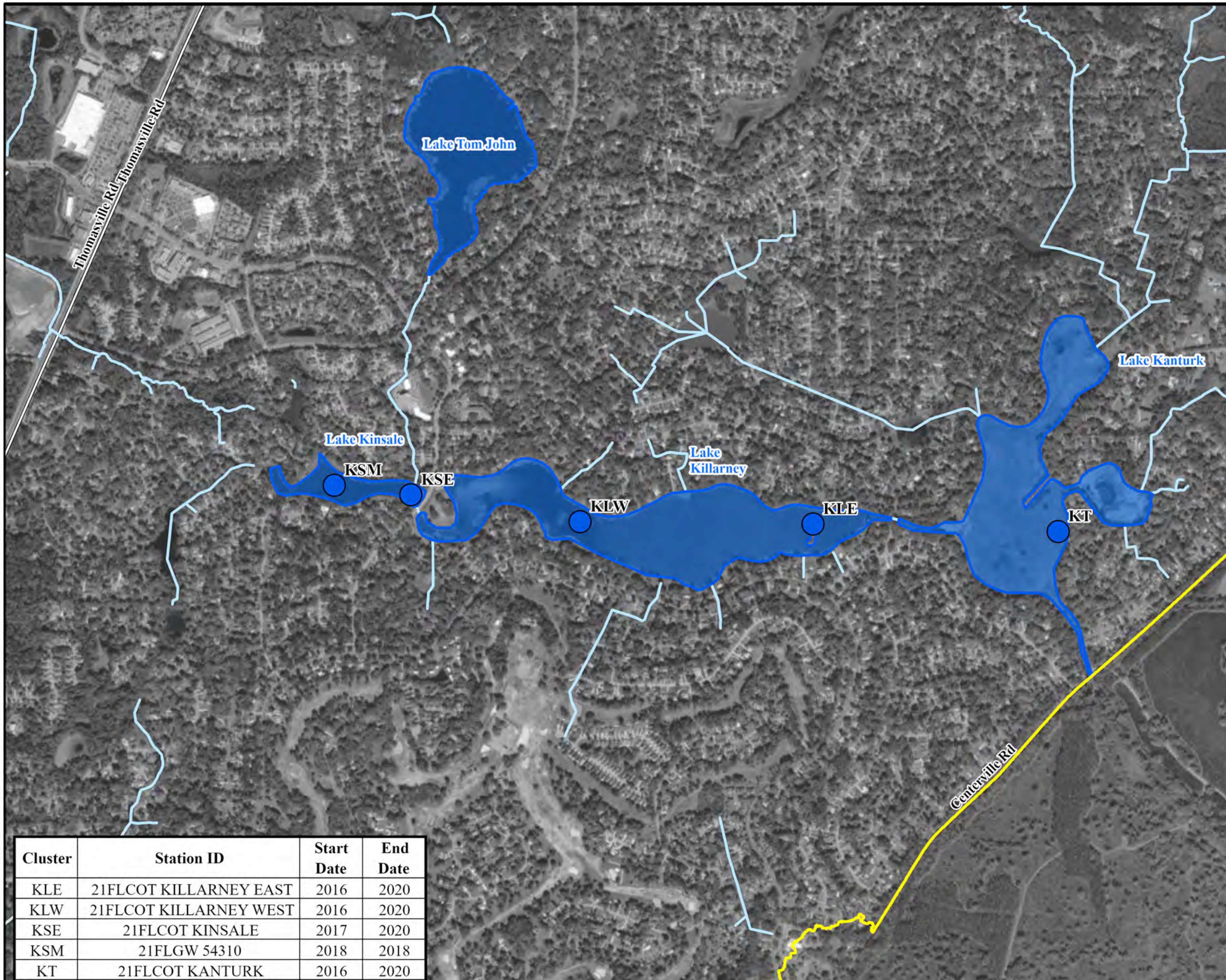
- 0-15
- 15-30
- 30-45
- 45-60
- >60

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 5-93: Spatial Assessment of TSI in Killearn Chain of Lakes

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



Cluster	Station ID	Start Date	End Date
KLE	21FLCOT KILLARNEY EAST	2016	2020
KLW	21FLCOT KILLARNEY WEST	2016	2020
KSE	21FLCOT KINSALE	2017	2020
KSM	21FLGW 54310	2018	2018
KT	21FLCOT KANTURK	2016	2020

CITY OF TALLAHASSEE

N

0 0.2
Miles

Legend

Killearn Chain of Lakes Drainage Basin
Waterbodies in Study
Watercourses
E. coli 90th Percentile 2010-2020
MPN/100mL
0-100
100-200
200-300
300-410
>410

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Drainage Basins: COT, 2020
Roads: COT-Leon County, 2023
Station Data: FDEP, 2021

Figure 5-94:
Spatial Assessment of E. coli in Killearn Chain of Lakes and Tributaries

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

The 2013 to 2014, field measurements of storm event inflow concentrations discussed above were performed at all of the primary inflow points around the chain of lakes. A total of 12 stations collected between 4 and 7 samples. The results showed that for most of the drainage areas, the TN and TP concentration geomeans were at or below typical EMC values utilized by the City for medium density and high density residential areas (**Table 5-8**) but (other than the Thomasville Road crossing input discussed above, were generally at levels above the stream NNC of 0.18 mg/L. One area south of the chain of lakes that discharges to the western end of Lake Killarney had a TP value slightly above the City's EMC. Another location that drains into the northeaster lobe of Lake Kanturk showed a TP value nearly twice the City's value. Finally, an area that drains into the northwester lobe of Lake Kanturk showed TP values twice the City's EMC and TN values 1.5 times the City's EMC.

To further assess stormwater runoff as a potential source of pollutant loads to the Killearn Chain of Lakes LDI levels within the sub-watersheds draining to the lakes were assessed. As discussed in **Section 5.4.4.2**, FDEP uses the LDI as a tool to estimate potential adverse human effects from various land uses on adjacent waterbodies with ratings from excellent to very poor in relation to the potential for adverse impacts from stormwater loads. **Figure 5-95** presents the LDI levels by sub-watershed within the Killearn Chain of Lakes drainage basin. The sub-watersheds draining directly to the lakes, and all sub-watersheds draining from the south and the immediate area to the west of Thomasville Road, range from moderate to poor. These classifications indicate potential for anthropogenic stormwater loads to the lakes. The areas along the northernmost upstream areas have good LDI values indicating limited potential for anthropogenic stormwater loads.

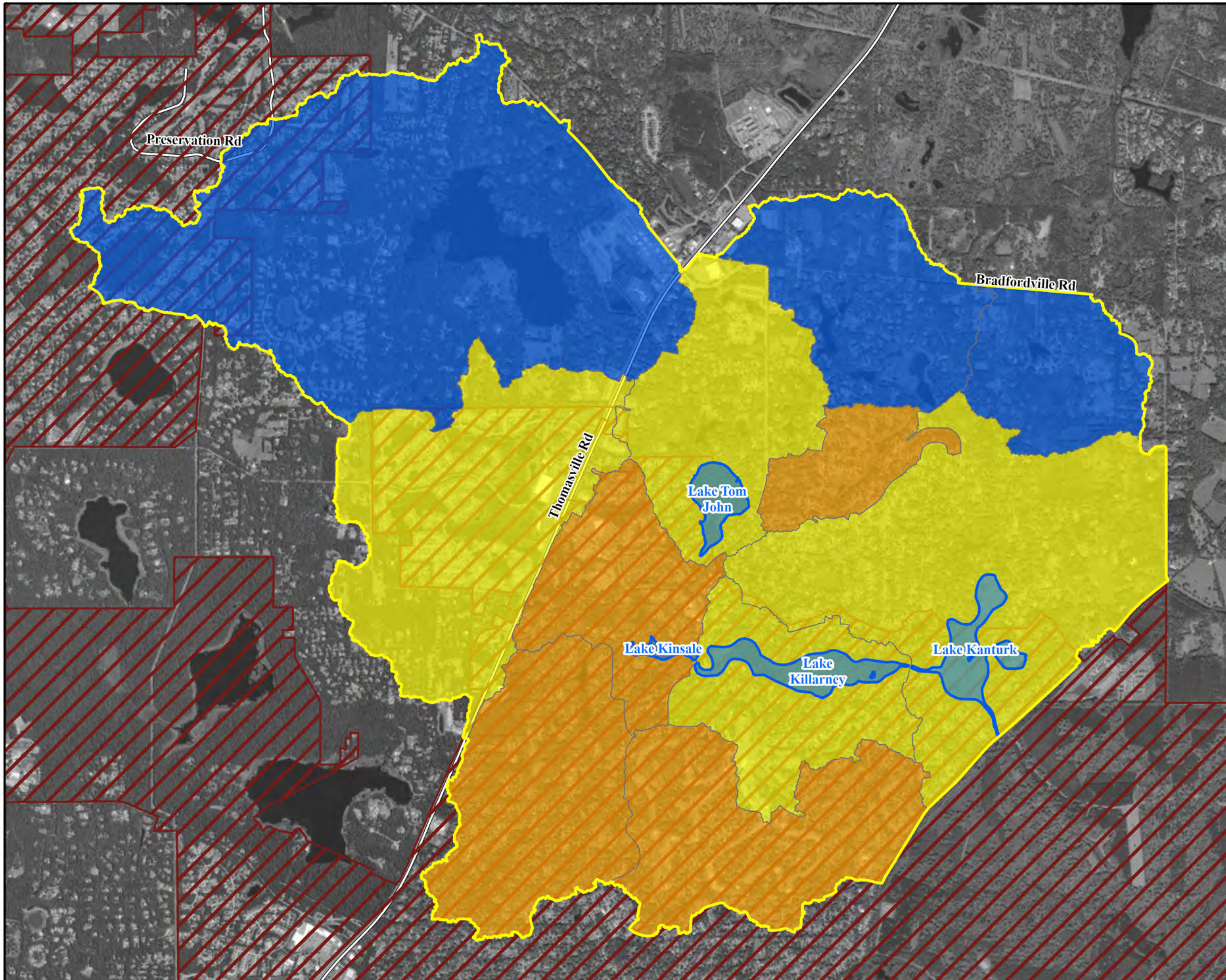
5.5.4.3 Septic Systems

Figure 5-58 presented the locations of septic systems within the Killearn Chain of Lakes basin. **Figure 5-96** presents a map showing the septic tank densities by subbasin. The septic densities for the subbasins that drain to Lake Kinsale and Lake Killarney are relatively low (less than 1 unit per 5 acres). In contrast the densities within the subbasins draining to northern end of Lake Kanturk are higher ranging near 1 unit per acre, which would indicate that septic loading may play a role in loading to the northern side of Lake Kanturk and is consistent with findings from a study conducted by ATM in 2015 that found higher inorganic nitrogen in stormwater samples from areas draining to the northern end of Lake Kanturk and concluded septic loading may be the cause. Additionally, spatial comparisons of average TN in the Killearn Chain showed elevated TN levels in Lake Kanturk compared to the other lakes (**Figure 5-90**). Septic loads to Lake Killarney and Lake Kinsale are not identified as a significant source due to the identified densities.

5.5.4.4 Internal Recycling and Seepage

<u>Internal Recycling</u>

ERD (2014) completed a study that evaluated the sediments and sediment flux of nutrients within the three lakes. A total of 62 cores were collected from the three lakes to characterize the sediments. Additionally, 8 large diameter (4-inch) cores were collected to support sediment benthic release experiments. Finally, sediment testing was performed to evaluate the potential release of nutrients following reflooding of desiccated areas. The following outlines the key findings from the study.



CITY OF TALLAHASSEE

N

0 0.5
Miles

Legend

- Killearn Chain of Lakes Drainage Basin
- Waterbodies in Study
- Tallahassee Corporate Limits

KilleanLDI

Land Development Index Wrong

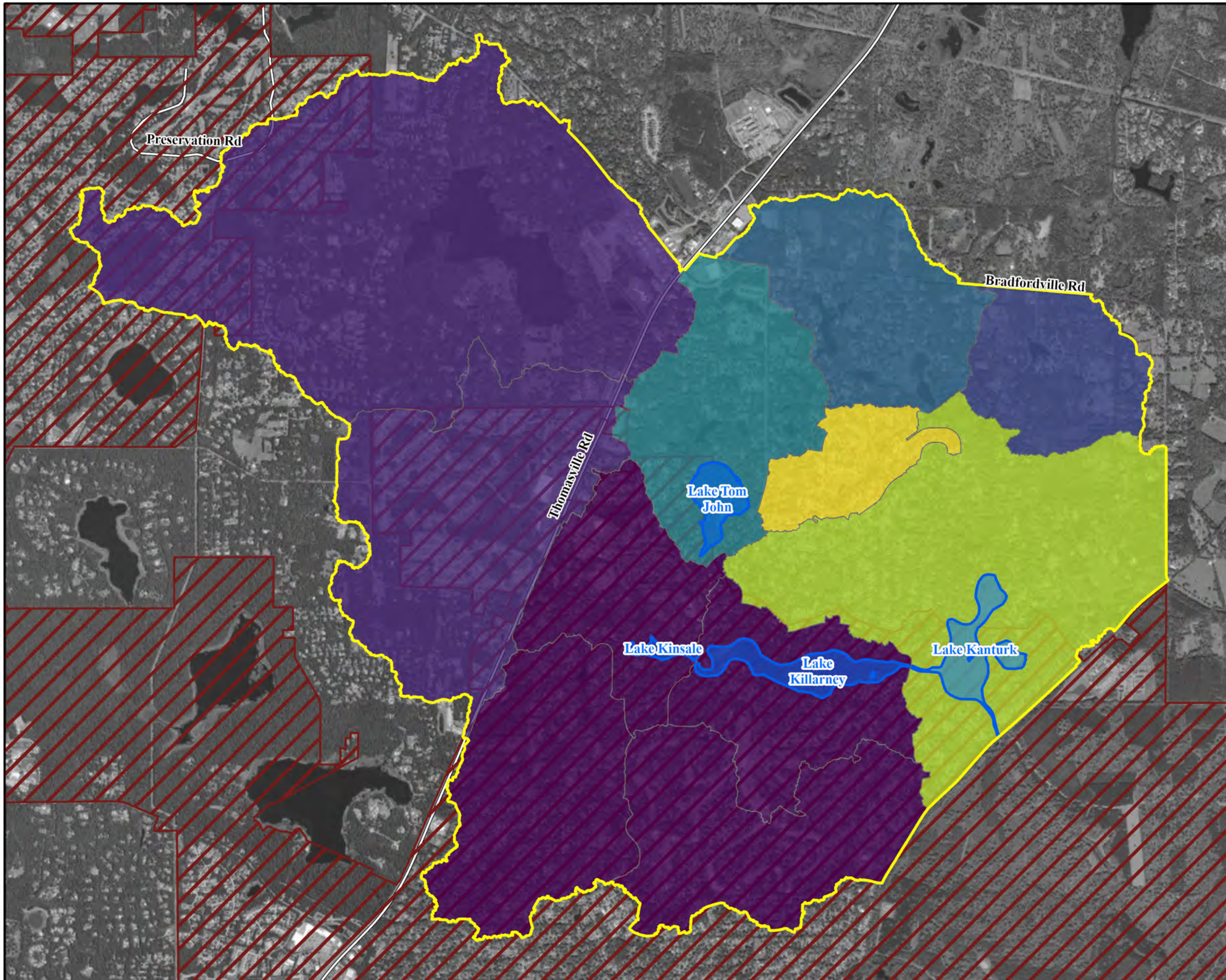
- Excellent
- Good
- Moderate
- Poor
- Very Poor

Sources:
Waterbodies: COT, 2020
Drainage Basins: COT, 2020
Roads: Leon County, 2023
City Limits: COT, 2022

Figure 5-95: Land Development Index by Sub-Watershed within Killearn Chain of Lakes Drainage Basin

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



CITY OF TALLAHASSEE

N

0 0.5

Miles

Legend

- Killearn Chain of Lakes Drainage Basin
- Waterbodies in Study
- Tallahassee Corporate Limits

Septic Tank Density

Density

- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1

Sources:
Waterbodies: COT, 2020
Drainage Basins: COT, 2020
Roads: Leon County, 2023
City Limits: COT, 2022
Septic Tanks: COT, 2020

Figure 5-96: Septic Tank Density by Sub-Basin within Killearn Chain of Lakes Drainage Basin

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

- The available phosphorus in the sediments for release was low in relation to values found in other urban lakes.
- The cores exhibited extremely low levels of nitrogen and phosphorus release under both aerobic and anoxic conditions.
- Nutrient loads from the reflooding were relatively minimal and equivalent to approximately 10 percent of the annual sediment release as a result of internal recycling.

Based on this study, internal recycling is not identified as a significant source of anthropogenic nutrients to the system. The internal recycling load, based on the 2014 study, will be presented in **Section 5.5.5.5** for comparison to other calculated loads.

Seepage

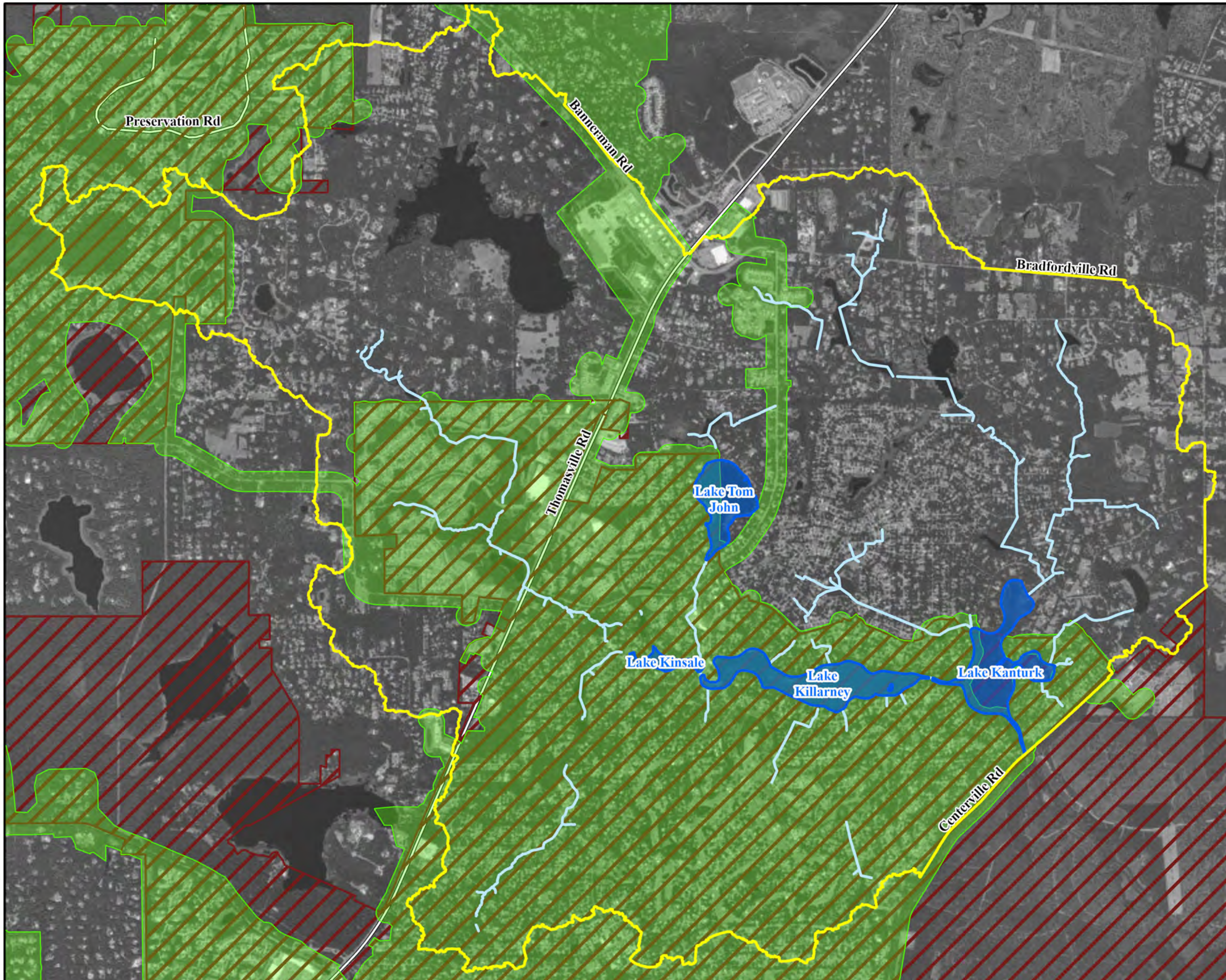
As outlined in **Section 5.5.3.7**, there are no surficial aquifer sampling sites identified within the Killearn Chain of Lakes basin to provide data on the potential for seepage to contribute to the loading to the lakes. It should be noted that based on the soil types in this basin, subsurface transmissivity levels are expected to be moderate to low, impeding transport of pollutants through seepage. Thus, seepage is not likely a significant direct source of nutrients to the Killearn Chain of Lakes. A primary potential source of seepage loads are septic systems which were evaluated in **Section 5.5.4.3** and are quantified in **Section 5.5.5.2**.

5.5.4.5 Wastewater

No direct wastewater discharges are currently within the Killearn Chain of Lakes basin. Additionally, no areas in the Killearn Chain of Lakes basin have reuse discharges. **Figure 5-97** presents a map of the Killearn Lakes basin boundaries in relation to sewer service areas. The sewer service areas are located around the direct discharge area of the three lakes, throughout the southern portions of the basin draining to the lakes, and the immediate area west of Thomasville Road that drains to Lake Kinsale. In the northern and northwestern (upstream) ends of the basin sewer infrastructure is isolated to developed areas along Velda Dairy Road and the intersection of Thomasville and Bannerman roads. Presently, 49 percent of the Killearn Chain of Lakes basin has sewer infrastructure. Based on the data analyses presented in **Section 5.5.3.6**, *E. coli* levels are generally low in the three lakes. Wastewater is not identified as a potential significant source in the Killearn Chain.

5.5.4.6 Atmospheric Deposition

For the overall surface area (combined three lakes) of the Killearn Chain of Lakes, the ratio of the watershed area to lake area is around 54:1. With this ratio, and the potential attenuation of rainfall runoff, direct atmospheric deposition to the lakes plays a minor role in overall loading to the lakes. Atmospheric deposition will be quantified in **Section 5.5.5.6** for comparison to other loads. **Section 5.5.3.10** identified the nearest atmospheric deposition station as the Quincy station (FL14). The data from this station will be utilized to calculate the atmospheric deposition to the Killearn Chain of Lakes.



CITY OF TALLAHASSEE

N

0 0.4
Miles

Legend

- Killearn Chain of Lakes Drainage Basin
- Waterbodies in Study
- Tallahassee Corporate Limits
- Sewer Service Areas

Sources:
Waterbodies: COT, 2020
Drainage Basins: COT, 2020
Roads: FDOT, 2020
City Limits: COT, 2022
Waste Water: COT, 2020

Figure 5-97:
City of Tallahassee Wastewater Service Areas within Killearn Chain of Lakes Basin

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

5.5.4.7 Interconnected Flows

Within the Killearn Chain of Lakes, Lake Kinsale is the most upstream waterbody. Lake Kinsale discharges directly into Lake Killarney. Lake Killarney then flows into Lake Kanturk. The upstream lakes, along with other upstream waterbodies, have the potential to contribute to nutrient loading and be a source to consider for the downstream lakes.

Lake Kinsale has a surface area of about 13 acres when full and receives drainage from the western portions of the basin across Thomasville Road (including the discharge from Lake McBride) and the discharge from Lake Tom John. Presently both Lake McBride and Lake Tom John are identified as impaired. Based on this, along with the nature of land use surrounding Lake Tom John, these two lakes are considered as potential sources of anthropogenic load to Lake Kinsale. Where data are available loads from the upstream lakes (Lake Tom John and Lake McBride) are quantified in **Section 5.5.5.5**.

Lake Killarney has a surface area of about 80 acres when full and receives flows out of Lake Kinsale. Presently, Lake Kinsale is identified as impaired. Based on this, along with the nature of land use draining to Lake Kinsale, it is considered as potential sources of anthropogenic load to Lake Killarney. The loads from Lake Kinsale are quantified in **Section 5.5.5.5**.

Lake Kanturk has a surface area of about 70 acres when full and receives flows out of Lake Killarney along with two waterbodies that drain into its northern lobes (Lake Saratoga and Lake Belmont). Presently Lake Killarney is identified as impaired. Based on this, along with the nature of land use draining to Lake Killarney and the other upstream waterbodies, these are considered as potential sources of anthropogenic load to Lake Kanturk. Where data are available, loads from the upstream lakes (Lake Killarney, Lake Saratoga, and Lake Belmont) are quantified in **Section 5.5.5.5**.

5.5.4.8 Summary of Findings

Based on the discussions above, and data and information presented in **Section 5.5.3**, there are various potential sources of pollutant loads to the Killearn Chain of Lakes. The primary constituent of concern is TP throughout the system and inorganic nitrogen for portions of Lake Kanturk.

Stormwater runoff contributing to tributary inflow and interconnected flow from upstream waterbodies along with septic load are identified as potentially significant contributors of anthropogenic load and are quantified in **Section 5.5.5**. Though not identified as potential significant sources, atmospheric deposition and internal recycling are quantified for comparative purposes in **Section 5.5.5** based on available data.

5.5.5 Calculation of Potential Nutrient Loads

This section presents calculations of potential nutrient (TN and TP) loads to the Killearn Chain of Lakes for the sources identified for calculation in **Section 5.5.4.8**. These include stormwater runoff, septic systems, interconnected flows, internal recycling and atmospheric deposition. Where loads were not calculated the sections below provide brief discussions. The load calculations are for the purpose of comparing the potential magnitudes of each source relative to one another to support determination of sources to target for load reduction.

5.5.5.1 Stormwater Pollutant Load

In order to calculate the stormwater TN and TP loads to the Killearn Chain of Lakes, average annual pollutant load modeling was performed. The goal was to identify outfalls that are contributing higher TN and TP loads relative to one another and to quantify the total TN and TP loads to each of the lakes (Lake Kinsale, Lake Killarney, Lake Kanturk). TN and TP loads were calculated using the Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE-Seasonal) model. The model methodology was described in detail in **Section 5.4.5.1** for the stormwater loads to the Lafayette Chain of Lakes.

Figure 5-98 presents the subbasins and the DEM utilized in the SIMPLE model calculations for the Killearn Chain of Lakes. **Figure 5-99** presents the aggregated land use. Finally, **Figure 5-100** presents the CDAs for the Chain of Lakes stormwater loading to define total and per acre TN and TP loads, as well as the ranking of CDAs around the Lakes.

<u>Stormwater Nutrient Loads to Killearn Chain of Lakes</u>

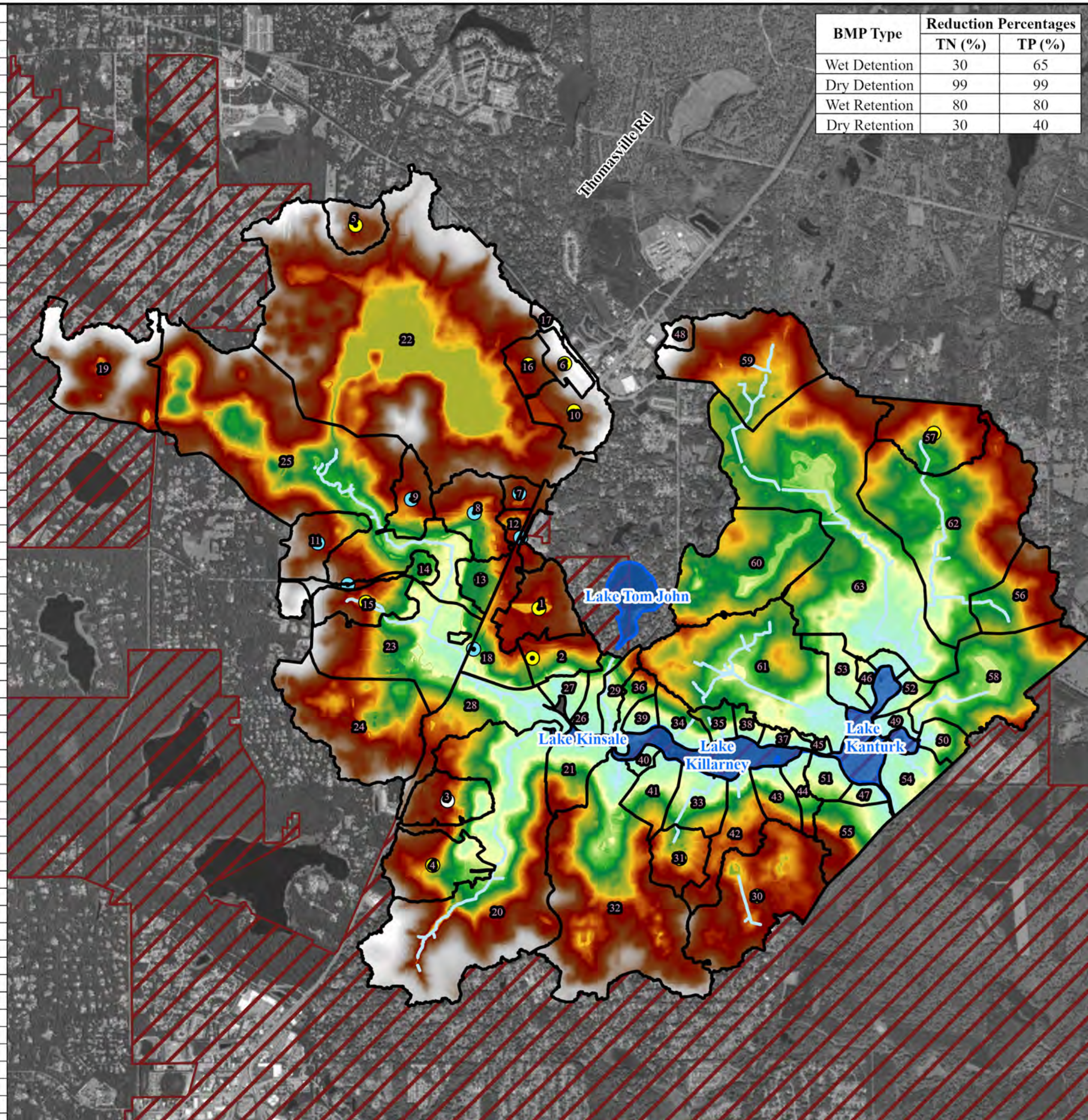
Figure 5-101 presents the distribution of the ranking of the CDAs for TN along with the total load and per acre loads, see the table on **Figure 5-101**. The rankings are color coded, with the highest ranked CDAs in dark green moving down to the lowest ranked in pale yellow. The calculated total stormwater TN loads from the CDAs ranged from as low as 41.0 lb/yr up to 6817.3 lb/yr. The per acre loads ranged from 1.7 lb/acre/yr up to 5.7 lb/acre/yr. The highest ranked CDAs were located along the southern side of the chain of lakes for the most part, which is likely a function of the land uses in conjunction with treatment considered in the model development. The total potential stormwater runoff loads for TN for Lake Kinsale, Lake Killarney, and Lake Kanturk are 10,244.9 lb/yr, 5,153.1 lb/yr, and 6,208.8 lb/yr, respectively.

Figure 5-102 presents the distribution of the ranking of the CDAs for TP along with the total load and per acre loads, see the table on **Figure 5-102**. The calculated total stormwater TP loads from the CDAs ranged from as low as 7.7 lb/yr up to 1408.0 lb/yr. The per acre loads ranged from 0.4 lb/acre/yr up to 1.9 lb/acre/yr. As was seen for the TN, the highest ranked CDAs were located along the southern side of the lakes. The total potential stormwater runoff loads for TP for Lake Kinsale, Lake Killarney, and Lake Kanturk are 2,247.8 lb/yr, 1,497.1 lb/yr, and 1,568.0 lb/yr respectively.

5.5.5.2 Septic Load

In order to analyze the potential impacts from septic tank units to the Killearn Chain of Lakes, the SPIL method adopted by FDEP was utilized to quantify the potential septic load. The calculations were done for each of the three waterbodies (Lake Kinsale, Lake Killarney, and Lake Kanturk). The approach and calculations were described earlier in **Section 5.4.5.2** which presented the septic loading to the Lafayette Chain of Lakes. As outlined earlier, the calculations were only done for nitrogen (TN), and based on literature on transport and assimilation, may represent a conservative potential load.

Killearn Chain of Lakes Subbasin Summary			
Number	Subbasin ID	Acreage	BMP Type
1	LFBLKIN0080	88	Wet Detention
2	LFBLKIN0070	59	Wet Detention
3	LFBLKIN0040	71	Dry Retention
4	LFBLKIN0050	109	Wet Detention
5	LFBLKIN0210	49	Wet Detention
6	LFBLKIN0190	32	Wet Detention
7	LFBLKIN0100	20	Dry Detention
8	LFBLKIN0110	89	Dry Detention
9	LFBLKIN0120	53	Dry Detention
10	LFBLKIN0170	83	Wet Detention
11	LFBLKIN0160	90	Dry Detention
12	LFBLKIN0090	25	Dry Detention
13	LFBLKIN0130	35	Dry Detention
14	LFBLKIN0140	28	Dry Detention
15	LFBLKIN0150	68	Wet Detention
16	LFBLKIN0180	38	Wet Detention
17	LFBLKIN0200	10	Dry Detention
18	LFBLKIN0075	90	Dry Detention
19	LFBLKIN0230	197	Dry Detention
20	LFBLKIN0030	545	None
21	LFBLKIN0010	61	None
22	LFBLKIN0012	1,133	None
23	LFBLKIN0013	215	None
24	LFBLKIN0014	238	None
25	LFBLKIN0015	646	None
26	LFBLKIN0020	30	None
27	LFBLKIN0021	26	None
28	LFBLKIN0022	124	None
29	LFBLKIN0280	32	None
30	LFBLKIL0027	225	None
31	LFBLKIL0030	61	Wet Detention
32	LFBLKIL0040	458	None
33	LFBLKIL0020	61	None
34	LFBLKIL0021	38	None
35	LFBLKIL0022	22	None
36	LFBLKIL0023	26	None
37	LFBLKIL0024	15	None
38	LFBLKIL0010	14	None
39	LFBLKIL0025	18	Wet Detention
40	LFBLKIL0012	10	None
41	LFBLKIL0013	51	None
42	LFBLKIL0014	81	None
43	LFBLKIL0015	40	None
44	LFBLKIL0026	29	None
45	LFBLKAN0012	6	None
46	LFBLKAN0011	13	None
47	LFBLKAN0025	15	None
48	LFBLKAN0070	16	Wet Detention
49	LFBLKAN0014	16	None
50	LFBLKAN0036	30	None
51	LFBLKAN0013	31	None
52	LFBLKAN0015	34	None
53	LFBLKAN0055	46	None
54	LFBLKAN0010	54	None
55	LFBLKAN0020	72	None
56	LFBLKAN0035	101	None
57	LFBLKAN0060	118	Wet Detention
58	LFBLKAN0031	204	None
59	LFBLKAN0034	220	None
60	LFBLKAN0033	227	None
61	LFBLKAN0050	326	None
62	LFBLKAN0032	399	None
63	LFBLKAN0030	629	None



BMP Type	Reduction Percentages	
	TN (%)	TP (%)
Wet Detention	30	65
Dry Detention	99	99
Wet Retention	80	80
Dry Retention	30	40

CITY OF TALLAHASSEE

N

0 0.7 Miles

Legend

- Subbasins
- Waterbodies in Study
- Watercourses
- Tallahassee Corporate Limits

BMP Type

- Dry Detention
- Dry Retention
- Wet Detention

Topographic Elevations

Ft. NAVD88

251

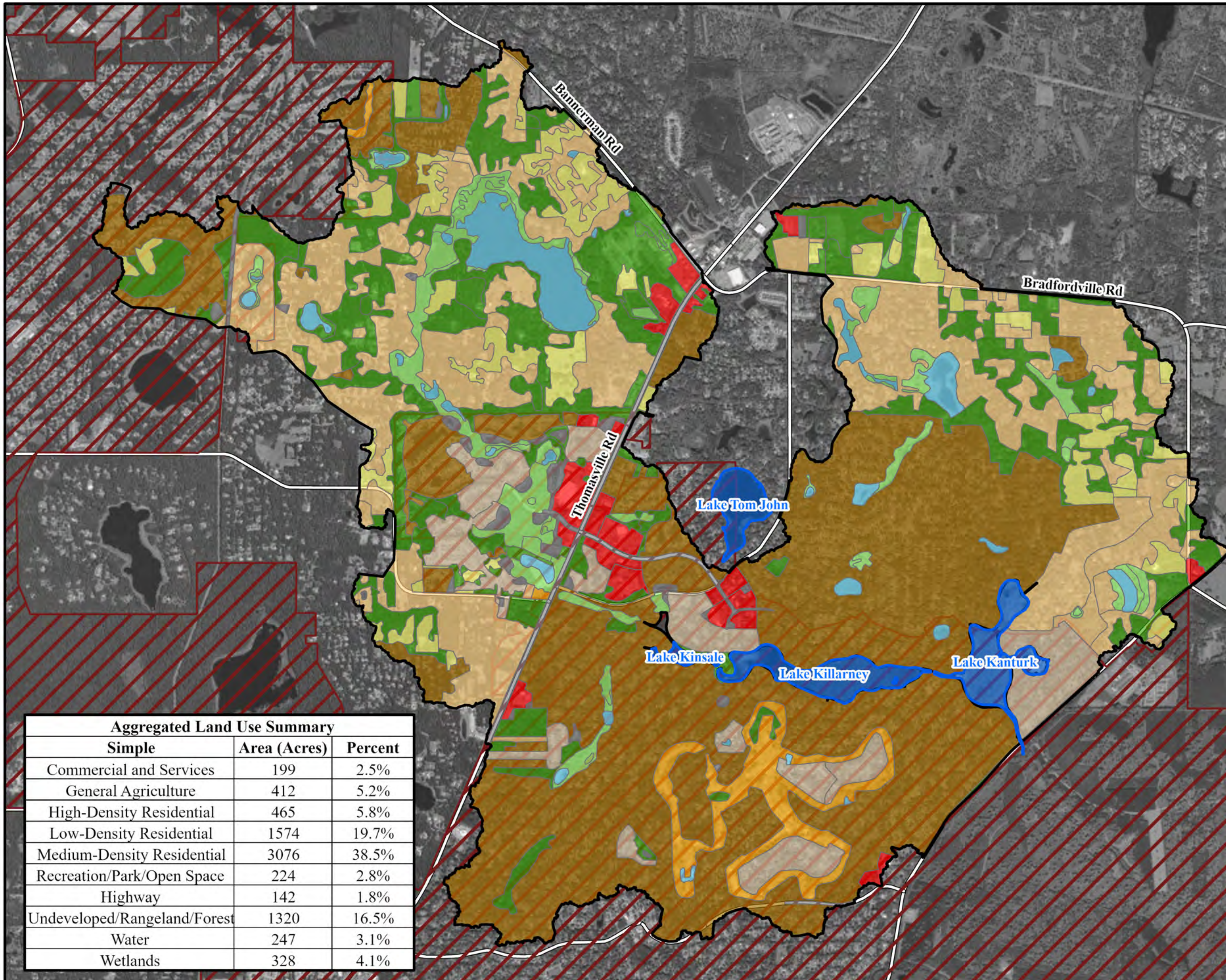
67

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Subbasins: Geosyntec, 2022
Roads: COT-Leon County, 2023
City Limits: COT, 2022
BMPs: Geosyntec, 2023
Elevation: COT-Leon County,

Figure 5-98:
Killearn Chain of Lakes Subbasin Delineation and BMPs

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



CITY OF TALLAHASSEE

Aggregated Land Use Summary

Simple	Area (Acres)	Percent
Commercial and Services	199	2.5%
General Agriculture	412	5.2%
High-Density Residential	465	5.8%
Low-Density Residential	1574	19.7%
Medium-Density Residential	3076	38.5%
Recreation/Park/Open Space	224	2.8%
Highway	142	1.8%
Undeveloped/Rangeland/Forest	1320	16.5%
Water	247	3.1%
Wetlands	328	4.1%

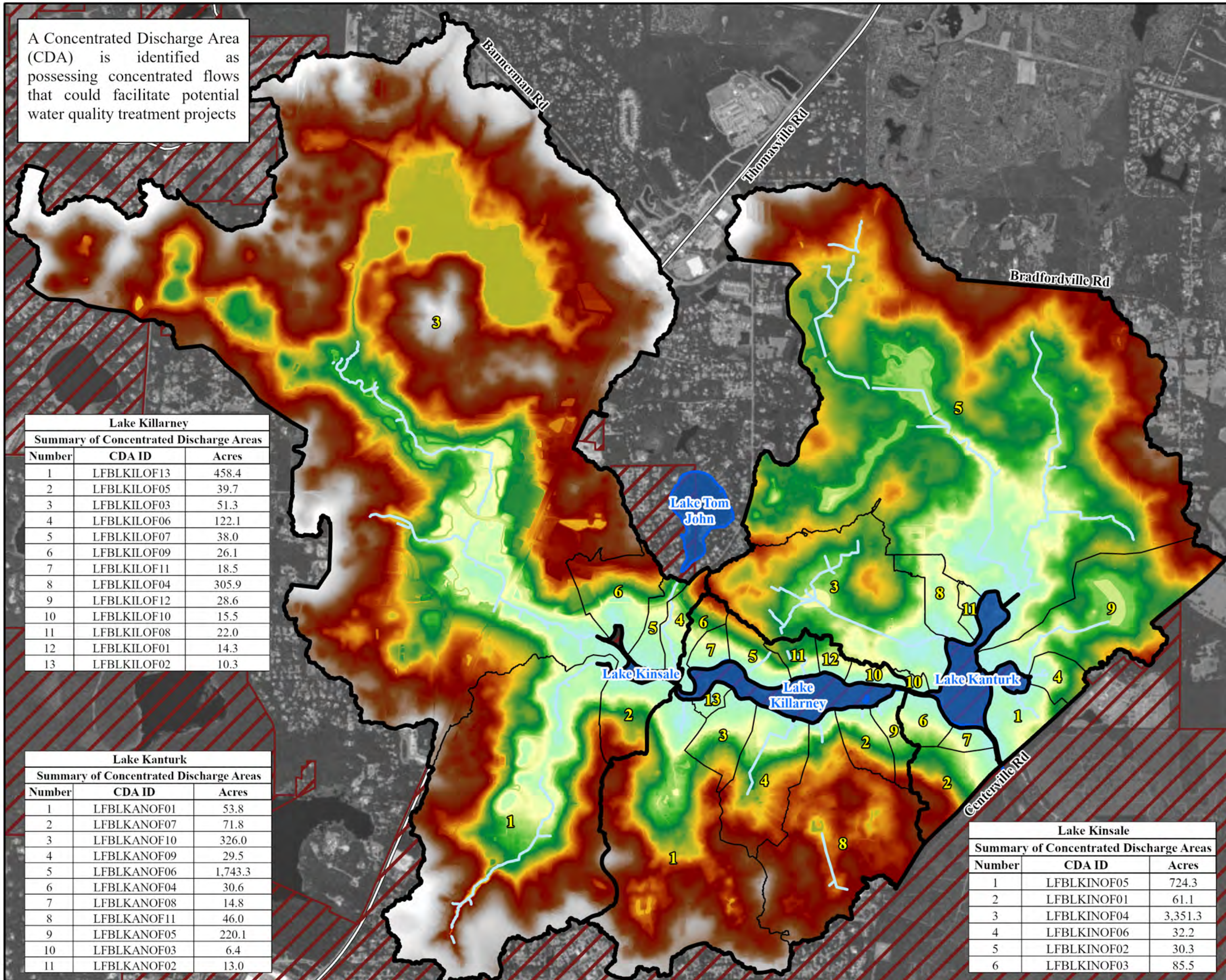
Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Land Use: Geosyntec, 2023
Roads: FDOT, 2020
City Limits: COT, 2020

Figure 5-99:
Killearn Chain of Lake Aggregated Land Use

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

A Concentrated Discharge Area (CDA) is identified as possessing concentrated flows that could facilitate potential water quality treatment projects



Lake Killarney		
Summary of Concentrated Discharge Areas		
Number	CDA ID	Acres
1	LFBLKILOF13	458.4
2	LFBLKILOF05	39.7
3	LFBLKILOF03	51.3
4	LFBLKILOF06	122.1
5	LFBLKILOF07	38.0
6	LFBLKILOF09	26.1
7	LFBLKILOF11	18.5
8	LFBLKILOF04	305.9
9	LFBLKILOF12	28.6
10	LFBLKILOF10	15.5
11	LFBLKILOF08	22.0
12	LFBLKILOF01	14.3
13	LFBLKILOF02	10.3

Lake Kanturk		
Summary of Concentrated Discharge Areas		
Number	CDA ID	Acres
1	LFBLKANOF01	53.8
2	LFBLKANOF07	71.8
3	LFBLKANOF10	326.0
4	LFBLKANOF09	29.5
5	LFBLKANOF06	1,743.3
6	LFBLKANOF04	30.6
7	LFBLKANOF08	14.8
8	LFBLKANOF11	46.0
9	LFBLKANOF05	220.1
10	LFBLKANOF03	6.4
11	LFBLKANOF02	13.0

Lake Kinsale		
Summary of Concentrated Discharge Areas		
Number	CDA ID	Acres
1	LFBLKINOF05	724.3
2	LFBLKINOF01	61.1
3	LFBLKINOF04	3,351.3
4	LFBLKINOF06	32.2
5	LFBLKINOF02	30.3
6	LFBLKINOF03	85.5

CITY OF TALLAHASSEE

N

0 0.4
Miles

Legend

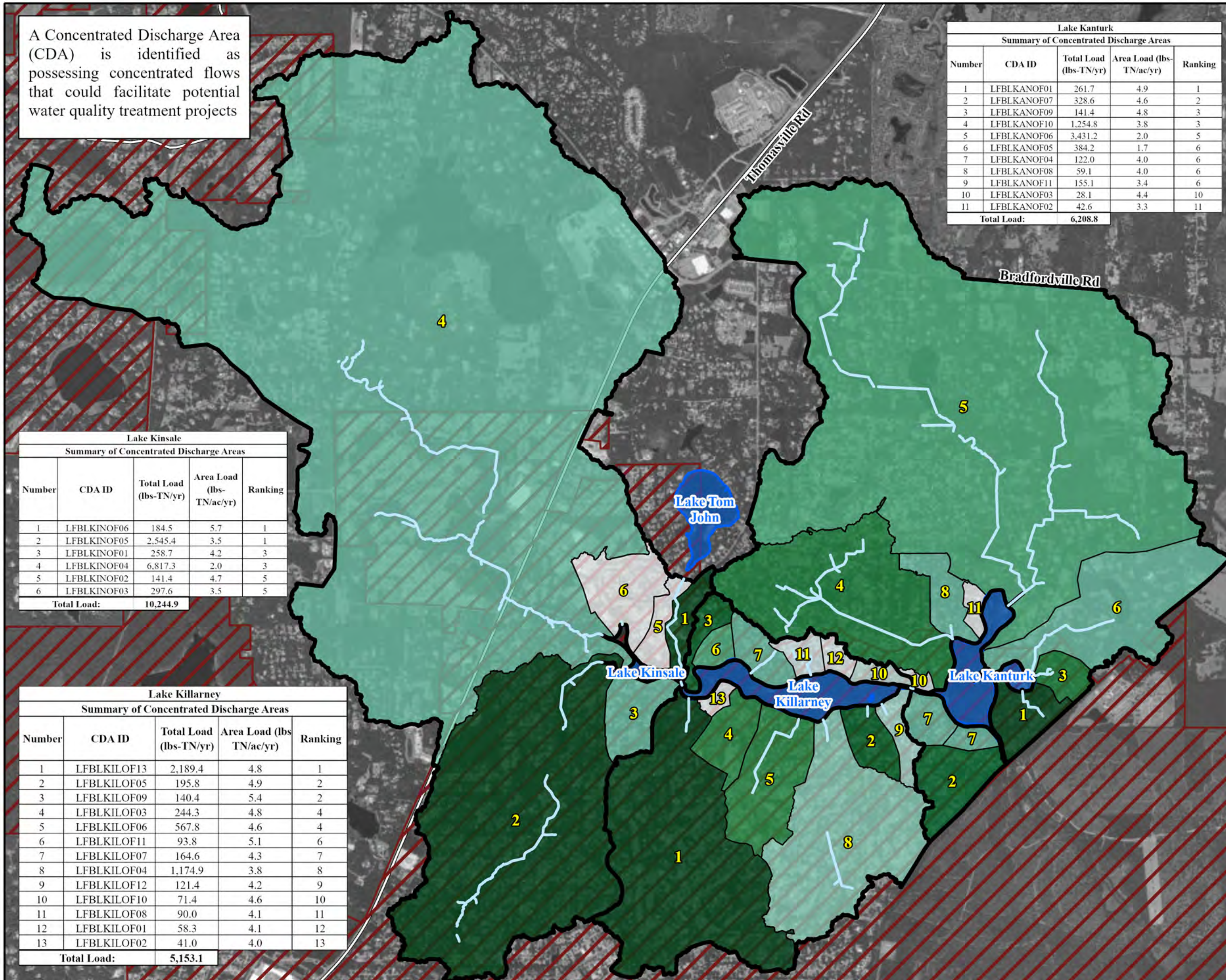
Concentrated Discharge Areas
Waterbodies in Study
Flowlines
Tallahassee Corporate Limits
Topographic Elevations
ft NAVD88
250
65

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
CDAs: Geosyntec, 2022
Roads: COT-Leon County, 2023
City Limits: COT, 2022
Elevation: COT-Leon County, 2018

Figure 5-100:
Killearn Chain of Lakes Concentrated Discharge Areas

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants



Lake Kanturk				
Summary of Concentrated Discharge Areas				
Number	CDA ID	Total Load (lbs-TN/yr)	Area Load (lbs-TN/ac/yr)	Ranking
1	LFBLKANOF01	261.7	4.9	1
2	LFBLKANOF07	328.6	4.6	2
3	LFBLKANOF09	141.4	4.8	3
4	LFBLKANOF10	1,254.8	3.8	3
5	LFBLKANOF06	3,431.2	2.0	5
6	LFBLKANOF05	384.2	1.7	6
7	LFBLKANOF04	122.0	4.0	6
8	LFBLKANOF08	59.1	4.0	6
9	LFBLKANOF11	155.1	3.4	6
10	LFBLKANOF03	28.1	4.4	10
11	LFBLKANOF02	42.6	3.3	11
Total Load:		6,208.8		

Lake Kinsale				
Summary of Concentrated Discharge Areas				
Number	CDA ID	Total Load (lbs-TN/yr)	Area Load (lbs-TN/ac/yr)	Ranking
1	LFBLKINOF06	184.5	5.7	1
2	LFBLKINOF05	2,545.4	3.5	1
3	LFBLKINOF01	258.7	4.2	3
4	LFBLKINOF04	6,817.3	2.0	3
5	LFBLKINOF02	141.4	4.7	5
6	LFBLKINOF03	297.6	3.5	5
Total Load:		10,244.9		

Lake Killarney				
Summary of Concentrated Discharge Areas				
Number	CDA ID	Total Load (lbs-TN/yr)	Area Load (lbs TN/ac/yr)	Ranking
1	LFBLKILOF13	2,189.4	4.8	1
2	LFBLKILOF05	195.8	4.9	2
3	LFBLKILOF09	140.4	5.4	2
4	LFBLKILOF03	244.3	4.8	4
5	LFBLKILOF06	567.8	4.6	4
6	LFBLKILOF11	93.8	5.1	6
7	LFBLKILOF07	164.6	4.3	7
8	LFBLKILOF04	1,174.9	3.8	8
9	LFBLKILOF12	121.4	4.2	9
10	LFBLKILOF10	71.4	4.6	10
11	LFBLKILOF08	90.0	4.1	11
12	LFBLKILOF01	58.3	4.1	12
13	LFBLKILOF02	41.0	4.0	13
Total Load:		5,153.1		

CITY OF TALLAHASSEE

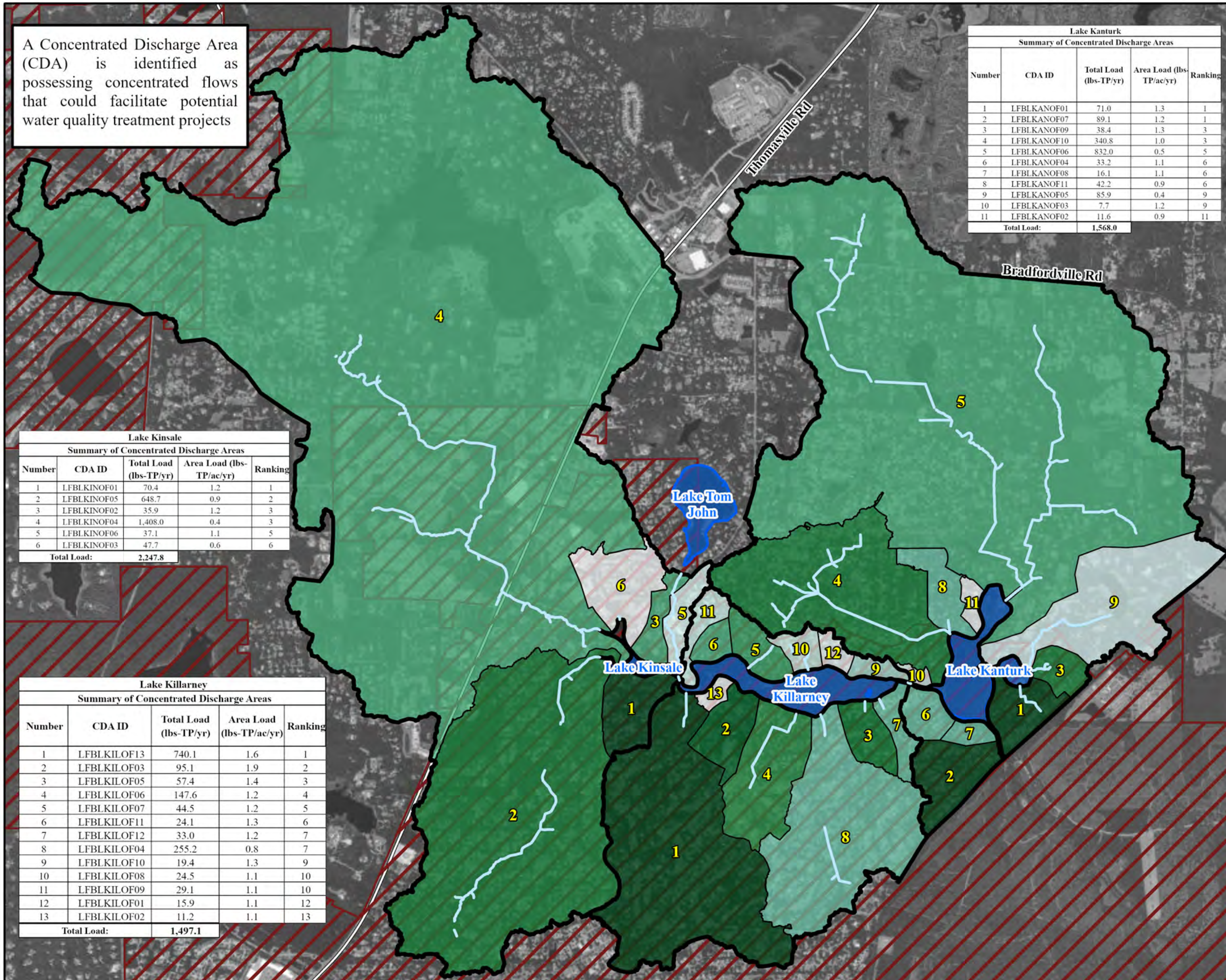
Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
CDAs: Geosyntec, 2022
Roads: COT-Leon County, 2023
City Limits: COT, 2022

Figure 5-101:
Killearn Chain of Lakes Concentrated Discharge Areas-Total Nitrogen

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

A Concentrated Discharge Area (CDA) is identified as possessing concentrated flows that could facilitate potential water quality treatment projects



Lake Kanturk				
Summary of Concentrated Discharge Areas				
Number	CDA ID	Total Load (lbs-TP/yr)	Area Load (lbs-TP/ac/yr)	Ranking
1	LFBLKANOF01	71.0	1.3	1
2	LFBLKANOF07	89.1	1.2	1
3	LFBLKANOF09	38.4	1.3	3
4	LFBLKANOF10	340.8	1.0	3
5	LFBLKANOF06	832.0	0.5	5
6	LFBLKANOF04	33.2	1.1	6
7	LFBLKANOF08	16.1	1.1	6
8	LFBLKANOF11	42.2	0.9	6
9	LFBLKANOF05	85.9	0.4	9
10	LFBLKANOF03	7.7	1.2	9
11	LFBLKANOF02	11.6	0.9	11
Total Load:		1,568.0		

Lake Kinsale				
Summary of Concentrated Discharge Areas				
Number	CDA ID	Total Load (lbs-TP/yr)	Area Load (lbs-TP/ac/yr)	Ranking
1	LFBLKINOF01	70.4	1.2	1
2	LFBLKINOF05	648.7	0.9	2
3	LFBLKINOF02	35.9	1.2	3
4	LFBLKINOF04	1,408.0	0.4	3
5	LFBLKINOF06	37.1	1.1	5
6	LFBLKINOF03	47.7	0.6	6
Total Load:		2,247.8		

Lake Killarney				
Summary of Concentrated Discharge Areas				
Number	CDA ID	Total Load (lbs-TP/yr)	Area Load (lbs-TP/ac/yr)	Ranking
1	LFBLKILOF13	740.1	1.6	1
2	LFBLKILOF03	95.1	1.9	2
3	LFBLKILOF05	57.4	1.4	3
4	LFBLKILOF06	147.6	1.2	4
5	LFBLKILOF07	44.5	1.2	5
6	LFBLKILOF11	24.1	1.3	6
7	LFBLKILOF12	33.0	1.2	7
8	LFBLKILOF04	255.2	0.8	7
9	LFBLKILOF10	19.4	1.3	9
10	LFBLKILOF08	24.5	1.1	10
11	LFBLKILOF09	29.1	1.1	10
12	LFBLKILOF01	15.9	1.1	12
13	LFBLKILOF02	11.2	1.1	13
Total Load:		1,497.1		

CITY OF TALLAHASSEE

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
CDAs: Geosyntec, 2022
Roads: COT-Leon County, 2023
City Limits: COT, 2022

Figure 5-102:
Killearn Chain of Lakes Concentrated Discharge Areas-Total Phosphorus

Tallahassee Master Plan - Surface Water (TMaPS)

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An estimated 945 septic tank units were identified within 200 meters of the Killearn Chain of Lakes, and associated tributaries. **Figure 5-103** shows the septic systems utilized in the analyses with those associated with direct loading to the waterbody green and those associated with loading to tributaries pink. Tables provided on the figure summarize the calculated nutrient load from septic units to each of the three waterbodies. The total TN load to Lake Kinsale is 346 lb/yr with all of that load coming from tributaries. The total TN load to Lake Killarney is 0 lb/yr as no septic units were identified within 200 meters of the lakeshore or tributaries draining to it. The potential TN load to Lake Kanturk is 9,852 lb/yr with 443 lb/yr from direct loading to the lake and the remaining from clusters of septic system along tributaries that drain to the upper parts of Lake Kanturk.

5.5.5.3 Point Source Load

No active point sources were identified within the Killearn Chain of Lakes basin. Therefore, the point source loads for TN and TP are set to 0 lb/yr for all three lakes.

5.5.5.4 Lake Inflow Load

As discussed in **Section 5.5.4.7** upstream lakes flow to downstream receiving lakes and represents load to the downstream lake. **Figure 5-104** presents the upstream and downstream connections. Calculations of the loads are provided herein based on the availability of modeled flows and in-lake concentrations. The approach utilized in the calculation of the inter-lake loading was described in **Section 5.5.5.5** for the Lafayette Chain of Lakes. The lakes and connections are shown in **Figure 5-104**, along with a table summarizing available water quality data, flow, load calculations and impairment status. These loads represent the surface runoff and baseflow load to the downstream lakes accounting for the changes in in-lake concentrations as the water passes through. Based on available water quality data and modeled inflows, loads were calculated for Lake Kinsale from Lake Tom John, Lake Killarney from Lake Kinsale, and Lake Kanturk from Lake Killarney. The loads out of Lake McBride were not calculated based on no modeled outflow. The loads out of Lake Saratoga and Lake Belmont were not calculated based on no modeled outflow or in-lake water quality data. The loads from these three lakes are incorporated into the load calculations presented in **Section 5.5.5.1**.

5.5.5.5 Internal Lake Load

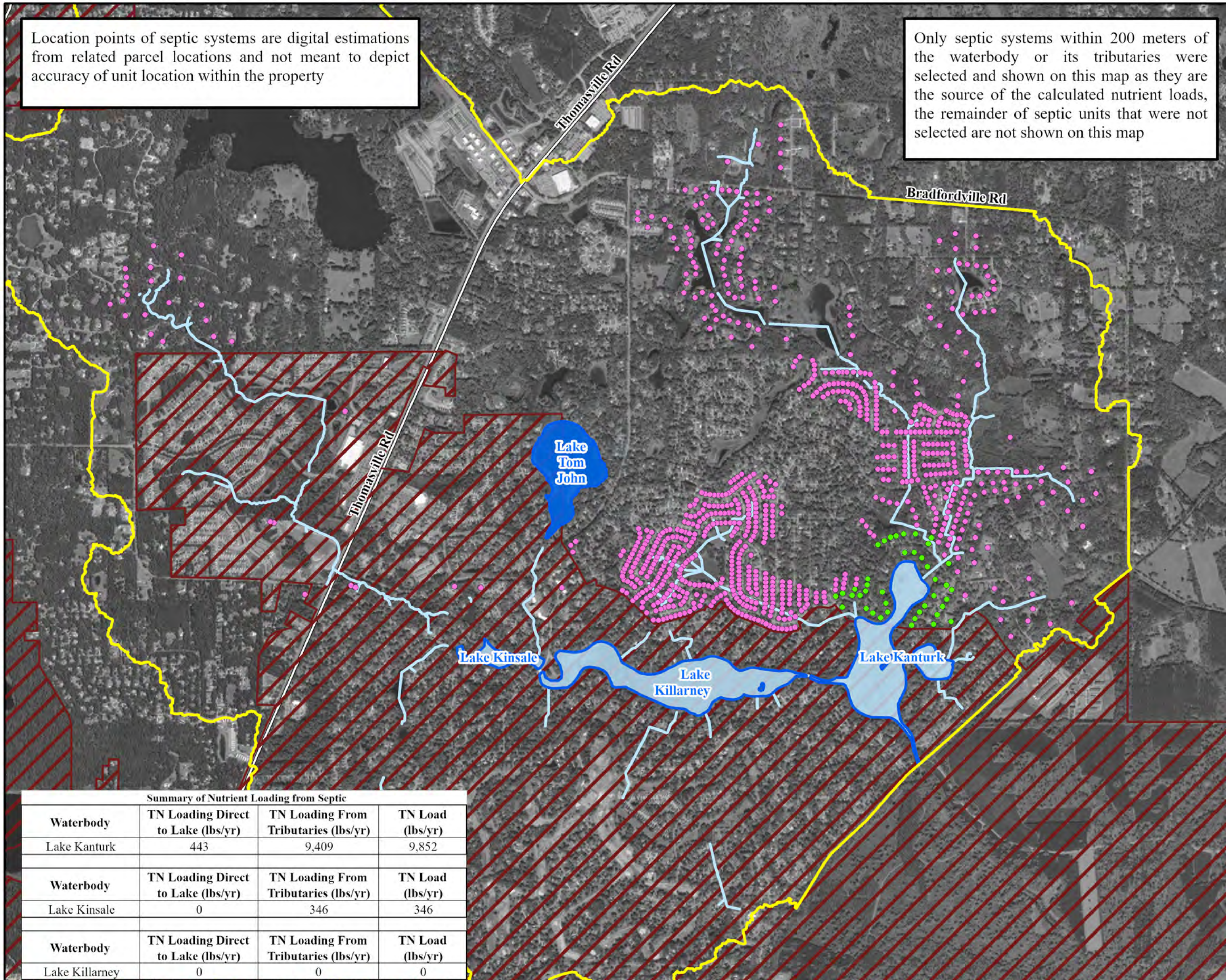
Section 5.5.4.4 outlined a study completed in 2014 that quantified the internal nutrient flux loads for the Killearn Chain of Lakes. **Table 5-16** presents the results from the study. TN internal loads ranged from 975 lb/year in Lake Kinsale up to 5,199 lb/year in Lake Kanturk. TP internal loads showed a similar pattern ranging from 64 lb/year in Lake Kinsale up to 238 lb/year in Lake Kanturk.

Table 5-16: Internal Nutrient Load to Killearn Chain of Lakes

Lake	TN (lb/year)	TP (lb/year)
Lake Kinsale	975	64
Lake Killarney	4,105	187
Lake Kanturk	5,199	238

Location points of septic systems are digital estimations from related parcel locations and not meant to depict accuracy of unit location within the property

Only septic systems within 200 meters of the waterbody or its tributaries were selected and shown on this map as they are the source of the calculated nutrient loads, the remainder of septic units that were not selected are not shown on this map



CITY OF TALLAHASSEE

N

0 0.4 Miles

Legend

- Killearn Chain of Lakes Drainage Basin
- Killearn Chain of Lakes
- Waterbodies in Study
- Watercourses

Relevant Septic Sites

- Lake
- Tributaries

Summary of Nutrient Loading from Septic

Waterbody	TN Loading Direct to Lake (lbs/yr)	TN Loading From Tributaries (lbs/yr)	TN Load (lbs/yr)
Lake Kanturk	443	9,409	9,852
Waterbody	**TN Loading Direct to Lake (lbs/yr)**	**TN Loading From Tributaries (lbs/yr)**	**TN Load (lbs/yr)**
Lake Kinsale	0	346	346
Waterbody	**TN Loading Direct to Lake (lbs/yr)**	**TN Loading From Tributaries (lbs/yr)**	**TN Load (lbs/yr)**
Lake Killarney	0	0	0

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Septic Systems: COT, 2020
Watershed: COT, 2020
Roads: COT-Leon County, 2023

Figure 5-103:
Septic Loading to Killearn Chain of Lakes

Tallahassee Master Plan - Surface Water (TMaPS)

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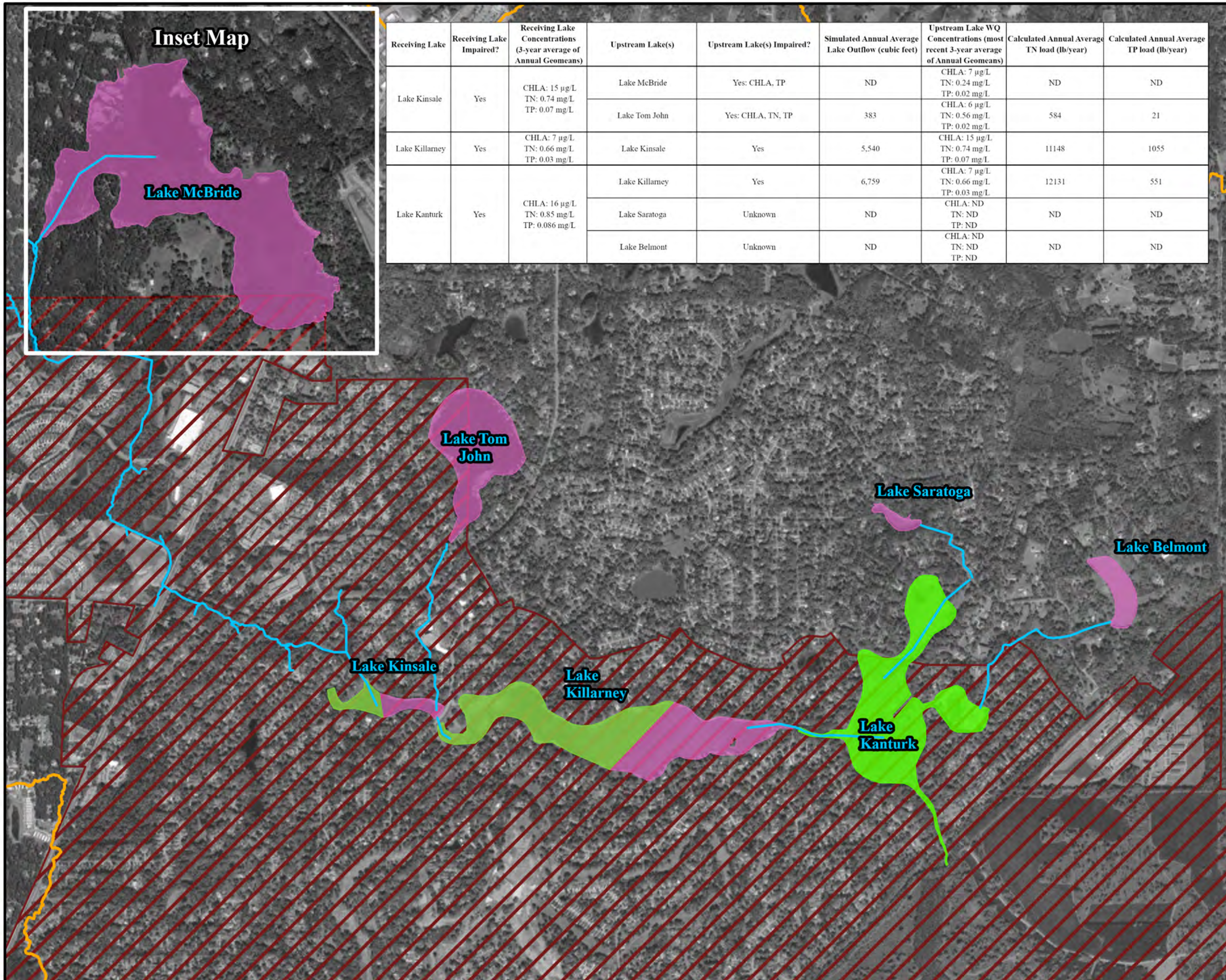
Receiving Lake	Receiving Lake Impaired?	Receiving Lake Concentrations (3-year average of Annual Geomeans)	Upstream Lake(s)	Upstream Lake(s) Impaired?	Simulated Annual Average Lake Outflow (cubic feet)	Upstream Lake WQ Concentrations (most recent 3-year average of Annual Geomeans)	Calculated Annual Average TN load (lb/year)	Calculated Annual Average TP load (lb/year)
Lake Kinsale	Yes	CHLA: 15 µg/L TN: 0.74 mg/L TP: 0.07 mg/L	Lake McBride	Yes: CHLA, TP	ND	CHLA: 7 µg/L TN: 0.24 mg/L TP: 0.02 mg/L	ND	ND
			Lake Tom John	Yes: CHLA, TN, TP	383	CHLA: 6 µg/L TN: 0.56 mg/L TP: 0.02 mg/L	584	21
Lake Killarney	Yes	CHLA: 7 µg/L TN: 0.66 mg/L TP: 0.03 mg/L	Lake Kinsale	Yes	5,540	CHLA: 15 µg/L TN: 0.74 mg/L TP: 0.07 mg/L	11148	1055
Lake Kanturk	Yes	CHLA: 16 µg/L TN: 0.85 mg/L TP: 0.086 mg/L	Lake Killarney	Yes	6,759	CHLA: 7 µg/L TN: 0.66 mg/L TP: 0.03 mg/L	12131	551
			Lake Saratoga	Unknown	ND	CHLA: ND TN: ND TP: ND	ND	ND
			Lake Belmont	Unknown	ND	CHLA: ND TN: ND TP: ND	ND	ND



CITY OF TALLAHASSEE

N

0 0.3

Miles

Legend

- Lake Lafayette Drainage Basin
- Receiving Lakes
- Inflowing Lakes
- Flowlines
- Tallahassee Corporate Limits

Sources:
Waterbodies: COT, 2020
Flowlines: USGS, 2020
Roads: COT-Leon County, 2023
City Limits, COT, 2020

Figure 5-104:
Inflow Loading to Killearn Chain of Lakes

Tallahassee Master Plan - Surface Water (TMaPS)

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5.5.5.6 Atmospheric Deposition

As presented and discussed in **Section 5.5.4.6** the annual average atmospheric TN load per acre was calculated from the Quincy NADP station (F14) at 2.56 lb/acre/yr. Multiplying this by the acreage of Lake Kinsale (12.6 acres), Lake Killarney (80 acres), and Lake Kanturk (70 acres) gives total TN loads of 32 lb/yr, 205 lb/yr, and 179 lb/yr respectively. No data are available for TP therefore only the nitrogen load is provided.

5.5.5.7 Summary of Calculated Loads

Nutrient loads to Lake Kinsale, Lake Killarney, and Lake Kanturk were calculated for stormwater runoff, septic systems, lake inflow, internal recycling, and atmospheric deposition. **Table 5-17** through **Table 5-19** present the calculated total loads to the lakes for TN and TP. For septic systems and atmospheric deposition only TN loads were calculated (see **Section 5.5.5.2** and **Section 5.5.5.6**, respectively, for explanation).

Table 5-17: Summary of Calculated Loads to Lake Kinsale

Source	TN (lb/year)	TP (lb/year)
Stormwater Runoff	10,245	2,248
Septic Systems	346	NC
Lake Inflow	584	21
Internal Recycling	975	64
Atmospheric Deposition	32	NC

NC – Not calculated.

Table 5-18: Summary of Calculated Loads to Lake Killarney

Source	TN (lb/year)	TP (lb/year)
Stormwater Runoff	5,153	1,497
Septic Systems	0	NC
Lake Inflow	11,148	1,055
Internal Recycling	4,105	187
Atmospheric Deposition	205	NC

NC – Not calculated.

Table 5-19: Summary of Calculated Loads to Lake Kanturk

Source	TN (lb/year)	TP (lb/year)
Stormwater Runoff	6,209	1,568
Septic Systems	9,852	NC
Lake Inflow	12,131	551
Internal Recycling	5,199	238
Atmospheric Deposition	179	NC

NC – Not calculated.

5.6 Lake Tom John

This section presents the results from Tasks 1 through 3 for Lake Tom John, which includes an overview and history of the lake and basin; present impairment status; an overview of available data; a qualitative assessment of potential pollutant sources; and calculation of potential pollutant loads.

5.6.1 Overview and History

Lake Tom John is a 40-acre lake located in a residential area between Velda Dairy Road and Thomasville Road north of Kerry Forest Road (**Figure 5-105**). The lake is surrounded almost entirely by residential properties. Drainage to Lake Tom John comes from the Pembridge Place, Highlands, Quail Rise and other smaller neighborhoods. **Photo 5-45** shows the lake from a dock along the southwestern side.

Photo 5-45: Lake Tom John (August 2019)

Photo 5-46 through **Photo 5-53** present aerials of Lake Tom John in 1937, 1949, 1954, 1970, 1983, 1996, 2007, and 2020. The aerials show that while the overall footprint of the lake has remained relatively constant, in the early years the system shows wetland characteristics with extensive dry and permanent pool areas. This condition extends from 1937 through 1954 (**Photo 5-46** to **Photo 5-48**). By the 1970 aerial (**Photo 5-49**) the extent of open water area extends more out to the total footprint with what appear to be areas of extensive aquatic vegetation. The increase in the overall open water area in the lake continues from 1983 through 2020 with nearly the entire footprint as open water in 2020 (**Photo 5-50** to **Photo 5-53**).

CITY OF TALLAHASSEE

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Miles

Legend

- Lake Tom John Drainage Basin
- Waterbodies in Study
- Watercourses
- Tallahassee Corporate Limits

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Facilities: COT, 2020
City Limits: COT, 2022

Figure 5-105:
Lake Tom John Basin Overview Map

Tallahassee Master Plan - Surface Water (TMaPS)

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Photo 5-46: Lake Tom John Basin Area Aerial (1937)

Photo 5-47: Lake Tom John Basin Area Aerial (1949)

Photo 5-48: Lake Tom John Basin Area Aerial (1954)

Photo 5-49: Lake Tom John Basin Area Aerial (1970)

Photo 5-50: Lake Tom John Basin Area Aerial (1983)

Photo 5-51: Lake Tom John Basin Area Aerial (1996)

Photo 5-52: Lake Tom John Basin Area Aerial (2007)

Photo 5-53: Lake Tom John Basin Area Aerial (2020)

The drainage basin for Lake Tom John covers an area of 656 acres **(Figure 5-105**) and generally extends between Thomasville Road, Velda Dairy Road, and Bradfordville Road. The bulk of the drainage basin is within residential neighborhoods with some natural areas. The northernmost portions of the basin contain some commercial area. Most of the basin is within unincorporated Leon County with the area to the west of the lake within the City boundary. Runoff from the basin passes through a series of smaller lakes north of Lake Tom John prior to discharging into the northern end of the lake. The outflow from the lake is at the southernmost end with water levels controlled by the elevation of the outflow channel. **Photo 5-54** shows the outflow from the lake. Flows out of the lake ultimately discharge into the eastern side of Lake Kinsale in the Killearn Chain of Lakes.

Photo 5-54: Lake Tom John Outflow Channel

5.6.2 Regulatory Status

Exhibit 5-2 presented the verified impaired waters within the overall Lake Lafayette basin. The Lake Tom John WBID 647A is presently verified impaired for nutrients (Chl-a, TN and TP). This impairment is based upon not meeting the criteria for a low color, low alkalinity lake as defined under FDEPs NNC. The criteria determination and water quality results that trigger the impairment are discussed further in **Section 5.6.3.6**.

5.6.3 Waterbody Data Review and Summary

This section presents an overview of available data and data sources for Lake Tom John and the Lake Tom John basin including bathymetry, land use, soils, septic systems, hydrologic measurements, surface water quality, groundwater quality, biological, stormwater treatment facilities, and atmospheric deposition.

5.6.3.1 Bathymetry

Presently, no bathymetric maps are available for Lake Tom John. Based on review of available reports, the maximum depth in the lake is 10 ft with an average depth of 6 ft.

5.6.3.2 Land Use

Figure 5-106 presents a map of the Level 2 land uses within the Lake Tom John basin. A table is provided to show the overall acreages and percent cover for the various levels. Tables are provided for both the Level 2 and grouped Level 1 land uses. The largest land use within the Lake Tom John Drainage Basin per the grouped Level 1 categories is Urban and Built Up (60 percent). The primary Level 2 land-use within Urban and Built Up is Medium Density Residential. The second largest land use in the overall basin is Upland Forest most of which is located just north of the lake (**Figure 5-106**).

5.6.3.3 Soils

The most prevalent soil group in the Lake Tom John basin is Group B **(Figure 5-107)**, accounting for 65.6 percent of the area. Group B soils are considered to have a moderate rate of infiltration. Group A/D soils (9.2 percent) and B/D (8 percent) are found along the primary tributary pathways draining to the lake. These are considered to have high to moderate infiltration potential, but due to elevated water table conditions, will act more similarly to soils with low infiltration potential.

5.6.3.4 Septic Systems

An estimated 266 septic systems are within the boundaries of the Lake Tom John basin based on the FDOH septic tank layer (**Figure 5-108**). The septic tanks are located throughout most of the unincorporated areas in the basin with limited systems at the northern end.

5.6.3.5 Hydrologic Data

No recent historic or present hydrologic monitoring stations are located within the Lake Tom John basin.

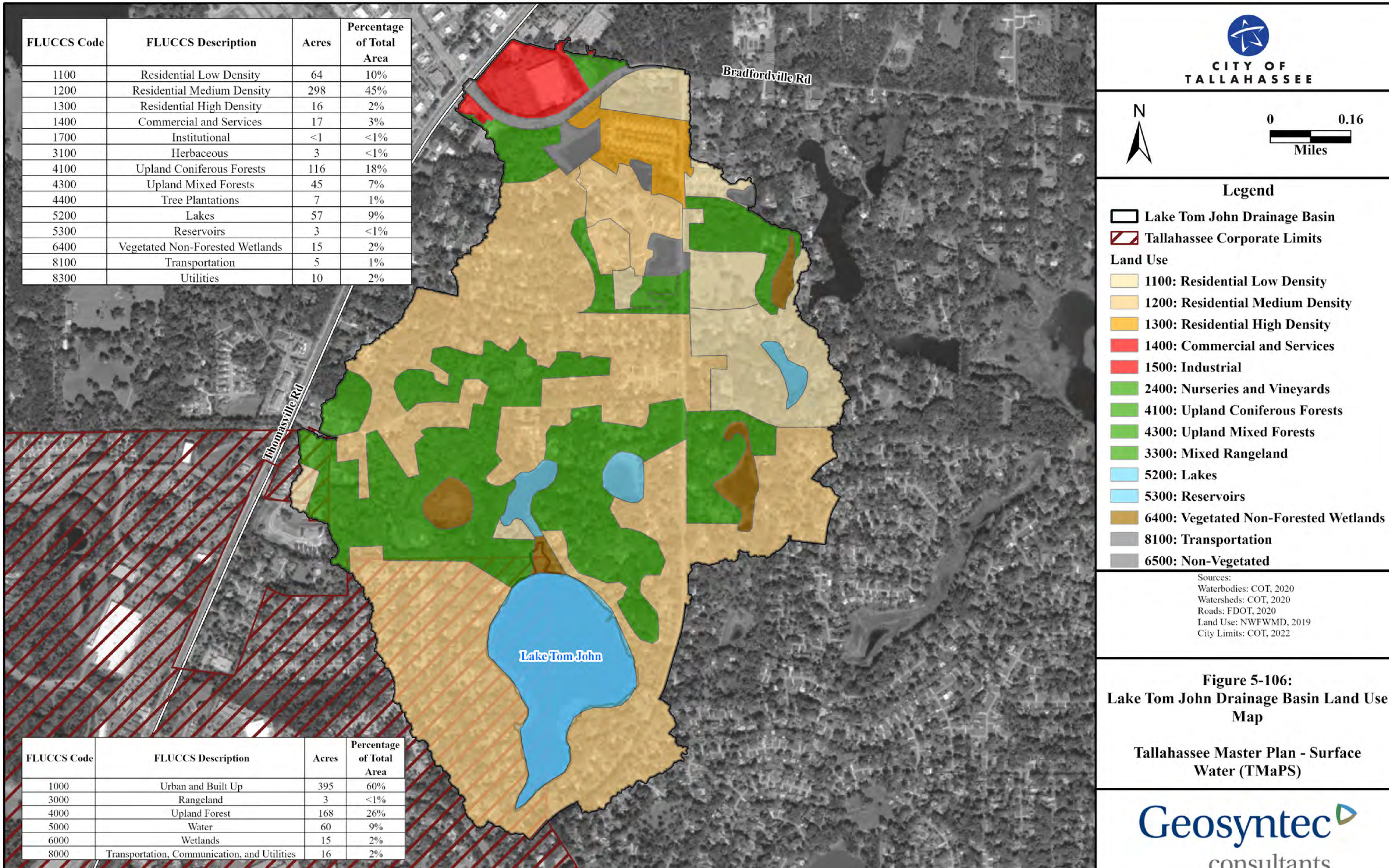
5.6.3.6 Surface Water Quality Data

The IWR dataset for Lake Tom John (WBID 647A) spans primarily from 2016 to the present and includes contributions from local and state agencies (City, Leon County and FDEP). One year's worth of data were collected quarterly in 2005 but that is the only data prior to 2016.

Figure 5-109 presents the locations of in-lake water quality monitoring stations for Lake Tom John (yellow). No data have been collected in the tributaries draining into or out of the lake. A table is provided in **Figure 5-109** that shows the station ID, station name, period of record, and if the station represents in-lake or tributary data. Based on the number of stations and the length of the station IDs, station IDs were not included on the figure, rather each of the stations is given a number and the numbers correspond to stations in the table.

Figure 5-109 shows that the only stations with a continuous record are the stations located in the middle of the lake. These are stations 1 and 6, which are basically at the same location.

FLUCCS Code	FLUCCS Description	Acres	Percentage of Total Area
1100	Residential Low Density	64	10%
1200	Residential Medium Density	298	45%
1300	Residential High Density	16	2%
1400	Commercial and Services	17	3%
1700	Institutional	<1	<1%
3100	Herbaceous	3	<1%
4100	Upland Coniferous Forests	116	18%
4300	Upland Mixed Forests	45	7%
4400	Tree Plantations	7	1%
5200	Lakes	57	9%
5300	Reservoirs	3	<1%
6400	Vegetated Non-Forested Wetlands	15	2%
8100	Transportation	5	1%
8300	Utilities	10	2%



FLUCCS Code	FLUCCS Description	Acres	Percentage of Total Area
1000	Urban and Built Up	395	60%
3000	Rangeland	3	<1%
4000	Upland Forest	168	26%
5000	Water	60	9%
6000	Wetlands	15	2%
8000	Transportation, Communication, and Utilities	16	2%

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Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Land Use: NWFWMD, 2019
City Limits: COT, 2022

**Figure 5-106:
Lake Tom John Drainage Basin Land Use Map**

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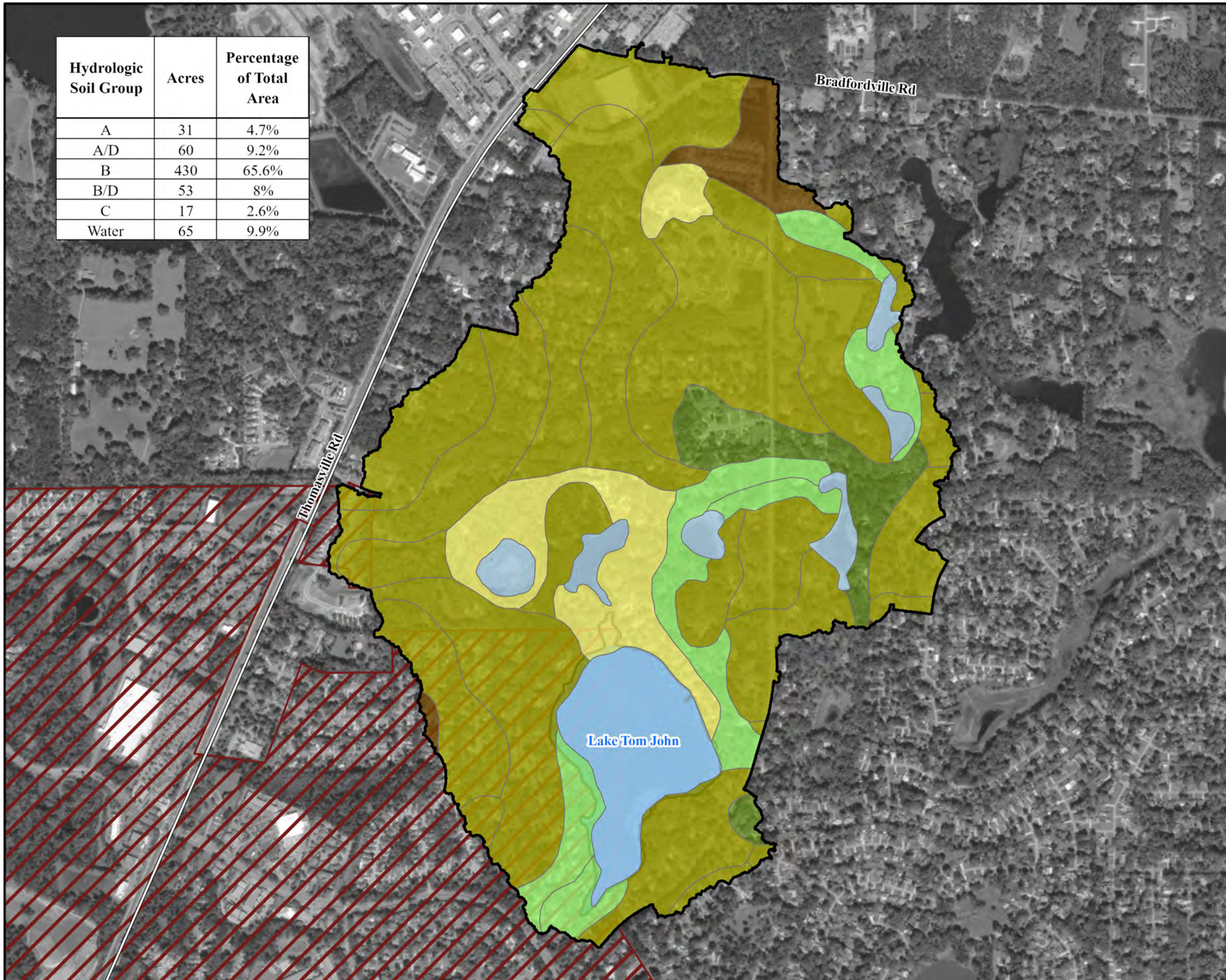

Hydrologic Soil Group	Acres	Percentage of Total Area
A	31	4.7%
A/D	60	9.2%
B	430	65.6%
B/D	53	8%
C	17	2.6%
Water	65	9.9%

CITY OF TALLAHASSEE

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Miles

Legend

- Lake Tom John Drainage Basin
- Tallahassee Corporate Limits

Hydrologic Soil Group

- A
- A/D
- B
- B/D
- C
- Water

Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Soils: NRCS, 2020
City Limits: COT, 2022

Figure 5-107:
Lake Tom John Drainage Basin Soils Map

Tallahassee Master Plan - Surface Water (TMaPS)

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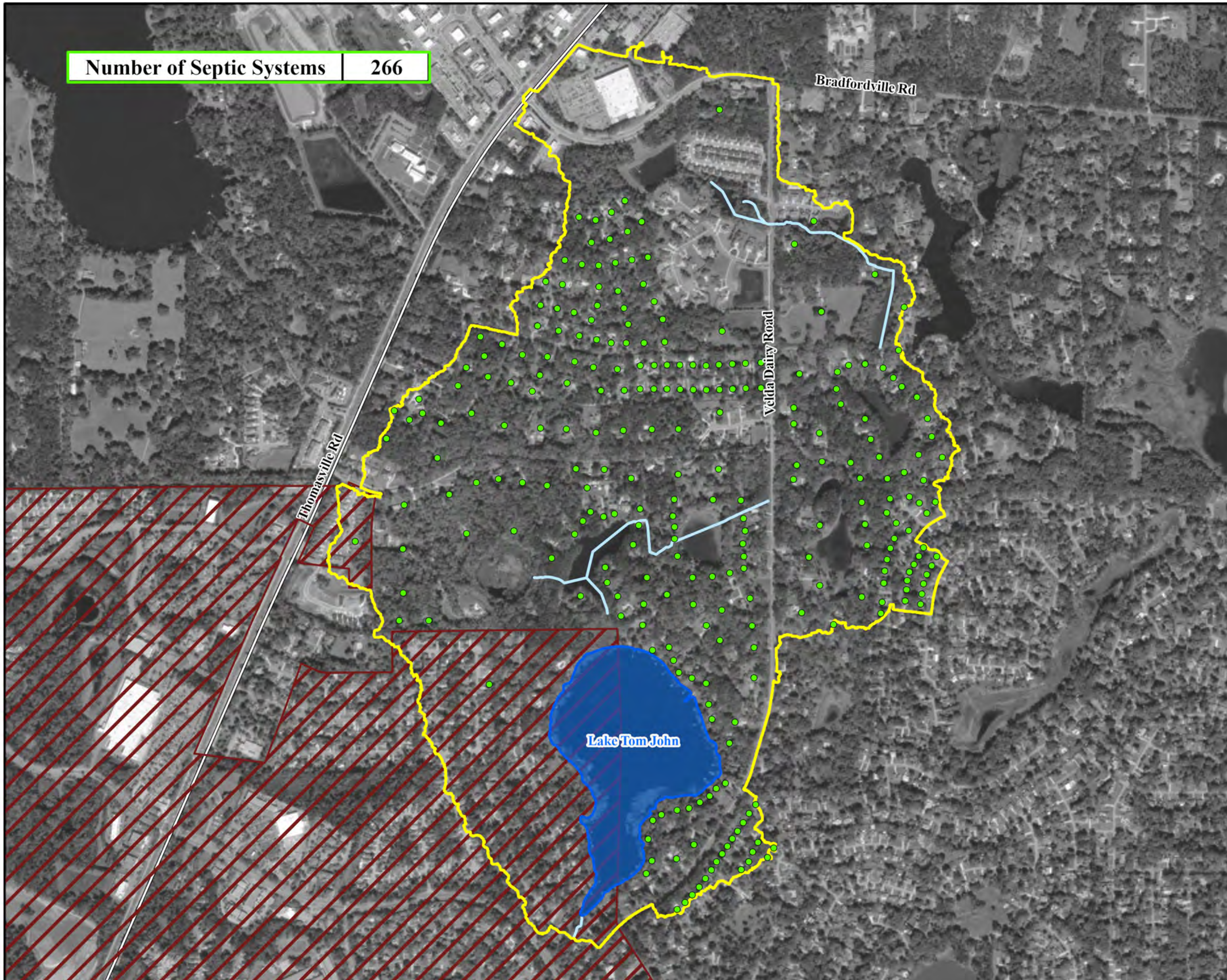

CITY OF TALLAHASSEE

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Miles

Legend

- Lake Tom John Drainage Basin
- Waterbodies in Study
- Watercourses
- Tallahassee Corporate Limits
- Septics Systems

Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
Septic Systems: COT, 2020
City Limits: COT, 2022

Figure 5-108:
Lake Tom John Drainage Basin Septic Systems Map

Tallahassee Master Plan - Surface Water (TMaPS)

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Number	Station ID	Station Name	Start of Record	End of Record	Position
1	21FLCOT LAKE TOM JOHN	Lake Tom John	2019	2022	In-Lake
2	21FLKWATLEO-TOMJOHN-1	Leon-Tom John-1	2021	2021	In-Lake
3	21FLKWATLEO-TOMJOHN-2	Leon-Tom John-2	2021	2021	In-Lake
4	21FLKWATLEO-TOMJOHN-3	Leon-Tom John-3	2021	2021	In-Lake
5	21FLWQSPLEO134UL	Tom John Pond near dock at end of berm (WBID 647A)	2005	2005	In-Lake
6	21FLWQA G1WA0043	Lake Tom John Middle	2016	2019	In-Lake

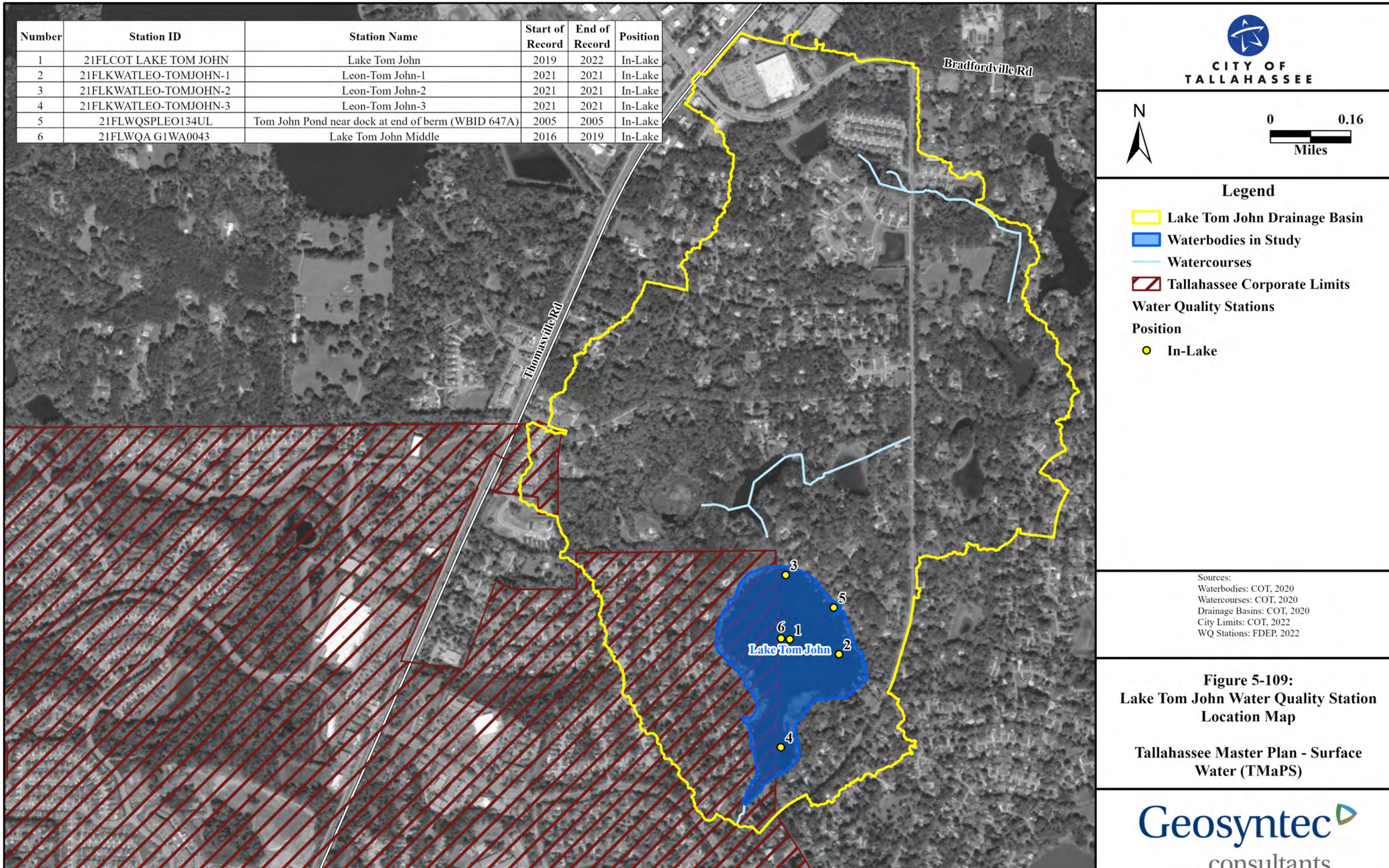

Figure 5-109: Lake Tom John Water Quality Station Location Map

Tallahassee Master Plan - Surface Water (TMaPS)

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Some initial plots of the available data in the lake are provided in this section, which includes plots of the raw data and trends along with AGM. Nutrients are the primary constituent of interest relative to water quality conditions in Lake Tom John, therefore, plots are provided for the key parameters related to potential nutrient impairment. These include TN, TP, Chl-a, and TSI. As discussed earlier, where available, data are plotted from 2010 to 2020 to represent present conditions. For Tom John data are plotted from 2016 to 2020. Additionally, based on interest in the area relative to septic systems and other sources, bacteria, specifically *E. coli* are included. Additional data plots and analyses are provided as part of the qualitative assessment of sources in **Section 5.6.4**.

Figure 5-110 through **Figure 5-112** present plots of the measured TN, TP and Chl-a from 2016 to 2020. The TN concentrations are relatively consistent from 2016 through 2020. TP concentrations show somewhat of a downward trend. Chl-a concentrations are highly variable year to year.

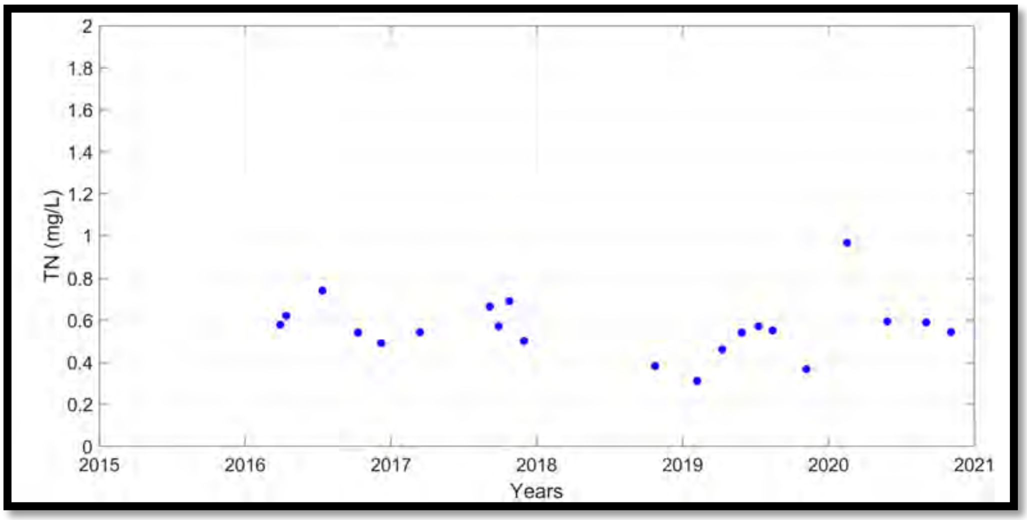


Figure 5-110: Plot of Measured TN (2016-2020)

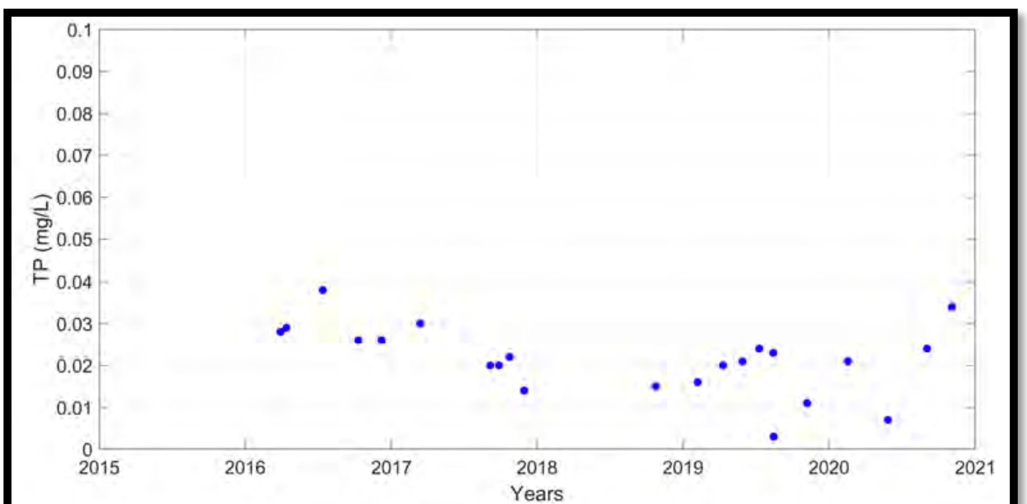


Figure 5-111: Plot of Measured TP (2016-2020)

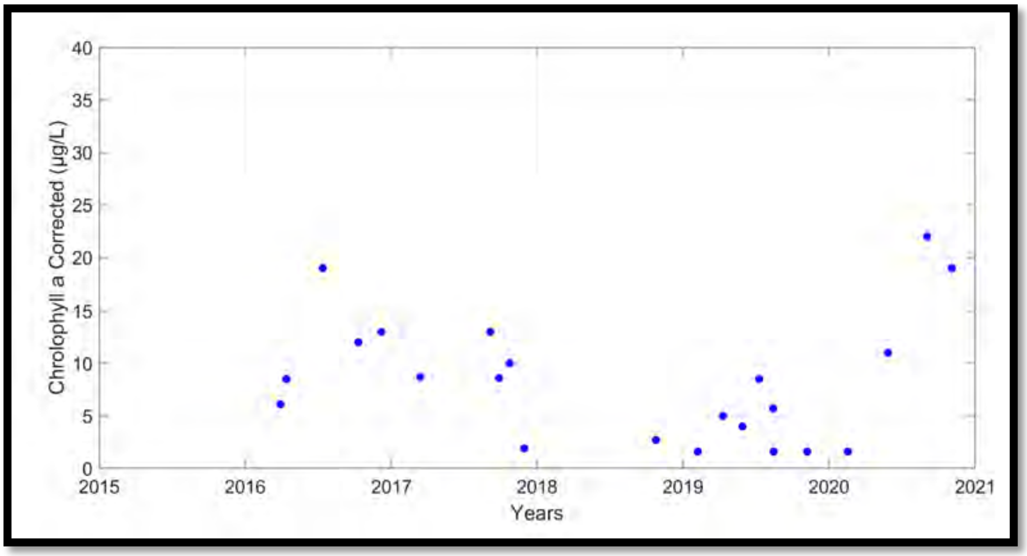


Figure 5-112: Plot of Measured Chl-a (2016-2020)

Under FDEP's NNC, Lake Tom John is defined as a low color, low alkalinity system. Based on this designation, the AGM threshold for Chl-a is 6 µg/L. For TN and TP, a range of concentrations are allowable, based on maintaining Chl-a levels in the lake below 6 µg/L. For TN, the range is 0.51 mg/L to 0.93 mg/L. For TP, the range is 0.01 mg/L to 0.03 mg/L. The designation is based on long-term average color lower than 40 PCU and long-term alkalinity levels less than 20 mg/L. Presently, the long-term average alkalinity is 18-19 mg/L which is right near the 20 mg/L. If the long-term average alkalinity were greater than 20 mg/L the lake would not be impaired. At present for *E. coli*, the criteria are monthly geometric means below 126 colonies per 100 mL of water and less than 10 percent of samples above 410 colonies per 100 mL of water in any 30-day period.

TN, TP, and Chl-a, AGMs are plotted in **Figure 5-113** through **Figure 5-115** as these define the status of the lake relative to nutrient impairments. Where sufficient data are available to assess the AGMs, the levels are provided from 2016 through 2020. The Chl-a threshold and the minimum and maximum thresholds for TN and TP relative to the NNC are on each of the graphs as pink dashed lines. **Figure 5-116** presents a plot of calculated TSI values in the lake. While TSI is no longer utilized for the determination of impairment, it does serve as an indicator of lake health. Based on TSI definitions, levels below 60 are deemed good condition, levels between 60 and 70 indicate fair condition, while levels above 70 indicate poor condition. **Figure 5-117** presents a plot of *E. coli* data for the available period of record.

Examination of the TN plot **(Figure 5-113)** shows that from 2016 to 2020 TN AGM levels have been just above or below the minimum threshold. TP AGM levels **(Figure 5-114)** have fallen between the minimum and maximum threshold values for each of the years with the later years closer to the minimum. The Chl-a AGMs from 2016 through 2020 (**Figure 5-115**) were above the 6 µg/L threshold in 3 of the 4 years with all levels generally around or below 10 µg/L. Under the case where the lake long-term average alkalinity is above 20 mg/L all Chl-a AGMs would be well below the threshold.

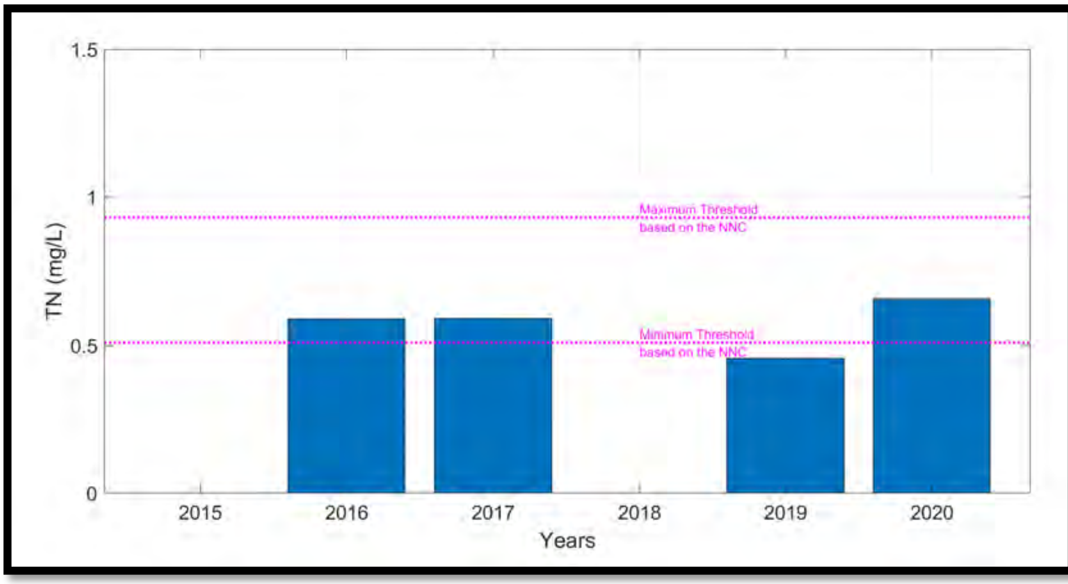


Figure 5-113: Plot of Annual Geometric Means for TN with NNC Criteria for Lake Tom John

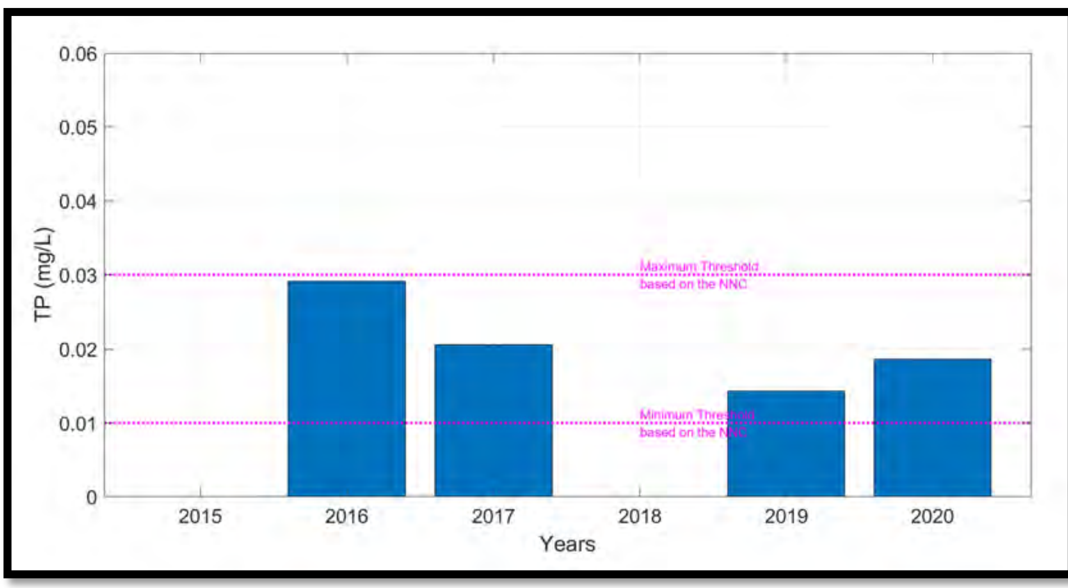


Figure 5-114: Plot of Annual Geometric Means for TP with NNC Criteria for Lake Tom John

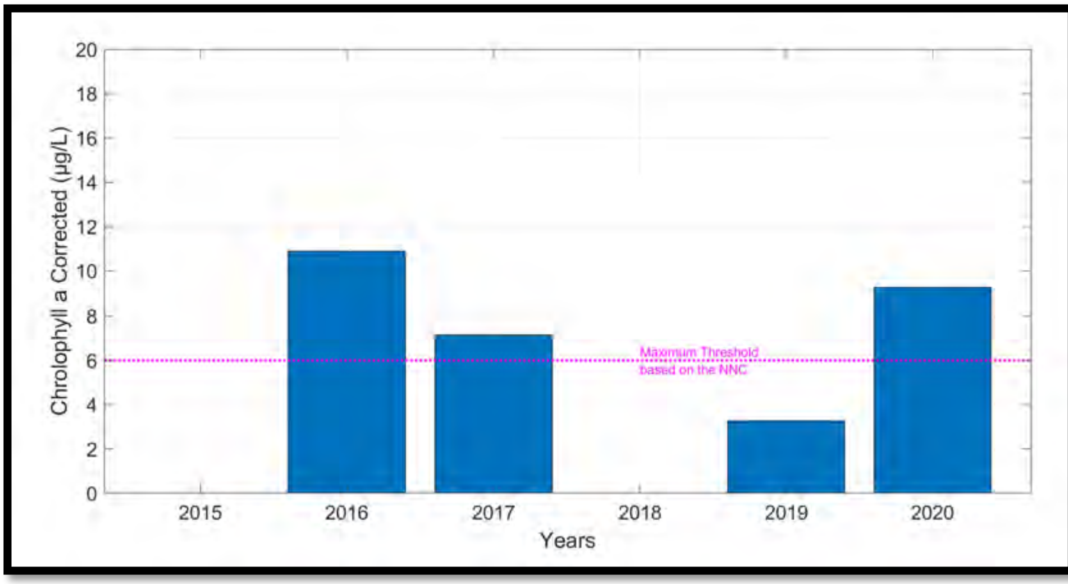


Figure 5-115: Plot of Annual Geometric Means for Chl-a with NNC Criteria for Lake Tom John

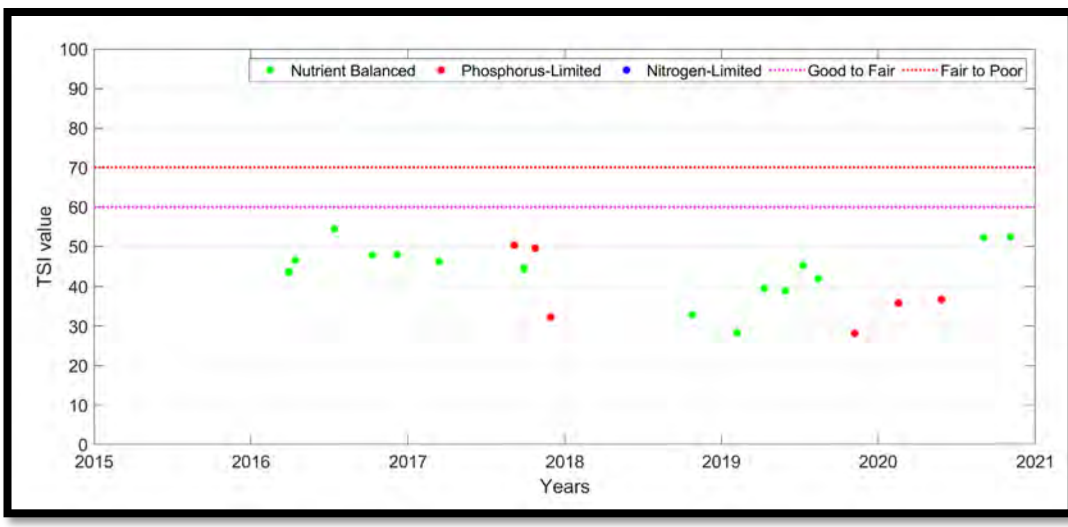


Figure 5-116: Trophic State Index for Lake Tom John (2016 to 2020)

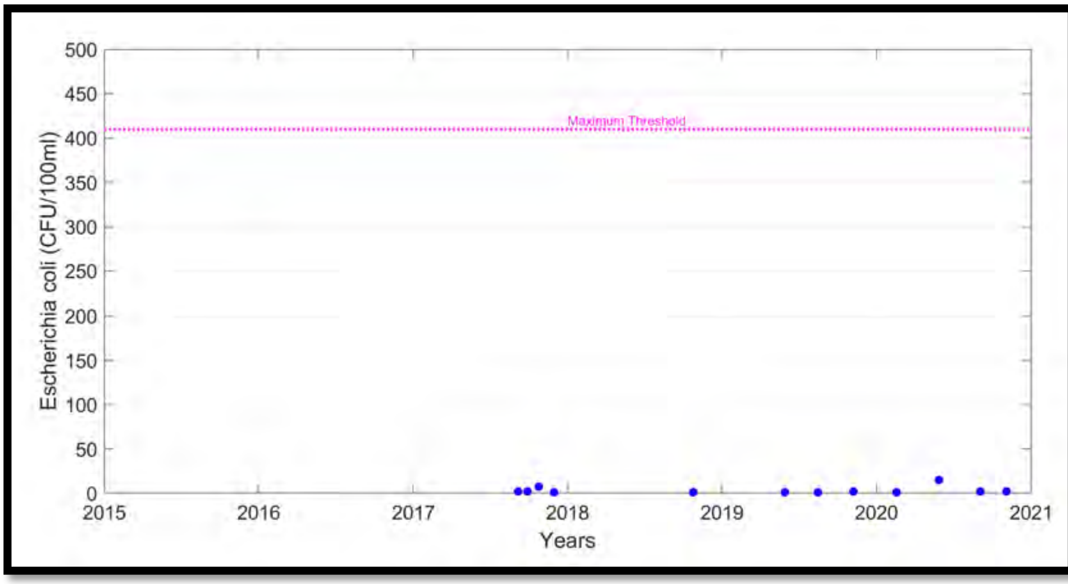


Figure 5-117: Plot of *E. coli* Measurements (2016 to 2020)

Examination of the TSI plot **(Figure 5-116)** shows all measurements in the good range with generally nutrient balanced conditions. No values went above the 60 threshold during the period of record.

Figure 5-117 presents a plot of measured *E. coli* levels in the lake from 2016 through 2020. The data all show very low values, with most at below detection limits.

5.6.3.7 Groundwater Data

Presently, there are no surficial groundwater monitoring wells within the Lake Tom John basin.

5.6.3.8 Biological Data

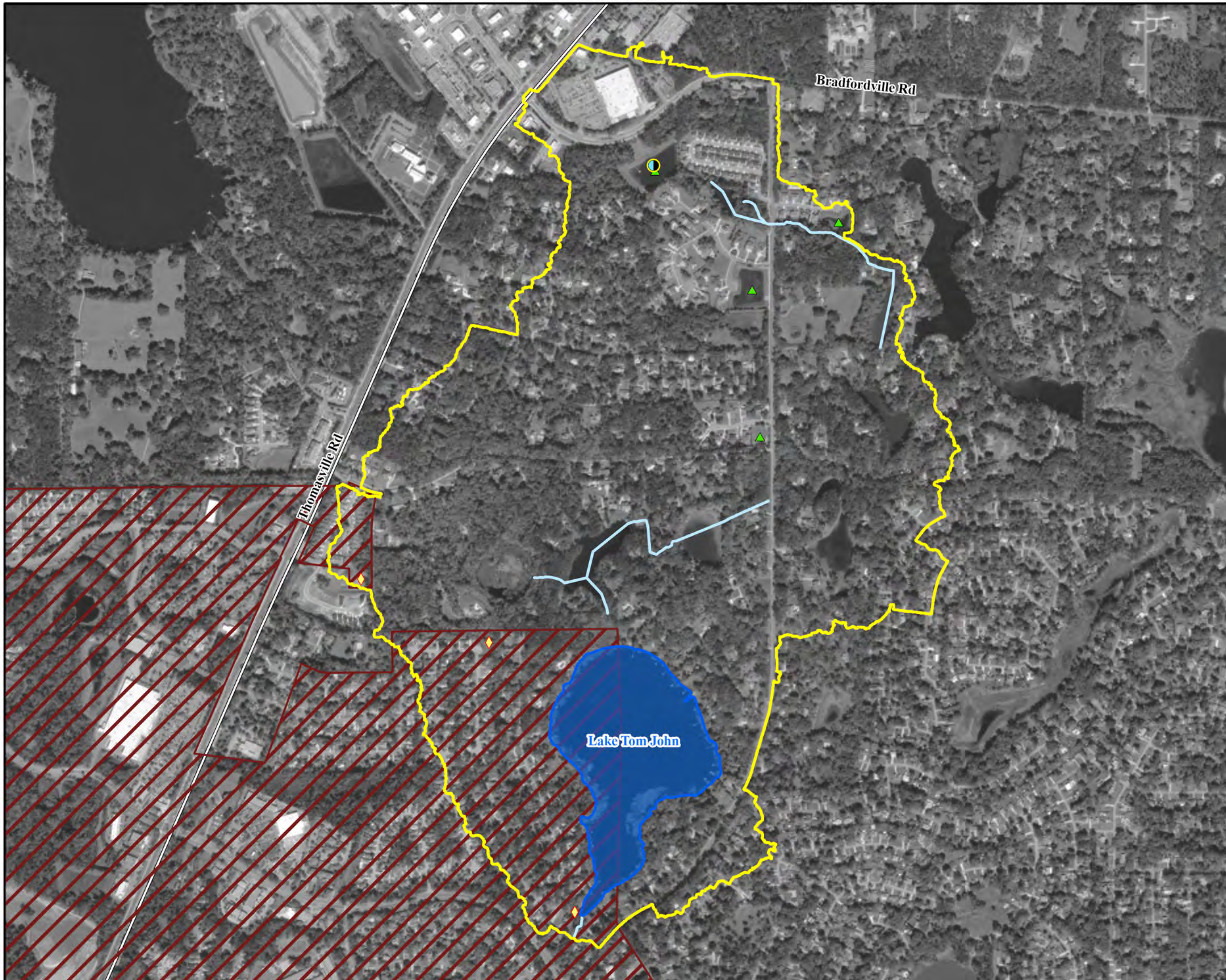
Table 5-20 presents LVI data collected in Lake Tom John. Only a single assessment is available for the lake. The LVI determination was 55, which represents a healthy condition.

Table 5-20: Summary of LVI Results from Lake Tom John

Date	Station ID	LVI	Aquatic Life Use Category
10/24/2018	21FLWQA G1WA0043	55	Healthy

5.6.3.9 Stormwater Treatment Facilities

Figure 5-118 presents a map showing the locations of stormwater treatment facilities throughout the Lake Tom John Basin. The figure shows a limited number of stormwater ponds within the basin. There are three Leon County facilities located along Velda Dairy Road, one large FDOT/Leon County facility at the upper end of the basin in the area of the commercial development, and three City facilities on the western side of the lake.



CITY OF TALLAHASSEE

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Miles

Legend

- Lake Tom John Drainage Basin
- Waterbodies in Study
- Watercourses
- Tallahassee Corporate Limits
- City of Tallahassee Stormwater Ponds
- Leon County Stormwater Ponds
- FDOT Stormwater Ponds

Sources:
Waterbodies: COT, 2020
Watersheds: COT, 2020
Roads: FDOT, 2020
BMPs: Geosyntec, 2022
City Limits: COT, 2022

Figure 5-118:
Lake Tom John Basin BMP Location Map

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

5.6.3.10 Atmospheric Deposition Data

Section 5.4.3.11 presented the location of the nearest atmospheric deposition station to the Lake Lafayette basin. The data from this station will be utilized to calculate atmospheric deposition to Lake Tom John.

5.6.3.11 Data Summary

For the purposes of the qualitative analysis of sources of pollutants to Lake Tom John (**Section 5.6.4**), the available data are limited. There are sufficient active surface water quality stations within the lake to support the qualitative assessment but data in the upstream reaches that flow into the lake do not exist. Specific recommendations on additional data collection efforts are provided in **Section 5.10.** The following outlines limitations in the available data.

- No hydrologic data (level or inflow/outflow) data has been collected on the lake or in the upstream discharge to the lake or the downstream discharge to the Killearn Chain of Lakes.
- There are no water quality monitoring stations for the inflow to the lake which represents the bulk of the stormwater inflow from the drainage basin.
- No surficial groundwater monitoring stations are located in the vicinity to determine the quality of potential seepage into the lake or ditch segments.
- No data are available to determine the potential for internal loading as a source.

5.6.4 Qualitative Assessment of Sources

As outlined in previous sections, prior to performing loading calculations and other analyses to quantify existing pollutant sources to Lake Tom John, it is important to analyze available data and summarize findings from historical studies to support identification of likely sources.

For Lake Tom John, the sources to be evaluated include the following:

- Stormwater runoff
- Septic systems
- Internal recycling and seepage
- Wastewater
- Atmospheric deposition
- Interconnected flows

An overview of analyses and findings for each source listed above is provided in the following sections.

5.6.4.1 Stormwater Runoff

To assess stormwater runoff as a potential source of pollutant loads to Lake Tom John the LDI level within the subbasin draining to the lake was evaluated. LDI values for the full basin draining to the Killearn Chain of Lakes were presented on **Figure 5-95** including the Lake Tom John Basin. The map shows that for the watershed draining to Lake Tom John, LDI levels are moderate, which would indicate that this area has potential for anthropogenic pollutant loads from stormwater runoff. No data are available for any of the tributaries flowing into Lake Tom John to support direct assessment of stormwater runoff.

5.6.4.2 Septic Systems

Figure 5-108 presented the locations of septic systems within the Lake Tom John basin. **Figure 5-96** presented a map showing the septic tank densities by subbasin for the Killearn Chain of Lakes, including Lake Tom John. For the overall area draining to Lake Tom John (**Figure 5-96**) the septic densities are around 1 system per 2 acres. Examination of the locations of the septic systems (**Figure 5-108**) shows there are a number of systems close to the lake along the eastern shore as well as along the tributaries and smaller lakes that drain into the upper end of Lake Tom John which increases their potential as a source of pollutants to the lake and drain. Presently, based on the low *E. coli* levels measured in the lake center (**Figure 5-117**), it would not appear that septic systems are likely not a significant source, but the potential loading will be quantified in **Section 5.6.5**.

5.6.4.3 Internal Recycling and Seepage

<u>Internal Recycling</u>

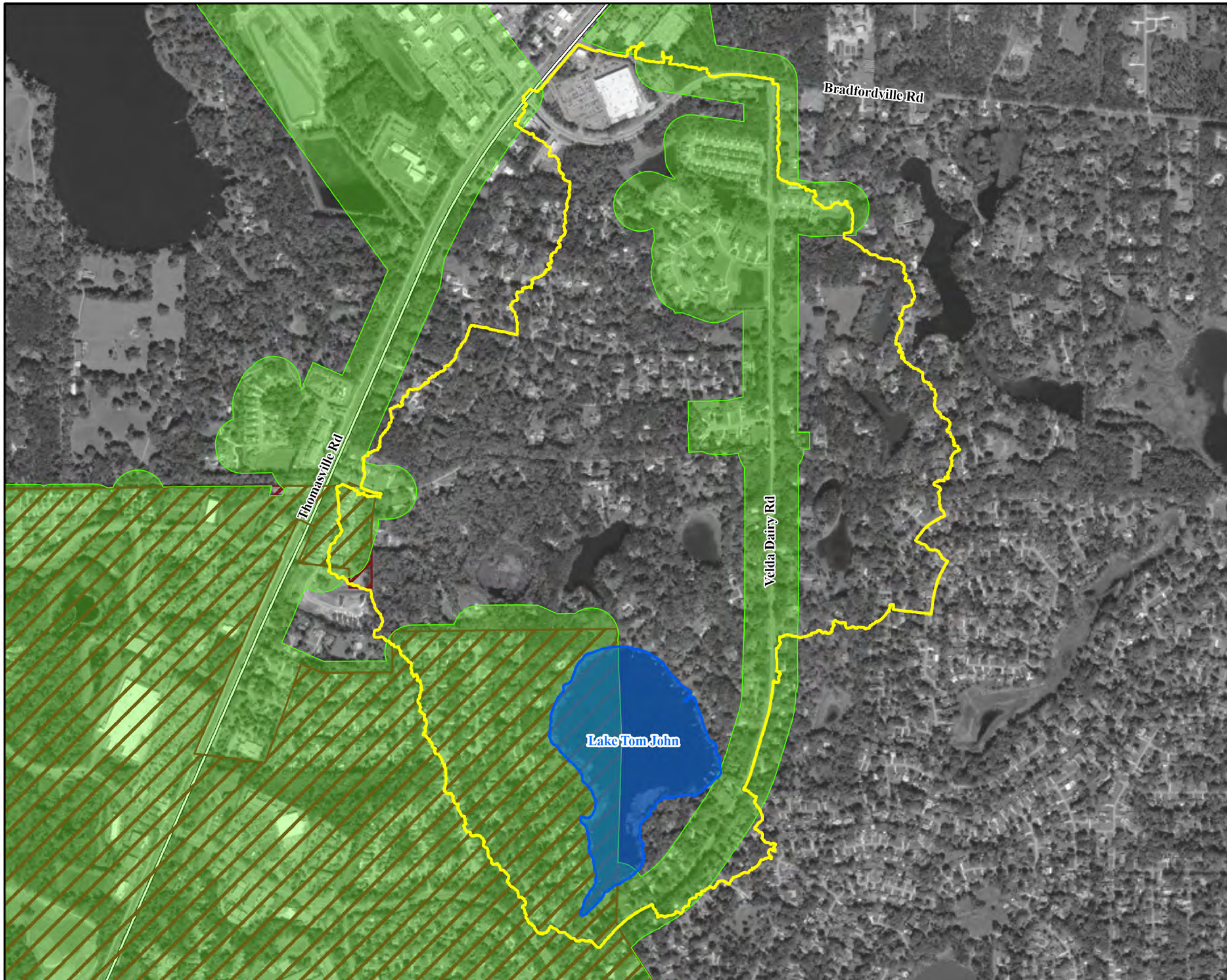
To date, no studies or data collection efforts have been undertaken to assess the potential for loading from sediments in Lake Tom John. Presently, based on the criteria outlined and discussed in **Section 5.5.2**, the lake is impaired for nutrients. While concerns exist on the applicability of the NNC targets for the lake, the impaired status would indicate a need to further quantify potential sources to the lake including internal recycling. As such, internal recycling is identified as a potential source of loads to the lake.

<u>Seepage</u>

As outlined in **Section 5.6.3.7**, no surficial aquifer data in the immediate vicinity of the lake and drain were identified. As was outlined for internal recycling, seepage is identified as a potential source to the lake that has not been quantified. As septic is the most likely source of seepage load, the evaluation of septic load would address this load source. The determination for septic loading (**Section 5.6.3.4**) was that it is likely not a significant source, but it will be quantified in **Section 5.6.5**.

5.6.4.4 Wastewater

Within the Lake Tom John basin, there currently are no direct wastewater discharges. Additionally, no areas in the Lake Lafayette basin presently have reuse discharges. **Figure 5-119** presents a map of the Lake Tom John basin boundaries in relation to sewer service areas and sewer infrastructure. The sewer infrastructure within the drainage basin is located along Velda Dairy Road and the incorporated area to the west of the lake. As was defined for septic systems, bacteria data do not indicate sources of sewage to the lake. Therefore, wastewater infrastructure is not identified as a potential significant source of pollutant loads to Lake Tom John.



CITY OF TALLAHASSEE

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Legend

- Lake Tom John Drainage Basin
- Waterbodies in Study
- Tallahassee Corporate Limits
- Sewer Service Areas

Sources:
Waterbodies: COT, 2020
Drainage Basins: COT, 2020
Roads: FDOT, 2020
City Limits: COT, 2022
Waste Water: COT, 2020

Figure 5-119:
City of Tallahassee Wastewater Service Areas within Lake Tom John Basin

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

5.6.4.5 Atmospheric Deposition

For the immediate Lake Tom John basin, the ratio of the watershed area to lake area is around 16:1. With this ratio, and the potential attenuation of rainfall runoff, direct atmospheric deposition to the lake can play a role in overall loading, especially for nitrogen. **Section 5.5.3.10** identified the nearest atmospheric deposition station as the Quincy Station (FL14) (**Figure 5-35**).

5.6.4.6 Interconnected Flows

Presently the bulk of the drainage basin flows into Lake Bess located immediately north of Lake Tom John and then discharges to Lake Tom John. As such, the interconnected flow into Lake Tom John may represent the primary loading of stormwater runoff from the basin and may be a significant source of load to Lake Tom John. As discussed earlier, presently there is no data available for Lake Bess or for the flow from Lake Bess into Lake Tom John.

5.6.4.7 Summary of Findings

Based on the discussions above, and data and information presented in **Section 5.5.3**, there are various potential sources of pollutant loads to Lake Tom John. Stormwater runoff contributing to direct inflow and interconnected flow from upstream waterbodies (Lake Bess) is identified as a potentially significant anthropogenic load and is quantified in **Section 5.6.5**. Internal loading is also identified as a potential load but at present data are not available to quantify it. Though not identified as potential significant sources, septic systems and atmospheric deposition are quantified for comparative purposes in **Section 5.6.5** based on available data.

5.6.5 Calculation of Potential Nutrient Loads

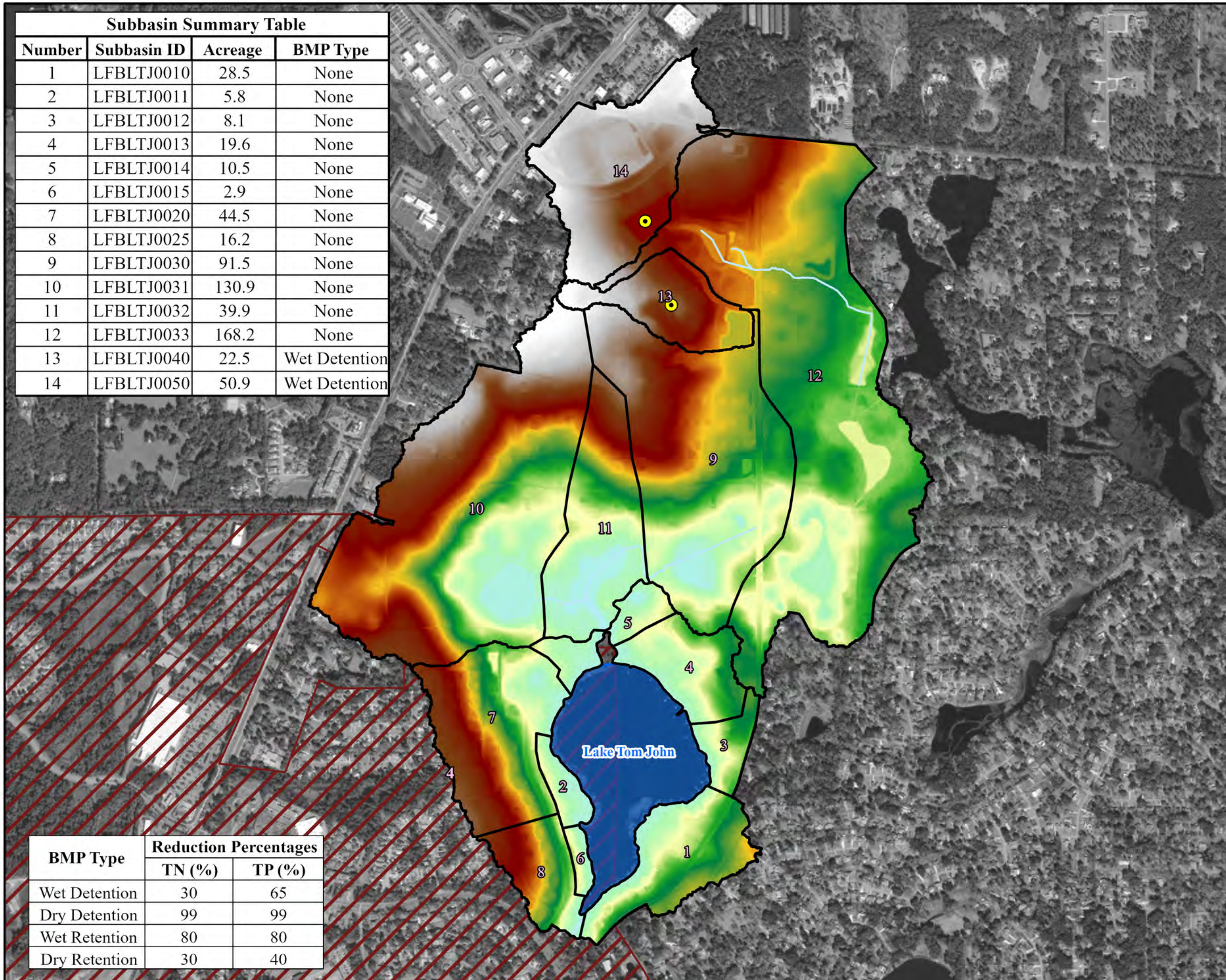
This section presents calculations of potential nutrient (TN and TP) loads to Lake Tom John for the sources identified for calculation in **Section 5.6.4.7.** These include stormwater runoff, septic systems, and atmospheric deposition. Where loads were not calculated the sections below provide brief discussions. The load calculations are for the purpose of comparing the potential magnitudes of each source relative to one another to support determination of sources to target for load reduction.

5.6.5.1 Stormwater Pollutant Load

In order to calculate the stormwater TN and TP loads to Lake Tom John, average annual pollutant load modeling was performed. The goal was to identify outfalls that are contributing higher TN and TP loads relative to one another and to quantify the total TN and TP loads to Lake Tom John. TN and TP loads were calculated using the Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE-Seasonal) model. The model methodology was described in detail in **Section 5.4.5.1** for the stormwater loads to the Lake Lafayette Chain of Lakes.

Figure 5-120 presents the subbasins and the DEM utilized in the SIMPLE model calculations for Lake Tom John. **Figure 5-121** presents the aggregated land use. Finally, **Figure 5-122** presents the CDAs for the Lake Tom John stormwater loading to define total and per acre TN and TP loads, as well as the ranking of CDAs around the lake.

Subbasin Summary Table			
Number	Subbasin ID	Acreage	BMP Type
1	LFBLTJ0010	28.5	None
2	LFBLTJ0011	5.8	None
3	LFBLTJ0012	8.1	None
4	LFBLTJ0013	19.6	None
5	LFBLTJ0014	10.5	None
6	LFBLTJ0015	2.9	None
7	LFBLTJ0020	44.5	None
8	LFBLTJ0025	16.2	None
9	LFBLTJ0030	91.5	None
10	LFBLTJ0031	130.9	None
11	LFBLTJ0032	39.9	None
12	LFBLTJ0033	168.2	None
13	LFBLTJ0040	22.5	Wet Detention
14	LFBLTJ0050	50.9	Wet Detention



BMP Type	Reduction Percentages	
	TN (%)	TP (%)
Wet Detention	30	65
Dry Detention	99	99
Wet Retention	80	80
Dry Retention	30	40

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Legend

Subbasins

Waterbodies in Study

Watercourses

Tallahassee Corporate Limits

BMP Type

Wet Detention

Topographic Elevations

ft NAVD88

242

103

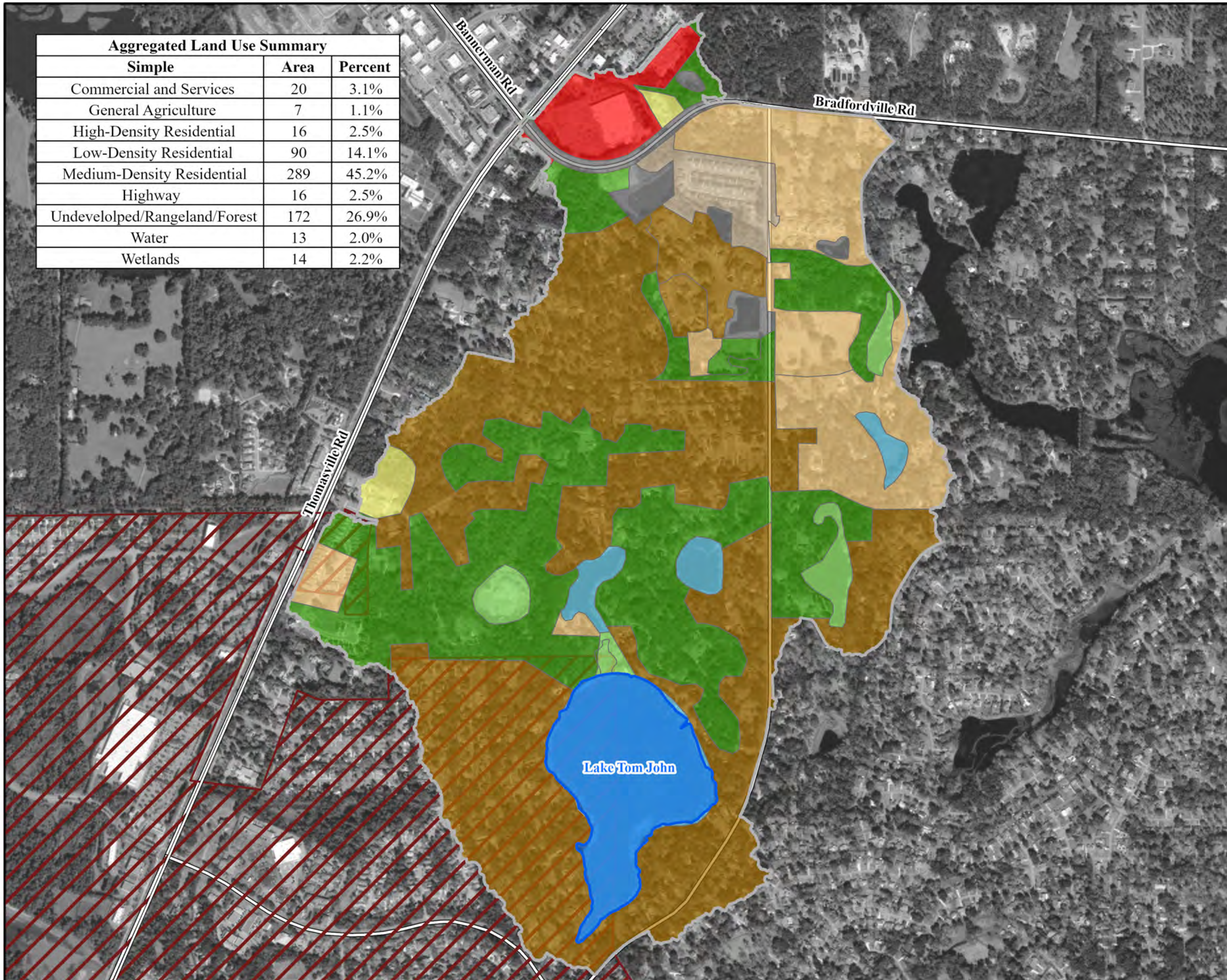
Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Subbasins: Geosyntec, 2022
Roads: COT-Leon County, 2023
City Limits: COT, 2022
BMPs: Geosyntec, 2023
Elevation: COT-Leon County, 2018

Figure 5-120:
Lake Tom John Subbasin Delineation and BMPs

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

Aggregated Land Use Summary		
Simple	Area	Percent
Commercial and Services	20	3.1%
General Agriculture	7	1.1%
High-Density Residential	16	2.5%
Low-Density Residential	90	14.1%
Medium-Density Residential	289	45.2%
Highway	16	2.5%
Undevelolped/Rangeland/Forest	172	26.9%
Water	13	2.0%
Wetlands	14	2.2%



CITY OF TALLAHASSEE

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Legend

- Lake Tom John Drainage Basin
- Waterbodies in Study
- Tallahassee Corporate Limits

Aggregated Land Use

Land Use Type

- Commercial and Services
- General Agriculture
- High-Density Residential
- Low-Density Residential
- Medium-Density Residential
- Highway
- Undeveloped/Rangeland/Forest
- Water
- Wetlands

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Land Use: Geosyntec, 2023
Roads: FDOT, 2020
City Limits: COT, 2020

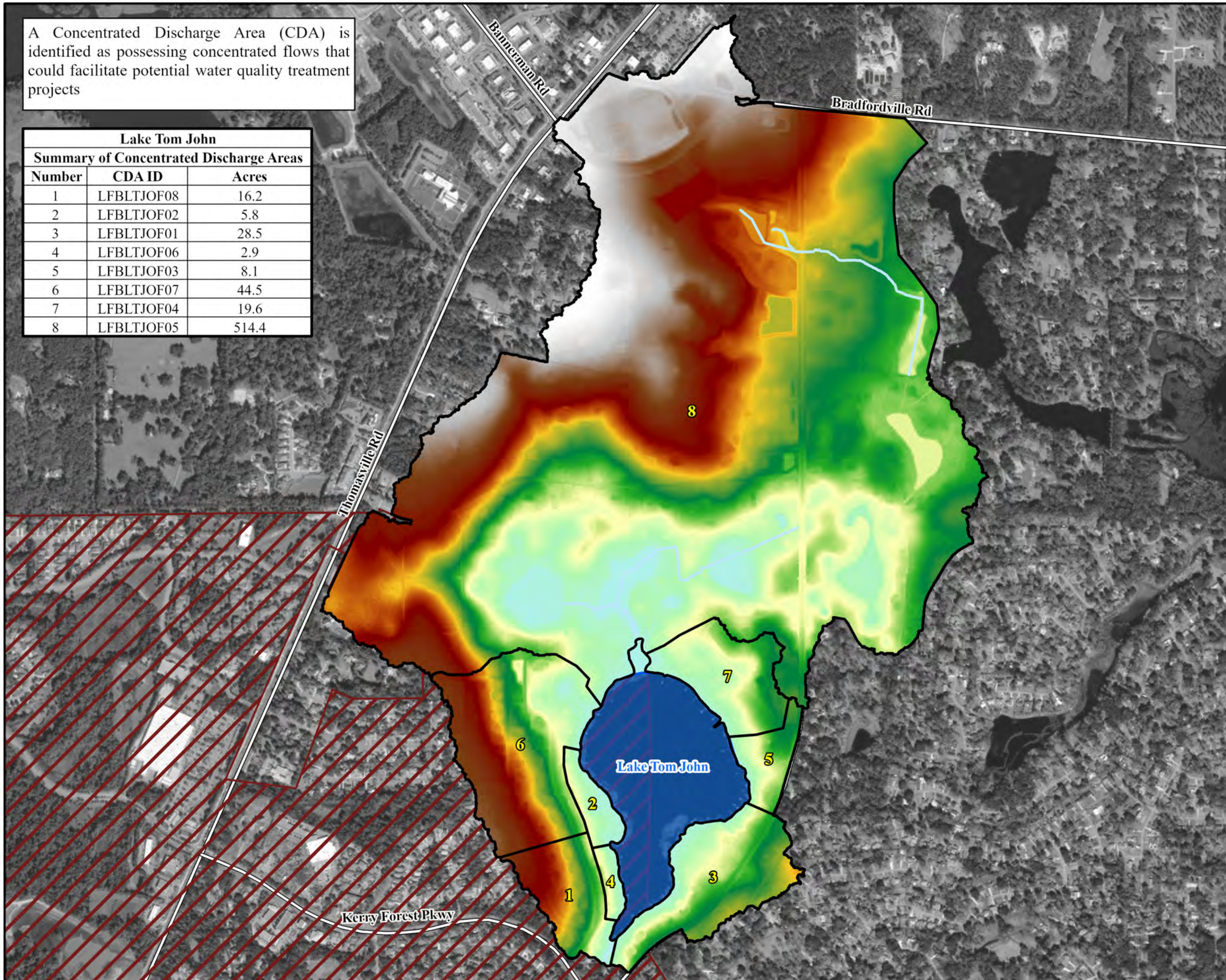
Figure 5-121:
Lake Tom John Aggregated Land Use

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

A Concentrated Discharge Area (CDA) is identified as possessing concentrated flows that could facilitate potential water quality treatment projects

Lake Tom John		
Summary of Concentrated Discharge Areas		
Number	CDA ID	Acres
1	LFBLTJOF08	16.2
2	LFBLTJOF02	5.8
3	LFBLTJOF01	28.5
4	LFBLTJOF06	2.9
5	LFBLTJOF03	8.1
6	LFBLTJOF07	44.5
7	LFBLTJOF04	19.6
8	LFBLTJOF05	514.4



CITY OF TALLAHASSEE

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
CDAs: Geosyntec, 2022
Roads: COT-Leon County, 2023
City Limits: COT, 2022
Elevation: COT-Leon County, 2018

Figure 5-122: Lake Tom John Concentrated Discharge Areas

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

Stormwater Nutrient Loads to Lake Tom John

Figure 5-123 presents the distribution of the ranking of the CDAs for TN along with the total load and per acre loads, see the table on **Figure 5-123**. The rankings are color coded with the highest ranked CDAs in dark green moving down to the lowest ranked in pale yellow. The calculated total stormwater TN loads from the CDAs ranged from as low as 11.4 lb/yr up to 1741.8 lb/yr. The per acre loads ranged from 1.6 lb/acre/yr up to 4.0 lb/acre/yr. The map identifies two CDAs as ranking highest, these are on the west side of the lake within the Cities incorporated area. The total potential stormwater runoff load for TN for Lake Tom John is 2,194 lb/yr.

Figure 5-124 presents the distribution of the ranking of the CDAs for TP along with the total load and per acre loads, see the table on **Figure 5-124**. The calculated total stormwater TP loads from the CDAs ranged from as low as 3.1 lb/yr up to 316.5 lb/yr. The per acre loads ranged from 0.45 lb/acre/yr up to 1.1 lb/acre/yr. The total potential stormwater runoff load for TP for Lake Tom John is 438.2 lb/yr.

5.6.5.2 Septic Load

In order to analyze the potential impacts from septic tank units to Lake Tom John, the SPIL method adopted by the FDEP was utilized to quantify the potential septic load. The approach and calculations were described earlier in **Section 5.4.5.2** which presented the septic loading to the Lake Lafayette Chain of Lakes. As outlined earlier, the calculations were only done for nitrogen (TN), and based on literature on transport and assimilation, may represent a conservative potential load.

There were 104 septic tank units identified within 200 meters of Lake Tom John and the primary tributary (and lakes) that drain to the north end of Lake Tom John. **Figure 5-125** shows the septic systems utilized in the analyses with those associated with direct loading to the lake as green and those to the tributary and lakes upstream as pink. A table provided on the figure summarizes the calculated TN load from septic units. The calculated direct load to the lake is 627 lb/yr and the load to the tributary/lakes is 497 lb/yr.

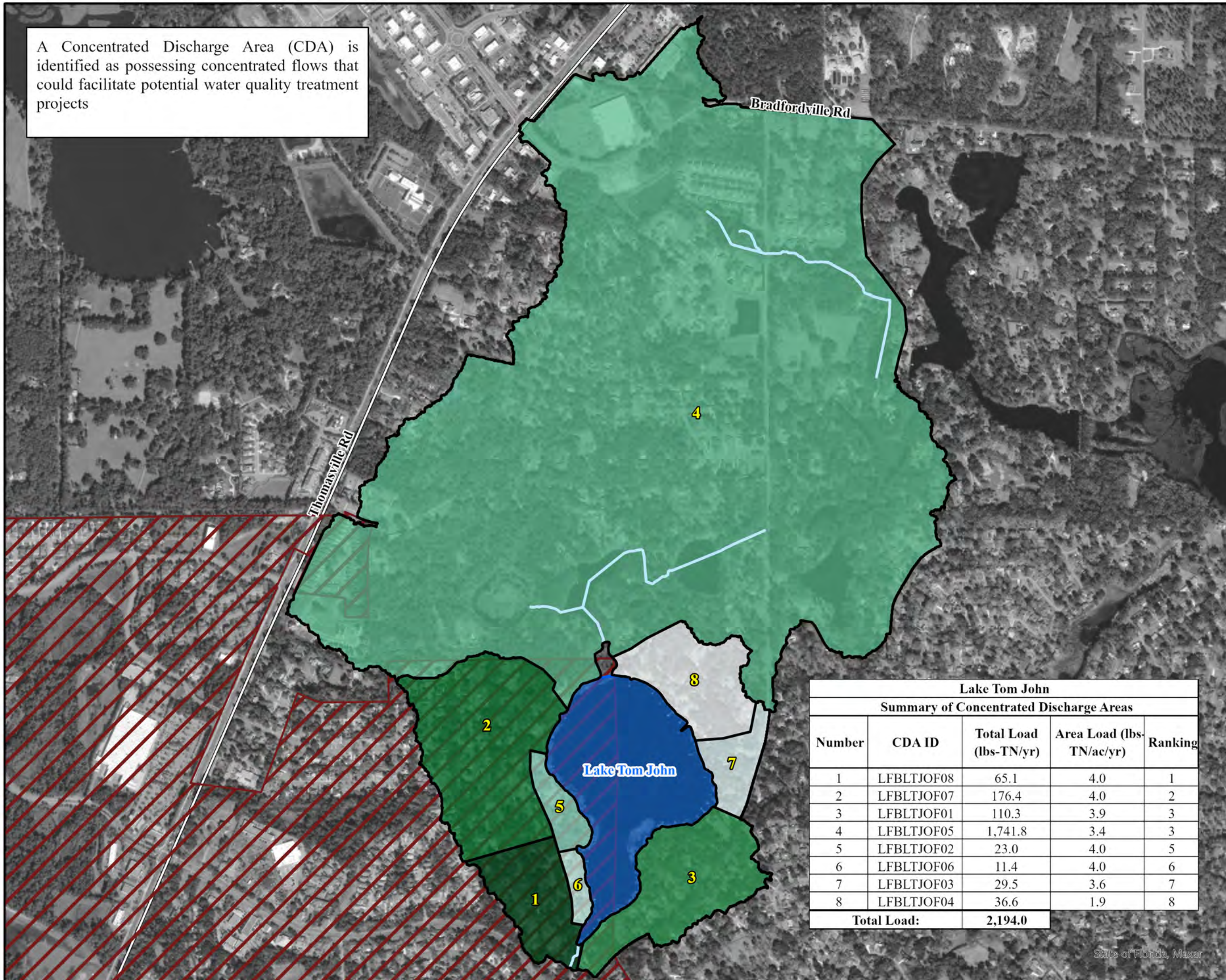
5.6.5.3 Point Source Load

No active point sources were identified within the Lake Lafayette Chain of Lakes basin. Therefore, the point source loads for TN and TP are set to 0 lb/yr for Lake Tom John.

5.6.5.4 Lake Inflow Load

As was discussed in **Section 5.6.4.6** inflows from the northern portion of the basin pass through Lake Bess prior to discharging to Lake Tom John (**Figure 5-126**). Presently, no water quality data are available for Lake Bess so calculation of the load from the lake cannot be done. Presently, the inflow load from Lake Bess is incorporated into the stormwater load calculations although any attenuation or increase in the loads as they pass through Lake Bess are not accounted for.

A Concentrated Discharge Area (CDA) is identified as possessing concentrated flows that could facilitate potential water quality treatment projects



Lake Tom John				
Summary of Concentrated Discharge Areas				
Number	CDA ID	Total Load (lbs-TN/yr)	Area Load (lbs-TN/ac/yr)	Ranking
1	LFBLTJOF08	65.1	4.0	1
2	LFBLTJOF07	176.4	4.0	2
3	LFBLTJOF01	110.3	3.9	3
4	LFBLTJOF05	1,741.8	3.4	3
5	LFBLTJOF02	23.0	4.0	5
6	LFBLTJOF06	11.4	4.0	6
7	LFBLTJOF03	29.5	3.6	7
8	LFBLTJOF04	36.6	1.9	8
Total Load:		2,194.0		

CITY OF TALLAHASSEE

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Legend

Concentrated Discharge Areas
Waterbodies in Study
Watercourses
Tallahassee Corporate Limits
Concentrated Discharge Areas Ranking
High (1)
Low (8)

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
CDAs: Geosyntec, 2022
Roads: COT-Leon County, 2023
City Limits: COT, 2022
Elevation: COT-Leon County, 2018

Figure 5-123: Lake Tom John Concentrated Discharge Areas-Total Nitrogen

Tallahassee Master Plan - Surface Water (TMaPS)

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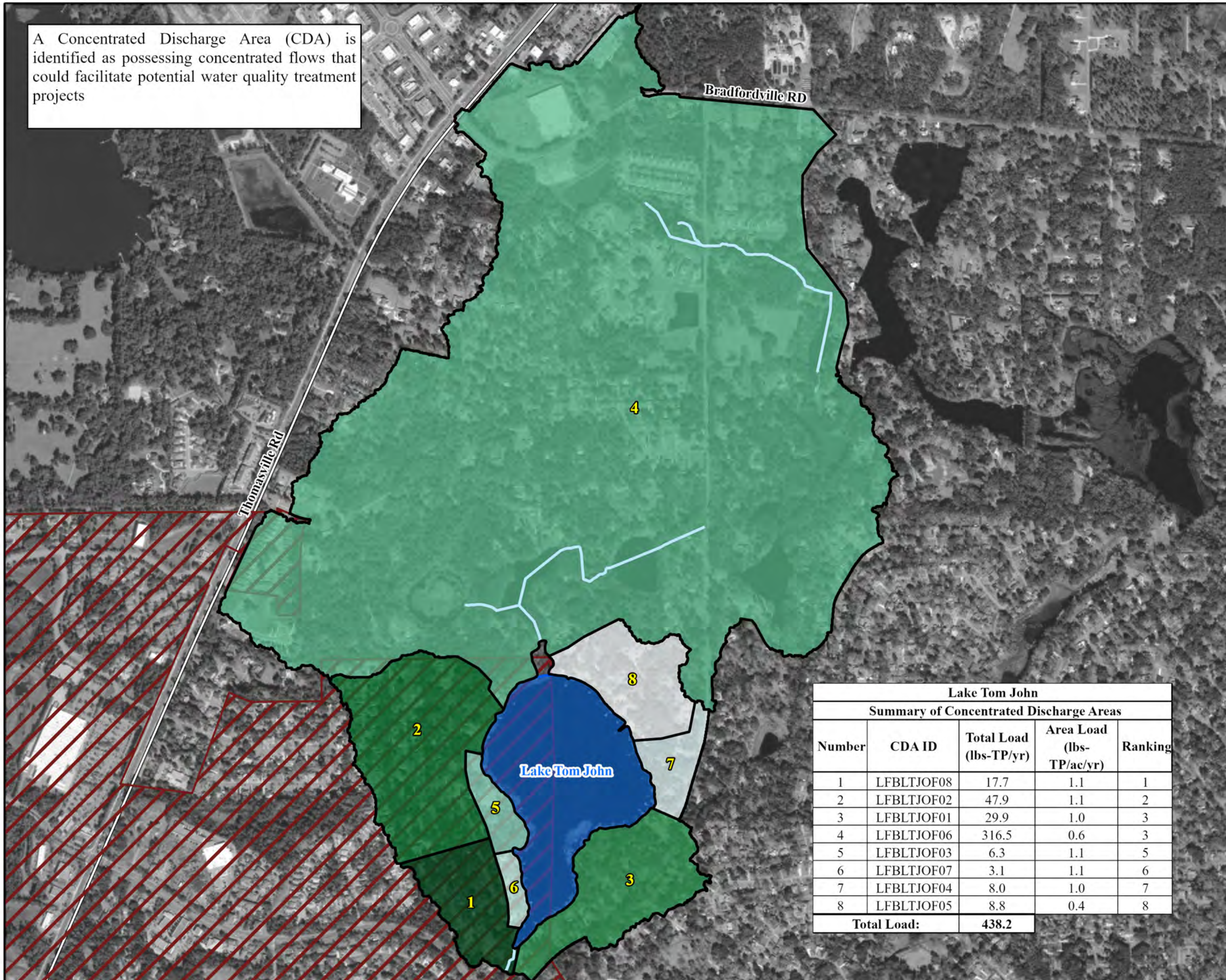

Lake Tom John				
Summary of Concentrated Discharge Areas				
Number	CDA ID	Total Load (lbs-TP/yr)	Area Load (lbs-TP/ac/yr)	Ranking
1	LFBLTJOF08	17.7	1.1	1
2	LFBLTJOF02	47.9	1.1	2
3	LFBLTJOF01	29.9	1.0	3
4	LFBLTJOF06	316.5	0.6	3
5	LFBLTJOF03	6.3	1.1	5
6	LFBLTJOF07	3.1	1.1	6
7	LFBLTJOF04	8.0	1.0	7
8	LFBLTJOF05	8.8	0.4	8
Total Load:		438.2		

CITY OF TALLAHASSEE

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
CDAs: Geosyntec, 2022
Roads: COT-Leon County, 2023
City Limits: COT, 2022

**Figure 5-124:
Lake Tom John Concentrated Discharge Areas-Total Phosphorus**

Tallahassee Master Plan - Surface Water (TMaPS)

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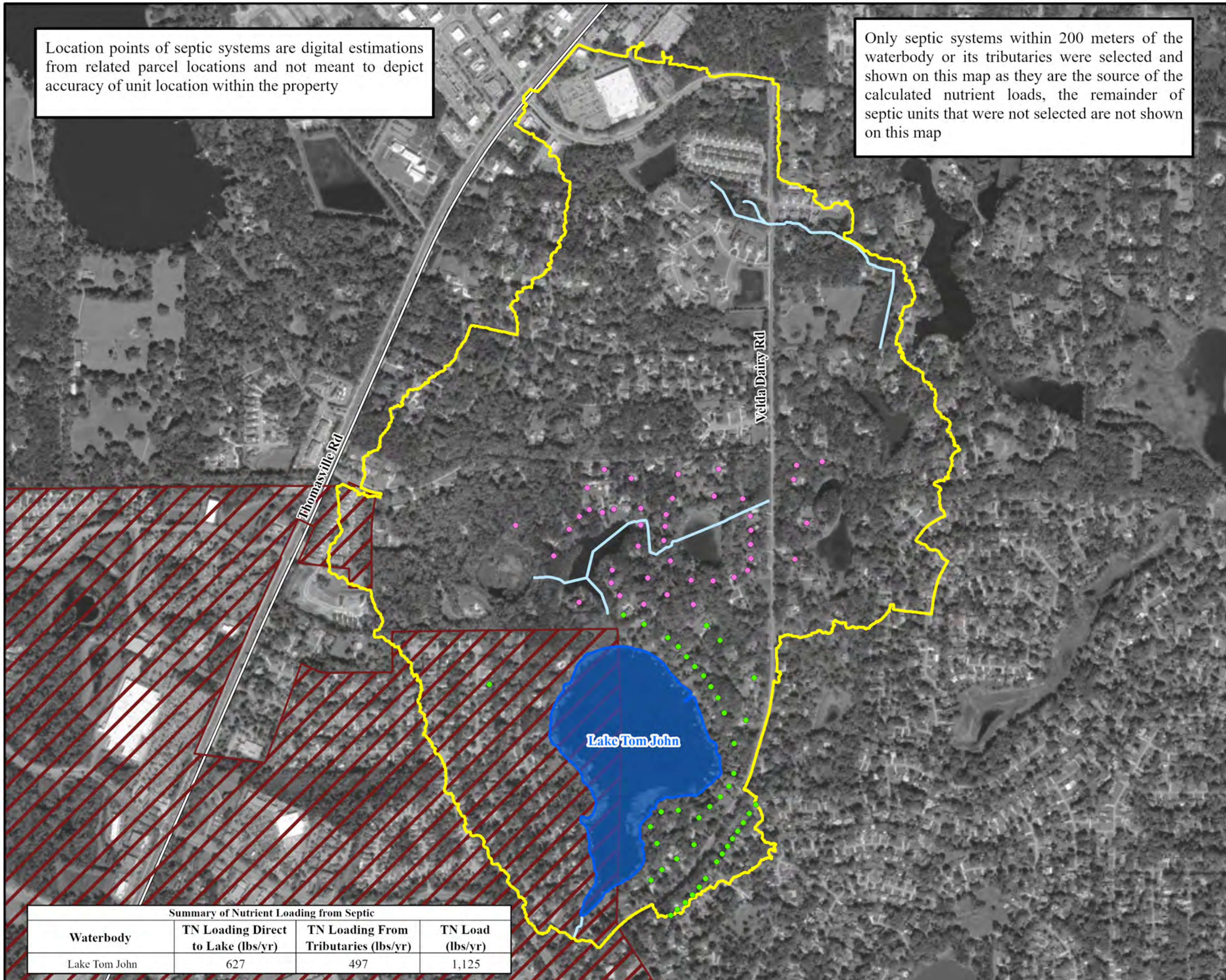
Location points of septic systems are digital estimations from related parcel locations and not meant to depict accuracy of unit location within the property

Only septic systems within 200 meters of the waterbody or its tributaries were selected and shown on this map as they are the source of the calculated nutrient loads, the remainder of septic units that were not selected are not shown on this map



Summary of Nutrient Loading from Septic			
Waterbody	TN Loading Direct to Lake (lbs/yr)	TN Loading From Tributaries (lbs/yr)	TN Load (lbs/yr)
Lake Tom John	627	497	1,125

CITY OF TALLAHASSEE

N

0 0.16
Miles

Legend

- Lake Tom John Drainage Basin
- Waterbodies in Study
- Tallahassee Corporate Limits
- Watercourses

Relevant Septic Sites

- Lake
- Tributaries

Sources:
Waterbodies: COT, 2020
Watercourses: COT, 2020
Septic Systems: COT, 2020
Watershed: COT, 2020
Roads: COT-Leon County, 2023

Figure 5-125:
Septic Loading to Lake Tom John

Tallahassee Master Plan - Surface Water (TMaPS)

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Receiving Lake	Receiving Lake Impaired?	Receiving Lake Concentrations (most recent 3-year average of Annual Geomeans)	Upstream Lake(s)	Upstream Lake(s) Impaired?	Simulated Annual Average Lake Outflow (cubic feet)	Upstream Lake WQ Concentrations (most recent 3-year average of Annual Geomeans)	Calculated Annual Average TN load (lb/year)	Calculated Annual Average TP load (lb/year)
Lake Tom John	Yes: CHLA, TN, TP	CHLA: 6 µg/L TN: 0.56 mg/L TP: 0.02 mg/L	Lake Bess	Unknown	ND	CHLA: ND TN: ND TP: ND	ND	ND

ND - No or insufficient data

CITY OF TALLAHASSEE

Legend

- Receiving Lakes
- Inflowing Lakes
- Flowlines
- Tallahassee Corporate Limits

Sources:
Waterbodies: COT, 2020
Flowlines: USGS, 2020
Watershed: COT, 2020
Roads: FDOT, 2020
City Limits: COT, 2022

Figure 5-126: Inflow Loading to Lake Tom John

Tallahassee Master Plan - Surface Water (TMaPS)

Geosyntec consultants

5.6.5.5 Internal Lake Load

The source assessment determined that internal loading may be a source of nutrients to the lake. At present no measurements have been completed to allow quantification of this load so it is not calculated.

5.6.5.6 Atmospheric Deposition

As presented and discussed in **Section 5.4.5.6** the annual average atmospheric TN load per acre was calculated from the Quincy NADP station (F14) at 2.56 lb/acre/yr. Multiplying this by the acreage of Lake Tom John (40 acres) gives a total TN load of 102 lb/yr. No data are available for TP therefore only the nitrogen load is provided.

5.6.5.7 Summary of Calculated Loads

Nutrient loads to Lake Tom John were calculated for stormwater runoff, septic systems, and atmospheric deposition. **Table 5-21** presents the calculated total loads to the lake for TN and TP. For septic systems and atmospheric deposition only TN loads were calculated.

Table 5-21: Summary of Calculated Loads to Lake Tom John

Source	TN (lb/year)	TP (lb/year)
Stormwater Runoff	2,194	438
Septic Systems	1,125	NC
Atmospheric Deposition	102	NC

NC – Not calculated.