Southwest District • Withlacoochee Basin • Peace River Basin

Final TMDL Report

Nutrient TMDLs for Lake Agnes (WBID 1466) and Lake McLeod (WBID 1588A) and Documentation in Support of the Development of Site-Specific Numeric Interpretations of the Narrative Nutrient Criterion

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Executive Summary

This report presents the total maximum daily loads (TMDLs) developed to address the nutrient impairment of Lake Agnes and Lake McLeod. Both lakes are located in north-central Polk County. Lake Agnes was identified as impaired for nutrients based on exceedances of the applicable chlorophyll *a*, total nitrogen (TN), and total phosphorus (TP) criteria for Florida lakes (Subparagraph 62-302.531[2][b]1., Florida Administrative Code (F.A.C.), and was added to the 303(d) list by Secretarial Order on June 27, 2017. Lake McLeod was identified as impaired for nutrients based on exceedances of the applicable chlorophyll *a* criterion for Florida lakes and was added to the 303(d) list by Secretarial Order on October 21, 2016. TMDLs for TN and TP will, on adoption, constitute the site-specific numeric interpretation of the narrative nutrient criterion set forth in Paragraph 62-302.530(48)(b), F.A.C.

Table EX-1 lists supporting information for the TMDLs. The TMDLs were developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by the U.S. Environmental Protection Agency.

Table EX-1. Summary of TMDL supporting information for Lake Agnes and Lake McLeod

Type of Information	Description
Waterbody name/ Waterbody identification (WBID) number	Lake Agnes/WBID 1466 Lake McLeod/WBID 1588A
Hydrologic Unit Code (HUC) 8	03100208 (Lake Agnes) 03100101 (Lake McLeod)
Use classification/ Waterbody designation	Class III/Freshwater
Targeted beneficial uses	Fish consumption; recreation; and propagation and maintenance of a healthy, well-balanced population of fish and wildlife
303(d) listing status	Verified List of Impaired Waters for Lake McLeod in the Group 3 basins (Sarasota Bay–Peace–Myakka) adopted via Secretarial Order dated October 21, 2016; and Lake Agnes in the Group 4 basins (Withlacoochee) adopted via Secretarial Order dated June 27, 2017.
TMDL pollutants	TN and TP
TMDLs and site-specific interpretations of the narrative nutrient criterion	**Lake Agnes (WBID 1466)** **TN:** 10,896 pounds per year (lbs/yr), expressed as a 7-year rolling average load not to be exceeded. **TP:** 618 lbs/yr, expressed as a 7-year rolling average load not to be exceeded. **Lake McLeod (WBID 1588A)** **TN:** 8,172 lbs/yr, expressed as a 7-year rolling average load not to be exceeded. **TP:** 609 lbs/yr, expressed as a 7-year rolling average load not to be exceeded.
Load reductions required to meet the TMDLs	**WBID 1466**: A 41 % TN reduction and 69 % TP reduction to achieve a chlorophyll *a* target of 6 micrograms per liter (µg/L). **WBID 1588A**: A 21 % TN reduction and 46 % TP reduction to achieve a chlorophyll *a* target of 6 µg/L.
Concentration-based lake restoration targets	**WBID 1466**: The nutrient concentrations corresponding to the chlorophyll *a* criterion and the loading-based criteria are a TN annual geometric mean (AGM) of 0.49 milligrams per liter (mg/L) and a TP AGM of 0.02 mg/L, not to be exceeded more than once in any consecutive 3-year period. **WBID 1588A**: The nutrient concentrations corresponding to the chlorophyll *a* criterion and the loading-based criteria are a TN AGM of 0.40 mg/L and a TP AGM of 0.02 mg/L, not to be exceeded more than once in any consecutive 3-year period.

Acknowledgments

This analysis was accomplished thanks to significant contributions from staff in the Florida Department of Environmental Protection (DEP) Division of Environmental Assessment and Restoration, specifically, the Office of Watershed Services, Watershed Assessment Section, Standards Development Section, Water Quality Restoration Program, Regional Operations Center, and Watershed Evaluation and TMDL Section. DEP also recognizes Polk County Natural Resource Division for their contributions towards understanding the issues, history, and processes at work in the Lake Agnes and Lake McLeod Watersheds.

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Contents

List of Figures

List of Tables

Acronyms and Additional Abbreviations used in Report

ac-ft/yr	Acre-Feet Per Year
AGM	Annual Geometric Mean
BMAP	Basin Management Action Plan
BMPs	Best Management Practices
$CaCO_3$	Calcium Carbonate
CFR	Code of Federal Regulations
Chla	Chlorophyll *a*
CWA	Clean Water Act
° F	Degrees Fahrenheit
DEP	Florida Department of Environmental Protection
DO	Dissolved Oxygen
EMC	Event Mean Concentration
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
F.A.C.	Florida Administrative Code
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FL	Florida
FLUCCS	Florida Land Use, Cover, and Forms Classification System
F.S.	Florida Statutes
ft	Feet
FWRA	Florida Watershed Restoration Act
FWS	Fish and Wildlife Service
ha^3/yr	Cubic Hectometers Per Year
HUC	Hydrologic Unit Code
IPaC	Information for Planning and Conservation
IWR	Impaired Surface Waters Rule
LA	Load Allocation
lbs	Pounds
lbs/yr	Pounds Per Year
m	Meter
MDL	Minimum Detection Limit
µg/L	Micrograms Per Liter
m/yr	Meters Per Year
mg/L	Milligrams Per Liter
mg/m^2/yr	Milligrams Per Square Meter Per Year
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NA	Not Applicable
NMFS	National Marine Fisheries Service
NNC	Numeric Nutrient Criteria
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OSTDS	Onsite Sewage Treatment and Disposal System

PCU	Platinum Cobalt Units
PET	Potential Evapotranspiration
PLRGs	Pollutant Load Reduction Goals
PLSM	Pollutant Loading Screening Model
POR	Period of Record
ROC	Runoff Coefficient
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
U.S.	United States
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WBID	Waterbody Identification
WLA	Wasteload Allocation
WQS	Water Quality Standards
WWTF	Wastewater Treatment Facility

Chapter 1: Introduction

1.1 Purpose of Report

This report presents the total maximum daily loads (TMDLs) developed to address the nutrient impairment of Lake Agnes and Lake McLeod, located in the Withlacoochee and Peace River Basins, respectively. Pursuant to Paragraph 62-302.531(2)(a), Florida Administrative Code (F.A.C.), the TMDLs will constitute the site-specific numeric interpretation of the narrative nutrient criterion set forth in Paragraph 62-302.530(48)(b), F.A.C. These waterbodies were verified as impaired for nutrients using the methodology in the Identification of Impaired Surface Waters Rule (IWR) (Chapter 62-303, F.A.C.), and were included on the Verified Lists of Impaired Waters for the Withlacoochee and Peace River Basins adopted by Secretarial Order in June 2017 and October 2016, respectively.

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and provides water quality targets needed to achieve compliance with applicable water quality criteria based on the relationship between pollutant sources and water quality in the receiving waterbody. The TMDLs establish the allowable loadings to Lake Agnes and Lake McLeod that would restore the waterbodies so that they meet their applicable water quality criteria for nutrients.

1.2 Identification of Waterbody

For assessment purposes, the Florida Department of Environmental Protection (DEP) divided the Withlacoochee Basin (Hydrologic Unit Code [HUC] 8 – 03100208) and Peace River Basin (HUC 8 – 03100101) into watershed assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or surface water segment. Lake Agnes is WBID 1466 within the Withlacoochee Basin and Lake McLeod is WBID 1588A within the Peace River Basin. **Figure 1.1** shows the location of the WBIDs in the basins and major geopolitical and hydrologic features in the region. **Figures 1.2** and **1.3** contain more detailed maps of Lake Agnes and Lake McLeod, respectively.

Lake Agnes and Lake McLeod are located in north-central Polk County in Polk City and Eagle Lake, respectively. Lake Agnes has a surface area of 393 acres, an average depth of 10 feet (ft), and a maximum depth of 20 ft. Lake McLeod has a surface area of 457 acres, an average depth of 12 ft, and a maximum depth of 16 ft.

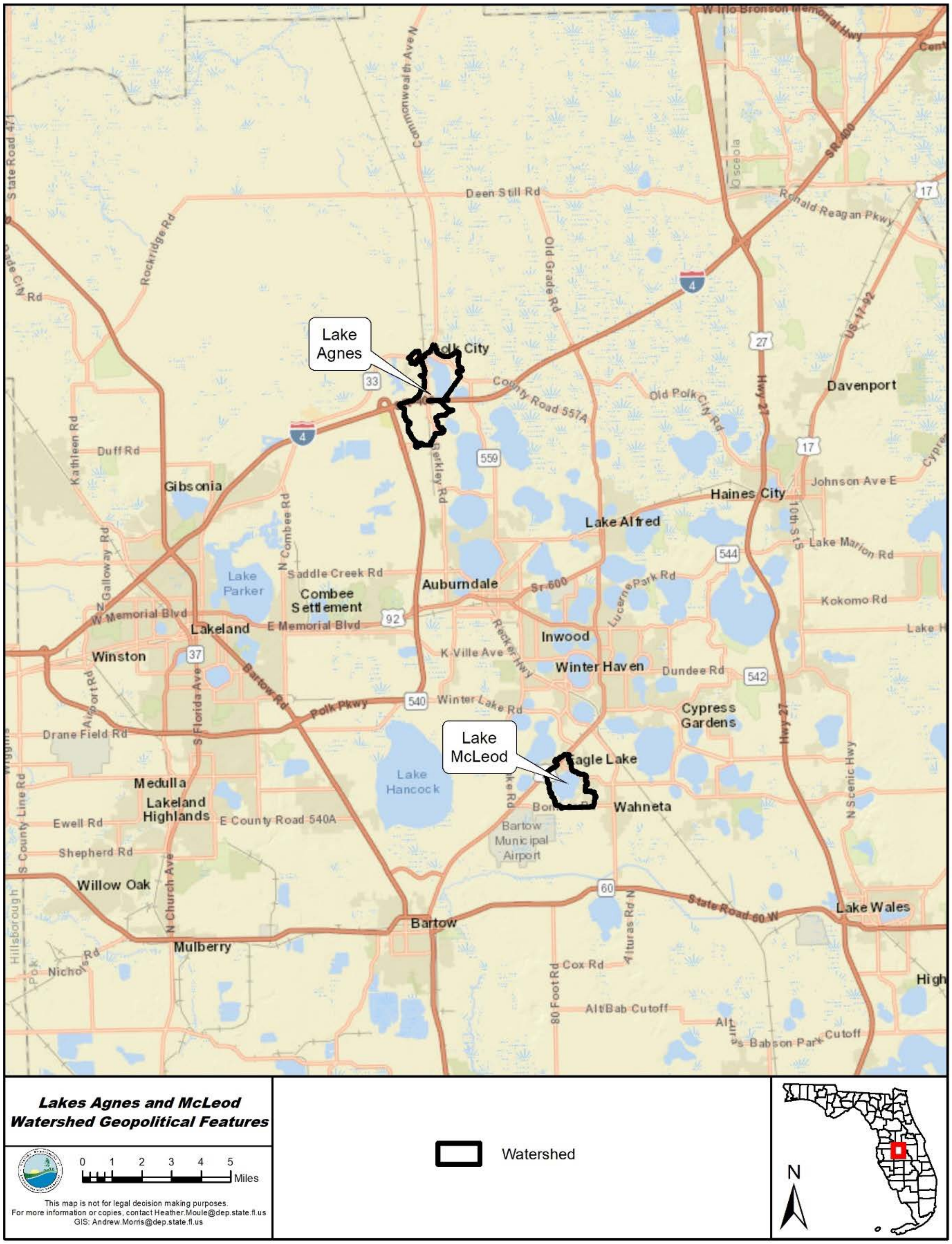


Figure 1.1. Location of Lake Agnes (WBID 1466) and Lake McLeod (WBID 1588A) in the Withlacoochee and Peace River Basins and major hydrologic and geopolitical features in the area

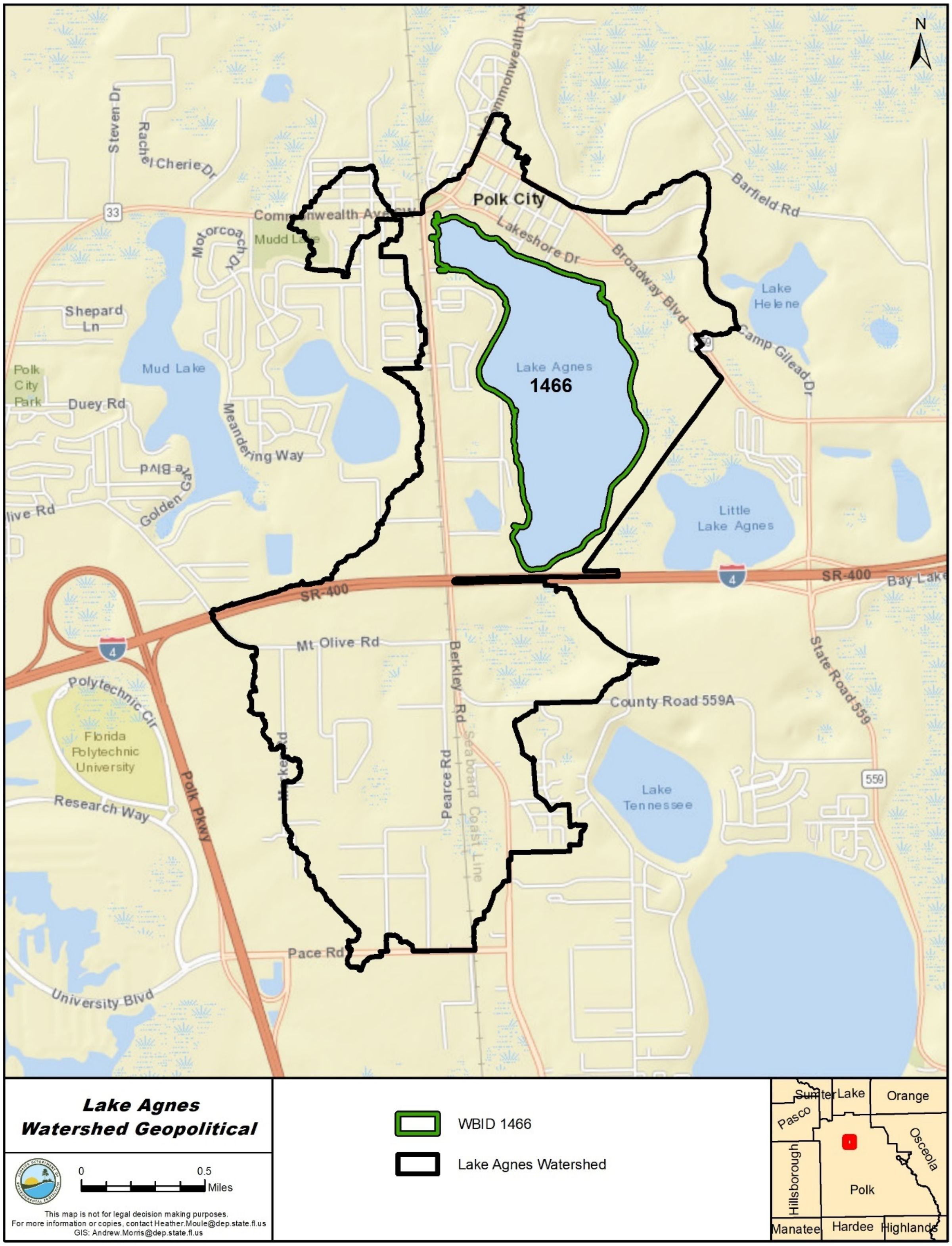


Figure 1.2. Lake Agnes (WBID 1466) Watershed

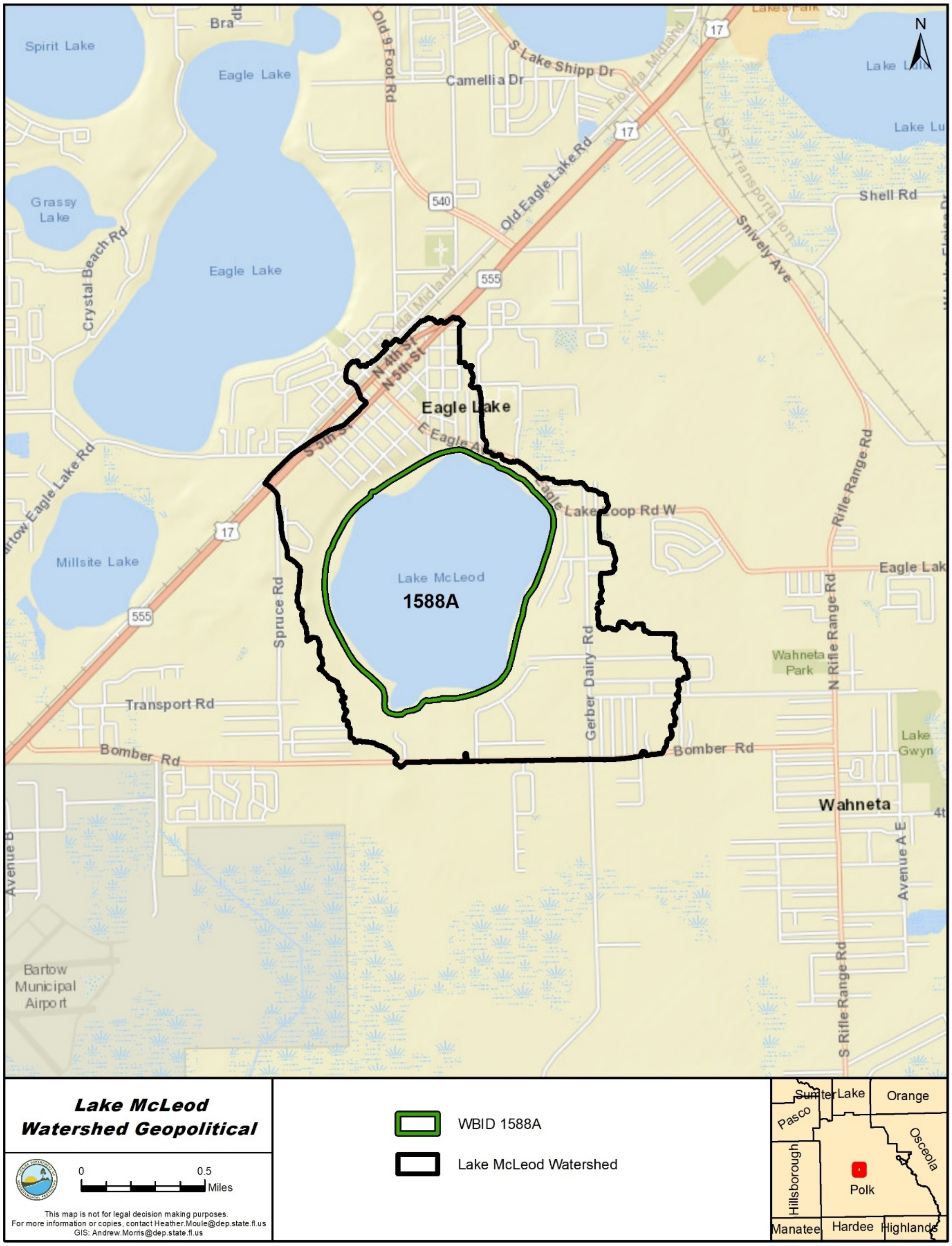


Figure 1.3. Lake McLeod (WBID 1588A) Watershed

1.3 Watershed Information

1.3.1 Population and Geopolitical Setting

Lake Agnes drains 2,260 acres of north-central Polk County, and Lake McLeod drains 1,183 acres. The Lake Agnes Watershed includes large areas of Polk City and Auburndale as well as a very small area of Lakeland. The total population of Polk City is 1,562 (U.S. Census Bureau 2010). The total populations of Auburndale and Lakeland are 13,507 and 97,422, respectively. The Lake McLeod Watershed includes a large portion of the City of Eagle Lake. The total population of Eagle Lake is 2,255. Land use is predominately urban in the Lake McLeod Watershed and mixed in the Lake Agnes Watershed.

1.3.2 Topography

The majority of the Lake Agnes and Lake McLeod Watersheds lie in the Winter Haven/Lake Henry Ridges region, which has elevations ranging from 130 to 170 ft and is characterized by upland karst with many small to medium eutrophic lakes (Griffith et al. 1997). The southern borders of both watersheds lie in the Southwestern Flatlands region, which has elevations ranging from sea level to 150 ft and is characterized by barrier islands, coastal flatlands, and coastal plain terraces. The Lake Agnes Watershed has an average slope of 2.4 %, and its elevation ranges from 185 ft on the northern side to 135 ft at the lake. The Lake McLeod Watershed has an average slope of 1.2 %, and its elevation ranges from 170 ft on the north to 140 ft at the lake.

1.3.3 Hydrogeological Setting

Lake Agnes has no inlet but has one outlet through a ditch, located on its northern side, that is not connected to any nearby surface waterbodies. Lake McLeod also has no inlet but has one outlet to Wahneta Farms Canal on its northeastern side through a culvert under East Eagle Avenue.

The primary soils in the Lake McLeod Watershed, based on the National Cooperative Soil Survey, are in Hydrologic Soil Groups A, A/D, and B/D. The primary soils in the Lake Agnes Watershed are in Hydrologic Soil Groups A, A/D, B, B/D, and C/D. Group A soils are sandy to loamy and are associated with a low runoff potential and high infiltration rates. Group B soils are silty to loamy and are moderately drained. Group C soils are characterized as sandy clay loam, associated with low infiltration rates and moderate to high runoff potential. Soils in Group D are often greater than 40 % clay and have a high runoff potential. Soils classified in dual hydrologic groups (A/D and B/D) have Type A and B soil characteristics when unsaturated but behave like Type D soil when saturated.

Table 1.1 lists the soil hydrologic groups and their corresponding acreages in the Lake Agnes and Lake McLeod Watersheds. Based on the soil characteristics shown in **Figures 1.4** and **1.5**, soils in the Lake Agnes and Lake McLeod Watersheds are mostly well drained. The hydrologic characteristics of soil can significantly influence the capability of a watershed to hold rainfall or produce surface runoff, and these characteristics are factored into in the calculation of background conditions described in **Section 5.4.3**.

The climate of the Lake Agnes and Lake McLeod Watersheds is subtropical. The average monthly temperature in Lakeland ranges from 61.9º F. in January to 83.6º F. in August, according to 1981 to 2010 climate normals calculated by Florida State University (Florida Climate Center 2010). Annual rainfall in Polk County averages 52 inches per year, based on data from the Southwest Florida Water Management District (SWFWMD) from 1915 to 2017.

Table 1.1. Soil type acreage in the Lake Agnes and Lake McLeod Watersheds

Hybrid soil types are A/D, B/D, and C/D.

Soil	Lake Agnes Watershed (Acres)	Lake Agnes Watershed (%)	Lake McLeod Watershed (Acres)	Lake McLeod Watershed (%)
N/A	400	18	468	40
A	1,128	50	437	37
A/D	609	27	192	16
B	89	4	0	0
B/D	25	1	87	7
C	0	0	0	0
C/D	9	0.4	0	0
D	0	0	0	0

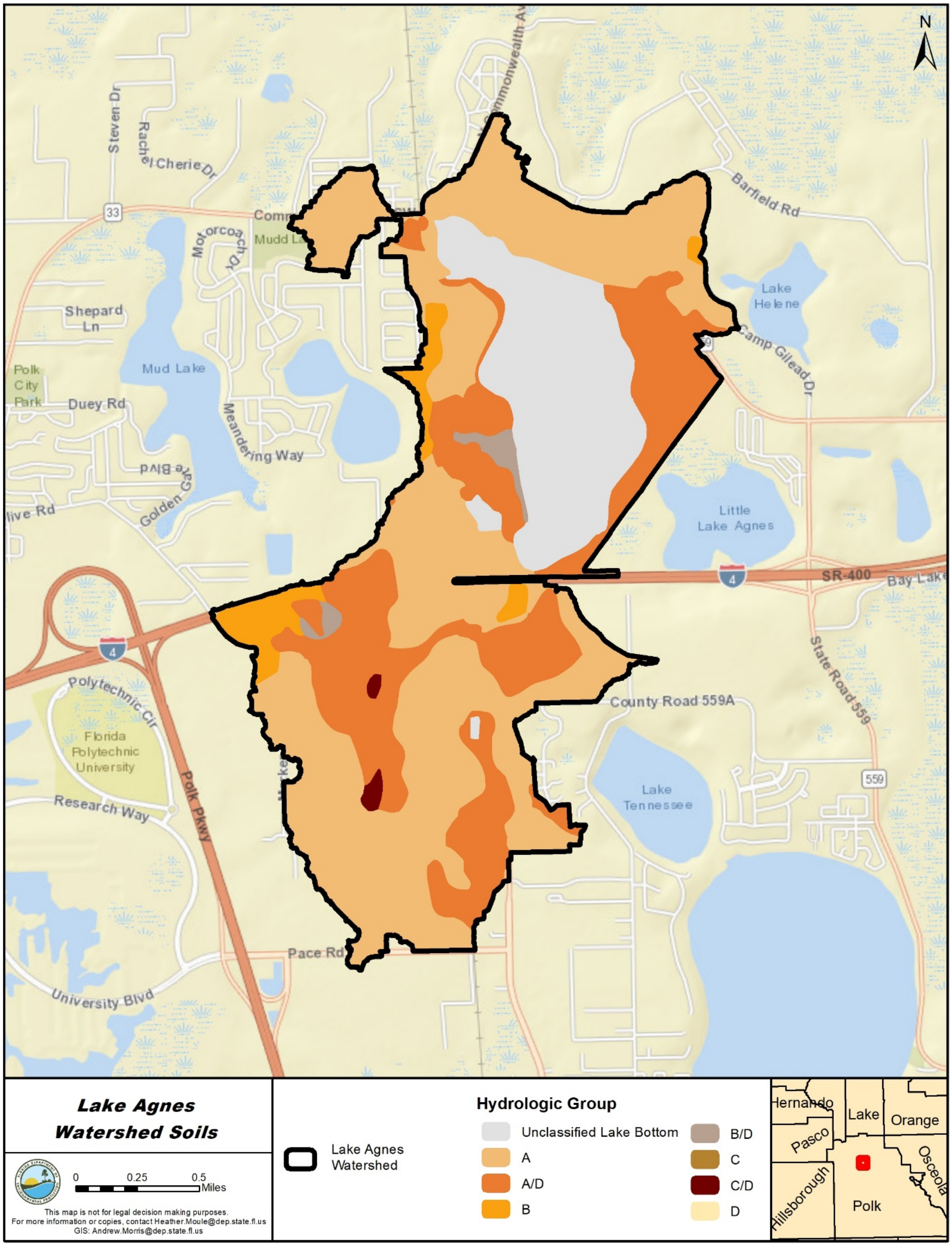


Figure 1.4. Hydrologic soil groups in the Lake Agnes Watershed

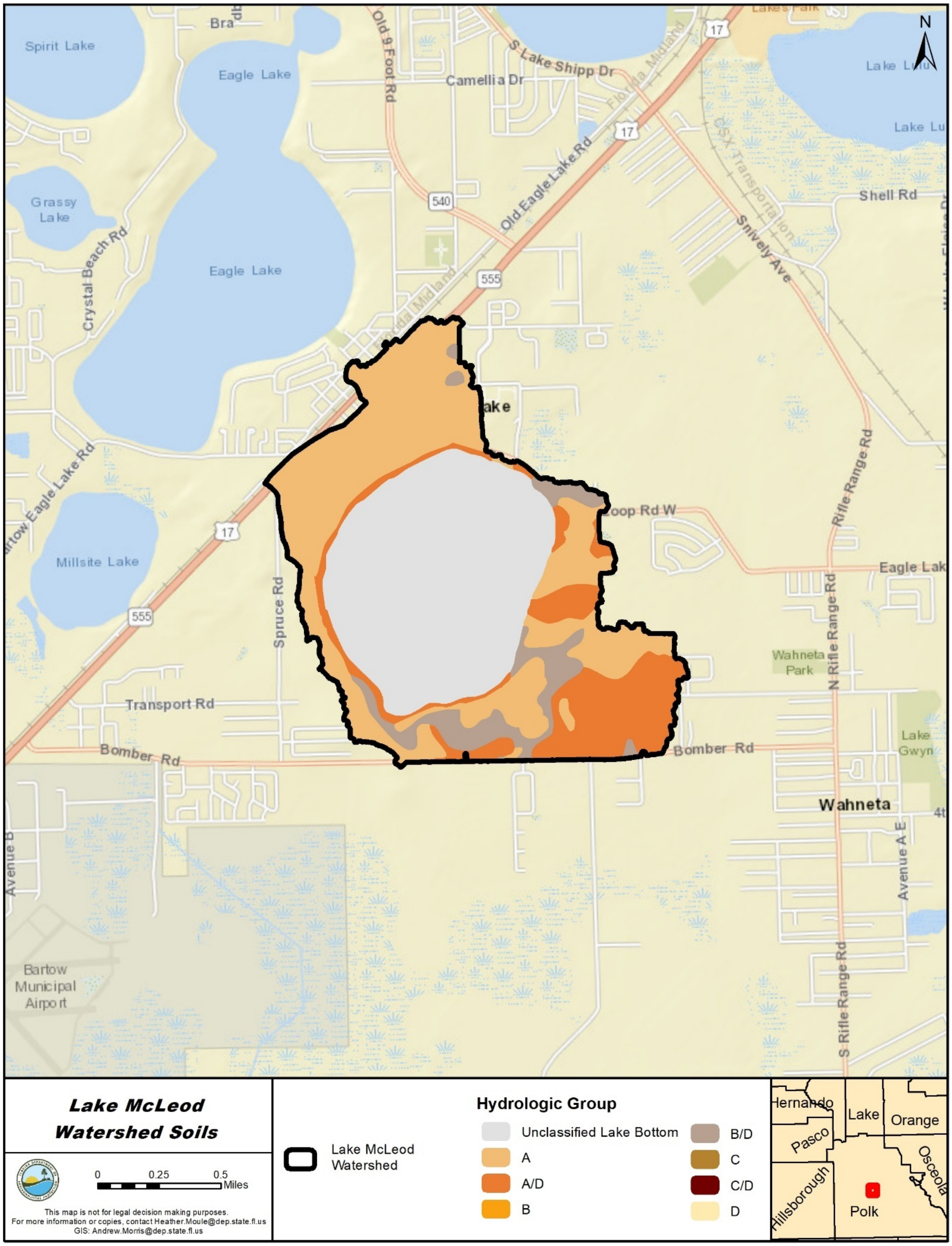


Figure 1.5. Hydrologic soil groups in the Lake Agnes Watershed

Chapter 2: Water Quality Assessment and Identification of Pollutants of Concern

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act (CWA) requires states to submit to the U.S. Environmental Protection Agency (EPA) lists of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. DEP has developed such lists, commonly referred to as 303(d) lists, since 1992.

The Florida Watershed Restoration Act (FWRA) (Section 403.067, Florida Statutes [F.S.]) directed DEP to develop, and adopt by rule, a science-based methodology to identify impaired waters. The Environmental Regulation Commission adopted the methodology as Chapter 62-303, F.A.C. (the IWR), in 2001. The rule was amended in 2006, 2007, 2012, 2013, and 2016.

The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], F.S.). The state's 303(d) list is amended annually to include basin updates.

2.2 Classification of the Waterbody and Applicable Water Quality Standards

Lake Agnes and Lake McLeod are Class III (fresh) waterbodies, with a designated use of fish consumption, recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criteria applicable to the verified impairment (nutrients) for these waterbodies are Florida's narrative nutrient criterion in Paragraph 62-302.530(48)(b), F.A.C., and the lake numeric nutrient criteria (NNC) in Subparagraph 62-302.532(2)(b)1., F.A.C. Florida adopted NNC for lakes, spring vents, and streams in 2011. These were approved by the EPA in 2012 and became effective in 2014.

The applicable lake NNC are dependent on alkalinity, measured in milligrams per liter as calcium carbonate (mg/L $CaCO_3$), and true color (color), measured in platinum cobalt units (PCU), based on long-term period of record (POR) geometric means (**Table 2.1**). The long-term averages of geometric means for alkalinity in Lake Agnes and Lake McLeod are 4.2 and 3.1 mg/L $CaCO_3$, respectively. The long-term averages of geometric means for color in Lake Agnes and Lake McLeod are 27.7 and 13.1 PCU, respectively. The geometric means were calculated based on the results in the IWR Run 55 Database. Using this methodology, Lake Agnes and Lake McLeod are classified as low-color, low-alkalinity ($\leq$40 PCU and $\leq$20 mg/L $CaCO_3$) lakes.

The chlorophyll *a* NNC for low-color, low-alkalinity lakes is an annual geometric mean (AGM) value of 6 micrograms per liter (µg/L), not to be exceeded more than once in any consecutive 3-year period. The associated total nitrogen (TN) and total phosphorus (TP) criteria for a lake can vary annually, depending on the availability of data for chlorophyll *a* and the concentrations of chlorophyll *a* in the lake.

If there are sufficient data to calculate an AGM for chlorophyll *a* and the mean does not exceed the chlorophyll *a* criterion for the lake type in **Table 2.1**, then the TN and TP numeric interpretations for that calendar year are the AGMs of lake TN and TP samples, subject to the minimum and maximum TN and TP limits in the table. If there are insufficient data to calculate the AGM for chlorophyll *a* for a given year or the AGM for chlorophyll *a* exceeds the values in the table for the lake type, then the applicable numeric interpretations for TN and TP are the minimum values in the table. **Table 2.1** lists the NNC for Florida lakes specified in Subparagraph 62-302.531(2)(b)1., F.A.C.

Table 2.1. Chlorophyll *a*, TN, and TP criteria for Florida lakes (Subparagraph 62-302.531[2][b]1., F.A.C.)

* For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit is the 0.49 mg/L TP streams threshold for the region.

Long-Term Geometric Mean Lake Color and Alkalinity	AGM Chlorophyll *a* (µg/L)	Minimum Calculated AGM TP NNC (mg/L)	Minimum Calculated AGM TN NNC (mg/L)	Maximum Calculated AGM TP NNC (mg/L)	Maximum Calculated AGM TN NNC (mg/L)
>40 PCU	20	0.05	1.27	0.16*	2.23
≤ 40 PCU and > 20 mg/L $CaCO_3$	20	0.03	1.05	0.09	1.91
≤ 40 PCU and ≤ 20 mg/L $CaCO_3$	6	0.01	0.51	0.03	0.93

2.3 Determination of the Pollutant of Concern

2.3.1 Data Providers

The sources of nutrient data for the lakes are stations sampled by the U.S. Geological Survey (USGS) (112WRD…), Polk County (21FLPOLK…), SWFWMD (21FLSWFD…), DEP (21FLGW…), and DEP Southwest District (21FLTPA…). Most of the nutrient data for both lakes came from monitoring conducted by Polk County. Data for Lake Agnes were collected at Station 21FLPOLKAGNES1 from 1986 to 2017. Data for Lake McLeod were collected at Station 21FLPOLKMCLEOD1 from 1997 to 2017. **Figure 2.1** shows the sampling locations in the Lake Agnes Watershed, and **Figure 2.2** shows the sampling locations in the Lake McLeod Watershed.

The individual water quality measurements discussed in this report are available in the IWR Run 55 Database and are available on request.

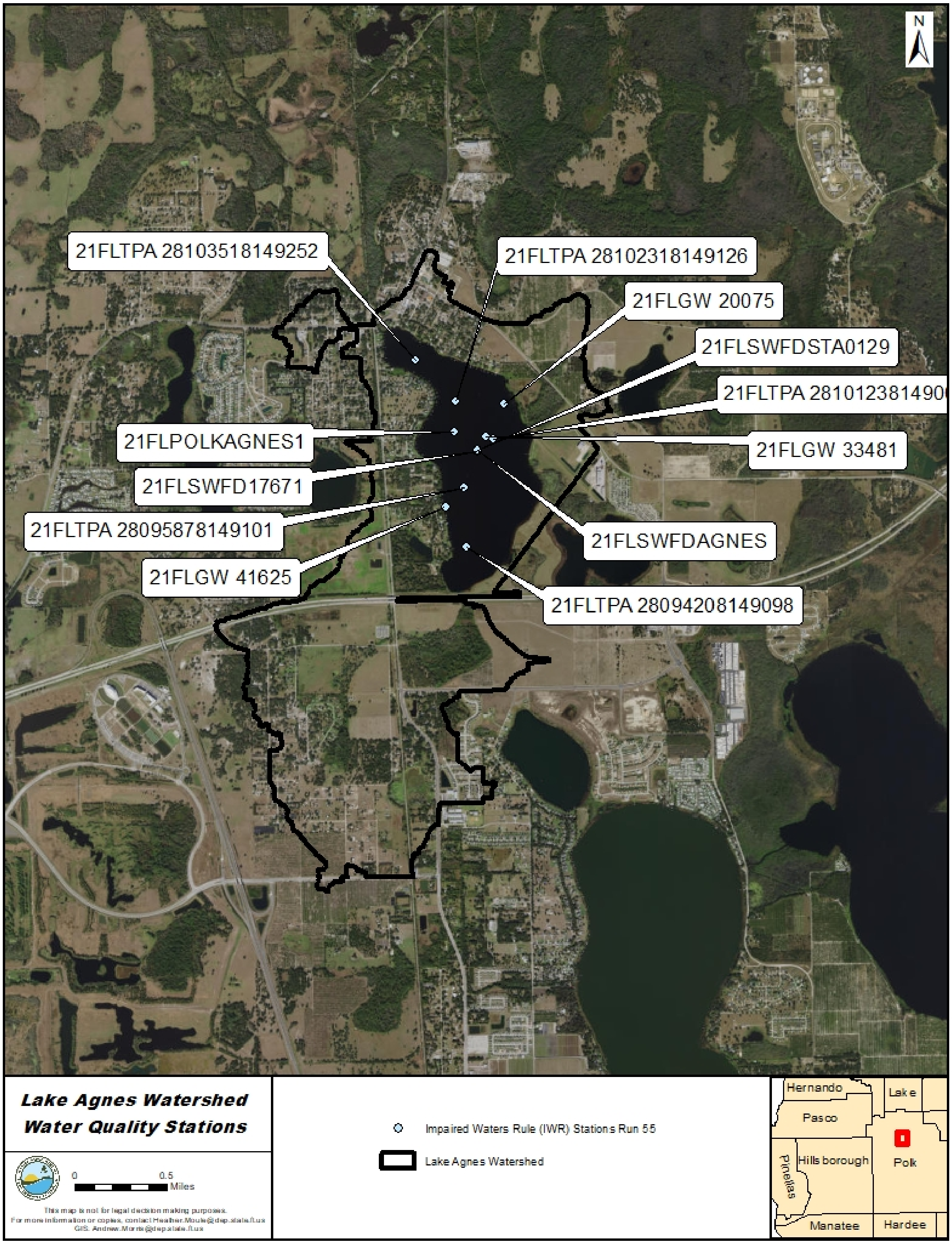


Figure 2.1. Monitoring stations in the Lake Agnes Watershed

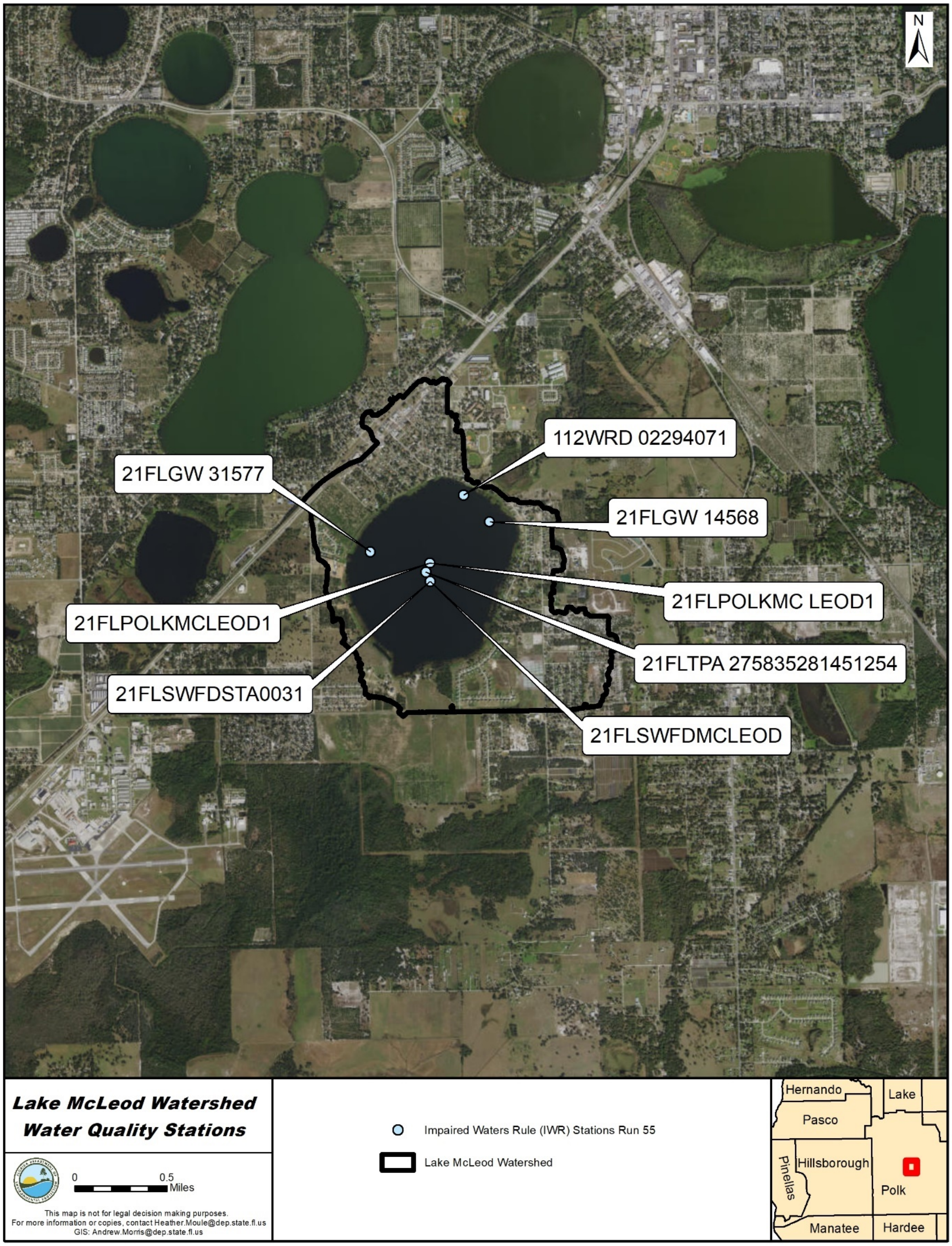


Figure 2.2. Monitoring stations in the Lake McLeod Watershed

2.3.2 Information on Verified Impairment

During the Cycle 3 assessment, the NNC were used to assess Lake McLeod during the verified period (January 1, 2008–June 30, 2015) during the Group 3, Cycle 3 assessment using IWR Run 52. The NNC were used to assess Lake Agnes during the verified period (January 1, 2009–June 30, 2016) during the Group 4, Cycle 3 assessment using IWR Run 53. Lake Agnes was assessed as verified impaired (Category 5) for biology, chlorophyll *a*, TN, and TP, and Lake McLeod was assessed as verified impaired for chlorophyll *a*. Lake McLeod was assessed as not impaired for TN or TP based on the generally applicable criteria. **Table 2.2** lists the Lake McLeod AGM values, and **Table 2.3** lists the Lake Agnes AGM values.

Table 2.2. Lake McLeod AGM values for the 2008–15 verified period

ID = Insufficient data
Note: Values shown in boldface type and shaded are greater than the NNC for lakes. Rule 62-302.531, F.A.C., states that the applicable numeric interpretations for TN, TP, and chlorophyll *a* shall not be exceeded more than once in any consecutive three-year period.

Year	Chlorophyll *a* (µg/L)	TN (mg/L)	TP (mg/L)
2008	**7**	0.16	0.01
2009	6	0.11	0.02
2010	**7**	0.36	**0.02**
2011	6	0.36	0.01
2012	6	0.25	0.02
2013	ID	ID	ID
2014	**9**	**0.60**	**0.02**
2015	ID	ID	ID

Table 2.3. Lake Agnes AGM values for the 2009–16 verified period

ID = Insufficient data
Note: Values shown in boldface type and shaded are greater than the NNC for lakes. Rule 62-302.531, F.A.C., states that the applicable numeric interpretations for TN, TP, and chlorophyll *a* shall not be exceeded more than once in any consecutive three-year period.

Year	Chlorophyll *a* (µg/L)	TN (mg/L)	TP (mg/L)
2009	5	0.54	0.03
2010	**11**	**0.70**	**0.04**
2011	**11**	**0.76**	**0.05**
2012	**7**	**0.64**	**0.03**
2013	**10**	**0.65**	**0.05**
2014	**10**	**0.67**	**0.04**
2015	**14**	**0.82**	**0.04**
2016	ID	ID	ID

Chapter 3: Site-Specific Numeric Interpretation of the Narrative Nutrient Criterion

3.1 Establishing the Site-Specific Interpretation

Pursuant to Paragraph 62-302.531(2)(a), F.A.C., the nutrient TMDL for Lake Agnes will, upon adoption into Chapter 62-304.640, F.A.C., constitute the site-specific numeric interpretations of the narrative nutrient criterion set forth in Paragraph 62-302.530(48)(b), F.A.C. Pursuant to Paragraph 62-302.531(2)(a), F.A.C., the nutrient TMDL for Lake McLeod will, upon adoption into Chapter 62-304.625, F.A.C., constitute the site-specific numeric interpretations of the narrative nutrient criterion set forth in Paragraph 62-302.530(48)(b), F.A.C. **Table 3.1** lists the elements of the nutrient TMDLs that constitute these numeric interpretations. **Appendix B** summarizes the relevant details to support the determination that the TMDLs provide for the protection of Lake Agnes and Lake McLeod and for the attainment and maintenance of water quality standards in downstream waters (pursuant to Subsection 62-302.531[4], F.A.C.), and to support using the nutrient TMDLs as the site-specific numeric interpretations of the narrative nutrient criterion.

When developing TMDLs to address nutrient impairment, it is essential to address those nutrients that typically contribute to excessive plant growth. In Florida waterbodies, nitrogen and phosphorus are most often the limiting nutrients. A limiting nutrient is a chemical that is necessary for plant growth, but available in quantities smaller than those needed for algae, represented by chlorophyll *a*, and macrophytes to grow. In the past, management activities to control lake eutrophication focused on phosphorus reduction, as phosphorus was generally recognized as the limiting nutrient in freshwater systems.

Recent studies, however, support the reduction of both nitrogen and phosphorus as necessary to control algal growth in aquatic systems (Conley et al. 2009, Paerl 2009, Lewis et al. 2011, Paerl and Otten 2013). Furthermore, the analysis used in the development of the Florida lake NNC also supports this idea, as statistically significant relationships were found between chlorophyll *a* values and both nitrogen and phosphorus concentrations (DEP 2012).

3.2 Site-Specific Response Variable Target Selection

The development of the generally applicable lake NNC was based on the selection of a protective chlorophyll *a* criterion and the subsequent evaluation of the relationship between chlorophyll *a* and TN and TP to develop TN and TP concentrations protective of designated uses (DEP 2012). Based on several lines of evidence, DEP developed a chlorophyll *a* criterion of 6 µg/L for lakes with low-color (less than 40 PCU) and low-alkalinity (less than 20 mg/L $CaCO_3$). DEP demonstrated that the chlorophyll *a* criterion of 6 µg/L is protective of designated uses and maintains the health of a balanced community of aquatic flora and fauna in low-color, low-alkalinity lakes.

There is no information available suggesting that Lake Agnes or Lake McLeod require lower chlorophyll *a* levels. Therefore, DEP has determined that the generally applicable chlorophyll *a* numeric criterion for a low-color, low-alkalinity lake is the most appropriate site-specific criterion, and it will be used as the TDML target.

3.3 Numeric Expression of the Site-Specific Numeric Interpretation

The site-specific interpretations of the narrative nutrient criterion for TN and TP were determined by using the watershed and waterbody models described in **Chapter 5** to determine the TN and TP loadings that would achieve the chlorophyll *a* criterion of 6 µg/L every year. **Section 5.4** discusses in more detail the method used to derive these loading values.

Seven-year rolling averages were calculated from yearly TN and TP loads that achieved the generally applicable chlorophyll *a* criterion, and the maximum 7-year averages of TN and TP loads were chosen as the site-specific interpretations of the narrative nutrient criterion. The resulting TN and TP target loads for Lake Agnes are 10,896 and 618 pounds per year (lbs/yr), respectively (**Table 3.1**), and for Lake McLeod, 8,172 and 609 lbs/yr, respectively.

Table 3.1. Site-specific interpretations of the narrative nutrient criterion

Note: Chlorophyll *a* shall not be exceeded more than once in any consecutive three-year period.

WBID	AGM Chlorophyll *a* (µg/L)	7-Year Rolling Average TN Load (lbs/yr)	7-Year Rolling Average TP Load (lbs/yr)
1466	6	10,896	618
1588A	6	8,172	609

DEP also determined the in-lake TN and TP concentrations corresponding to the conditions that attain the chlorophyll *a* criterion and the TN and TP load-based criteria. These concentration-based restoration targets are presented for informational purposes only. The TN and TP restoration concentrations for Lake Agnes are AGM concentrations of 0.49 and 0.02 mg/L, respectively, not to be exceeded more than once in any consecutive 3-year period. The TN and TP restoration concentrations for Lake McLeod are AGM concentrations of 0.40 and 0.02 mg/L, respectively, not to be exceeded more than once in any consecutive 3-year period.

3.4 Downstream Protection

Lake Agnes does not flow into any nearby surface waterbodies. Lake McLeod (WBID 1588A) flows into Wahneta Farms Drainage Canal (WBID 1580). The canal flows into the Peace Creek Drainage Canal, which, along with Saddle Creek, makes up the headwaters of the Peace River. The Peace River Basin is located in the West-Central Nutrient Watershed Region. The generally applicable NNC for streams in this region, set forth in Subparagraph 62-302.531(2)(c)2., F.A.C., are a TN concentration of 1.65 mg/L and a TP concentration of 0.49 mg/L. These nutrient thresholds, which are expressed as AGMs not to be exceeded more than once in a 3-year period, are higher than the AGM site-specific interpretations of the narrative nutrient criterion for the southern chain of lakes. The reductions in nutrient concentrations prescribed in the TMDLs are not expected to cause nutrient impairments downstream and should improve water quality in waterbody segments downstream by reducing algal biomass and associated nutrients transported downstream.

Based on the healthy existing conditions in the downstream receiving waters, the existing nutrient loads from Lake McLeod to Wahneta Farms Drainage Canal have not caused the impairment of the downstream water and are not preventing the downstream water from attaining its designated uses and maintaining a balanced aquatic flora and fauna. The reductions in nutrient loads described in this TMDL analysis are not expected to cause nutrient impairments but to improve water quality in downstream waters.

3.5 Endangered Species Considerations

Section 7(a)(2) of the Endangered Species Act (ESA) requires each federal agency, in consultation with the services (i.e., the U.S. Fish and Wildlife Service [FWS] and the National Oceanic and Atmospheric Administration [NOAA] National Marine Fisheries Service [NMFS]), to ensure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. The EPA must review and approve changes in water quality standards (WQS) such as setting site-specific criteria.

Prior to approving WQS changes for aquatic life criteria, the EPA will prepare an Effect Determination summarizing the direct or indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. The EPA categorizes potential effect outcomes as either (1) "no effect," (2) "may affect, not likely to adversely affect," or (3) "may affect: likely to adversely affect."

The service(s) must concur on the Effect Determination before the EPA approves a WQS change. A finding and concurrence by the service(s) of "no effect" will allow the EPA to approve an otherwise approvable WQS change. However, findings of either "may affect, not likely to adversely affect" or "may affect: likely to adversely affect" will result in a longer consultation process between the federal agencies and may result in a disapproval or a required modification to the WQS change.

The FWS online Information for Planning and Conservation (IPaC) tool identifies terrestrial species potentially affected by activities in the Lake Agnes and Lake McLeod Watersheds. DEP is not aware of the presence of any endangered species in either watershed. Furthermore, it is expected that restoration efforts and subsequent water quality improvements will positively affect species living in the lakes and their respective watersheds.

Chapter 4: Assessment of Sources

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of the pollutant of concern in the target watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either point sources or nonpoint sources. Historically, the term "point sources" has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from septic systems; and atmospheric deposition.

However, the 1987 amendments to the CWA redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA's National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, such as those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with CWA definitions, the term "point source" is used to describe traditional point sources (such as domestic and industrial wastewater discharges) and stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1** on **Expression and Allocation of the TMDL**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Point Sources

4.2.1 Wastewater Point Sources

When these TMDLs were being developed, no NPDES-permitted wastewater facilities that discharge to Lake Agnes or Lake McLeod were identified in the watersheds.

4.2.2 Municipal Separate Storm Sewer System (MS4) Permittees

The stormwater collection systems in the Lake Agnes and Lake McLeod Watersheds, which are owned and operated by Polk County in conjunction with the Florida Department of Transportation (FDOT) District 1, are covered by an NPDES Phase I MS4 permit (FLS000015). The City of Polk City is a copermittee in the MS4 permit for the Lake Agnes Watershed, and the

City of Eagle Lake is a copermittee in the MS4 permit for the Lake McLeod Watershed (**Figures 4.1** and **4.2**). For more information on MS4s in the watersheds, send an email to: NPDES-stormwater@dep.state.fl.us. **Table 4.1** lists the permittees/copermittees and their MS4 permit numbers.

4.3 Nonpoint Sources

Pollutant sources that are not NPDES wastewater or stormwater dischargers are generally considered nonpoint sources. Nutrient loadings to Lake Agnes and Lake McLeod are primarily generated from nonpoint sources. Nonpoint sources addressed in this analysis primarily include loadings from surface runoff based on land use and precipitation directly onto the lake surface (atmospheric deposition).

4.3.1 Land Uses

Land use is one of the most important factors in determining nutrient loadings from the Lake Agnes and Lake McLeod Watersheds. Nutrients can be flushed into a receiving water through surface runoff and stormwater conveyance systems during stormwater events. Both human land use areas and natural land areas generate nutrients. However, human land uses typically generate more nutrient loads per unit of land surface area than natural lands can produce. **Tables 4.2** and **4.3** list land use in the watersheds in 2011, based on data from the SWFWMD, and **Figures 4.3** and **4.4** show the information graphically. These data were applied in the development of watershed loadings to the lake, described in **Section 4.4**. The watershed loadings were then used in the development of the lake water quality model documented in **Chapter 5**.

The total watershed area for Lake Agnes is 2,260 acres. The predominant land use is urban (Florida Land Use, Cover, and Forms Classification System [FLUCCS] land use code 1100-1900), which covers 41 % of the area. Agriculture covers 23 % of the watershed and water (FLUCCS 5200-5300) covers 16 %. The remaining land use categories make up 19 % of the watershed area.

The total watershed area for Lake McLeod is 1,183 acres. The predominant land uses are urban and water, covering 41 % and 38 % of the area, respectively. Agriculture covers 16 % of the watershed and the remaining land use categories make up 5 %.

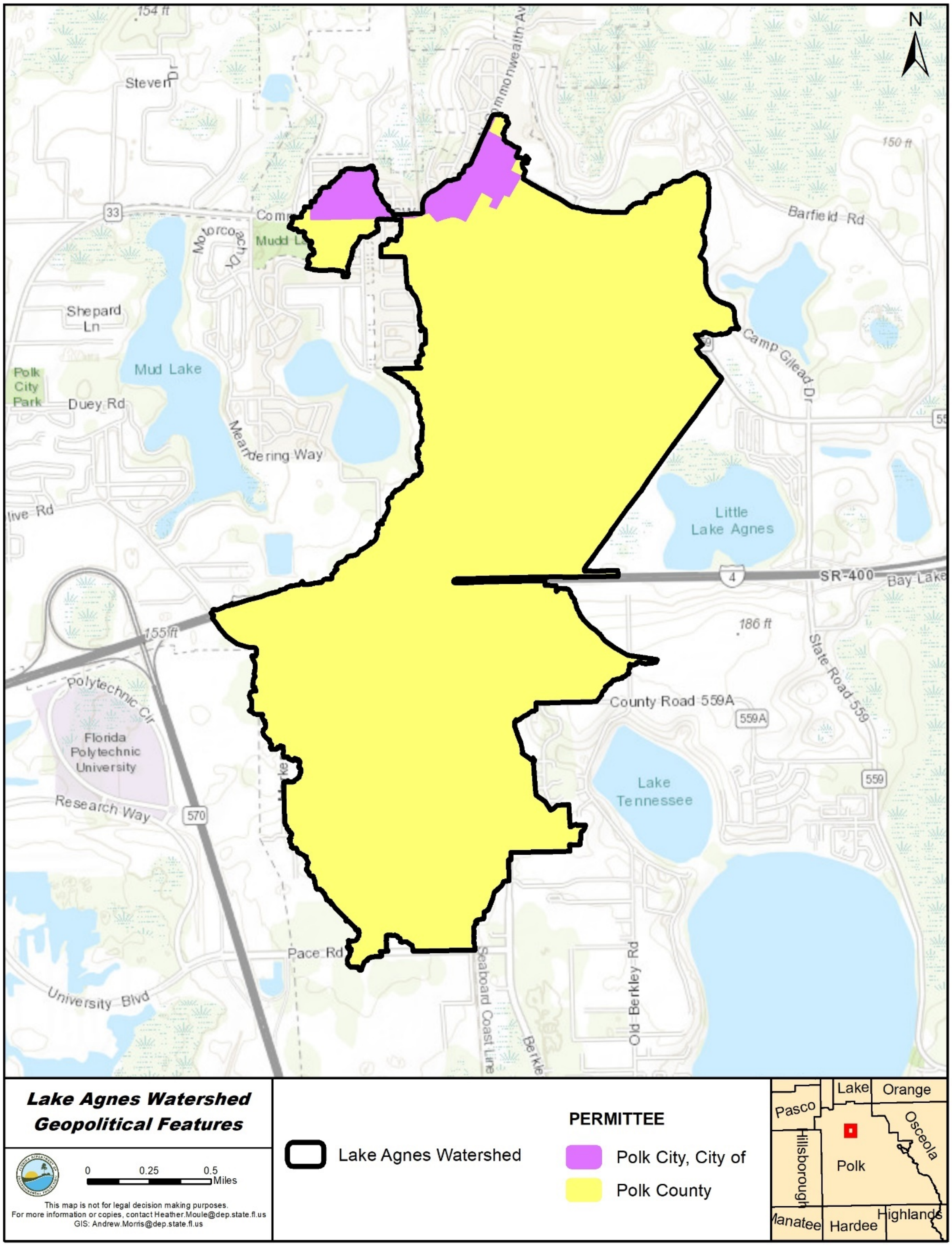


Figure 4.1. Location of MS4 permittees in the Lake Agnes Watershed

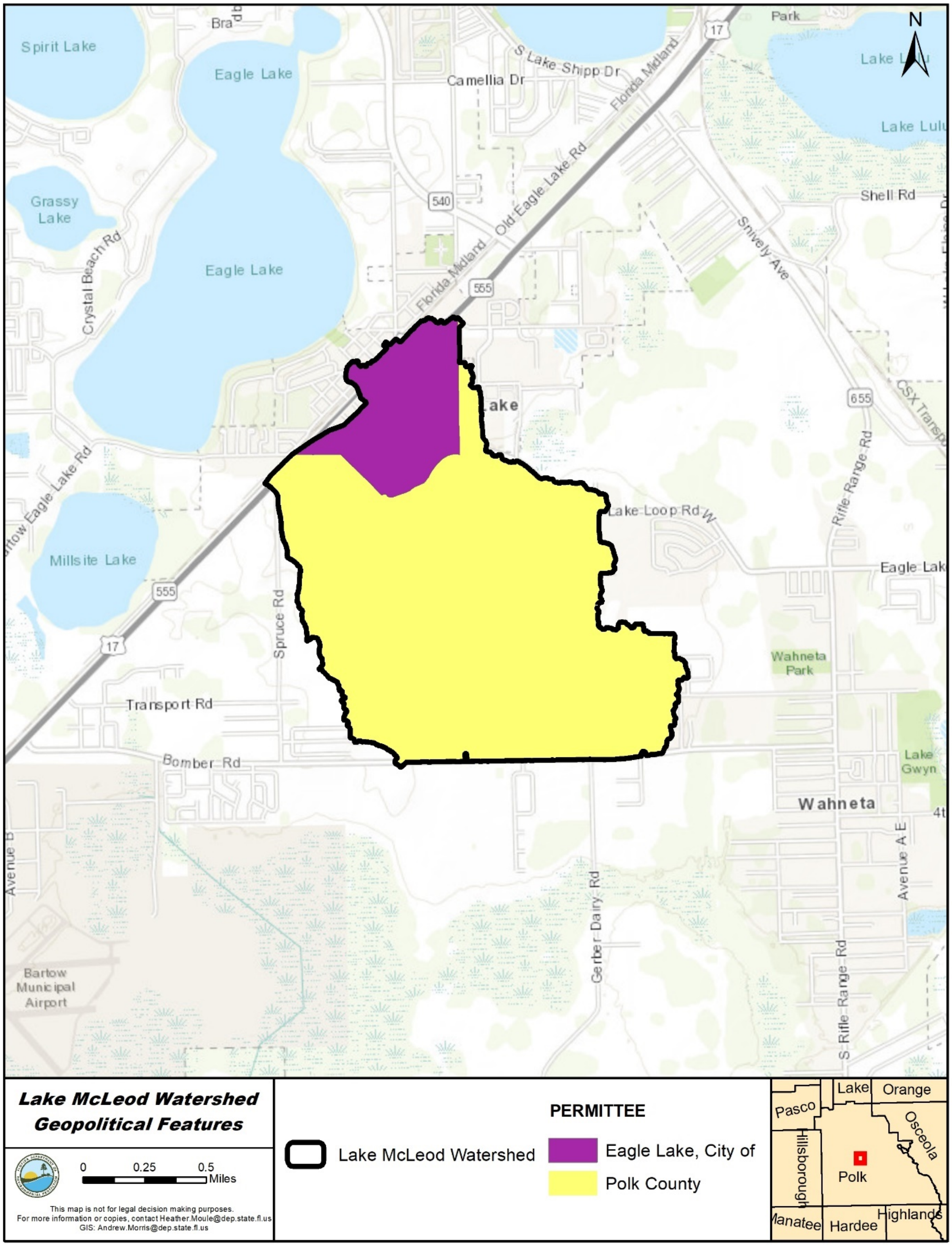


Figure 4.2. Location of MS4 permittees in the Lake McLeod Watershed

Table 4.1. NPDES MS4 permits with jurisdiction in the Lake Agnes and Lake McLeod Watersheds

Permit Number	Permittee/Copermittees	Phase
FLS000015	Polk County	I
FLS266779	FDOT District 1 – Polk	I
FLS266752	City of Polk City	I
FLS266647	City of Eagle Lake	I

Table 4.2. SWFWMD land use in the Lake Agnes Watershed in 2011

Note: Percent values may not actually add to 100 because of rounding.

Land Use Code	Land Use Classification	Acres	% of Watershed
1100	Low-Density Residential	480.26	21
1200	Medium-Density Residential	263.27	12
1300	High-Density Residential	11.40	1
1400	Commercial and Services	22.83	1
1600	Extractive	0.10	0
1700	Institutional	13.85	1
1800	Recreational	13.14	1
1900	Open Land	126.59	6
2100	Cropland and Pastureland	295.58	13
2200	Tree Crops	160.93	7
2400	Nurseries and Vineyards	0.02	0
2600	Other Open Lands <Rural>	65.14	3
4100	Upland Coniferous Forests	0.42	0
4300	Upland Mixed Forests	3.35	0
4400	Tree Plantations	65.07	3
5200	Lakes	364.35	16
5300	Reservoirs	3.69	0
6100	Wetland Hardwood Forests	124.03	5
6300	Wetland Forested Mixed	25.73	1
6400	Vegetated Nonforested Wetlands	35.17	2
6500	Nonvegetated Wetlands	38.49	2
8100	Transportation	132.63	6
8200	Communications	4.80	0
8300	Utilities	9.39	0
Total		**2,260.24**	**100**

Table 4.3. SWFWMD land use in the Lake McLeod Watershed in 2011

Note: Percent values may not actually add to 100 because of rounding.

Land Use Code	Land Use Classification	Acres	% of Watershed
1100	Low-Density Residential	36.90	3
1200	Medium-Density Residential	334.08	28
1300	High-Density Residential	36.58	3
1400	Commercial and Services	35.68	3
1700	Institutional	0.56	0
1900	Open Land	36.54	3
2200	Tree Crops	77.63	7
2400	Nurseries and Vineyards	1.60	0
2600	Other Open Lands <Rural>	109.49	9
3300	Mixed Rangeland	17.06	1
4300	Upland Mixed Forests	15.14	1
5200	Lakes	449.62	38
5300	Reservoirs	3.71	0
6400	Vegetated Nonforested Wetlands	13.16	1
6500	Nonvegetated Wetlands	5.48	0
8100	Transportation	9.58	1
Total		**1,182.81**	**100**

4.3.2 Onsite Sewage Treatment and Disposal Systems (OSTDS)

OSTDS, including septic tanks, are commonly used where providing central sewer service is not cost-effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDS are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTDS is comparable to secondarily treated wastewater from a sewage treatment plant. However, OSTDS can be a source of nutrients (nitrogen and phosphorus), pathogens, and other pollutants to both groundwater and surface water.

The Florida Department of Health (FDOH) maintains a list of septic tanks by county, and the Polk County 2018 database was used to determine the number of known and likely septic tanks in the watersheds. The number of septic tanks estimated for the Lake Agnes Watershed was 598. The number of septic tanks estimated for the Lake McLeod Watershed was 342. **Figures 4.5** and **4.6** show the OSTDS locations in the Lake Agnes and McLeod Watersheds, respectively.

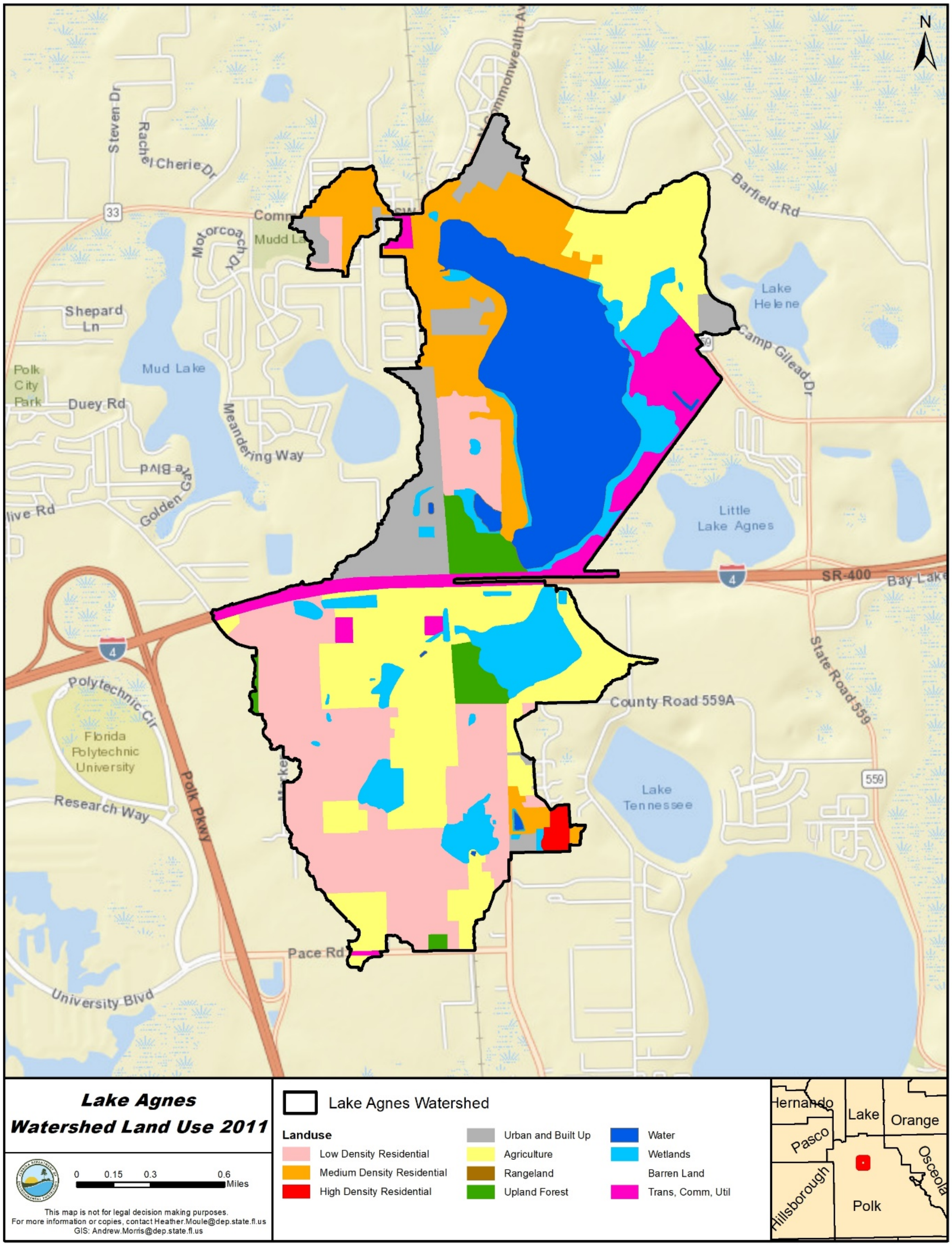


Figure 4.3. Land use in the Lake Agnes Watershed in 2011

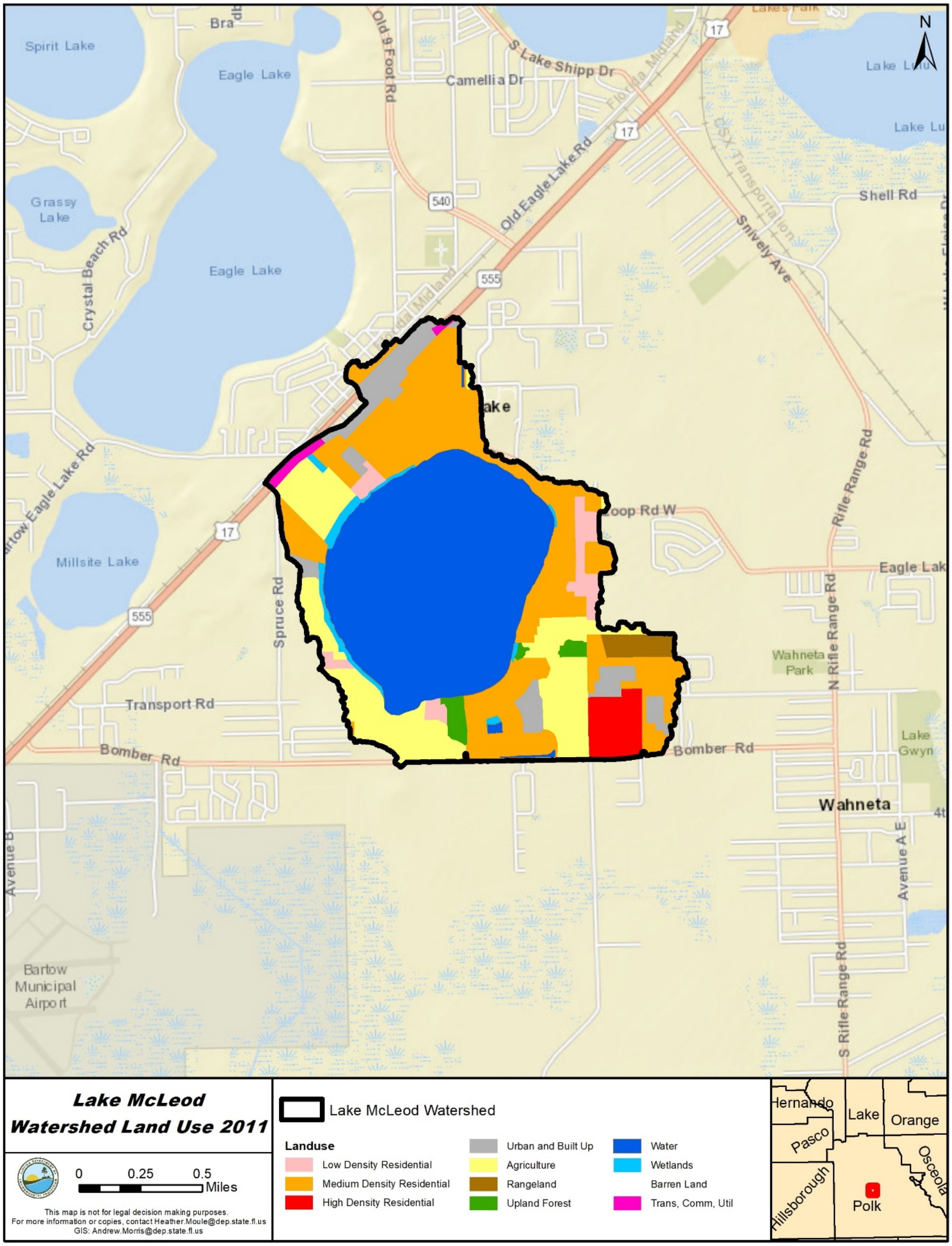


Figure 4.4. Land use in the Lake McLeod Watershed in 2011

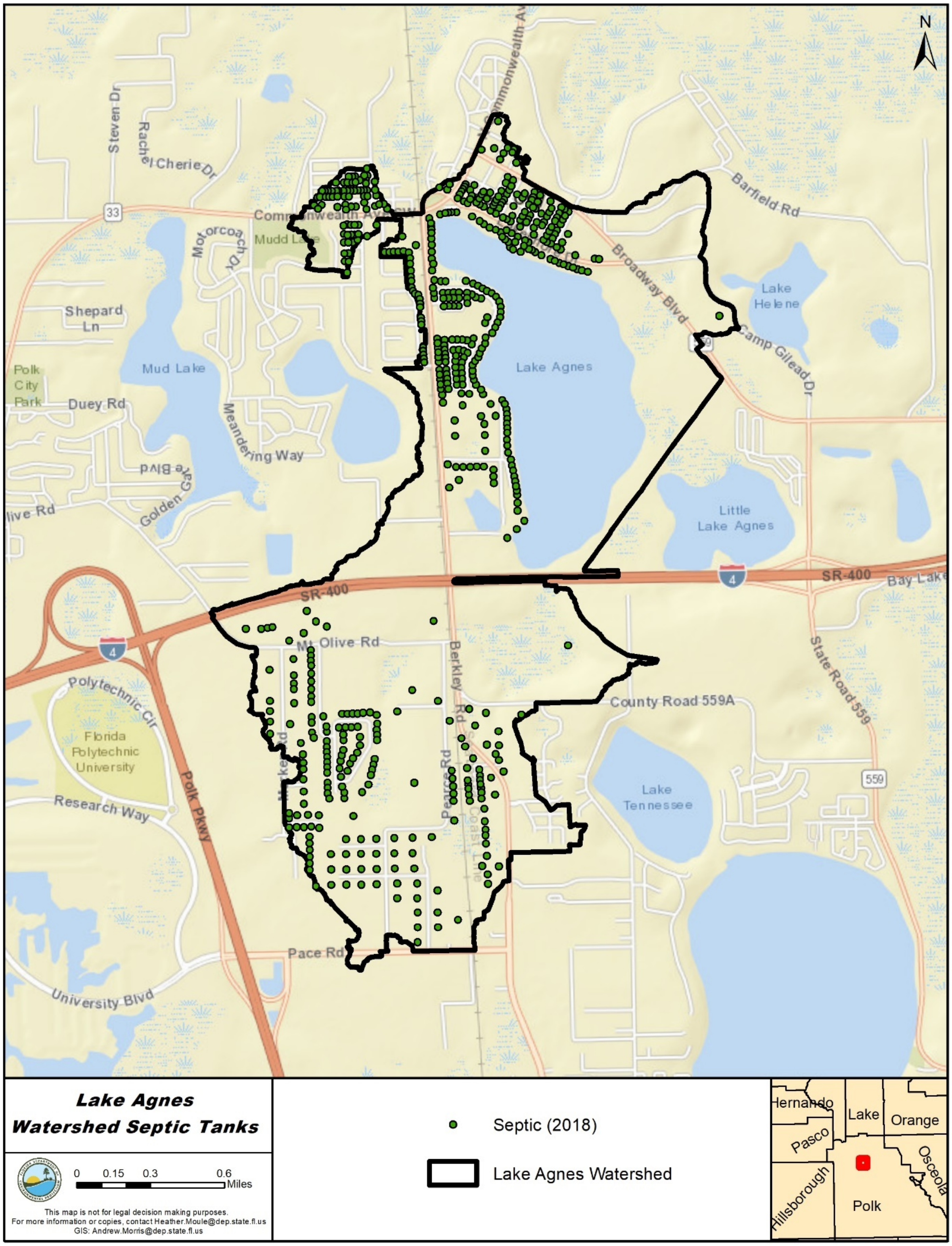


Figure 4.5. OSTDS in the Lake Agnes Watershed in 2018

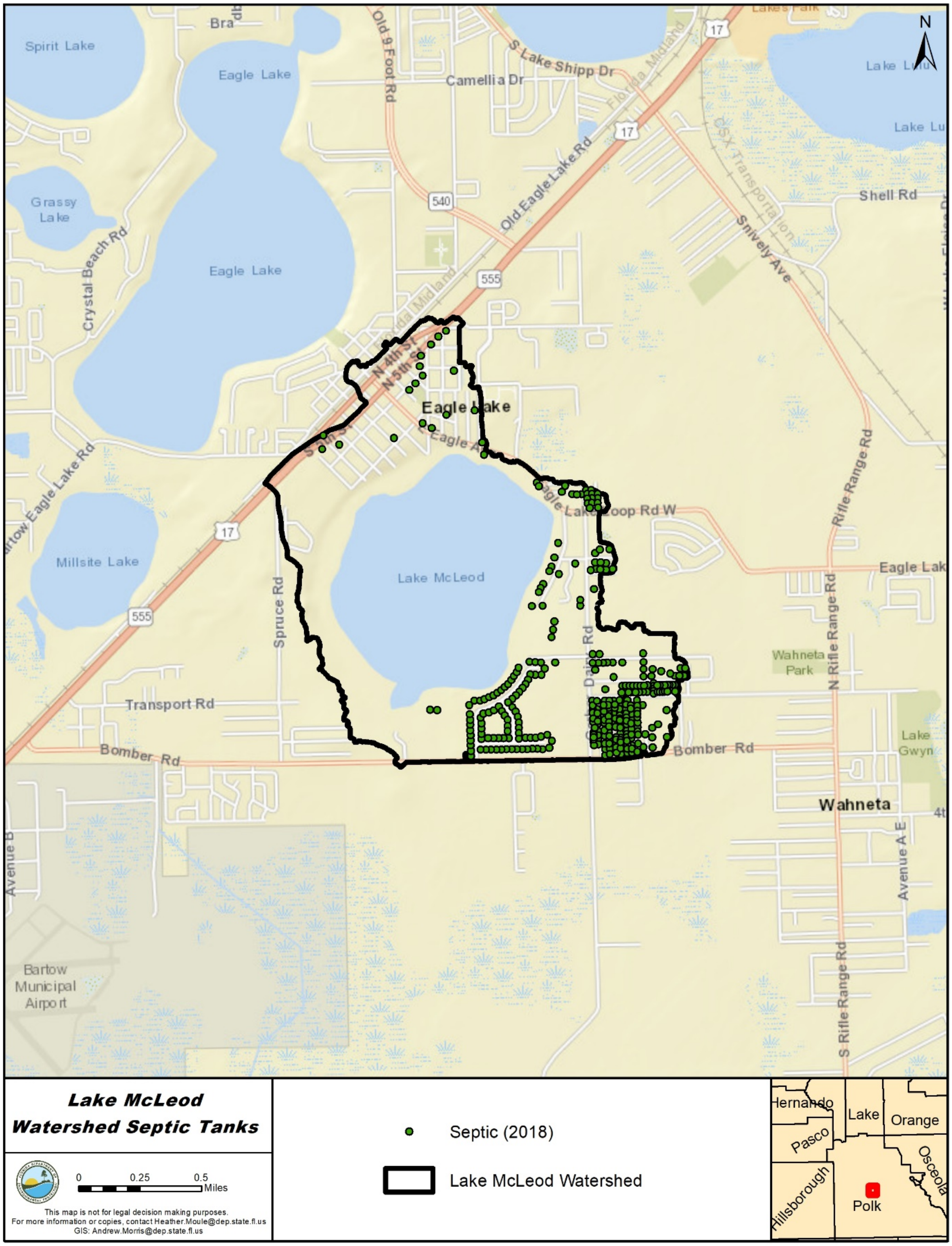


Figure 4.6. OSTDS in the Lake McLeod Watershed in 2018

4.3.3 Atmospheric Deposition

Nutrient loadings from the atmosphere are an important component of the nutrient budget in many Florida lakes. Nutrients are delivered through two pathways: wet atmospheric deposition with precipitation and dry particulate-driven deposition. Atmospheric deposition to terrestrial portions of the Lake Agnes and Lake McLeod Watersheds is assumed to be accounted for in the loading rates used to estimate the watershed loading from land. There are no known complete atmospheric deposition data for Lake Agnes and Lake McLeod. Therefore, loading from atmospheric deposition directly onto the water surface was estimated based on data collected by the St. Johns River Water Management District in Lake Apopka. These included both wet and dry atmospheric deposition data.

The dry deposition portion is expressed as a per area loading rate (areal loading rate) on an annual scale. The area of each lake was multiplied by the annual areal loading rate to calculate the total annual dry deposition. Wet deposition is delivered by precipitation (based on Polk County data), and annual wet deposition is therefore expressed as a concentration of solutes in precipitation multiplied by the total volume of precipitation. An annual areal loading rate was then calculated by dividing the wet deposition for each entire lake by the lake surface area. Atmospheric deposition values for years beyond 2012 were estimated by averaging dry deposition and rainfall components for wet deposition values from 2000 to 2012. **Table 4.4** lists rainfall, total atmospheric deposition rates and loads for Lake Agnes and Lake McLeod.

Table 4.4. Estimated atmospheric deposition in Lake Agnes and Lake McLeod based on field measurements in Lake Apopka, 2000–12

M = Meters; Mg/m^2/yr = Milligrams per square meter per year; NA = Not applicable

Year	Rainfall (m)	TN Deposition (mg/m^2/yr)	TP Deposition (mg/m^2/yr)	Lake Agnes TN Atmospheric Loading (lbs)	Lake Agnes TP Atmospheric Loading (lbs)	Lake McLeod TN Atmospheric Loading (lbs)	Lake McLeod TP Atmospheric Loading (lbs)
2000	0.73	733	38	2,569	134	NA	NA
2001	1.14	1,009	24	3,538	84	4,139	99
2002	1.61	956	26	3,352	91	3,921	107
2003	1.22	860	26	3,015	92	3,527	108
2004	1.66	1,133	36	3,972	126	4,646	147
2005	1.55	922	31	3,232	110	3,781	129
2006	0.94	723	23	2,533	82	2,964	95
2007	0.95	868	42	3,042	149	3,558	174
2008	1.17	831	43	2,912	149	3,406	175
2009	1.25	804	46	2,819	160	3,297	187
2010	1.24	761	49	2,669	171	3,122	200
2011	1.30	695	39	2,438	136	2,852	159
2012	1.20	1,136	77	3,982	269	4,658	315
2013	1.15	846	38	2,965	132	3,469	155
2014	1.37	975	41	3,417	143	3,997	167
2015	1.43	1,006	42	3,528	146	4,127	171
2016	1.40	990	41	3,471	144	4,060	169

4.3.4 Evaporation

Since there were no full evaporation data for Lake Agnes or Lake McLeod, values were used from the Lake Roberts TMDL report (Kang 2017). The potential evapotranspiration (PET) data were obtained from the Lisbon weather station from 2000 to 2012 by SJRWMD. The evaporation data were converted to lake evaporation by multiplying a pan coefficient of 0.76. Values beyond 2012 were calculated using an average of the available data period. **Table 4.5** shows the evaporation data calculated for Lake Roberts.

Table 4.5. Annual total evaporation for Lake Roberts, 2000–12

m/yr = Meters per year

Year	Lake Evaporation (m/yr)
2000	1.14
2001	1.10
2002	1.16
2003	1.13
2004	1.00
2005	0.99
2006	1.06
2007	1.02
2008	1.01
2009	1.03
2010	1.01
2011	1.08
2012	1.05
Average	1.06

4.4 Estimating Watershed Loadings

To simulate nutrient loading from the Lake Agnes and Lake McLeod Watersheds, the Pollutant Loading Screening Model (PLSM) was used. The PLSM multiplies event mean concentrations (EMCs), rainfall, and runoff coefficients (ROCs) to estimate yearly nutrient loads for a watershed. EMCs and ROCs were based on general land use descriptions. The EMCs and ROCs used in the PLSM were from spatially averaged data in Florida (Harper 2012; 1994). Polk County collected the rainfall data used in the PLSM. Land use descriptions for EMC and ROC values were matched with SWFWMD 2011 land use coverage. **Tables 4.6** and **4.7** list the PLSM results for Lake Agnes (2000–16) and Lake McLeod (2001–16), respectively, for the model periods.

Table 4.6. PLSM-simulated runoff volumes and nutrient loadings to Lake Agnes

ac-ft/yr = Acre-feet per year

Year	Runoff Volume (ac-ft/yr)	TN Load (lbs/yr)	TP Load (lbs/yr)
2000	1,536	7,094	1,022
2001	2,397	11,065	1,594
2002	3,375	15,583	2,245
2003	2,571	11,870	1,710
2004	3,488	16,103	2,320
2005	3,252	15,014	2,163
2006	1,981	9,147	1,318
2007	2,003	9,245	1,332
2008	2,452	11,319	1,631
2009	2,635	12,163	1,753
2010	2,612	12,060	1,738
2011	2,733	12,616	1,818
2012	2,510	11,587	1,670
2013	2,417	11,161	1,608
2014	2,884	13,313	1,918
2015	2,998	13,842	1,994
2016	2,940	13,572	1,955

Table 4.7. PLSM-simulated runoff volumes and nutrient loadings to Lake McLeod

ac-ft/yr = Acre-feet per year

Year	Runoff Volume (ac-ft/yr)	TN Load (lbs/yr)	TP Load (lbs/yr)
2001	1,077	5,080	816
2002	1,517	7,154	1,149
2003	1,156	5,450	875
2004	1,568	7,393	1,187
2005	1,462	6,893	1,107
2006	891	4,199	674
2007	900	4,245	681
2008	1,102	5,196	834
2009	1,184	5,584	896
2010	1,174	5,537	889
2011	1,229	5,792	930
2012	1,128	5,320	854
2013	1,087	5,124	823
2014	1,296	6,112	981
2015	1,348	6,355	1,020
2016	1,322	6,231	1,000

4.4.1 Estimating Septic Tank Flow Rates and Loads

Flow was estimated to include septic tank contributions in the watershed loading. To estimate flow, the following equation was used:

$$S * P * W * flr * 365 = \text{Flow rate (gallons/year)}$$

Where:

S = # of known septic tanks within 200 meters.
P = average number of people per household.
W = individual water consumption (70 gallons/day).
flr = flow loss rate (15 %).

The number of known and likely septic tanks within a 200 m buffer of Lake Agnes and Lake McLeod was 206 and 62, respectively. According to the U.S. Census Bureau, Polk County had an average of 2.82 people per household. Each individual uses approximately 70 gallons of water per day with a flow loss rate of 15 % (EPA 2002, Tetra Tech 2017). The number of septic tanks, the number of people per household, the individual water consumption, and a value of 0.85 were multiplied to estimate the total flow rate for septic tanks. Flow rates were converted to cubic hectometers for modeling. Lake Agnes has an estimated septic tank flow of 0.05 cubic hectometers per year (hm^3/yr). Lake McLeod has an estimated septic tank flow of 0.014 hm^3/yr.

Inorganic nutrients, such as nitrate nitrogen and ammonia, are the main nutrients associated with septic tanks, since the majority of phosphorus loads to groundwater from septic tanks are adsorbed onto soil particles immediately or very soon after discharge. For modeling purposes, these various forms of nutrients are referred to as TN. The following equation was used to estimate nitrogen loading from septic tanks:

S * P * I * L = Total TN (lbs) from septic tanks

Where:

S = # of known septic tanks in groundwater zones.
P = average number of people per household.
I = # lbs. TN per person per septic tank.
L = percentage of TN lost during seepage.

The number of septic tanks was multiplied by the number of people per household. These values were then multiplied by 9.012, which is the approximate number of pounds of TN per person seeping from a septic tank per year (EPA 2002; Toor et al. 2011); and by 0.50, which accounts for the approximated 50 % nitrogen loss that occurs as septic tank effluent moves through the unsaturated zone to groundwater. Lake Agnes and Lake McLeod have an estimated septic tank nitrogen load of 2,741 and 767 lbs/yr, respectively.

Chapter 5: Determination of Assimilative Capacity

5.1 Determination of Loading Capacity

Nutrient enrichment and the resulting problems related to eutrophication tend to be widespread and are frequently manifested far (in both time and space) from their sources. Addressing eutrophication involves relating water quality and biological effects such as photosynthesis, decomposition, and nutrient recycling as acted on by environmental factors (rainfall, point source discharge, etc.) to the timing and magnitude of constituent loads supplied from various categories of pollution sources. Assimilative capacity should be related to some specific hydrometeorological condition during a selected period or to some range of expected variation in these conditions.

The goal of this TMDL analysis is to determine the assimilative capacity of Lake Agnes and Lake McLeod and to identify the maximum allowable TN and TP loadings from the watersheds, so that the lakes will meet the TMDL targets and thus maintain their function and designated use as Class III waters.

5.2 Evaluation of Water Quality Conditions

Figures 5.1 and **5.2** show the chlorophyll *a* AGM values for Lake Agnes and Lake McLeod, respectively, and annual total rainfall for Polk County. No clear direct relationships were seen between rainfall and chlorophyll in either lake. Furthermore, simple linear regressions of rainfall on chlorophyll *a* did not uncover any significant relationships. The lack of strong relationships between nutrients and rainfall suggests that adjustments for seasonality and rainfall are unlikely to affect the TMDL determination.

For the water quality analysis conducted for TMDL development, AGMs were used to be consistent with the expression of the adopted NNC for lakes. They were calculated using a minimum of four sample results per year, with at least one of the samples collected in the May to September period and at least one sample collected from other months. Values with an "I" qualifier code were used as reported. Values with "U" or "T" qualifier codes were changed to the minimum detection limit (MDL) divided by the square root of 2. Values with "G" or "V" qualifier codes were removed from the analysis for quality control reasons. Negative values and zero values were also removed. Multiple sample results collected in the same day were averaged.

The AGM calculation method for this purpose is somewhat different than the one used to calculate AGMs for performing water quality assessments, following the methodology in Chapter 62-303, F.A.C. Therefore, the AGMs presented in **Chapter 2** may not match the AGMs used for TMDL development.

5.3 Critical Conditions and Seasonal Variation

The lakes' estimated assimilative capacity is based on annual conditions, rather than critical/seasonal conditions, because (1) the methodology used to determine assimilative capacity does not lend itself very well to short-term assessments; (2) DEP is generally more concerned with the net change in overall primary productivity in the segments, which is better addressed on an annual basis; and (3) the methodology used to determine impairment is based on annual conditions (AGM values).

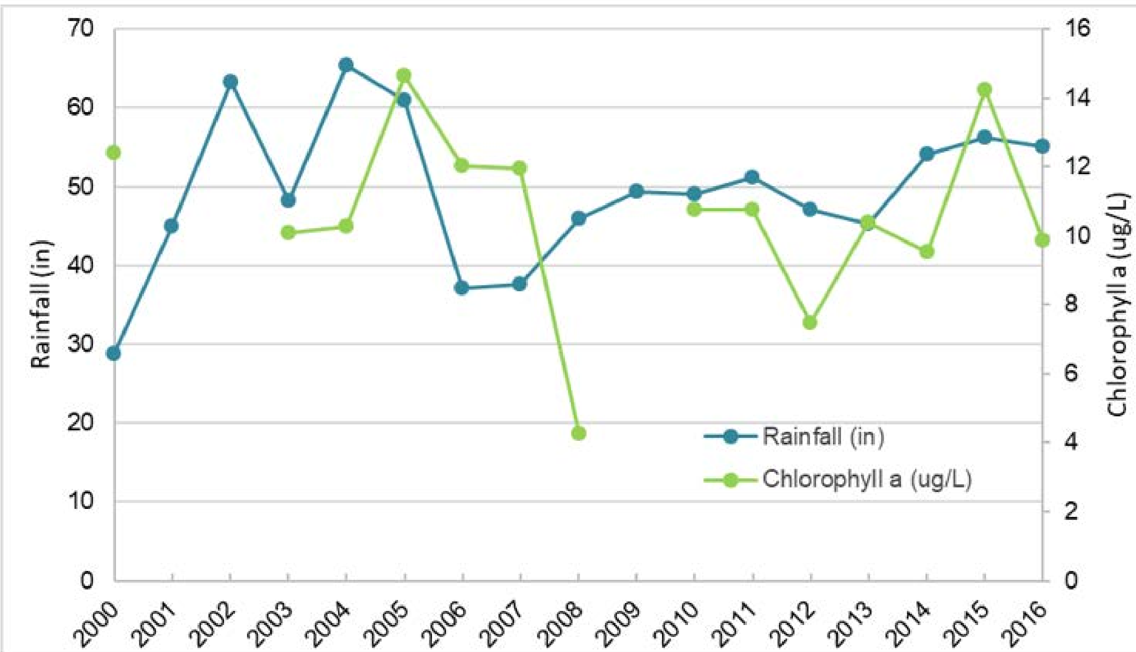


Figure 5.1. Annual rainfall vs. chlorophyll *a* AGMs in Lake Agnes

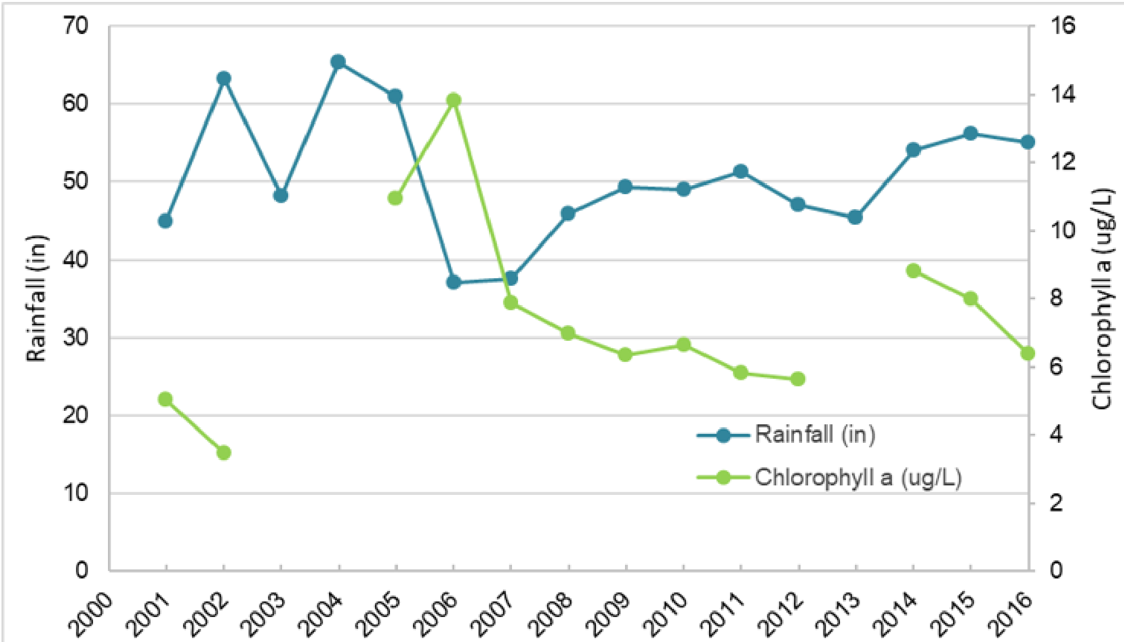


Figure 5.2. Annual rainfall vs. chlorophyll *a* AGMs in Lake McLeod

5.4 Water Quality Modeling to Determine Assimilative Capacity

The BATHTUB eutrophication model was used to predict nutrient and chlorophyll conditions for Lake Agnes and Lake McLeod based on physical lake characteristics and PLSM-derived watershed loads. The model was then used to simulate nutrient loading conditions when the lakes had balanced aquatic flora and fauna to ensure that natural conditions would not be abated.

5.4.1 Water Quality Model Description

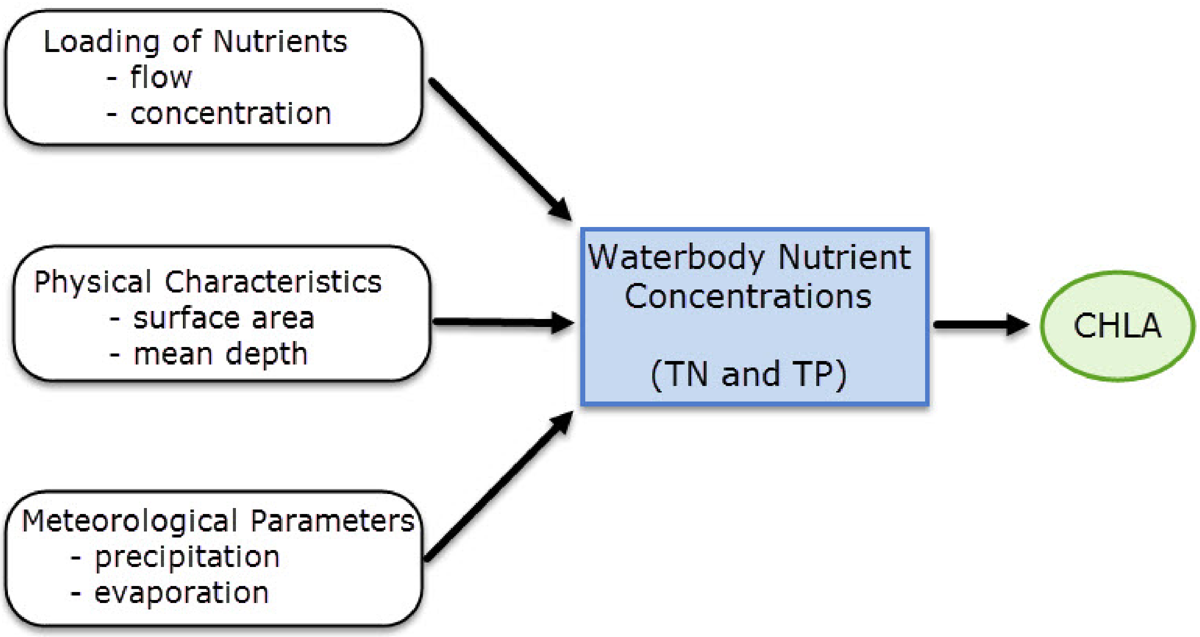
The BATHTUB eutrophication model is a suite of empirically derived steady-state models developed by the U.S. Army Corps of Engineers (USACE) Waterways Experimental Station. The primary function of these models is to estimate nutrient concentrations and algal biomass resulting from different patterns of nutrient loadings.

The User's Manual (Walker 2004) describes the procedures for selecting the appropriate model for a particular waterbody. The empirical prediction of eutrophication with this approach is typically a two-stage procedure using the following two categories of models (Walker 1987):

- The **nutrient balance model** relates the nutrient concentration to the external nutrient loadings, morphometrics, and hydraulics of the waterbody.

- The **eutrophication response model** describes the relationships among eutrophication indicators in the waterbody, including nutrient levels, chlorophyll *a*, transparency, and hypolimnetic oxygen depletion.

Figure 5.3 shows the model concept for BATHTUB. It relates the external loading of nutrients to the waterbody nutrient concentrations and the physical, chemical, and biological responses of the waterbody to the level of nutrients. The BATHTUB model includes a suite of phosphorus and nitrogen sedimentation models, along with a set of chlorophyll and Secchi depth models. The nutrient balance models assume that the net accumulation of nutrients in a waterbody is the difference between the nutrient loadings into the waterbody from various sources and the nutrients carried out through outflow and the losses of nutrients through decay processes inside the waterbody. Different limiting factors such as nitrogen, phosphorus, light, or flushing are considered in the selection of an appropriate chlorophyll *a* model. The variety of models available in BATHTUB allows the user to choose specific models based on a waterbody's particular condition.



Chla = Chlorophyll *a*

Figure 5.3. BATHTUB model concept

5.4.2 Model Selection and Calibration

In Lake Agnes, Model 3 (2nd order fixed), Model 3 (2nd order fixed), and Model 3 (phosphorus, nitrogen, low turbidity) were selected to simulate phosphorus sedimentation, nitrogen sedimentation, and chlorophyll *a*, respectively. In Lake McLeod, Model 3 (2nd order fixed), Model 3 (2nd order fixed), and Model 3 (phosphorus, nitrogen, low turbidity) were selected to simulate phosphorus sedimentation, nitrogen sedimentation, and chlorophyll *a*, respectively.

Calibration factors were not used to fit the Lake McLeod model predictions to the observed TN and TP data. A calibration factor of 0.8 was used on chlorophyll to fit the Lake Agnes model predictions. Internal loading rates for in-lake processes were also not adjusted for both models. Global variables input into BATHTUB include the averaging period for the analysis, precipitation, evaporation, and atmospheric loads. The averaging period for the analysis is one year, since inputs are on a year-to-year basis.

Figures 5.4, **5.5**, and **5.6** show the model-predicted results and observed concentrations for chlorophyll *a*, TN, and TP, respectively, for Lake Agnes. **Figures 5.7**, **5.8**, and **5.9** show the model-predicted results and observed values for chlorophyll *a*, TN, and TP, respectively, for Lake McLeod. To evaluate model performance, the percent difference between the average simulated and average observed values was calculated for the model period. The long-term percent difference, for the model period, of predicted and observed chlorophyll *a*, TN, and TP was 2 %, 0.4 %, and 2 %, respectively, for Lake Agnes. The long-term percent difference, for the model period, of predicted and observed chlorophyll *a*, TN, and TP was 8 %, 10 %, and 18 %, respectively, for Lake McLeod.

Therefore, for most years the model performance for Lake Agnes and Lake McLeod is considered "good" to "very good," according to generally accepted model calibration tolerances (Donigian 2000). However, the model predicted chlorophyll *a* and TN quite poorly in 2008 for Lake Agnes, which in that year had unusually low observed chlorophyll *a* and TN concentrations. Only four samples were taken in 2008, which could explain the outlier.

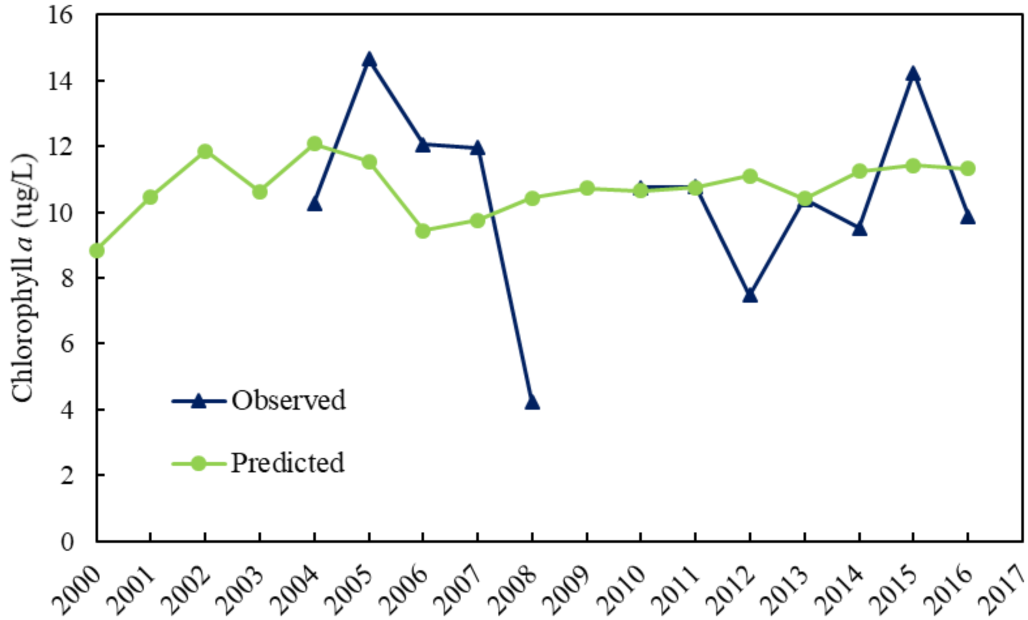


Figure 5.4. Predicted and observed chlorophyll *a* concentrations for Lake Agnes

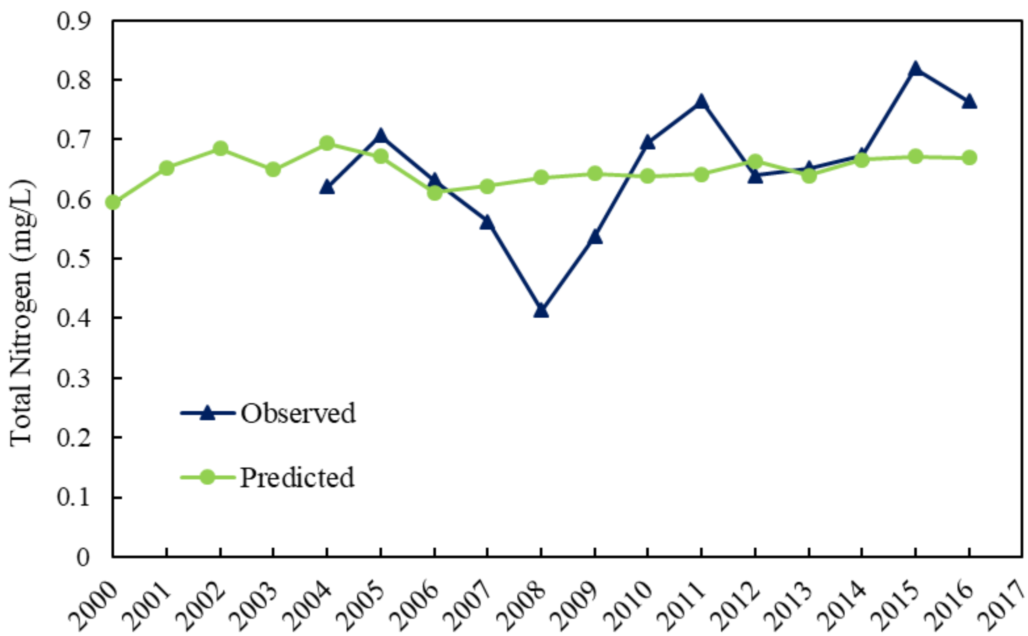


Figure 5.5. Predicted and observed TN concentrations for Lake Agnes

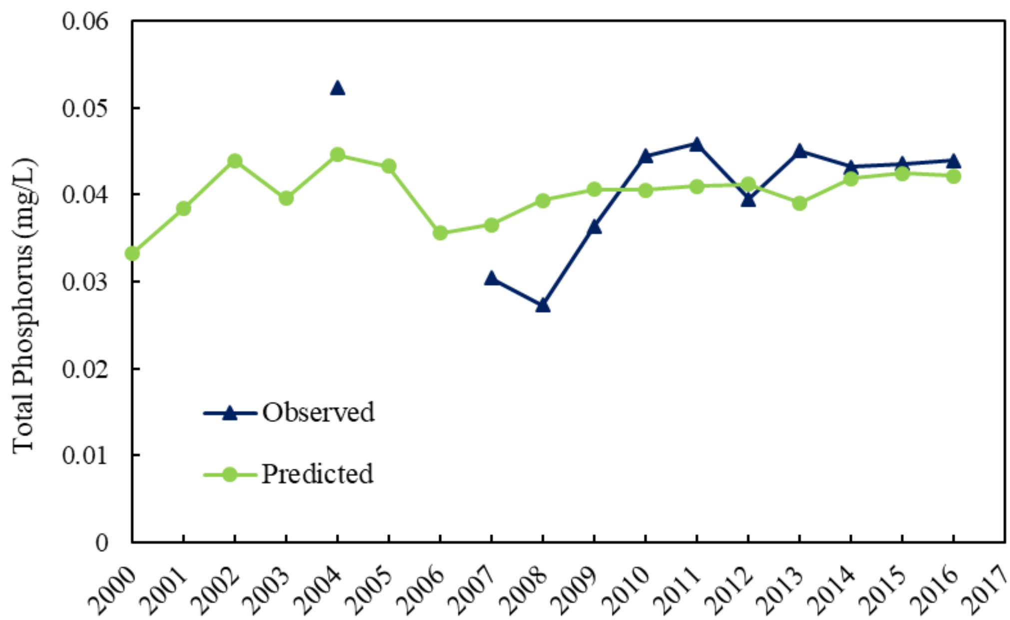


Figure 5.6. Predicted and observed TP concentrations for Lake Agnes

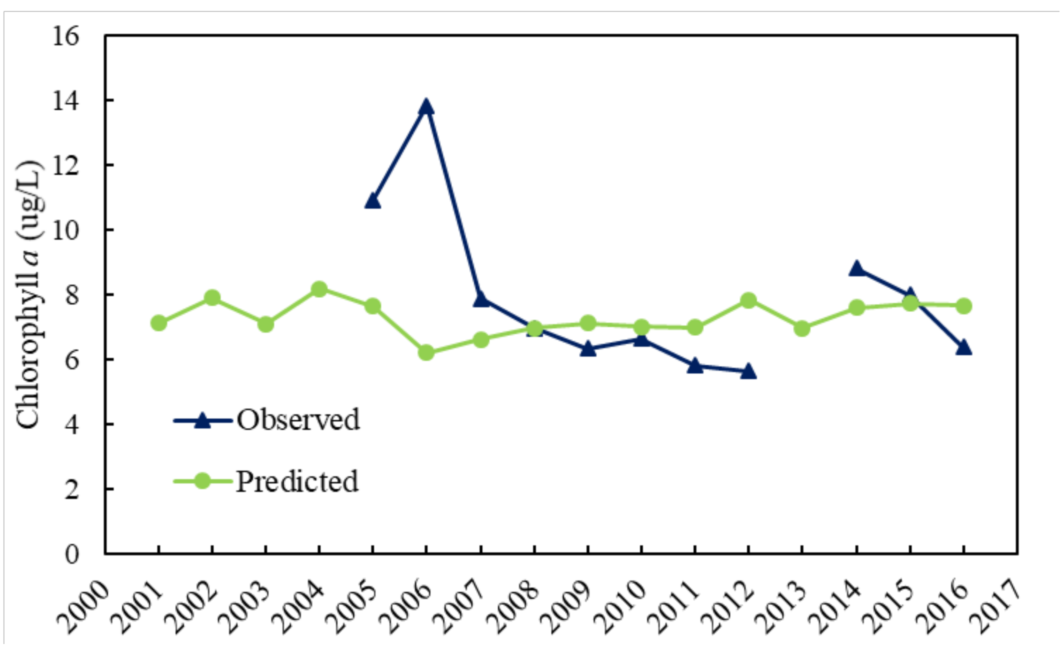


Figure 5.7. Predicted and observed chlorophyll *a* concentrations for Lake McLeod

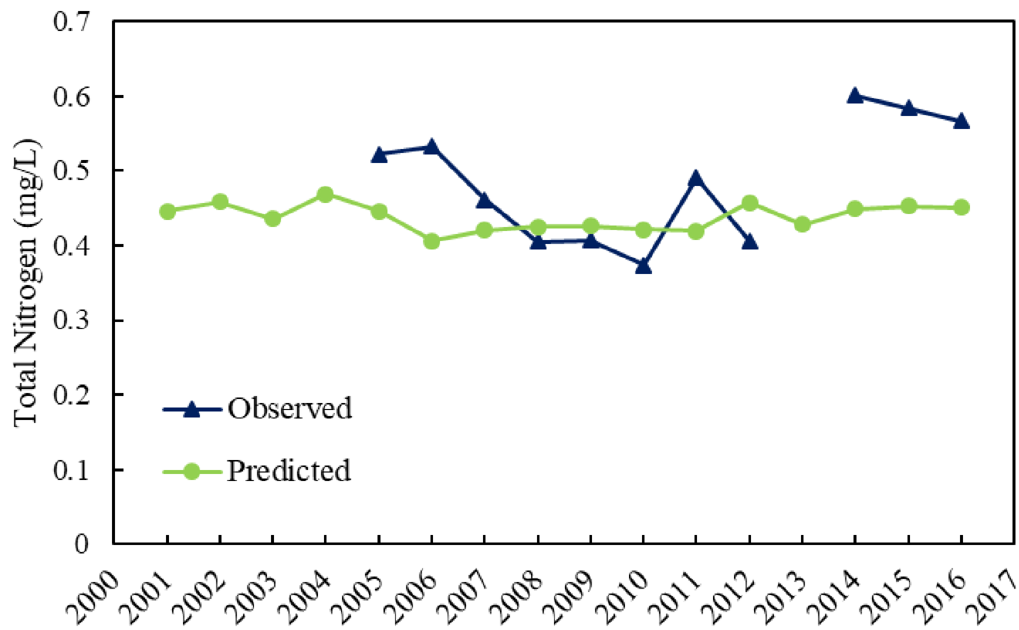


Figure 5.8. Predicted and observed TN concentrations for Lake McLeod

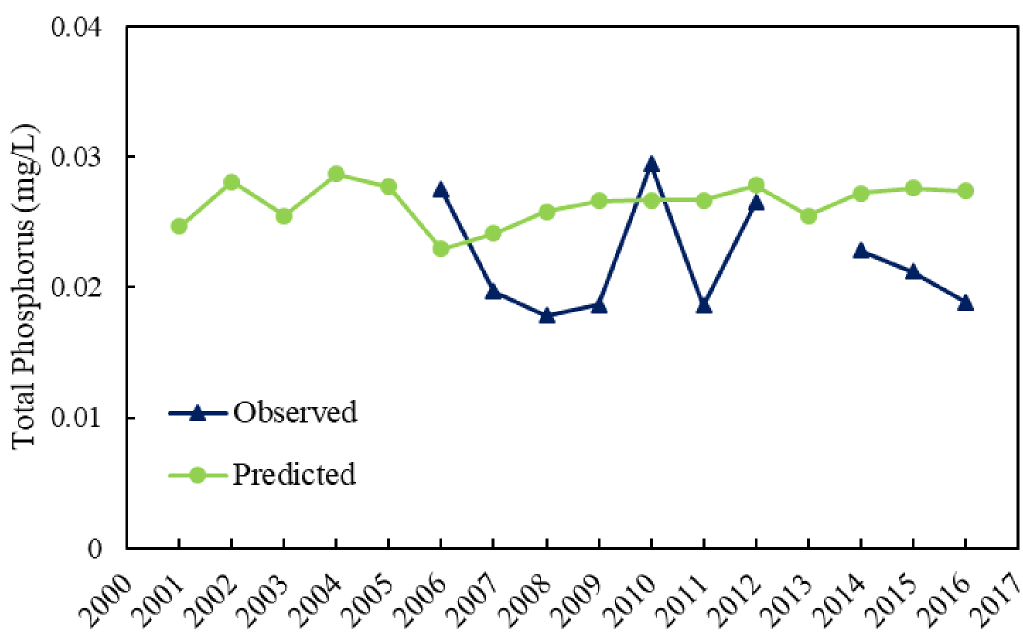


Figure 5.9. Predicted and observed TP concentrations for Lake McLeod

5.5 Calculation of the TMDLs

To achieve the target chlorophyll *a* concentration of 6 µg/L, the existing TN and TP loads were iteratively reduced until the chlorophyll *a* target was achieved in every year of the modeling period (2000–16). Meeting the chlorophyll *a* target in every year is considered a conservative assumption for establishing TMDLs, as this will ensure that all exceedances of the nutrient targets are addressed. **Tables 5.1** and **5.2** list the BATHTUB modeled loads for Lake Agnes and Lake McLeod, respectively, including the TN and TP existing loads, the loads that achieve the criterion of 6 µg/L chlorophyll *a* (TMDL condition), and their maximum 7-year rolling averages.

The final reductions to establish the TMDLs for Lake Agnes and Lake McLeod were calculated by using the maximum 7-year rolling average of both the existing and TMDL condition TN and TP loads. The maximum 7-year rolling averages for TN existing loads and TMDL condition loads for Lake Agnes are 18,552 and 10,896 lbs/yr, respectively. The maximum 7-year rolling averages for TP existing loads and TMDL condition loads for Lake Agnes are 1,979 and 618 lbs/yr, respectively. The maximum 7-year rolling averages for TN existing loads and TMDL condition loads for Lake McLeod are 10,330 and 8,172 lbs/yr, respectively. The maximum 7-year rolling averages for TP existing loads and TMDL condition loads for Lake McLeod are 1,120 and 609 lbs/yr, respectively.

The general equation used to calculate the percent reductions based on maximum 7-year rolling averages is as follows:

$$\frac{\textbf{Existing Load} - \textbf{TMDL Condition Load}}{\textbf{Existing Load}} * \mathbf{100}$$

To meet the TMDL loads for Lake Agnes, the required percent reductions for the TN and TP existing loads are 41 % and 69 %, respectively. To meet the TMDL loads for Lake McLeod, the required percent reductions for the TN and TP existing loads are 21 % and 46 %, respectively. The nutrient TMDLs, which are expressed as a 7-year rolling average load, not to be exceeded, address the anthropogenic nutrient inputs that contribute to the exceedances of the chlorophyll *a* restoration target. Additionally, the TMDLs do not abate natural background in Lake Agnes or Lake McLeod.

Table 5.1. Lake Agnes TMDL existing and TMDL condition nutrient loads

Year	Existing TN Loads (lbs/yr)	Existing TP Loads (lbs/yr)	Existing 7-Year Rolling Average TN Loads (lbs)	Existing 7-Year Rolling Average TP Loads (lbs)	TMDL Condition TN Loads (lbs/yr)	TMDL Condition TP Loads (lbs/yr)	TMDL Condition 7-Year Rolling Average TN Loads (lbs)	TMDL Condition 7-Year Rolling Average TP Loads (lbs)
2000	12,421	1,158			7,496	389		
2001	17,356	1,680			10,447	483		
2002	21,662	2,335			12,507	652		
2003	17,620	1,801			10,317	519		
2004	22,807	2,445			13,389	706		
2005	20,981	2,271			12,107	649		
2006	14,408	1,397	18,179	1,869	8,471	410	10,676	544
2007	15,028	1,479	18,552	1,915	9,035	480	10,896	557
2008	16,957	1,779	18,495	1,930	9,935	558	10,823	568
2009	17,723	1,914	17,932	1,869	10,271	599	10,504	560
2010	17,460	1,908	17,909	1,885	10,064	606	10,468	573
2011	17,790	1,954	17,193	1,815	10,113	591	10,000	556
2012	18,326	1,942	16,813	1,768	11,154	688	9,863	562
2013	16,860	1,740	17,164	1,817	9,913	535	10,069	580
2014	19,483	2,064	17,800	1,900	11,450	624	10,414	600
2015	20,116	2,143	18,251	1,952	11,821	646	10,684	613
2016	19,798	2,101	18,547	1,979	11,634	633	10,879	618
Maximum 7-Year Rolling Average			**18,552**	**1,979**			**10,896**	**618**

Table 5.2. Lake McLeod existing and TMDL condition nutrient loads

Year	Existing TN Loads (lbs/yr)	Existing TP Loads (lbs/yr)	Existing 7-Year Rolling Average TN Loads (lbs)	Existing 7-Year Rolling Average TP Loads (lbs)	TMDL Condition TN Loads (lbs/yr)	TMDL Condition TP Loads (lbs/yr)	TMDL Condition 7-Year Rolling Average TN Loads (lbs)	TMDL Condition 7-Year Rolling Average TP Loads (lbs)
2001	9,989	915			8,058	466		
2002	11,835	1,254			9,223	623		
2003	9,760	984			7,703	501		
2004	12,791	1,332			10,103	681		
2005	11,428	1,232			8,905	624		
2006	7,937	769			6,296	398		
2007	8,570	853	10,330	1,048	6,916	479	8,172	539
2008	9,373	1,011	10,242	1,062	7,405	552	8,079	551
2009	9,645	1,085	9,929	1,038	7,550	592	7,840	547
2010	9,431	1,091	9,882	1,053	7,348	601	7,789	561
2011	9,427	1,093	9,402	1,019	7,257	580	7,382	547
2012	10,739	1,169	9,303	1,010	8,732	700	7,358	557
2013	9,358	978	9,506	1,040	7,415	526	7,518	576
2014	10,881	1,150	9,836	1,082	8,610	610	7,760	594
2015	11,238	1,191	10,103	1,108	8,891	631	7,972	606
2016	11,057	1,168	10,305	1,120	8,748	618	8,143	609
Maximum 7-Year Rolling Average			**10,330**	**1,120**			**8,172**	**609**

Chapter 6: Determination of Loading Allocations

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating loads to all the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (wasteload allocations, or WLAs), nonpoint source loads (load allocations, or LAs), and an appropriate margin of safety (MOS), which accounts for uncertainty in the relationship between effluent limitations and water quality:

$$\textbf{TMDL} = \sum \textbf{WLAs} + \sum \textbf{LAs} + \textbf{MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\textbf{TMDL} \cong \sum \textbf{WLAs}_{\textbf{wastewater}} + \sum \textbf{WLAs}_{\textbf{NPDES Stormwater}} + \sum \textbf{LAs} + \textbf{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (1) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for in the LA, and (2) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as "percent reduction" because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the "maximum extent practical" through the implementation of best management practices (BMPs).

This approach is consistent with federal regulations (40 Code of Federal Regulations [CFR] § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure. The TMDLs for Lake Agnes and Lake McLeod (**Tables 6.1** and **6.2**, respectively) are expressed in terms of pounds per year and percent reduction of TN and TP, and represent the loads of TN and TP that the waterbodies can assimilate while maintaining a balanced aquatic flora and fauna. These TMDLs are based on the maximum 7-year rolling averages of simulated data from 2000 to 2016 for Lake Agnes and from

2001 to 2016 for Lake McLeod. The restoration goal is to achieve the generally applicable chlorophyll *a* criterion of 6 µg/L, which is expressed as an AGM not to be exceeded more than once in any consecutive 3-year period, meeting water quality criteria, and thus protecting Lake Agnes and Lake McLeod's designated uses. The TMDL TN and TP loads will constitute the site-specific numeric interpretations of the narrative nutrient criterion set forth in Paragraph 62-302.530(48)(b), F.A.C., for these particular waters.

Table 6.1. TMDL components for nutrients in Lake Agnes (WBID 1466)

Note: The LA and TMDL daily load for TN is 30 lbs/day, and for TP 2 lbs/day.
NA = Not applicable
* The required percent reductions listed in this table represent the reduction from all sources.

Waterbody (WBID)	Parameter	TMDL (lbs/yr)	WLA Wastewater (% reduction)	WLA NPDES Stormwater (% reduction)*	LA (% reduction)*	MOS
1466	TN	10,896	NA	41	41	Implicit
1466	TP	618	NA	69	69	Implicit

Table 6.2. TMDL components for nutrients in Lake McLeod (WBID 1588A)

Note: The LA and TMDL daily load for TN is 22 lbs/day, and for TP 2 lb/day.
NA = Not applicable
* The required percent reductions listed in this table represent the reduction from all sources.

Waterbody (WBID)	Parameter	TMDL (lbs/yr)	WLA Wastewater (% reduction)	WLA NPDES Stormwater (% reduction)*	LA (% reduction)*	MOS
1588A	TN	8,172	NA	21	21	Implicit
1588A	TP	609	NA	46	46	Implicit

6.2 Load Allocation

To achieve the LA for Lake Agnes, 41 % and 69 % reductions in current TN and TP loads, respectively, will be required. To achieve the LA for Lake McLeod, 21 % and 46 % reductions in current TN and TP loads, respectively, will be required.

The TMDLs are based on the percent reduction in total watershed loading. However, it is not DEP's intent to abate natural conditions. It should be noted that the LA includes loading from stormwater discharges regulated by DEP and the water management districts that are not part of the NPDES stormwater program (see **Appendix A**).

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

As noted in **Chapter 4**, no active NPDES-permitted facilities in the Lake Agnes and Lake McLeod Watersheds discharge into either waterbody or watershed. Therefore, a WLA for wastewater discharges is not applicable.

6.3.2 NPDES Stormwater Discharges

Polk County and co-permittees (FDOT District 1 and the Cities of Polk City and Eagle Lake) are covered by a Phase I NPDES MS4 permit (FLS000015). Areas within these jurisdictions are responsible for a 41 % reduction in TN and a 69 % reduction in TP from the current anthropogenic loading to Lake Agnes and a 21 % reduction in TN and a 46 % reduction in TP loadings to Lake McLeod.

It should be noted that any MS4 permittee is only responsible for reducing the anthropogenic loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety

The MOS can either be implicitly accounted for by choosing conservative assumptions about loading or water quality response, or explicitly accounted for during the allocation of loadings. Consistent with the recommendations of the Allocation Technical Advisory Committee (DEP 2001), an implicit MOS was used in the development of these TMDLs. The MOS is a required component of a TMDL and accounts for the uncertainty about the relationship between pollutant loads and the water quality of the receiving waterbody (CWA, Section 303[d][1][c]).

An implicit MOS was used because the TMDLs were based on the conservative decisions associated with a number of the modeling assumptions in determining the assimilative capacity (i.e., loading and water quality response for Lake Agnes and Lake McLeod). The TMDLs were developed using water quality results from both high- and low-rainfall years. The EMC values used in the PLSM were based on 2011 land use. Therefore, the values remained the same every year and the PLSM did not account for nutrient attenuation. Additionally, the TMDL nutrient loads were derived based on the chlorophyll *a* criterion being met in every year of the model simulation, while the criterion is expressed as not to be exceeded more than once in any consecutive 3-year period.

Chapter 7: Implementation Plan Development and Beyond

7.1 Implementation Mechanisms

Following the adoption of a TMDL, implementation takes place through various measures. The implementation of TMDLs may occur through specific requirements in NPDES wastewater and MS4 permits, and, as appropriate, through local or regional water quality initiatives or basin management action plans (BMAPs).

Facilities with NPDES permits that discharge to the TMDL waterbody must implement the permit conditions that reflect target concentrations, reductions, or wasteload allocations identified in the TMDL. NPDES permits are required for Phase I and Phase II MS4s as well as domestic and industrial wastewater facilities. MS4 Phase I permits require a permit holder to prioritize and act to address a TMDL unless management actions to achieve that particular TMDL are already defined in a BMAP. MS4 Phase II permit holders must also implement the responsibilities defined in a BMAP or other form of restoration plan (e.g., a reasonable assurance plan).

7.2 BMAPs

Information concerning the development and implementation of BMAPs is found in Section 403.067, F.S. (the FWRA). DEP or a local entity may initiate and develop a BMAP that addresses some or all of the contributing areas to the TMDL waterbody. BMAPs are adopted by the DEP Secretary and are legally enforceable.

BMAPs describe the fair and equitable allocations of pollution reduction responsibilities to the sources in the watershed, as well as the management strategies that will be implemented to meet those responsibilities, funding strategies, mechanisms to track progress, and water quality monitoring. Local entities—such as wastewater facilities, industrial sources, agricultural producers, county and city stormwater systems, military bases, water control districts, state agencies, and individual property owners—usually implement these strategies. BMAPs can also identify mechanisms to address potential pollutant loading from future growth and development.

Additional information about BMAPs is available online.

7.3 Implementation Considerations for the Waterbody

In addition to addressing reductions in watershed pollutant contributions to impaired waters during the implementation phase, it may also be necessary to consider the impacts of internal sources (e.g., sediment nutrient fluxes or the presence of nitrogen-fixing cyanobacteria) and the results of any associated remediation projects on surface water quality. In the case of Lake Agnes and Lake McLeod, other factors—such as the calibration of watershed nutrient loading, sediment nutrient fluxes, and/or nitrogen fixation—also influence lake nutrient budgets and the growth of phytoplankton. Additionally, herbicide treatment is used to control the growth of invasive aquatic plants in both lakes, and this management activity can contribute to the cycling of nutrients in the lakes and influence phytoplankton growth.

Approaches for addressing these other factors should be included in a comprehensive management plan for the lakes. Furthermore, the current water quality and water level monitoring of Lake Agnes and Lake McLeod should continue and be expanded, as necessary, during the implementation phase to ensure that adequate information is available for tracking restoration progress.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C. In 1994, DEP stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations, as authorized under Part IV of Chapter 373, F.S.

Chapter 62-40, F.A.C., also requires the state's water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) Program plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, they have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka.

In 1987, the U.S. Congress established Section 402(p) as part of the federal CWA Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES stormwater program in 1990 to address stormwater discharges associated with industrial activity, including 11 categories of industrial activity, construction activities disturbing 5 or more acres of land, and large and medium MS4s located in incorporated places and counties with populations of 100,000 or more.

However, because the master drainage systems of most local governments in Florida are physically interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 special districts; community development districts, water control districts, and FDOT throughout the 15 counties meeting the population criteria. DEP received authorization to implement the NPDES stormwater program in 2000. The authority to administer the program is set forth in Section 403.0885, F.S.

The Phase II NPDES stormwater program, promulgated in 1999, addresses additional sources, including small MS4s and small construction activities disturbing between 1 and 5 acres, and urbanized areas serving a minimum resident population of at least 1,000 individuals. While these urban stormwater discharges are technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that Phase I MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Information in Support of Site-Specific Interpretations of the Narrative Nutrient Criterion

Table B-1. Spatial extent of the numeric interpretation of the narrative nutrient criterion

Location	Description
Waterbody name	Lake Agnes and Lake McLeod
Waterbody type(s)	Lake
WBID	Lake Agnes (WBID 1466) and Lake McLeod (WBID 1588A) (see **Figure 1.1** of this report)
Description	Lake Agnes and Lake McLeod are located in north-central Polk County. The combined watershed area for the lakes is 3,443 acres. In the Lake Agnes Watershed, the dominant land use is urban, which covers 41 % of the total area. In the Lake McLeod Watershed, the dominant land uses are urban and water, which cover 41 % and 38 % of the total area, respectively. **Chapter 1** of this report describes the Lake Agnes and Lake McLeod systems in more detail.
Specific location (latitude/longitude or river miles)	The center of Lake Agnes is located at N: 28°10'07"/ W: 81°49'05" and the center of Lake McLeod is located at N: 27°58'03"/ W: 81°45'10." Lake McLeod is situated 14 miles southeast of Lake Agnes.
Map	**Figure 1.1** shows the general locations of Lake Agnes and Lake McLeod and their watersheds. **Figure 4.3** shows land uses in the Lake Agnes Watershed, and **Figure 4.4** shows land uses in the Lake McLeod Watershed.
Classification(s)	Class III Freshwater
Basin name (HUC 8)	Withlacoochee Basin (03100208) Peace River Basin (03100101)

Table B-2. Description of the numeric interpretation of the narrative nutrient criterion

Numeric Interpretation of Narrative Nutrient Criterion	Information on Parameters Related to Numeric Interpretation of the Narrative Nutrient Criterion
NNC summary: Generally applicable lake classification (if applicable) and corresponding NNC	Lake Agnes and Lake McLeod are low-color, low-alkalinity lakes, and the generally applicable NNC, expressed as AGM concentrations not to be exceeded more than once in any 3-year period, are chlorophyll *a* of 6 µg/L, TN of 0.51 to 0.93 mg/L, and TP of 0.01 to 0.03 mg/L.
Proposed TN, TP, chlorophyll *a*, and/or nitrate + nitrite concentrations (magnitude, duration, and frequency)	Numeric interpretations of the narrative nutrient criterion: The TN and TP for Lake Agnes are expressed as 7-year rolling annual average loads not to be exceeded and are 10,896 lbs/yr for TN and 618 lbs/yr for TP. The TN and TP for Lake McLeod are expressed as 7-year rolling annual average loads not to be exceeded and are 8,172 lbs/yr for TN and 609 lbs/yr for TP. Nutrient concentrations are provided for comparative purposes only. The in-lake TN and TP AGM concentrations for Lake Agnes at the allowable TMDL loading are 0.49 and 0.02 mg/L, respectively, not to be exceeded more than once in any consecutive 3-year period. The in-lake TN and TP AGM concentrations for Lake McLeod at the allowable TMDL loading are 0.40 and 0.02 mg/L, respectively, not to be exceeded more than once in any consecutive 3-year period. These restoration concentrations represent the in-lake concentrations that would still meet the target chlorophyll *a* concentration of 6 µg/L with a 1-in-3-year exceedance rate.
Period of record used to develop numeric interpretations of the narrative nutrient criterion for TN and TP	The criteria were developed based on the application of the PLSM and the BATHTUB model, which simulated hydrology and water quality conditions over the 2000–16 period for Lake Agnes and the 2001–16 period for Lake McLeod. The primary datasets for this period include water quality data from IWR Database Run 55, Polk County rainfall data, and 2011 SWFWMD land use coverage. **Sections 2.3** and **4.4** of this report describe the data used in the derivation of the proposed site-specific criteria.
How the criteria developed are spatially and temporally representative of the waterbody or critical condition	The models simulated the 2000–16 period for Lake Agnes and the 2001–16 period for Lake McLeod. Both periods included wet and dry years. The long-term average annual rainfall in Polk County (1915–2017) was 52 inches. A comparison with long-term average rainfall data indicates that 2000, 2006, and 2007 were much drier years, while 2002, 2004, and 2005 were wet years. This period captures the hydrologic variability of the Lake Agnes and Lake McLeod systems. The models simulated each watershed to evaluate how changes in watershed loads impacted lake nutrient and chlorophyll *a* concentrations. **Figure 2.1** shows the locations of the sampling stations in Lake Agnes, and **Figure 2.2** shows the locations of the sampling stations in Lake McLeod. Monitoring stations were distributed across the spatial extent and represented the spatial distribution of nutrient dynamics in both lakes.

Table B-3. Summary of how designated use (or uses) is protected by the criterion

Designated Use Requirements	Information Related to Designated Use Requirements
History of assessment of designated use support	DEP used the IWR Database to assess water quality impairments in Lake Agnes (WBID 1466) and Lake McLeod (WBID 1588A). During the Cycle 3 assessment, the NNC were used to assess Lake Agnes during the verified period (January 1, 2009–June 30, 2016), using data from IWR Database Run 52. During the Cycle 3 assessment, the NNC were used to assess Lake McLeod during the verified period (January 1, 2008–June 30, 2015). Lake Agnes was found to be impaired for chlorophyll *a*, TN, and TP because the AGMs exceeded the NNC more than once in a 3-year period (2010–15) for chlorophyll *a*, TN, and TP. The waterbody was added to the 303(d) list for these parameters. Lake McLeod was found to be impaired for chlorophyll *a* because the AGMs exceeded the NNC more than once in a 3-year period (2008 and 2010). The waterbody was added to the 303(d) list for chlorophyll *a*. See **Section 2.3.2** of this report for a detailed discussion.
Basis for use support	The basis for use support is the NNC chlorophyll *a* concentration of 6 µg/L, which is protective of designated uses for low-color, low-alkalinity lakes. Based on the available information, there is nothing unique about Lake Agnes or Lake McLeod that would make the use of the chlorophyll *a* threshold of 6 µg/L inappropriate.
Approach used to develop criteria and how it protects uses	For the Lake Agnes and Lake McLeod nutrient TMDLs, DEP created loading-based criteria using the PLSM to simulate loading from each watershed, and this information was input into BATHTUB for the lakes. DEP established the site-specific TN and TP loadings using the calibrated models to achieve an in-lake chlorophyll *a* AGM concentration of 6 µg/L, because this target is the generally applicable NNC demonstrated to be protective of the designated use for low-color, low-alkalinity lakes. The maximum of the 7-year rolling averages of TN and TP loadings to achieve the chlorophyll *a* target was determined by decreasing TN and TP loads from anthropogenic sources into the lakes until the chlorophyll *a* target was achieved.
How the TMDL analysis will ensure that nutrient-related parameters are attained to demonstrate that the TMDLs will not negatively impact other water quality criteria	Model simulations indicated that the target chlorophyll *a* concentration (6 µg/L) in the lakes will be attained at the TMDL loads for TN and TP. DEP notes that no other impairments were verified for Lake Agnes or Lake McLeod that may be related to nutrients (such as dissolved oxygen [DO] or un-ionized ammonia). Reducing the nutrient loads entering the lakes will not negatively impact other water quality parameters.

Table B-4. Documentation of the means to attain and maintain water quality standards for downstream waters

Protection of Downstream Waters and Monitoring Requirements	Information Related to Protection of Downstream Waters and Monitoring Requirements
Identification of downstream waters: List receiving waters and identify technical justification for concluding downstream waters are protected	Lake Agnes has no inlet but has one outlet through a ditch, located on its northern side, that is not connected to any nearby surface waterbodies. Lake McLeod flows into Wahneta Farms Drainage Canal (WBID 1580), which has no water quality impairments. The reductions in nutrient loads resulting from the Lake McLeod TMDLs are not expected to cause nutrient impairments downstream and are expected to improve water quality downstream by reducing algal biomass and associated nutrients.
Summary of existing monitoring and assessment related to the implementation of Subsection 62-302.531(4), F.A.C., and trends tests in Chapter 62-303, F.A.C.	Polk County and DEP conduct routine monitoring of Lake Agnes and Lake McLeod. The data collected through these monitoring activities will be used to evaluate the effect of BMPs implemented in the watershed on lake TN and TP loads in subsequent water quality assessment cycles.

Table B-5. Documentation of endangered species consideration

Administrative Requirements	Information for Administrative Requirements
Endangered species consideration	DEP is not aware of the presence of any endangered species in the Lake Agnes and Lake McLeod Watersheds. It is expected that restoration efforts and subsequent water quality improvements will positively affect species living in the lakes and their respective watersheds.

Table B-6. Documentation that administrative requirements are met

Administrative Requirements	Information for Administrative Requirements
Notice and comment notifications	DEP published a Notice of Development of Rulemaking on March 29, 2019 to initiate TMDL development for impaired waters in the Peace River Basin. A rule development public workshop for the TMDLs was held on May 7, 2019.
Hearing requirements and adoption format used; responsiveness summary	Following the publication of the Notice of Proposed Rule, DEP will provide a 21-day challenge period and a public hearing that will be noticed no less than 45 days prior.
Official submittal to EPA for review and General Counsel certification	If DEP does not receive a rule challenge, the certification package for the rule will be prepared by the DEP program attorney. DEP will prepare the TMDLs and submittal package for the TMDLs to be considered site-specific interpretations of the narrative nutrient criterion, and will submit these documents to the EPA.