Central District • Middle St. Johns River Basin

Draft Report

Nutrient TMDLs for Lake Davis (WBID 3168Y4), Lake Wade (WBID 3168W3), and Lake Weldona (WBID 3168Y8)

Janelle Strong
Division of Environmental Assessment and Restoration
Florida Department of Environmental Protection

August 2022

2600 Blair Stone Road
Mail Station 3000
Tallahassee, FL 32399-2400
https://floridadep.gov

Executive Summary

This report presents the total maximum daily loads (TMDLs) developed to address the nutrient impairments for the following segments with waterbody identification (WBID) numbers: Lake Davis (WBID 3168Y4), Lake Wade (WBID 3168W3), and Lake Weldona (WBID 3168Y8). These waterbody segments are located in the Middle St. Johns River Basin in the east Orlando area in Orange County, Florida.

These three waterbodies were identified as impaired for nutrients based on elevated chlorophyll *a* concentrations exceeding the numeric nutrient criteria (NNC) in Subsection 62-302.531(2), Florida Administrative Code (F.A.C.). Lake Davis and Lake Weldona were also identified as impaired for nutrients based on elevated total nitrogen (TN) and total phosphorus (TP) concentrations exceeding the NNC in Subsection 62-302.531(2), F.A.C. The lakes were verified as impaired for nutrients and were included on the Verified List of Impaired Waters for the Kissimmee River Basin Group 4 in Assessment Cycle 3, adopted by Secretarial Order in June 2017.

The TMDLs are based on the generally applicable NNC in Subsection 62-302.531(2), F.A.C. TMDLs for TN and TP have been developed, and **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 Lakes Davis, Wade, and Weldona

Type of Information	Description
Waterbody name/ WBID number	Lake Davis/WBID 3168Y4, Lake Wade/WBID 3168W3, and Lake Weldona/WBID 3168Y8
Hydrologic Unit Code (HUC) 8	03090101 (see **Section 1.2** for additional information)
Use classification/ Waterbody designation	Class III/Fresh
Targeted beneficial uses	Fish consumption; recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife
303(d) listing status	Placed on the Verified List of Impaired Waters for the Kissimmee River Group 4 Basin adopted via Secretarial Order in June 2017.
TMDL pollutants	TN and TP
Generally applicable chlorophyll *a* criterion	**Low-color (color ≤ 40 platinum cobalt units [PCUs]), high-alkalinity (> 20 milligrams per liter [mg/L]) lakes:** **Chlorophyll *a***: 20 micrograms per liter (µg/L), expressed as an annual geometric mean (AGM) concentration not to be exceeded more than once in any consecutive 3-year period.
TMDLs	**Lake Davis (WBID 3168Y4):** **TN:** 48 % reduction in in-lake concentration to meet the generally applicable NNC for low-color, high-alkalinity lakes. **TP:** 78 % reduction in in-lake concentration to meet the generally applicable NNC for low-color, high-alkalinity lakes. **Lake Wade (WBID 3168W3):** **TN:** 22 % reduction in in-lake concentration to meet the generally applicable NNC for low-color, high-alkalinity lakes. **TP:** 74 % reduction in in-lake concentration to meet the generally applicable NNC for low-color, high-alkalinity lakes. **Lake Weldona (WBID 3168Y8):** **TN:** 50 % reduction in in-lake concentration to meet the generally applicable NNC for low-color, high-alkalinity lakes. **TP:** 83 % reduction in in-lake concentration to meet the generally applicable NNC for low-color, high-alkalinity lakes.

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, and Watershed Evaluation and TMDL Section. DEP would like to acknowledge the City of Orlando and Orange County for their contributions towards understanding the issues, history, and processes at work in the lake watersheds.

For additional information regarding the development of this report, please contact the Division of Environmental Assessment and Restoration office at:

2600 Blair Stone Road
Mail Station 3000
Tallahassee, FL 32399-2400
Phone: (850) 245–8668

Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

µg/L	Micrograms Per Liter
AGM	Annual Geometric Mean
BMAP	Basin Management Action Plan
BMP	Best Management Practice
$CaCO_3$	Calcium Carbonate
CFR	Code of Federal Regulations
CWA	Clean Water Act
DEP	Florida Department of Environmental Protection
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
F.A.C.	Florida Administrative Code
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FLUCCS	Florida Land Use, Cover and Forms Classification System
F.S.	Florida Statutes
ft	Feet
ft^3	Cubic Feet
FWRA	Florida Watershed Restoration Act
HUC	Hydrologic Unit Code
ID	Insufficient Data
IWR	Impaired Surface Waters Rule
LA	Load Allocation
MDL	Method Detection Limit
mg/L	Milligrams Per Liter
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NA	Not Applicable
NAD	North American Datum
NNC	Numeric Nutrient Criteria
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OSTDS	Onsite Sewage Treatment and Disposal System
PCU	Platinum Cobalt Unit
PLRG	Pollutant Load Reduction Goal
POR	Period of Record
SFWMD	South Florida Water Management District
SJRWMD	St. John’s River Water Management District
SWIM	Surface Water Improvement and Management (Program)

TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WBID	Waterbody Identification (Number)
WLA	Wasteload Allocation
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 Davis, Lake Wade, and Lake Weldona, located in the Middle St. Johns River Basin in Orange County. The TMDLs are established to achieve the generally applicable numeric nutrient criteria (NNC) in Subsection 62-302.531(2), Florida Administrative Code (F.A.C.), and are intended to attain the chlorophyll *a* criterion applicable to each lake. The TMDL targets are not being adopted as Hierarchy 1 site-specific interpretations of the NNC because the generally applicable NNC fully protect designated uses.

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 nutrient concentrations for Lakes Davis, Wade, and Weldona and associated nutrient reductions that would restore the waterbodies so that they meet their applicable water quality criteria for nutrients.

1.2 Identification of Waterbodies

The three 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.). Lakes Davis, Wade, and Weldona were included on the Verified List of Impaired Waters for the Kissimmee River Basin that was adopted by Secretarial Order in June 2017. Based on the basin boundaries used by the South Florida Water Management District (SFWMD) and the St. Johns River Water Management District (SJRWMD), these lakes are located in the Middle St. Johns River Basin. The river basins delineated by the water management districts best reflect the hydrology of the region and, for purposes of this report, Lakes Davis, Wade, and Weldona are identified within the Middle St. Johns River Basin. **Figure 1.1** shows the former and revised Kissimmee River Basin boundaries in the area of the impaired lakes.

For assessment purposes, the Florida Department of Environmental Protection (DEP) divided the state into assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or surface water segment. Lake Davis is WBID 3168Y4, Lake Wade is WBID 3168W3, and Lake Weldona is WBID 3168Y8. **Figure 1.2** shows the location of the WBIDs and their watersheds in the basins. **Figures 1.3** through **1.5** contain detailed maps of the WBIDs and their watersheds, and the major geopolitical and hydrologic features surrounding them.

None of these lakes has known surface hydrologic connections. They are seepage lakes within closed basins as they appear to have no surface water inlets or outlets. Lake Davis has a surface

area of 18 acres, a volume of 4,603,127 cubic feet (ft^3), and a mean depth of 6.2 feet (ft). Lake Wade has a surface area of 3 areas, a volume of 720,000 ft^3, and a mean depth of 5.9 ft. Lake Weldona has a surface area of 9 acres, a volume of 2,859,000 ft^3, and a mean depth of 7.4 ft. The three lakes are classified as eutrophic (City of Orlando 2019).

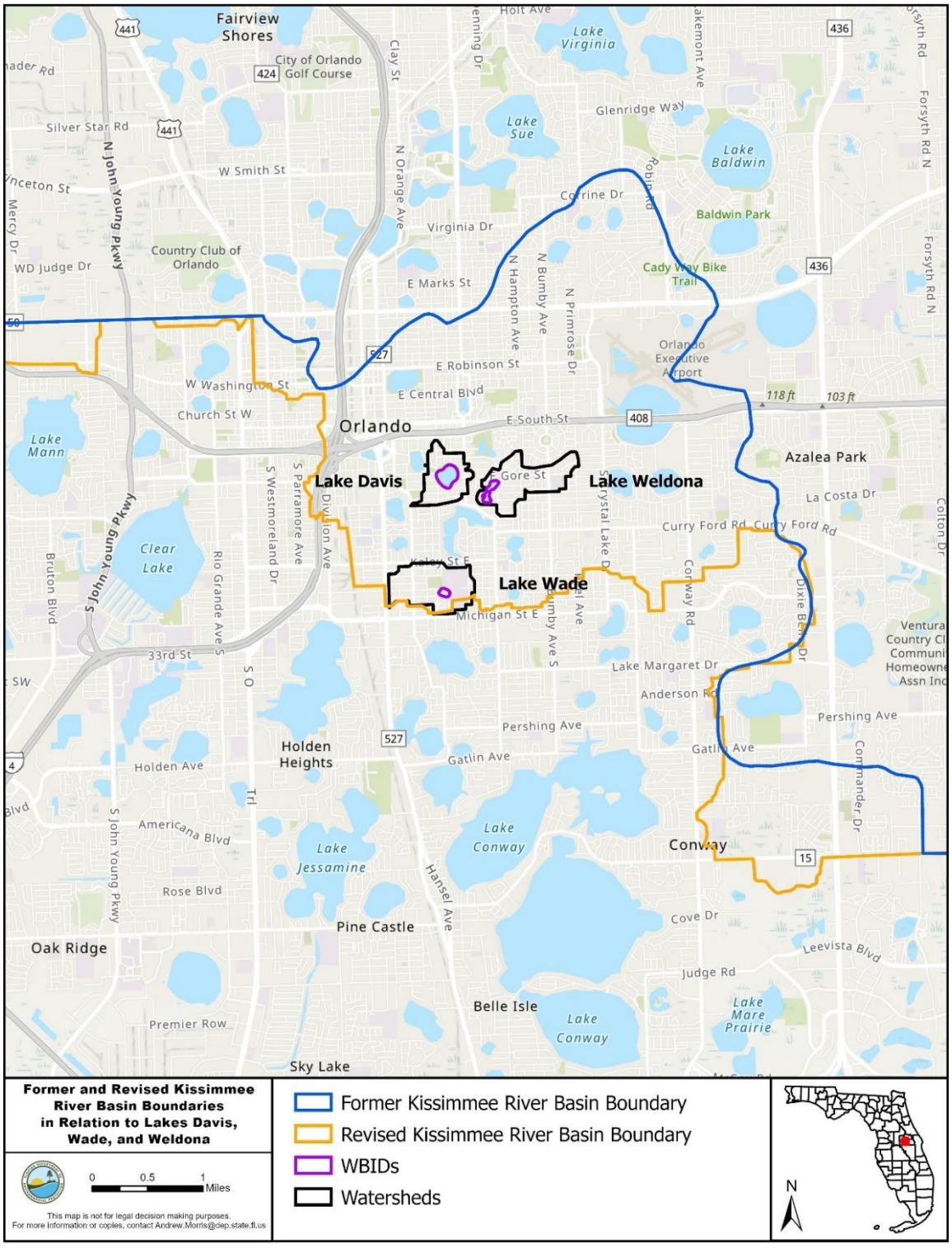

Figure 1.1. Former and revised Kissimmee River Basin boundaries in relation to Lakes Davis, Wade, and Weldona

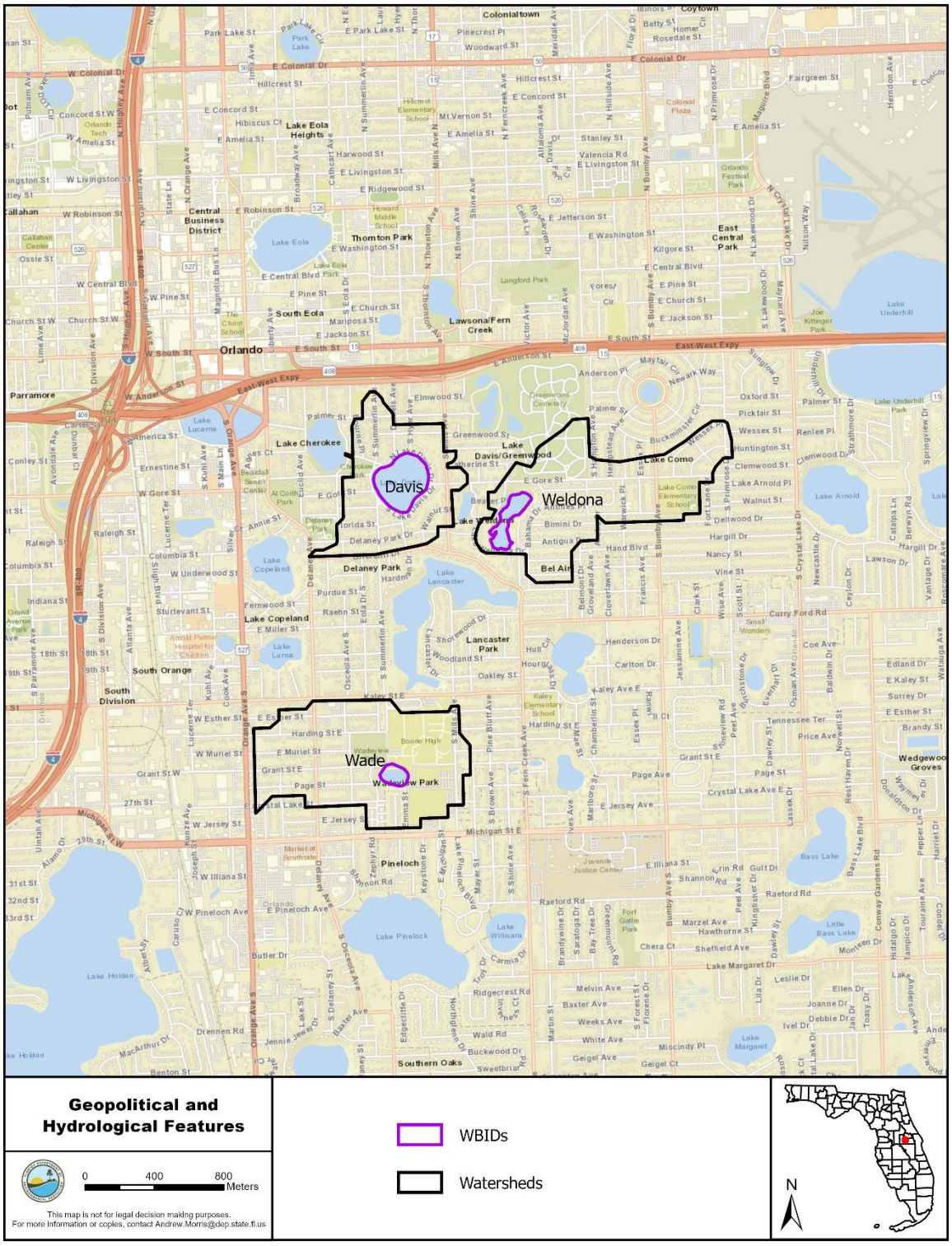

Figure 1.2. Lakes Davis, Wade, and Weldona Watersheds and major geopolitical and hydrological features

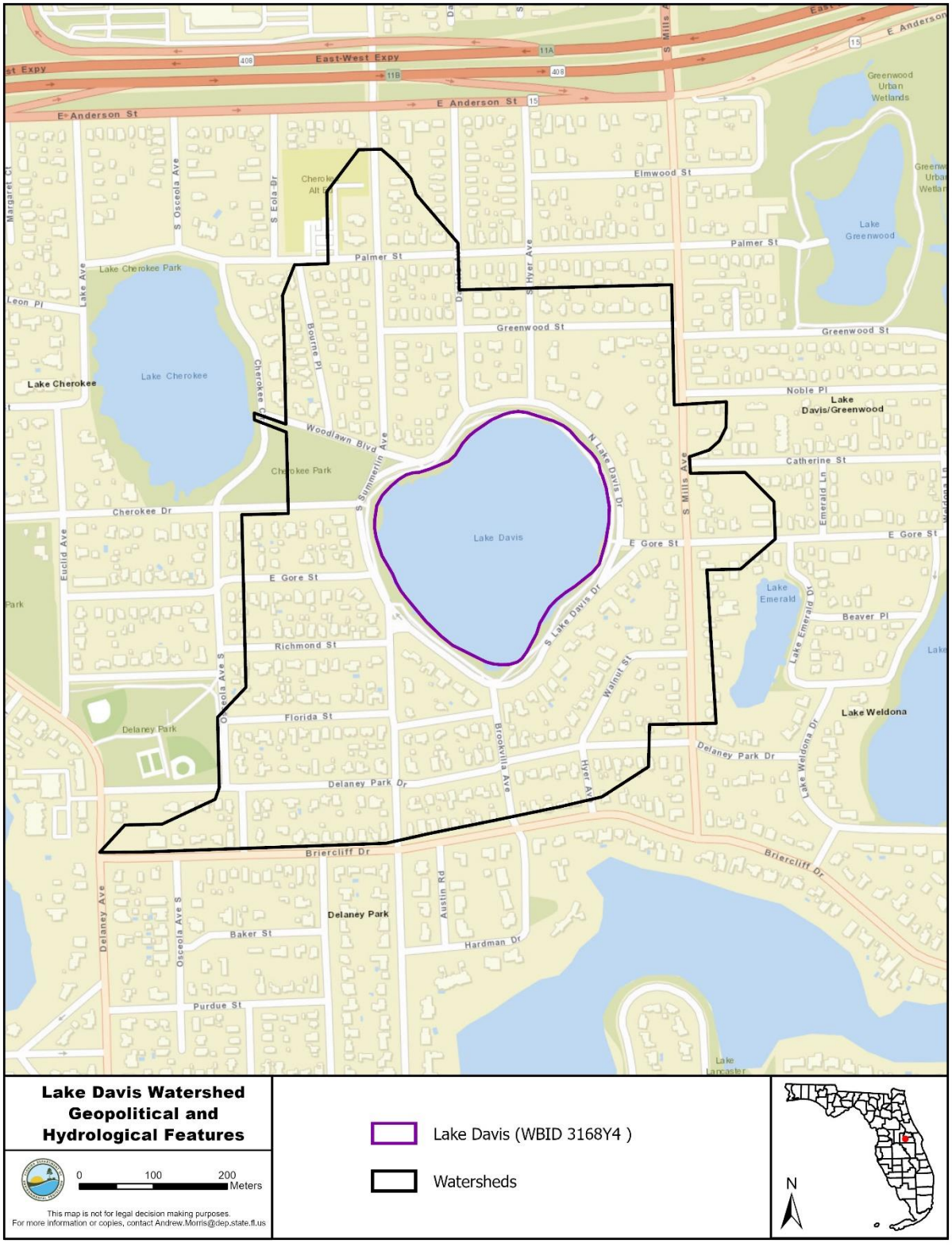

Figure 1.3. Lake Davis (WBID 3168Y4) and the Lake Davis Watershed

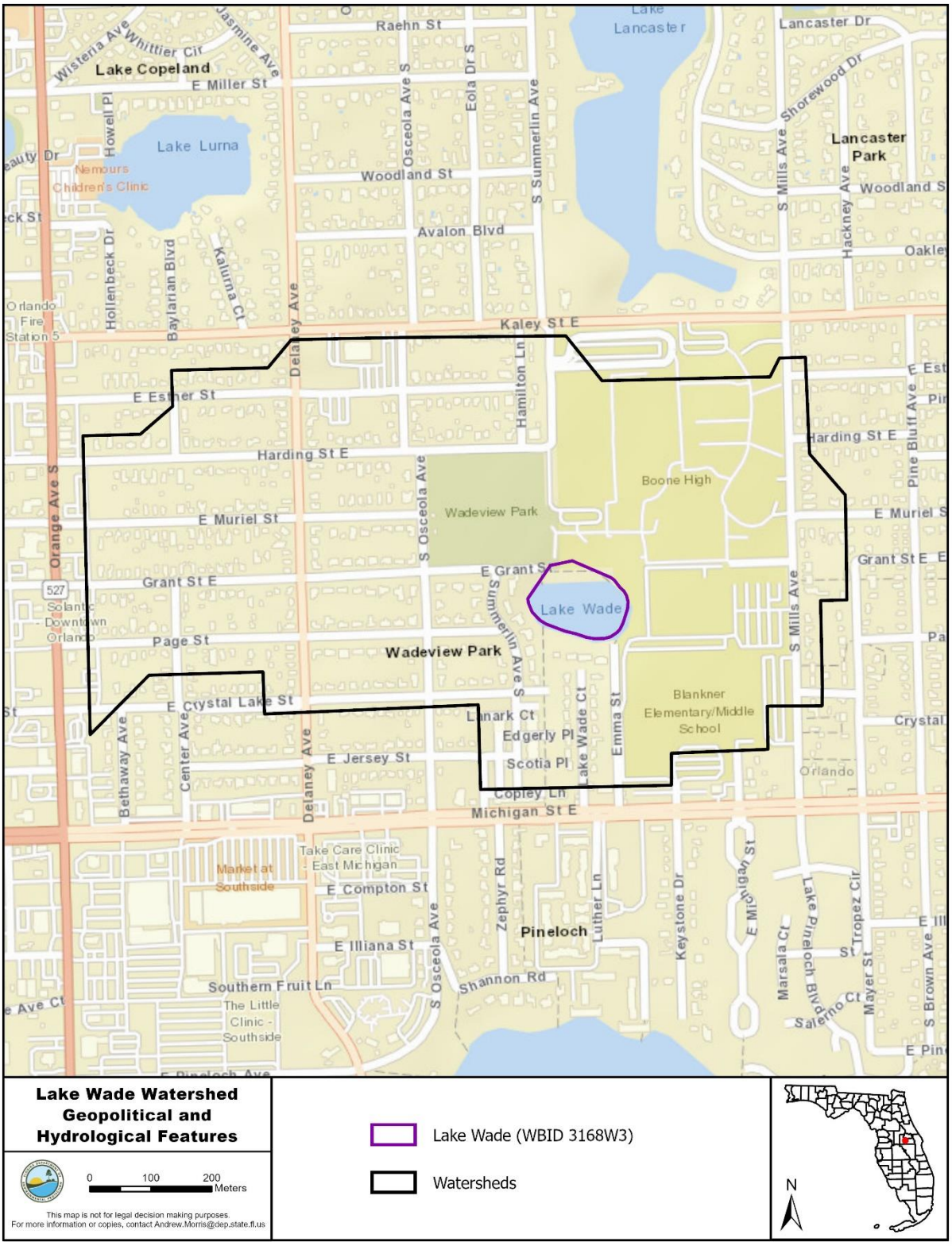

Figure 1.4. Lake Wade (WBID 3168W3) and the Lake Wade Watershed

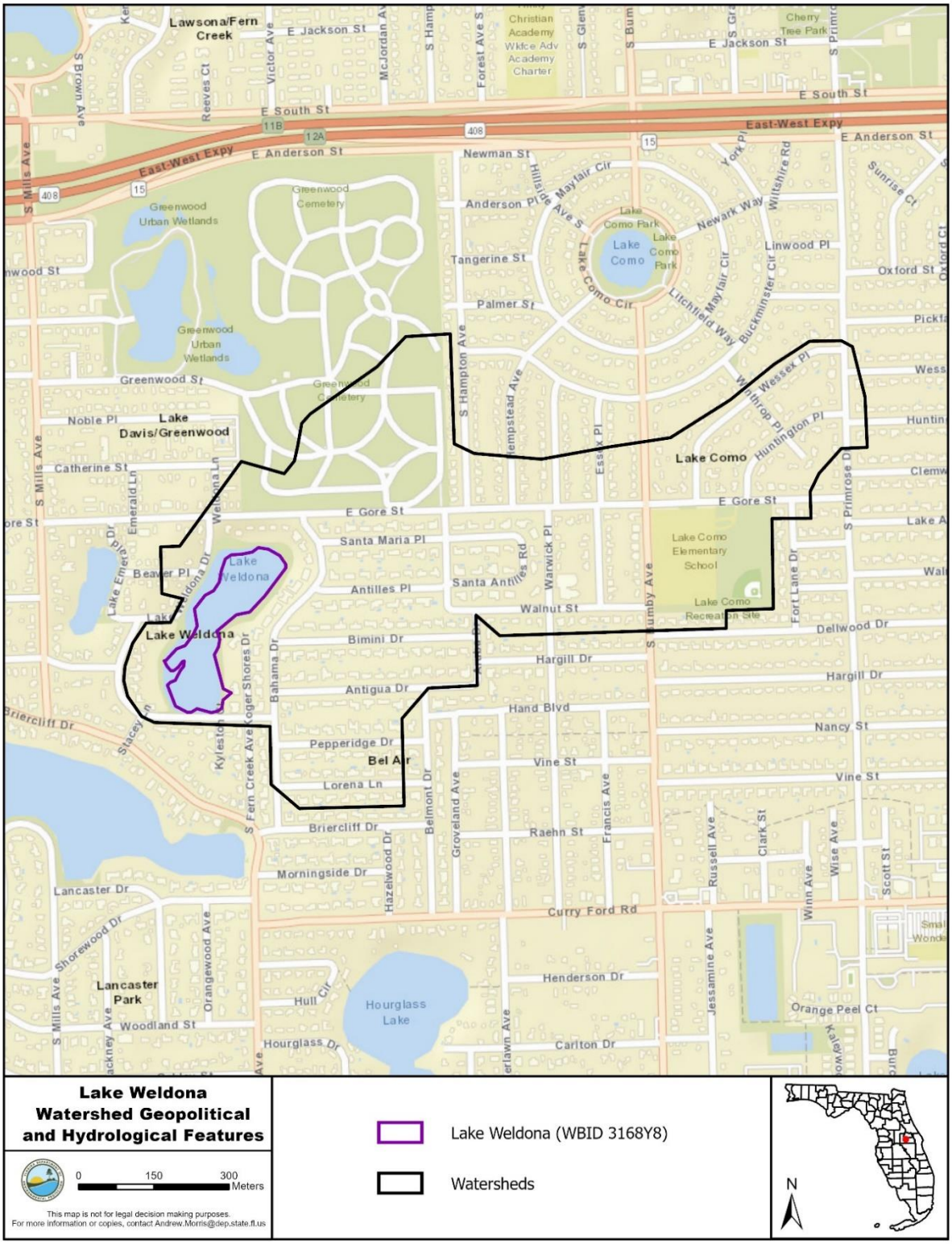

Figure 1.5. Lake Weldona (WBID 3168Y8) and the Lake Weldona Watershed

1.3 Watershed Information

1.3.1 Population and Geopolitical Setting

Lakes Davis, Wade, and Weldona and their respective watersheds are all located in Orange County in the eastern portion of the City of Orlando. According to data available from the U.S. Census Bureau (2019), the population of Orange County is 1,393,452, with a density of 1,268.5 people per square mile. The county occupies an area of 903.43 square miles and contains 556,896 housing units, with a housing density of 616 houses per square mile. The City of Orlando has a population of 307,573 (U.S. Census Bureau 2020).

1.3.2 Topography

Lakes Davis, Wade, and Weldona lie in the Orlando Ridge (75-21) lake region, which is an urbanized karst area of low relief with elevations from 75 to 120 ft. Longleaf pine and xerophytic oaks are the dominant trees of the natural vegetation, with soils primarily of the Tavares, Smyrna, and Pomello series. Miocene-age coarse quartz sands and pebbles imbedded in kaolinitic clay form the ridge. Phosphatic sand and clayey sand are at a shallow depth. Lakes in this region are characterized as clear, alkaline, hardwater lakes of moderate mineral content. They are mesotrophic to eutrophic, with phosphorus levels generally between 20 and 50 micrograms per liter (µg/L). Lakes are more phosphatic than in the Crescent City/DeLand Ridges (75-11) lake region, and only slightly more than in the Apopka Upland (75-16) lake region (Griffith et al. 1997).

The elevations in the Lakes Davis, Wade, and Weldona Watersheds range from 70 to 110 ft North American Datum 1983 (NAD). The elevation in the Lake Davis Watershed ranges from 70 to 90 ft NAD, in the Lake Wade Watershed from 90 to 110 ft NAD, and in the Lake Weldona Watershed from 75 to 110 ft NAD.

1.3.3 Hydrogeological Setting

The greater hydrogeological context in which these lakes function is determined in part by the topography, but also by their similar soil geology, aquifer/groundwater interactions, and climate.

The climate of the region is subtropical and is characterized by warm, relatively wet summers and mild, relatively dry winters. Summer temperatures commonly exceed 90° F, while the winter months may have a few days of below freezing temperatures. The average annual temperature in the region is 72° F. Annual rainfall averages 51 inches, and 55 % of the rainfall occurs from June through September (U.S. Geological Survey [USGS] 1996).

The area hydrogeology is characterized by a thin surficial aquifer underlain by the thick, highly productive rocks of the Floridan aquifer system (USGS 1996). The lake watersheds are located in the Undifferentiated Sediment geological region, which is characterized by siliciclastics, organics, and freshwater carbonates. The siliciclastics are light gray, tan, brown to black,

unconsolidated to poorly consolidated, clean to clayey, silty, unfossiliferous, variably organic-bearing sands to blue green to olive green, poorly to moderately consolidated, sandy, silty clays (Scott 2001).

The hydrologic characteristics of soil can significantly influence the capability of a watershed to hold rainfall or produce surface runoff. Soils are generally classified as one of four major types based on their hydrologic characteristics (Viessman et al. 1989). Type A soils have high infiltration rates even if thoroughly wetted. They consist chiefly of deep, well-drained to excessively drained sands or gravels. These soils have a high rate of water transmission. Type B soils have moderate infiltration rates if thoroughly wetted. They consist chiefly of moderately deep to deep, moderately well-drained to well-drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission. Type C soils have slow infiltration rates if thoroughly wetted. They consist chiefly of soils with a layer that impedes the downward movement of water, or soils with moderately fine to fine texture. These soils have a slow rate of water transmission. Type D soils have very slow infiltration rates if thoroughly wetted. They consist chiefly of clay soils with a high swelling potential, soils with a permanent high-water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

Tables 1.1 through **1.3** show that Type A soils predominate in each of the watersheds. Type A/D soil has Type A soil characteristics when unsaturated but behaves like Type D soil when saturated. **Figure 1.6** contains detailed maps of the soil hydrologic groups in each watershed. The map is based on the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) 2010 dataset developed by the National Cooperative Soil Survey.

Table 1.1. Hydrologic soil groups and acreages in the Lake Davis Watershed

Hydrologic Soil Group	Area (acres)	%
A	95	5
A/D	6	81
Unspecified	16	14
Total	**117**	**100**

Table 1.2. Hydrologic soil groups and acreages in the Lake Wade Watershed

Hydrologic Soil Group	Area (acres)	%
A	176	98
Unspecified	3	2
Total	**179**	**100**

Table 1.3. Hydrologic soil groups and acreages in the Lake Weldona Watershed

Hydrologic Soil Group	Area (acres)	%
A	164	96
Unspecified	7	4
Total	**171**	**100**

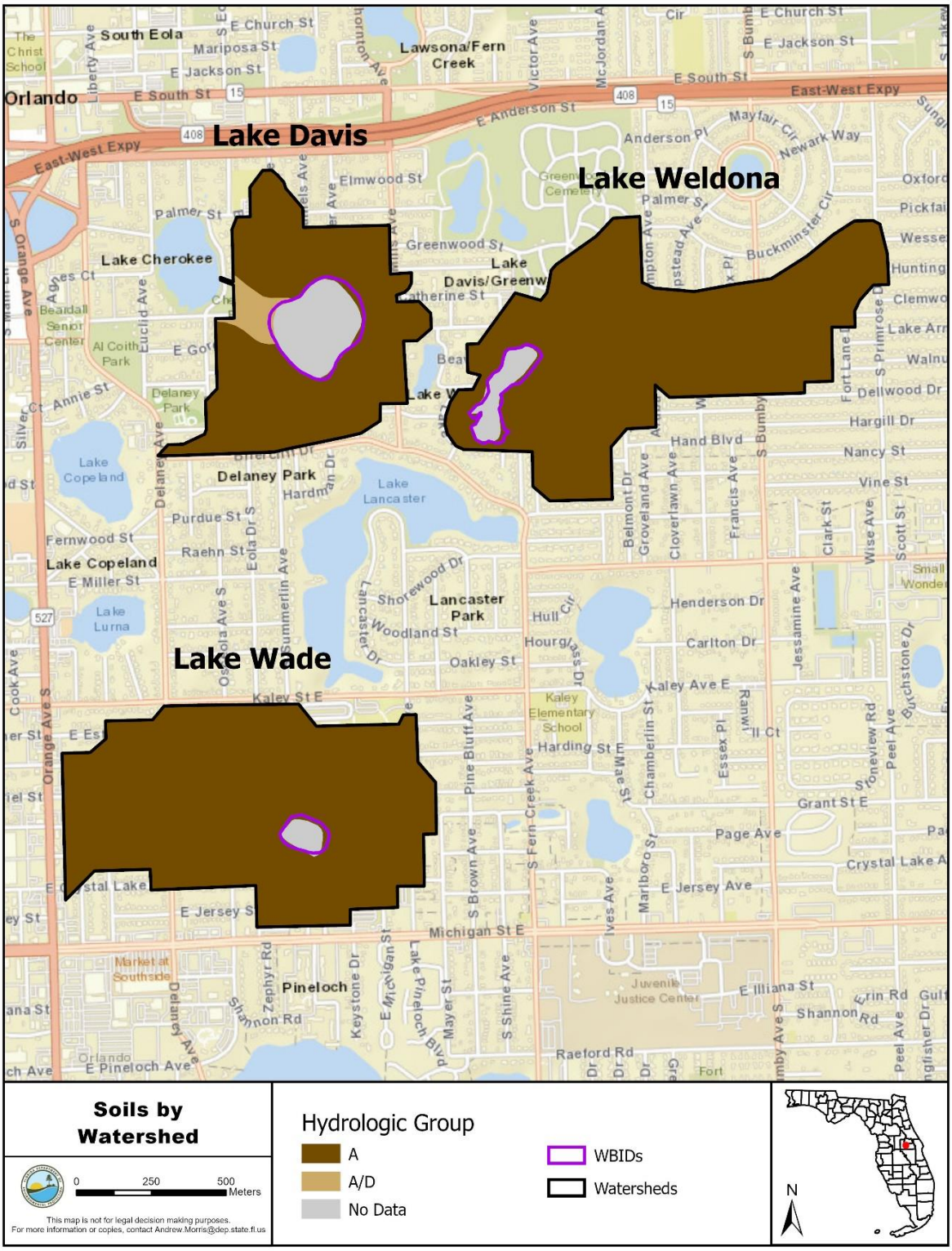

Figure 1.6. Hydrologic soil groups in the Lakes Davis, Wade, and Weldona Watersheds

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 last amended in 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.). In the past, the state's 303(d) list has been amended annually to include basin updates for 20 % of the state every year, conducted as part of a rotating basin approach to cover the whole state every 5 years. However, the state's 303(d) list will soon be amended biennially and will consist of a statewide assessment every 2 years, beginning with the 2022 biennial assessment.

2.2 Classification of the Waterbodies and Applicable Water Quality Standards

Lakes Davis, Wade, and Weldona 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 impairments for these waterbodies are Florida's nutrient criteria in Paragraph 62-302.530(48)(b), 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 (mg/L) as calcium carbonate ($CaCO_3$), and true color (color), measured in platinum cobalt units (PCU), based on long-term period of record (POR) geometric means. For the purpose of Subparagraph 62-302.531(2)(b)1., F.A.C., color is assessed as true color and should be free from turbidity. Lake color and alkalinity are based on a minimum of ten data points over at least three years with at least one data point in each year. Based on available color and alkalinity results (**Table 2.1),** all three lakes are characterized as low-color (≤ 40 PCU), high-alkalinity (> 20 mg/L $CaCO_3$). The POR data for the lakes are from IWR Database Run 62.

Table 2.1. Long-term geometric means for color and alkalinity for the POR

Waterbody	POR for Color	# of Years of Color Data	# of Color Samples	Long-Term Geometric Mean Color (PCU)	POR for Alkalinity	# of Years of Alkalinity Data	# of Alkalinity Samples	Long-Term Geometric Mean Alkalinity (mg/L $CaCO_3$)
Lake Davis	2012–20	9	36	26	1993–2020	19	72	48
Lake Wade	2012–20	9	38	18	1993–2020	21	83	50
Lake Weldona	2012–20	9	32	21	1993–2020	21	76	40

Table 2.2 lists the NNC for Florida lakes specified in Subparagraph 62-302.531(2)(b)1., F.A.C. The relevant row for Lakes Davis, Wade, and Weldona is the middle row corresponding to low-color, high-alkalinity lakes (color ≤ 40 PCU; alkalinity > 20 mg/L $CaCO_3$). The chlorophyll *a* NNC for low-color, high-alkalinity lakes is an annual geometric mean (AGM) value of 20 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 AGM does not exceed the chlorophyll *a* criterion for the lake type listed in **Table 2.2**, then the corresponding numeric interpretations for TN and TP are the maximum values. 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 corresponding numeric interpretations for TN and TP are the minimum values.

Table 2.2. 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.

Note: Values shown in boldface type and shaded represent the relevant NNC for Lakes Davis, Wade, and Weldona

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 lake nutrient data for Lakes Davis, Wade, and Weldona used in the most recent verified assessment period, beginning in 2009, are stations sampled by the City of Orlando (21FLORL) and DEP (21FLGW, 21FLCEN). These same stations were also the source of the data used for the development of the TMDLs. **Figures 2.1** through **2.3** show the sampling locations in Lakes Davis, Wade, and Weldona, respectively.

Ninety-seven percent (97 %) of the data used in the assessment of Lake Davis came from City of Orlando Station 21FLORL DAVIS. The rest of the data came from DEP Station 21FLGW 50003. Ninety-five percent (95 %) of the data used in the assessment of Lake Wade came from City of Orlando Station 21FLORL WADE. The rest of the data came from DEP Central District Station 21FLCEN 26011388. The data used in the assessment of Lake Weldona came from City of Orlando Station 21FLORL WELDONA.

The water quality measurements discussed in this report are available in the IWR Run 62 Database and are available on request.

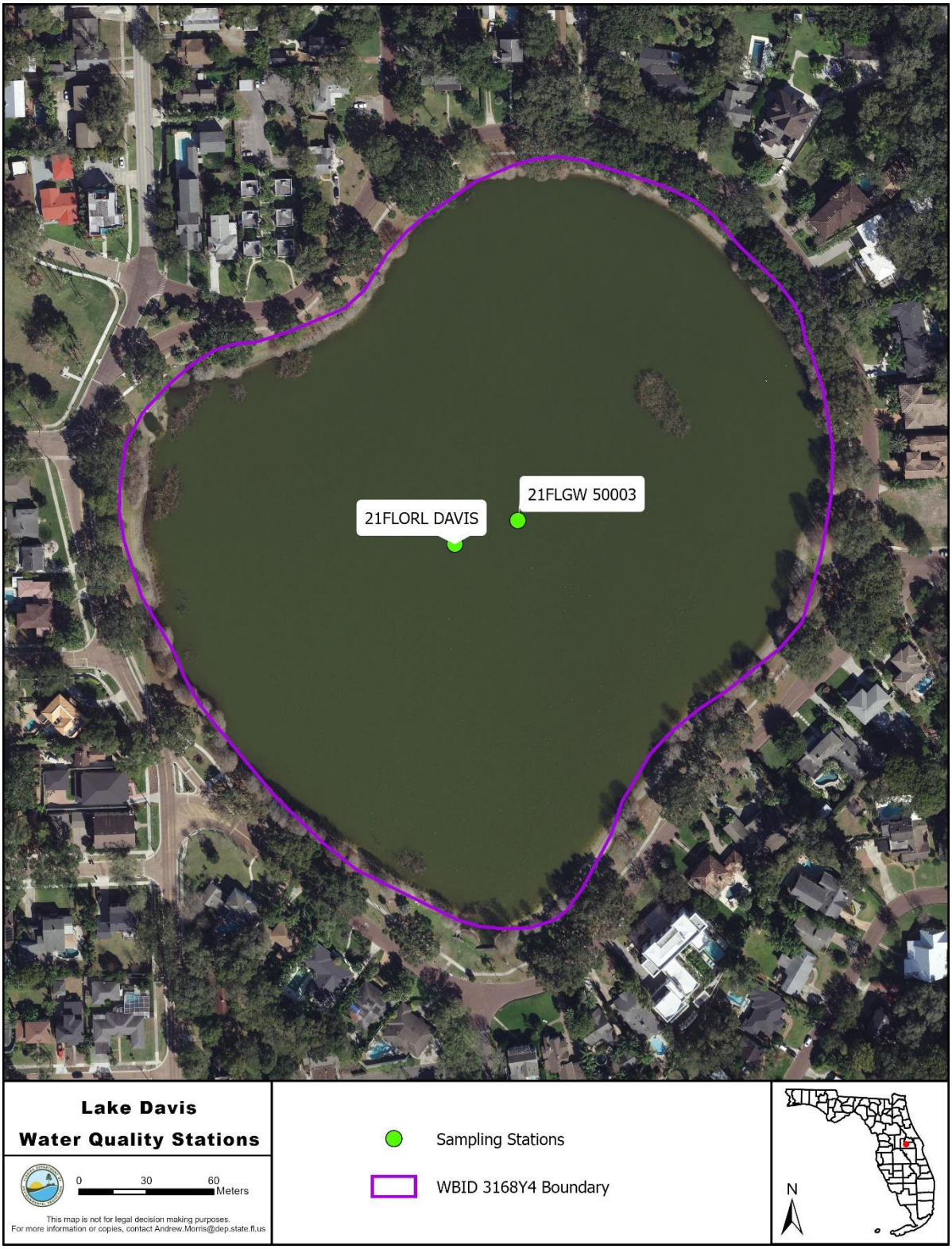

Figure 2.1. Water quality monitoring stations in Lake Davis

Figure 2.2. Water quality monitoring stations in Lake Wade

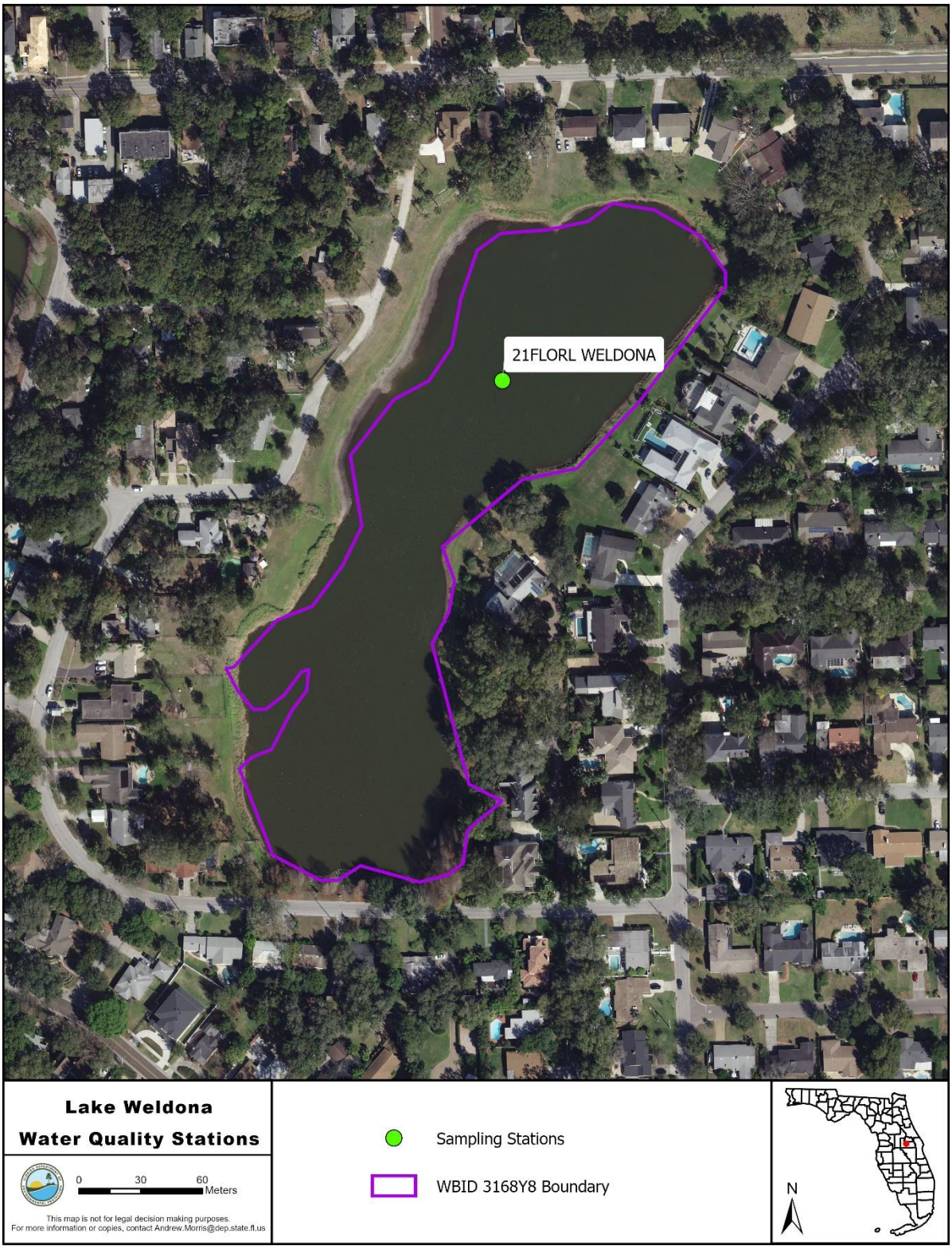

Figure 2.3. Water quality monitoring stations in Lake Weldona

2.3.2 Information on Verified Impairment

Lake Davis (WBID 3168Y4), Lake Wade (WBID 3168W3), and Lake Weldona (WBID 3168Y8) were assessed for nutrients as part of the Group 4, Cycle 3 IWR assessment. The verified period was January 1, 2009, to June 30, 2016. Data for the Group 4, Cycle 3 IWR assessment are stored in the IWR Run 53 Access Database. All three lakes were identified as nutrient impaired (Category 5) and were included on the Verified List of Impaired Waters.

Tables 2.3 through **2.5** list the lakes AGM values for chlorophyll *a*, TN, and TP for the 2009–16 verified period and AGM results for subsequent years, calculated using the most recent results found in the IWR Run 62 Database. To be assessed as impaired (Category 5) for nutrients, AGMs for a particular nutrient had to have exceeded the NNC more than once in a three-year period.

Table 2.3. Lake Davis AGM values for the 2009–20 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	**39.24**	**1.70**	**0.09**
2010	16.74	1.05	**0.06**
2011	**57.08**	**2.01**	**0.11**
2012	**23.33**	**1.61**	**0.10**
2013	**39.40**	**1.45**	**0.12**
2014	ID	ID	ID
2015	**29.45**	**1.08**	**0.07**
2016	**32.02**	**1.20**	**0.08**
2017	**65.20**	**1.13**	**0.13**
2018	**35.75**	**1.28**	**0.10**
2019	**37.45**	1.03	**0.07**
2020	**36.23**	**1.15**	**0.08**

Table 2.4. Lake Wade AGM values for the 2009–20 period

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	**33.90**	**1.21**	**0.10**
2010	ID	ID	ID
2011	ID	ID	ID
2012	**29.03**	**1.35**	**0.11**
2013	**21.73**	**1.20**	**0.08**
2014	**48.34**	**1.11**	**0.10**
2015	**27.62**	0.94	**0.07**
2016	**36.76**	0.95	**0.08**
2017	**32.68**	**1.11**	**0.07**
2018	**35.31**	0.99	**0.09**
2019	**27.85**	0.74	**0.05**
2020	**37.63**	0.82	**0.10**

Table 2.5. Lake Weldona AGM values for the 2009–20 period

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	**23.29**	**1.33**	**0.07**
2010	**33.89**	**1.57**	**0.08**
2011	**54.83**	**1.92**	**0.13**
2012	**35.07**	**2.10**	**0.18**
2013	ID	ID	ID
2014	ID	ID	ID
2015	**27.30**	0.99	**0.05**
2016	**28.26**	1.05	**0.06**
2017	**50.66**	0.77	**0.12**
2018	**31.75**	0.96	**0.09**
2019	**33.06**	0.86	**0.06**
2020	**34.59**	0.90	**0.07**

Chapter 3: Assessment of Sources

3.1 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. Point sources also include 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). 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.

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 a National Pollutant Discharge Elimination System (NPDES) stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 5.1** 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.

3.2 Point Sources

3.2.1 Wastewater Point Sources

No NPDES-permitted wastewater facilities discharge to Lakes Davis, Wade, or Weldona, or to surface waters in their watersheds.

3.2.2 Municipal Separate Storm Sewer System (MS4) Permittees

The Lake Davis and Lake Weldona Watersheds and a majority of the Lake Wade Watershed are covered by the City of Orlando’s NPDES MS4 Phase I Permit (FLS000014). The remainder of the Lake Wade Watershed, located in the southeastern portion, is covered by Orange County’s NPDES MS4 Phase I Permit (FLS000011). The City of Apopka, Florida Department of Transportation (FDOT) District Five, Valencia Water Control District, City of Belle Isle, City of Maitland, City of Winter Garden, Town of Eatonville, City of Ocoee, and City of Winter Park are co-permittees for this MS4 permit, but only FDOT District Five has jurisdiction in the Lake Wade Watershed.

For more information on MS4s in the watersheds, send an email to NPDES-stormwater@dep.state.fl.us. **Table 3.1** lists the MS4 permittees and their permit numbers.

Table 3.1. NPDES MS4 permittees with jurisdiction in the watersheds

Permittee/Copermittee	Permit Number	Phase
City of Orlando	FLS000014	I
Orange County	FLS000011	I
FDOT District Five	FLS000011	I

3.3 Nonpoint Sources

Pollutant sources that are not NPDES wastewater or stormwater dischargers are generally considered nonpoint sources. Nutrient loadings to Lakes Davis, Wade, and Weldona are mainly generated from nonpoint sources. Nonpoint sources addressed in this analysis primarily include loadings from surface runoff, baseflow, and precipitation directly onto the lake surface (atmospheric deposition).

3.3.1 Land Use

Land use is one of the most important factors in determining nutrient loadings from the Lakes Davis, Wade, and Weldona 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 3.2** through **3.4** list land use in the watersheds, based on the statewide land use land cover dataset (including the land use dataset from SJRWMD 2013–16). **Figures 3.1** through **3.3** show the information graphically.

Table 3.2. Land use in the Lake Davis Watershed, 2013–16

FLUCCS = Florida Land Use, Cover and Forms Classification System

FLUCCS Codes	Land Use Classification	Lake Davis (acres)	% of Watershed
120	Medium Density Residential	95	81
130	High Density Residential	<1	<1
170	Institutional	2	2
186	Recreational	<1	<1
190	Open Land	2	2
520	Lakes	18	15
Total		**117**	**100**

Table 3.3. Land use in the Lake Wade Watershed, 2013–16

FLUCCS = Florida Land Use, Cover and Forms Classification System

FLUCCS Codes	Land Use Classification	Lake Wade (acres)	% of Watershed
120	Medium Density Residential	99	55
130	High Density Residential	4	2
140	Commercial and Services	4	2
170	Institutional	58	33
186	Recreational	10	5
520	Lakes	3	2
644, 646	Vegetated Nonforested Wetlands	1	<1
Total		**179**	**100**

Table 3.4. Land use in the Lake Weldona Watershed, 2013–16

FLUCCS = Florida Land Use, Cover and Forms Classification System

FLUCCS Code	Land Use Classification	Lake Weldona (acres)	% of Watershed
120	Medium Density Residential	125	73
140	Commercial and Services	23	13
170	Institutional	14	9
520	Lakes	8	4
640	Vegetated Nonforested Wetlands	1	1
Total		**171**	**100**

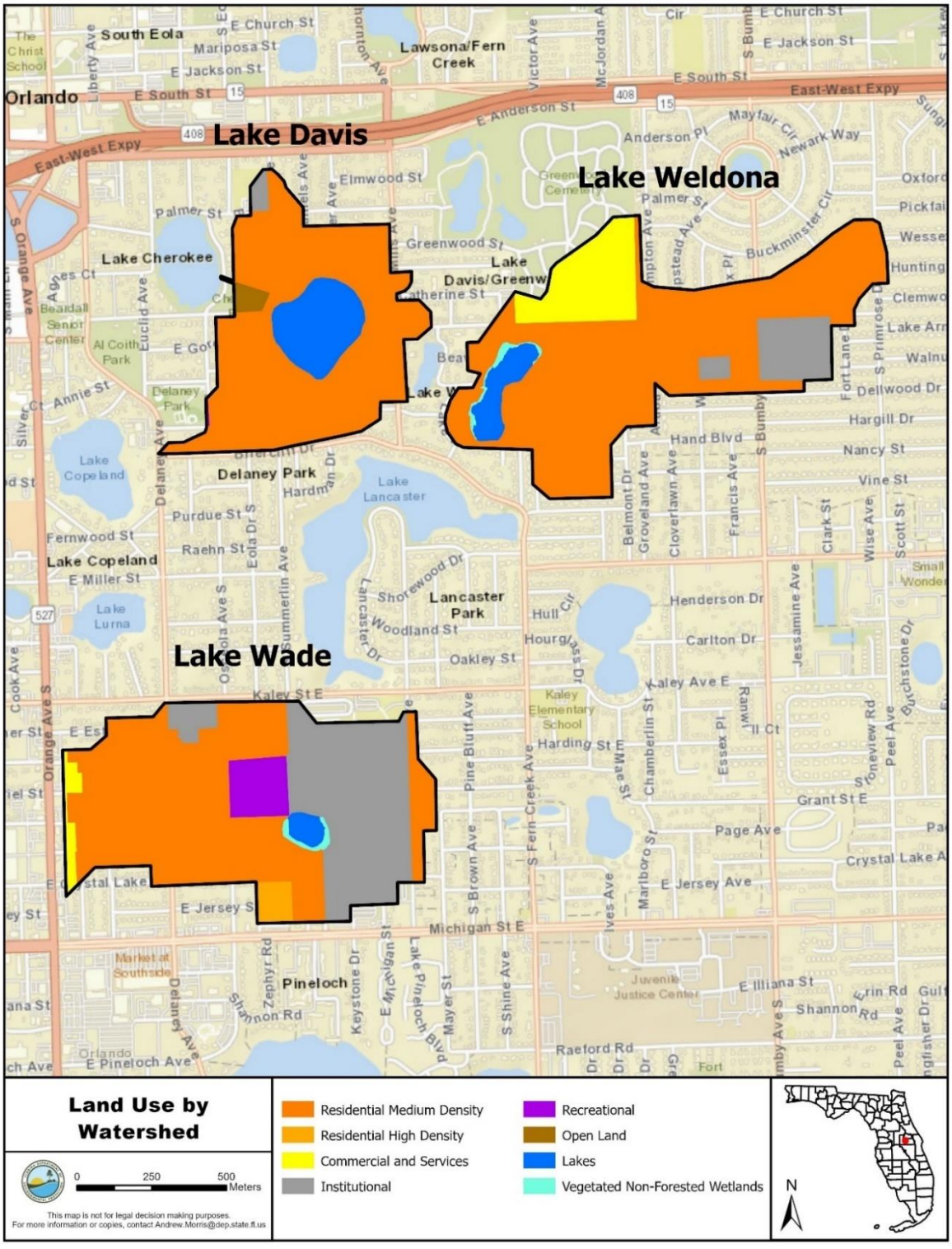

Figure 3.1. Land use in the Lakes Davis, Wade, and Weldona Watersheds, 2013–16

3.3.2 Onsite Sewage Treatment and Disposal Systems (OSTDS)

OSTDS, including septic systems, 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. OSTDS can be a source of nutrients (nitrogen and phosphorus), pathogens, and other pollutants to both groundwater and surface water. **Figure 3.2** shows the approximate locations of OSTDS in the watersheds based on centroids of parcels with known septic systems.

The Florida Department of Health (FDOH) maintains a list of septic systems by county, and the FDOH Florida Water Management Inventory dataset was used to determine the number of "known" and "likely" septic systems in the area. As listed in **Table 3.5**, there are 50 such septic systems in the combined Lakes Davis, Wade, and Weldona Watersheds. The largest number, 35, is found in the Lake Wade Watershed, followed by 15 in the Lake Weldona Watershed, and 0 in the Lake Davis Watershed.

Table 3.5. Number of known and likely OSTDS in the individual lake watersheds

Watershed	Number of Known and Likely OSTDS
Lake Davis	0
Lake Wade	35
Lake Weldona	15
Total	**50**

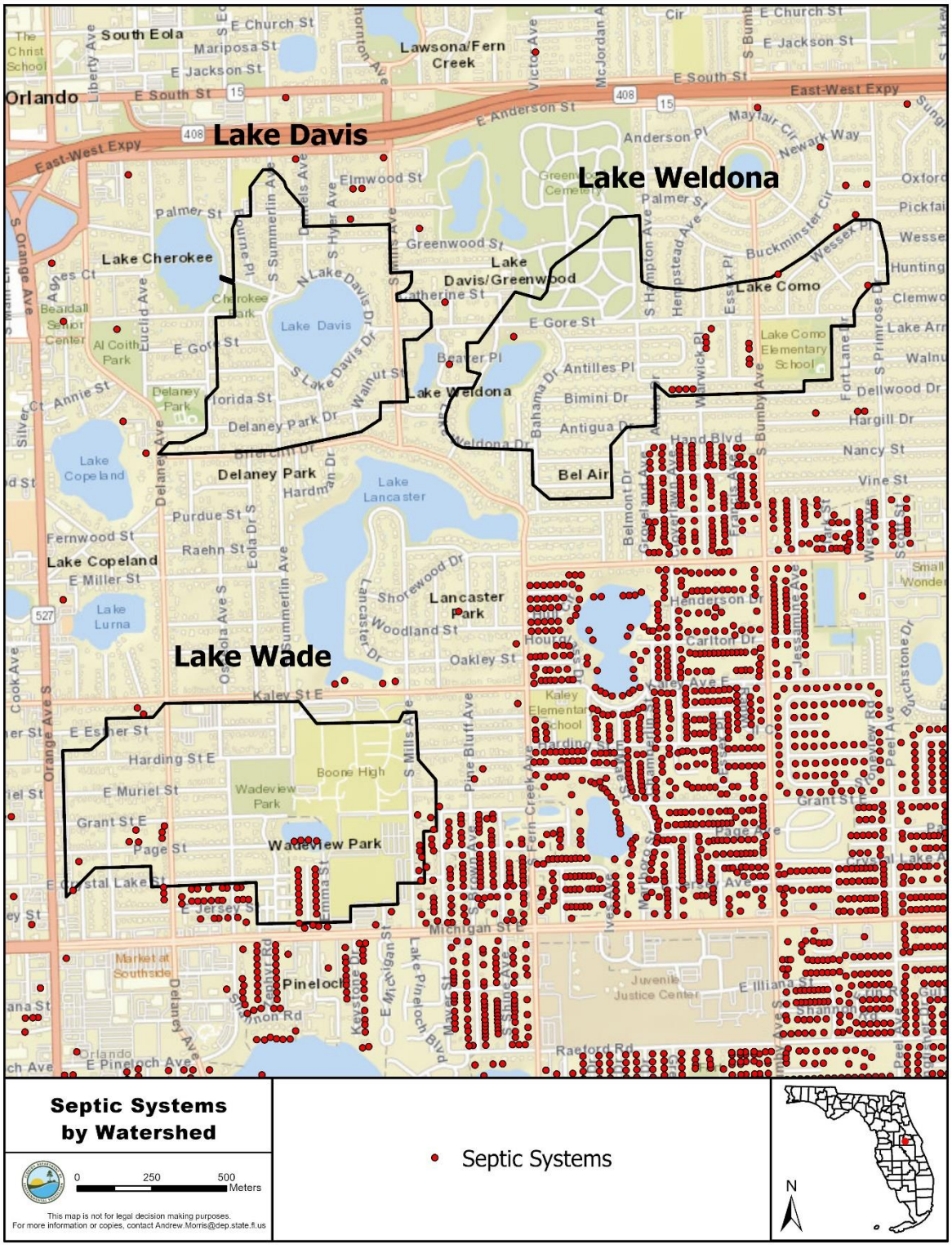

Figure 3.2. Known and likely OSTDS in the Lakes Davis, Wade, and Weldona Watersheds

Chapter 4: Determination of Assimilative Capacity

4.1 Overview

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 identify the necessary reductions in the in-lake nutrient concentrations, so that the lakes will meet the TMDL restoration target for chlorophyll *a* and thus maintain their function and designated use as Class III freshwaters.

4.2 Evaluation of Water Quality Conditions

4.2.1 Water Quality Data-Handling Procedures for TMDL Development

For the water quality analyses conducted for TMDL development, AGMs were used in order to be consistent with the expression of the adopted NNC for lakes. AGMs 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, defined as values greater than or equal to the method detection limit (MDL) but less than the practical quantitation limit (PQL), were used as reported. Values reported as either compound analyzed for but not detected or is less than the MDL, "U" or "T" qualifier codes, respectively, were changed to the MDL divided by the square root of two. Values with "G" or "V" qualifier codes, associated with results that do not meet data quality objectives, were removed from the analysis. Negative values and zero values were also removed. Multiple sample results collected in the same day at the same station 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 IWR methodology in Chapter 62-303, F.A.C. The IWR methods are designed to determine compliance with surface water quality criteria that focuses more on measurement uncertainty associated with qualified results. For results reported to be less than the MDL or PQL, the IWR rule follows the same method used for determining compliance with permit effluent limits. Results applied in TMDL development are used in part to describe the variability in ambient water quality, and not compliance with criteria, and for this reason results reported as less than the MDL or PQL are expressed differently when calculating AGMs. Therefore, the AGMs listed in **Tables 2.3** through

2.5 in **Chapter 2** may not exactly match the AGMs used in these analyses and for TMDL development.

4.2.2 Relationships Between Water Quality Variables

The City of Orlando and DEP have conducted water quality monitoring for nutrients in all three lakes. The period from 2005 to 2020 has recent, complete long-term sets of AGM values for evaluating surface water quality in these lakes. **Figures 4.1** through **4.9** show the water quality AGMs from this period based on the IWR Run 62 Database. Standard data quality assurance practices were followed when evaluating the data and developing the TMDLs.

Chlorophyll *a* AGM values from 2006 to 2020 for Lake Davis (**Figure 4.1**) have almost always been above the NNC AGM of 20 µg/L and have risen to over 60 µg/L, ranging from 16.6 to 65.2 µg/L over this period.

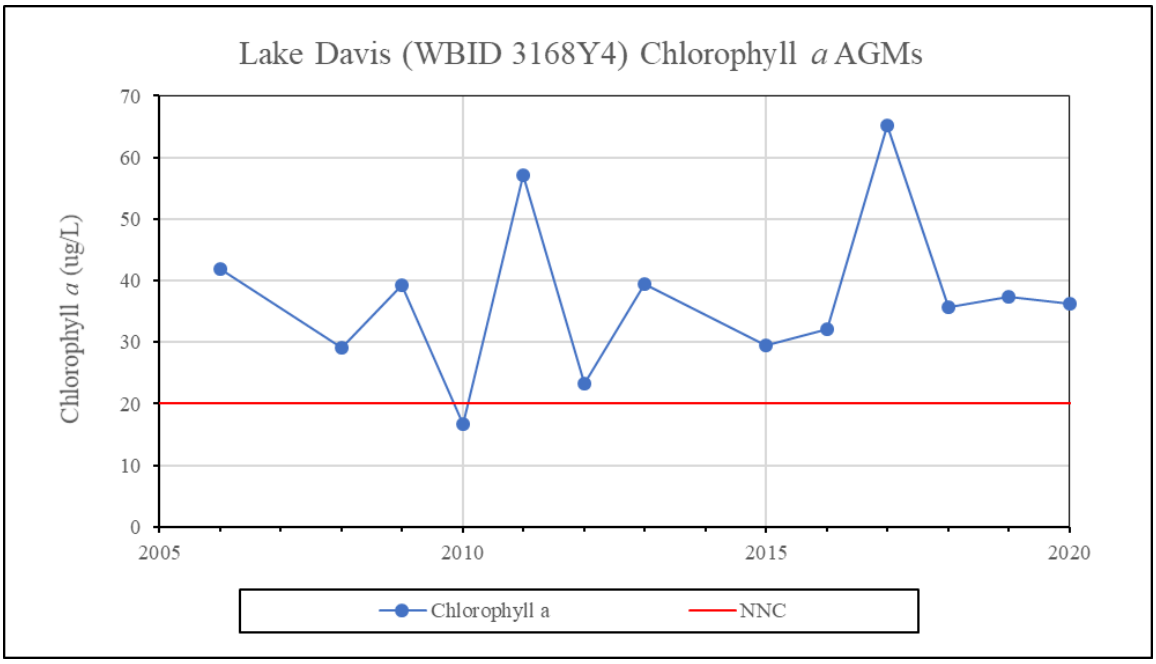

Figure 4.1. Chlorophyll *a* AGM values for Lake Davis, 2006–20

In all except 2 years, TN AGM values from 2006 to 2020 for Lake Davis (**Figure 4.2**) have been above the minimum NNC AGM of 1.05 mg/L. Values over this period range from 1.03 to 2.01 mg/L.

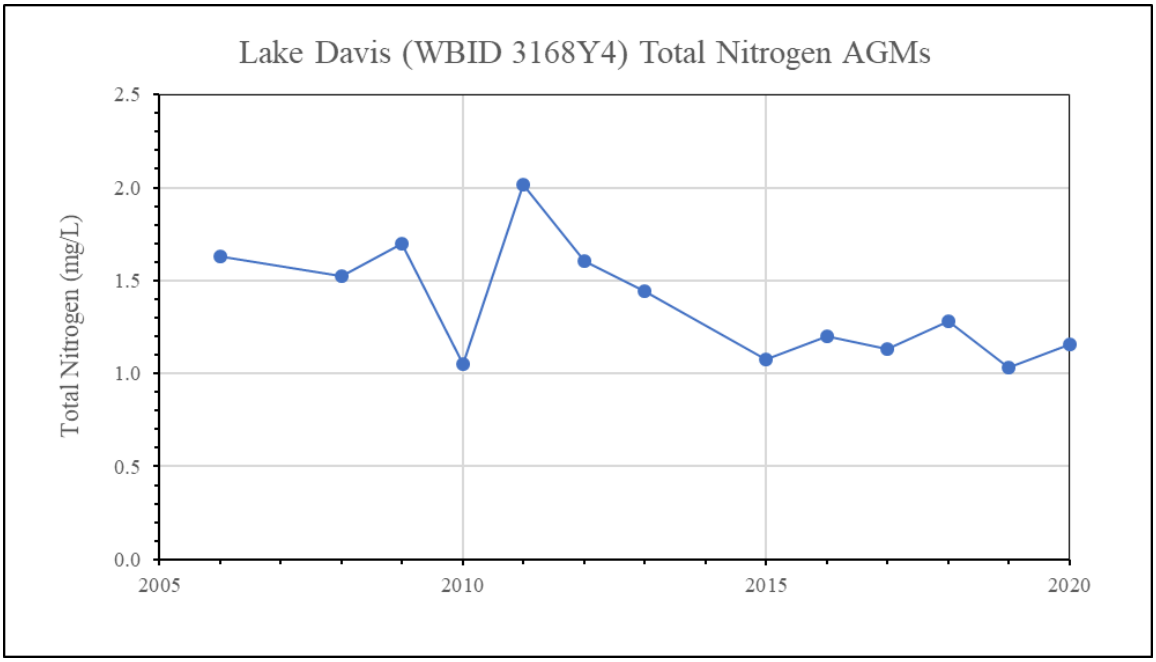

Figure 4.2. TN AGM values for Lake Davis, 2006–20

TP AGM values from 2006 to 2020 for Lake Davis (**Figure 4.3**) have consistently been well above the minimum NNC AGM of 0.03 mg/L. Values over this period range from 0.06 to 0.13 mg/L.

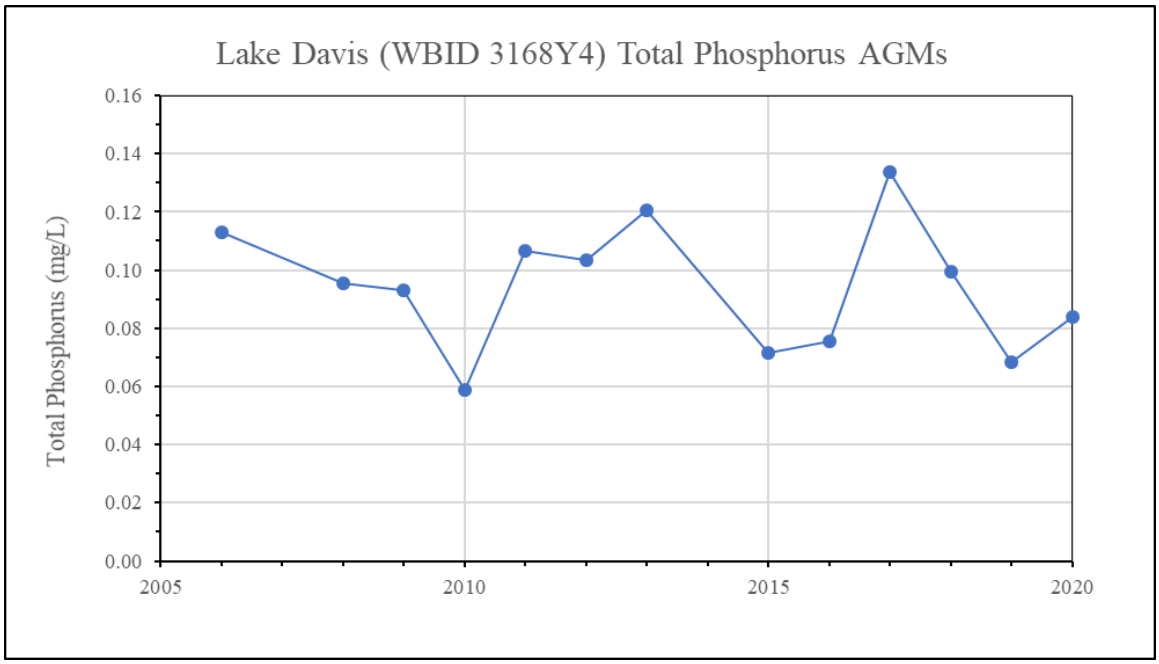

Figure 4.3. TP AGM values for Lake Davis, 2006–20

In all but one year, chlorophyll *a* AGM values from 2005 to 2020 for Lake Wade (**Figure 4.4**) have been above the NNC AGM of 20 µg/L, ranging from 17.8 to 48.3 µg/L over this period.

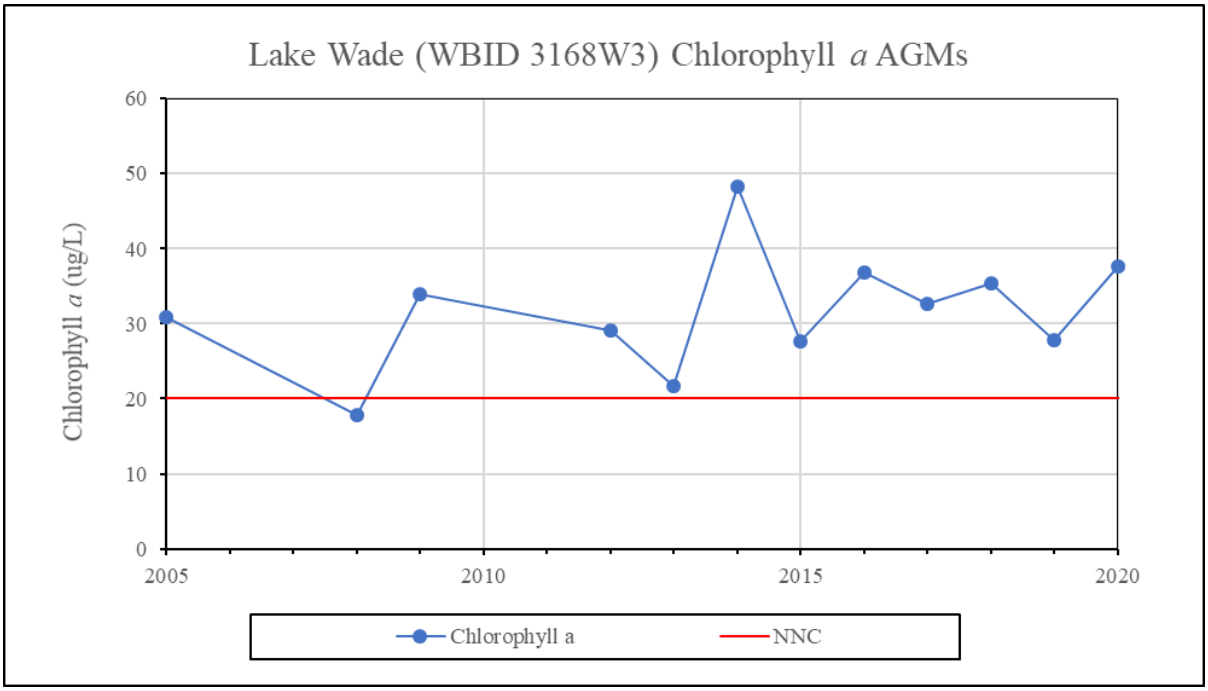

Figure 4.4. Chlorophyll *a* AGM values for Lake Wade, 2005–20

TN AGM values from 2005 to 2020 for Lake Wade (**Figure 4.5**) show a pattern of fluctuating concentrations above and below the minimum NNC AGM of 1.05 mg/L. Values over this period range from 0.74 to 1.4 mg/L.

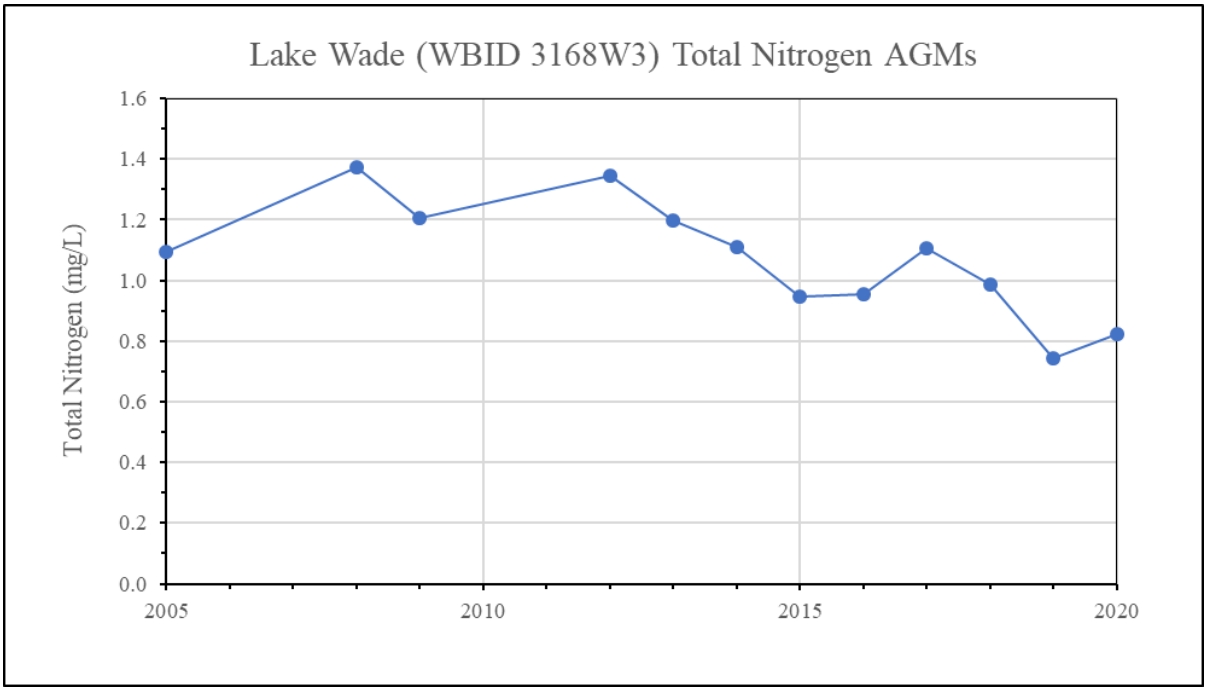

Figure 4.5. TN AGM values for Lake Wade, 2005–20

TP AGM values from 2005 to 2020 for Lake Wade (**Figure 4.6**) have consistently been well above the minimum NNC AGM of 0.03 mg/L, ranging from 0.05 to 0.11 mg/L over this period.

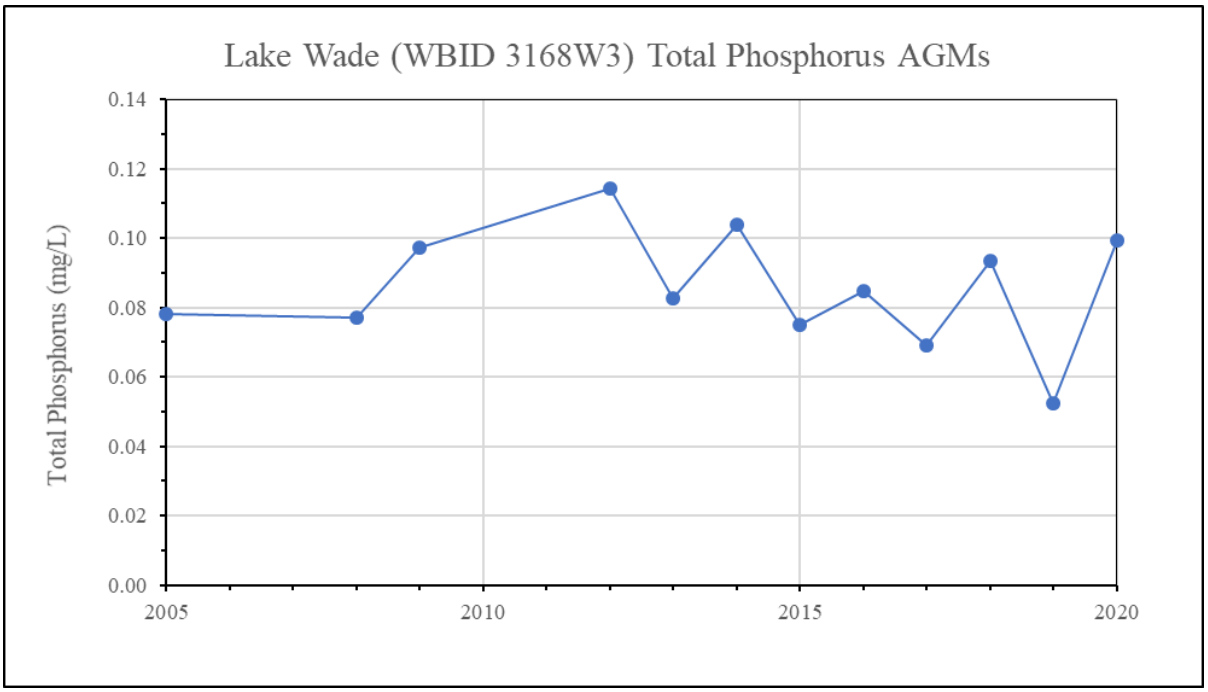

Figure 4.6. TP AGM values for Lake Wade, 2005–20

In all but two years, chlorophyll *a* AGM values from 2005 to 2020 for Lake Weldona (**Figure 4.7**) have been above the NNC AGM of 20 µg/L. Values over this period range from 13.9 to 54.8 µg/L.

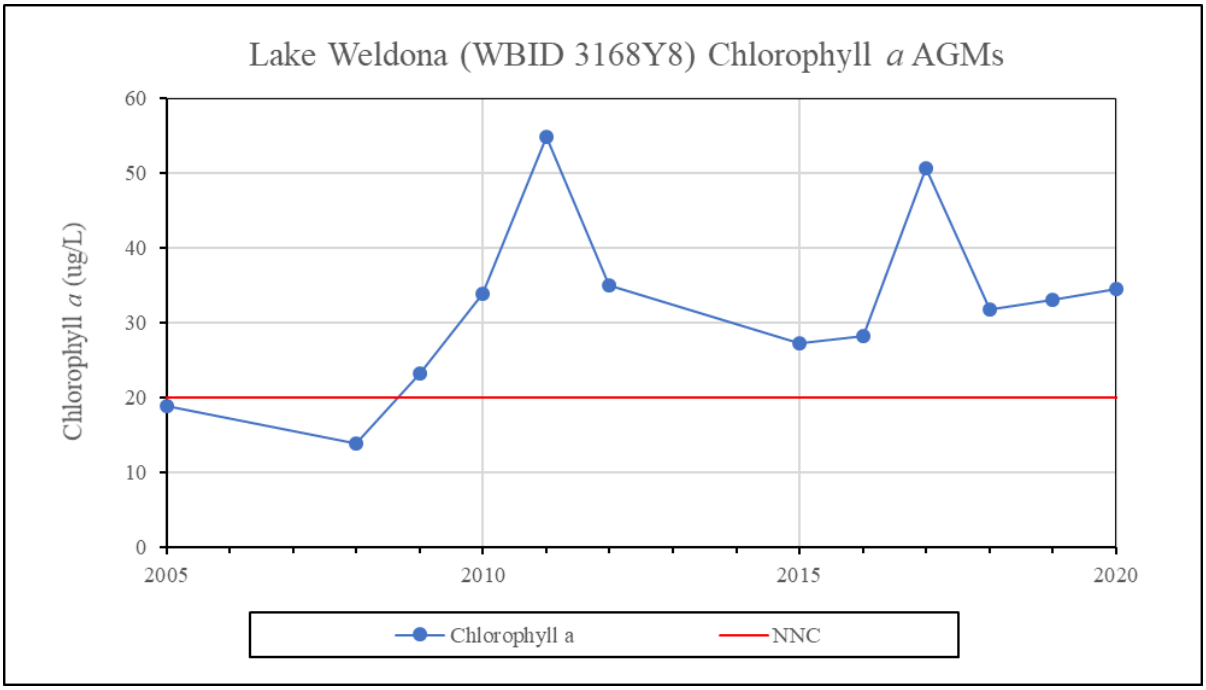

Figure 4.7. Chlorophyll *a* AGM values for Lake Weldona, 2005–20

TN AGM values from 2005 to 2020 for Lake Weldona (**Figure 4.8**) show a pattern of fluctuating concentrations above and below the minimum NNC AGM of 1.05 mg/L. Values over this period range from 0.76 to 2.1 mg/L.

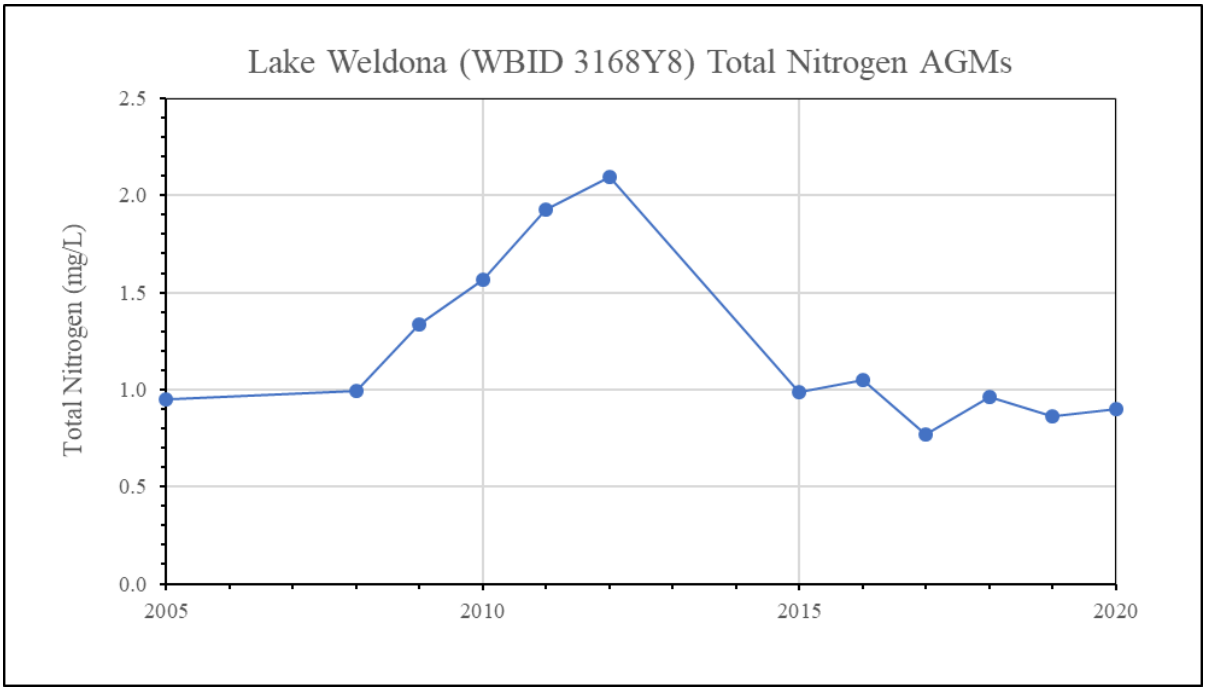

Figure 4.8. TN AGM values for Lake Weldona, 2005–20

TP AGM values from 2005 to 2020 for Lake Weldona (**Figure 4.9**) have been consistently above the minimum NNC AGM of 0.03 mg/L, ranging from 0.05 to 0.18 mg/L over this period.

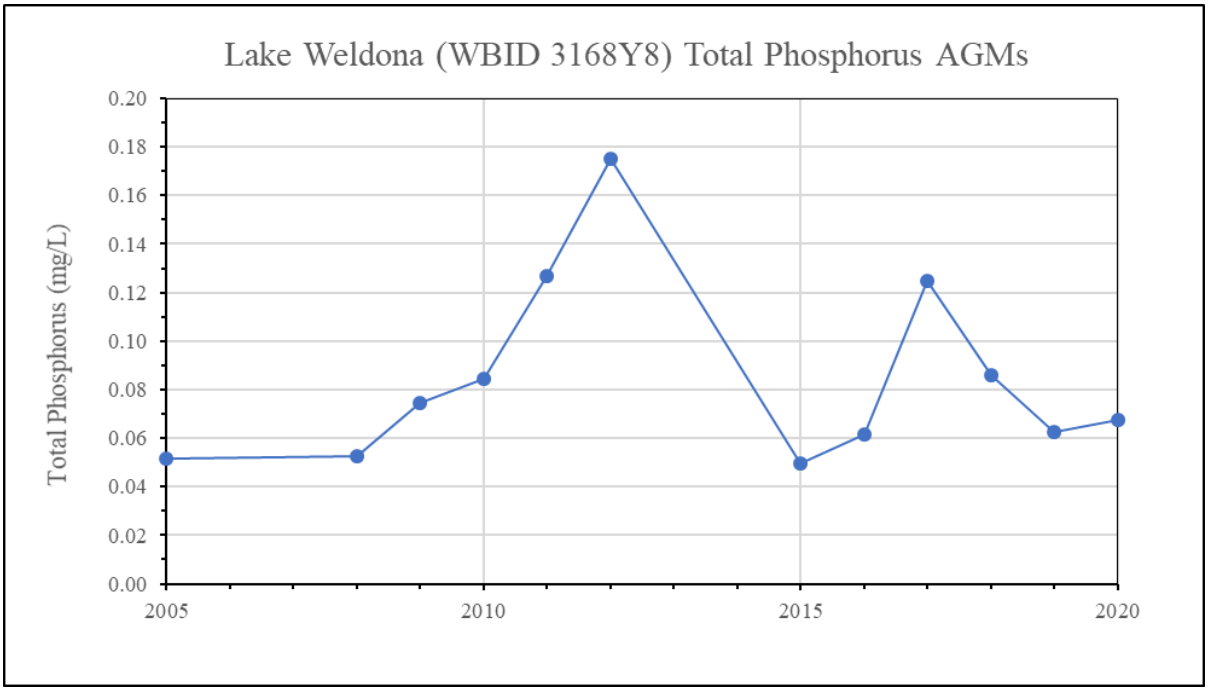

Figure 4.9. TP AGM values for Lake Weldona, 2005–20

4.3 Critical Conditions and Seasonal Variation

The estimated assimilative capacity is based on annual conditions, rather than critical/seasonal conditions, because (1) the methodology used to determine assimilative capacity in Florida lakes 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 segment, which is better addressed on an annual basis, (3) the methodology used to determine impairment is based on annual conditions, and (4) the chlorophyll *a* criterion used as the TMDL target is expressed as an AGM.

4.4 Basis of the TMDLs

The data collected by DEP and the City of Orlando were used in evaluating the in-lake concentrations of nutrients and chlorophyll *a*. The period from 2005 to 2020 has recent, complete long-term sets of AGM values for evaluating surface water quality in these lakes. This analysis used nutrient and corrected chlorophyll *a* AGMs to be consistent with the expression of the adopted NNC for lakes.

DEP developed the generally applicable statewide NNC based on robust empirical relationships between nutrients and chlorophyll *a* derived from a large dataset of lakes statewide, and an evaluation of the relationships between chlorophyll *a* and TN and TP in those lakes (DEP 2012). The dataset consists of paired nutrient and chlorophyll *a* data for 195 low-color lakes and 129 high-color lakes dating from 1996 to 2008. DEP developed a chlorophyll *a* criterion of 20 µg/L for both high-color (> 40 PCU) lakes and low-color (≤ 40 PCU), high-alkalinity (> 20 mg/L CaCO3) lakes, and a chlorophyll *a* criterion of 6 µg/L for low-color (≤ 40 PCU), low-alkalinity (≤ 20 mg/L $CaCO_3$) lakes. DEP (2012) has demonstrated that this criterion protects designated uses and maintains the health of a balanced community of aquatic flora and fauna.

The generally applicable TN and TP criteria are subject to a range of AGMs based on whether there are sufficient data to calculate an AGM for chlorophyll *a*, and whether the AGM chlorophyll *a* exceed the criterion for the particular lake type in Subparagraph 62-302.531(2)(b)1., F.A.C. If there are insufficient data to calculate the AGM chlorophyll *a* for a given year or the AGM chlorophyll *a* exceeds the criterion for the lake type, then the applicable numeric interpretations for TN and TP are the minimum values. If there are sufficient data to calculate the AGM chlorophyll *a* and the AGM does not exceed the chlorophyll *a* value for the lake type (e.g., 20 µg/L in a high-color lake), then the TN and TP AGMs for that calendar year may not exceed the maximum TN and TP limits for the particular lake type.

For the low-color, high-alkalinity lakes, including Lakes Davis, Wade, and Weldona, the criterion range for TN is 1.05 to 1.91 mg/L, and 0.03 to 0.09 mg/L for TP, with an exceedance frequency of no more than once in any 3-year period. AGMs for chlorophyll *a* concentrations in the 3 lakes all exceeded the NNC values for the applicable lake types; therefore, the applicable

numeric interpretations for TN and TP are the minimum values in the criteria ranges, ensuring the attainment of the applicable chlorophyll *a* targets.

The individual nutrient data for these three lakes were compared with the larger statewide nutrient datasets to see if they fell within the range of the data used to establish the generally applicable NNC. This was done to verify that these lakes are operating like the NNC lakes and are exhibiting the same nutrient responses to determine if site-specific criteria were needed. **Figures 4.10** and **4.11** show the TN and TP data, respectively, for Lake Davis plotted against the statewide population of low-color lakes. **Figures 4.12** and **4.13** show the TN and TP data, respectively, for Lake Wade plotted against the statewide population of low-color lakes. **Figures 4.14** and **4.15** show the TN and TP data, respectively, for Lake Weldona plotted against the statewide population of low-color lakes.

These graphs demonstrate that the relationship of TN and TP to chlorophyll *a* in the lakes does not fall outside the range used to develop the generally applicable NNC. The TN and TP values for the lakes are indicated with red circles. The statewide lake population results are represented by the gray "x's". The dashed line shown on these graphs bounds the distributions at the 90 % prediction intervals. Lakes that plot within these intervals are characteristic of the majority of lakes in the dataset, while lakes that plot outside those bounds are not functioning in a manner consistent with the majority of lakes in the statewide dataset.

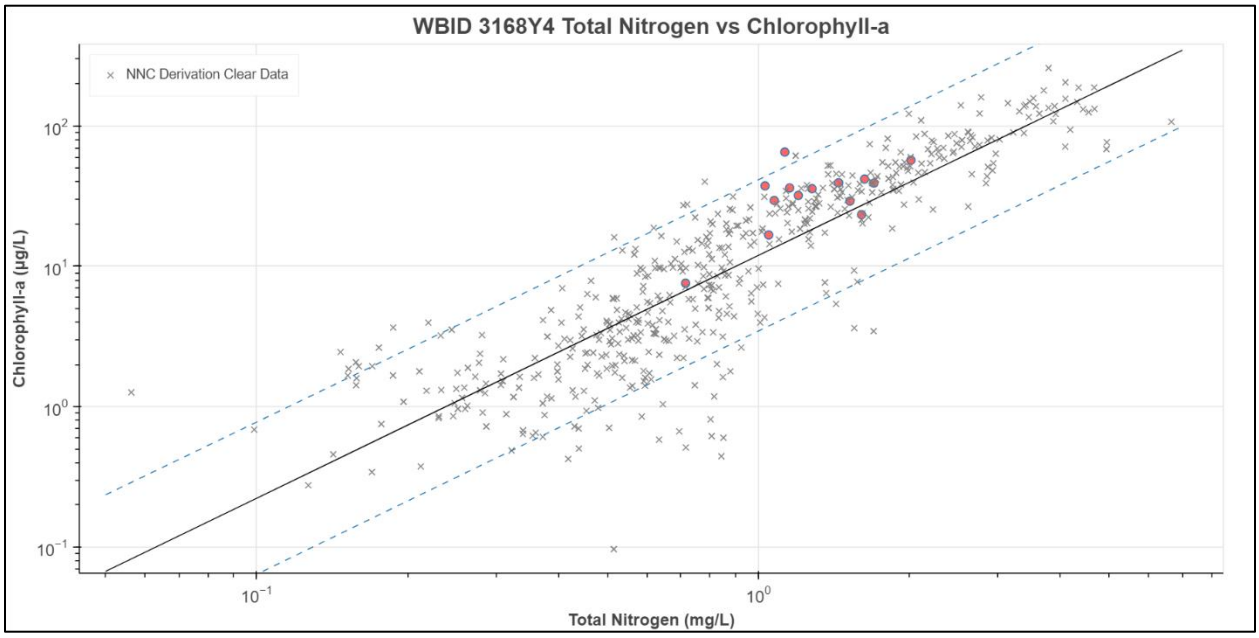

Figure 4.10. Relationship between chlorophyll *a* and TN AGMs in Lake Davis (red circles) plotted against the statewide dataset used to derive the NNC for low-color lakes

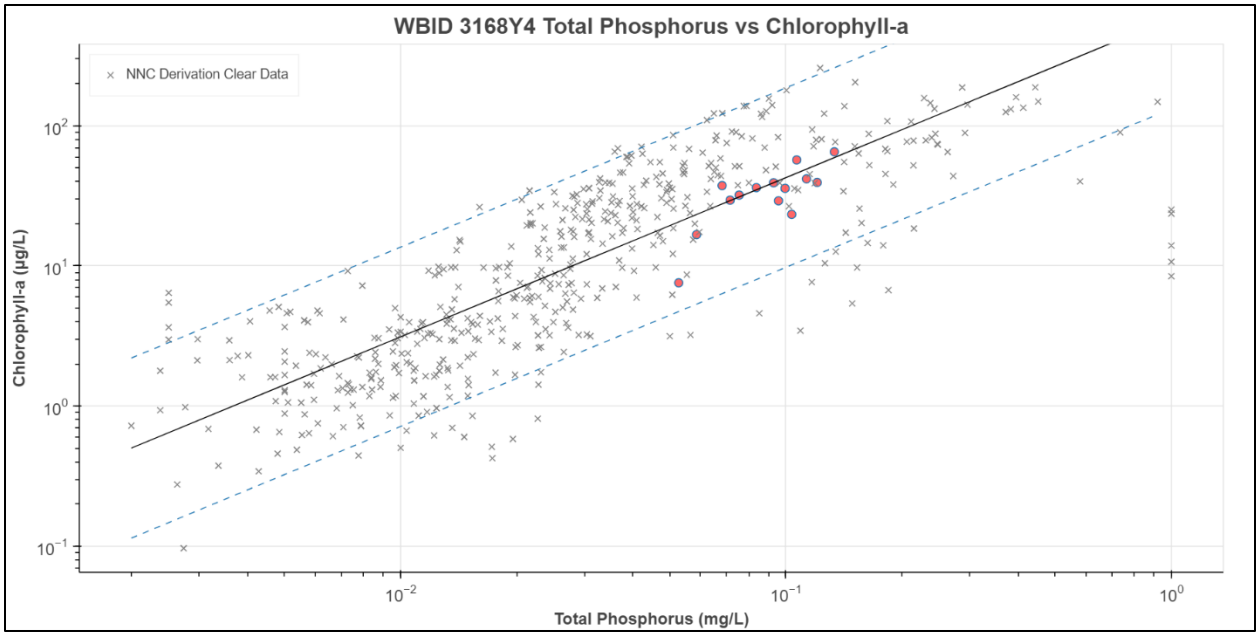

Figure 4.11. Relationship between chlorophyll *a* and TP AGMs in Lake Davis (red circles) plotted against the statewide dataset used to derive the NNC for low-color lakes

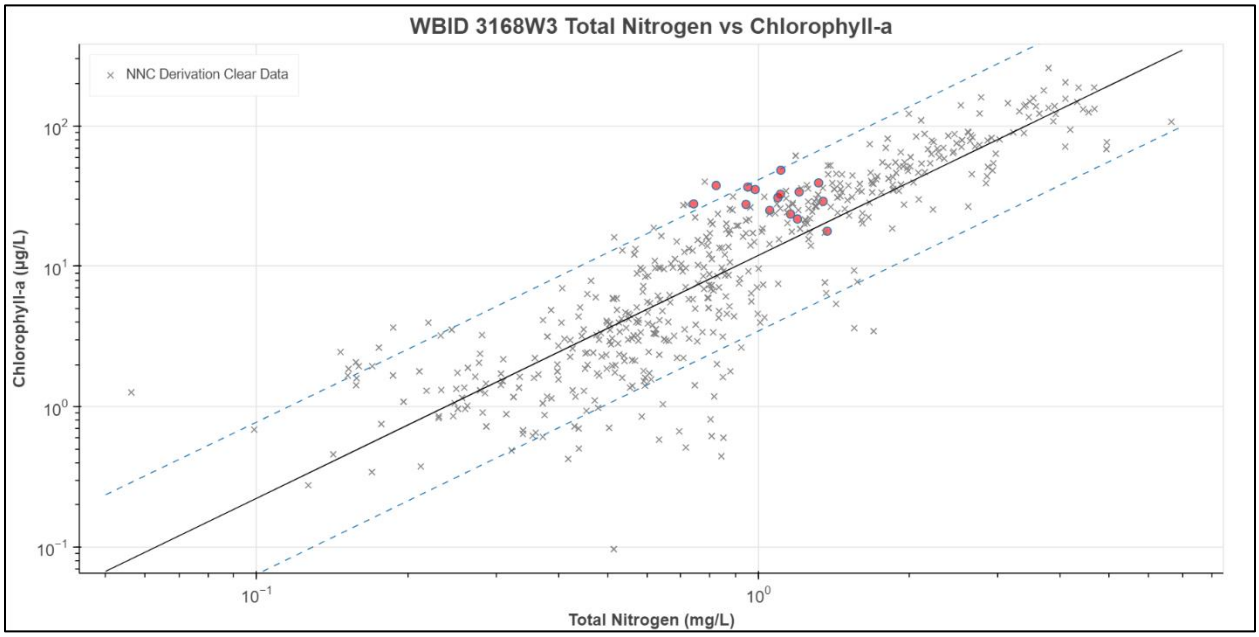

Figure 4.12. Relationship between chlorophyll *a* and TN AGMs in Lake Wade (red circles) plotted against the statewide dataset used to derive the NNC for low-color lakes

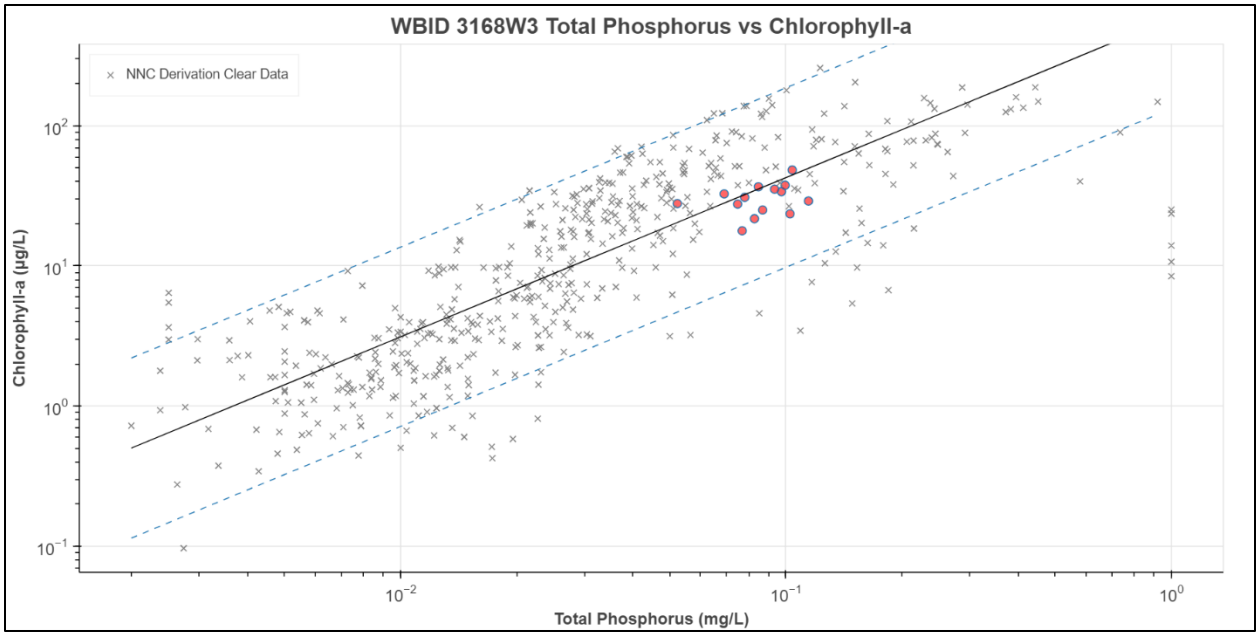

Figure 4.13. Relationship between chlorophyll *a* and TP AGMs in Lake Wade (red circles) plotted against the statewide dataset used to derive the NNC for low-color lakes

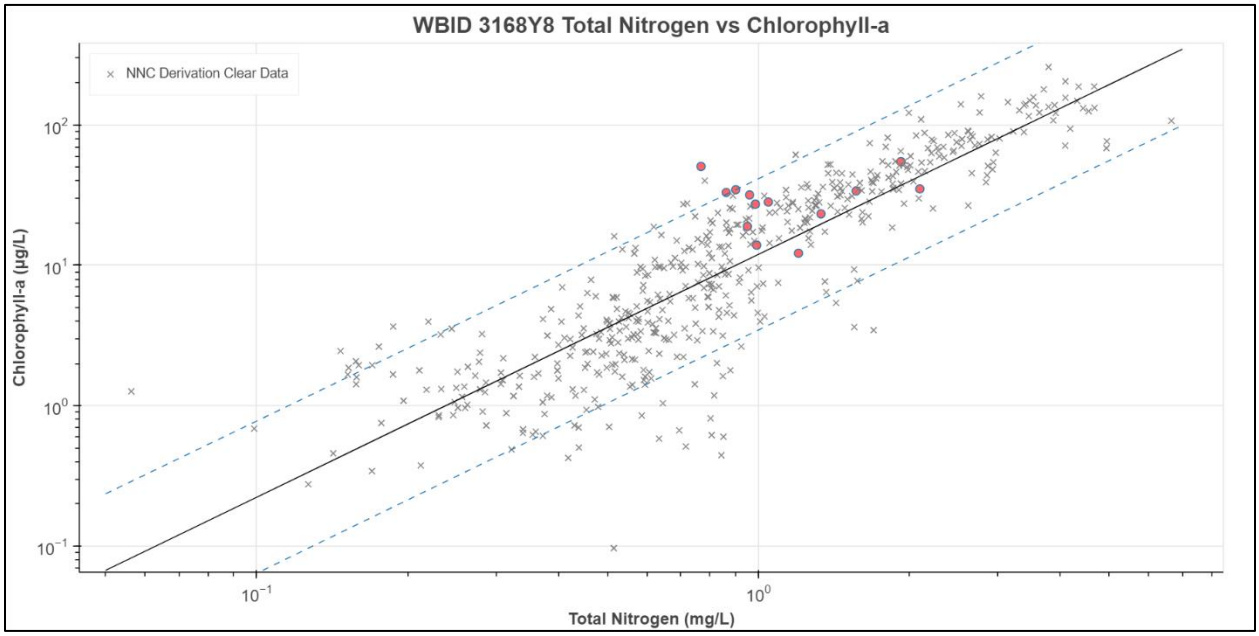

Figure 4.14. Relationship between chlorophyll *a* and TN AGMs in Lake Weldona (red circles) plotted against the statewide dataset used to derive the NNC for low-color lakes

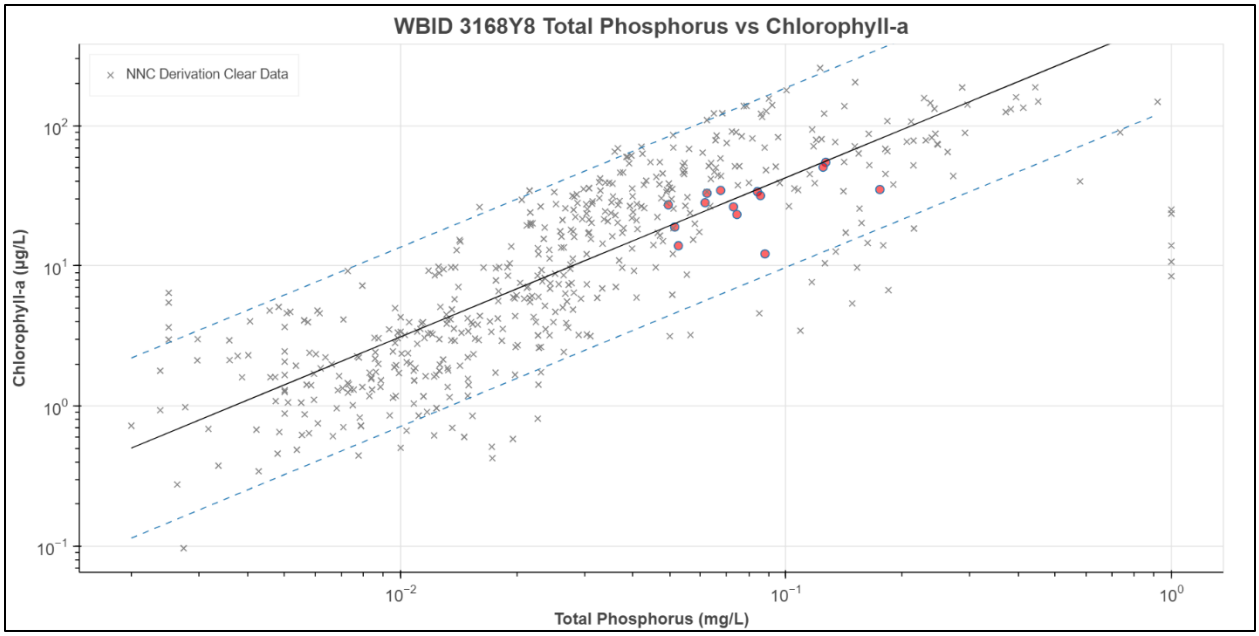

Figure 4.15. Relationship between chlorophyll *a* and TP AGMs in Lake Weldona (red circles) plotted against the statewide dataset used to derive the NNC for low-color lakes

The available information suggests that designated use attainment for Lakes Davis, Wade, and Weldona would be protected at the chlorophyll *a* threshold of 20 µg/L. The data do not indicate that the lakes respond differently from the statewide generally applicable relationships shown in **Figures 4.10** through **4.15**. Nutrient concentrations less than or equal to the lower lake NNC threshold are unlikely to exceed the chlorophyll *a* criterion (DEP 2012). Therefore, it can be concluded that basing the TMDL targets on the low-end generally applicable NNC (TN of 1.05 mg/L and TP of 0.03 mg/L) will meet the TMDL targets for chlorophyll *a* and fully protect designated uses in these lakes. Additionally, the TMDL targets do not need to be adopted as Hierarchy 1 site-specific interpretations of the NNC because the generally applicable NNC for low-color, high-alkalinity lakes fully protect designated uses.

The lakes are expected to meet the applicable nutrient criteria and maintain their function and designated use as Class III freshwater lakes when surface water nutrient concentrations are reduced to the target concentrations, addressing the anthropogenic contributions to the water quality impairments.

The method used to determine the reductions needed to attain the nutrient TMDLs is the percent reduction approach. Existing lake nutrient condition calculations are based on nutrient concentrations measured in the 2011–20 period, which is considered representative of current conditions. The existing nutrient conditions used to calculate the required reductions were the maximum values of the TN and TP AGMs in each lake that exceeded the water quality targets.

The geometric means were calculated from nutrient results available in the IWR Run 62 Database.

The equation used to calculate the percent reduction is as follows:

$$\frac{\text{[measured exceedance – target]}}{\text{measured exceedance}} \times 100$$

Table 4.1 lists the percent reductions in the maximum AGMs needed to achieve the TN AGM target of 1.05 mg/L and the TP AGM target of 0.03 mg/L for Lakes Davis, Wade, and Weldona. The TN percent reductions are 48 % in Lake Davis, 22 % in Lake Wade, and 50 % in Lake Weldona. The TP percent reductions are 78 % in Lake Davis, 74 % in Lake Wade, and 83 % in Lake Weldona. The nutrient AGM TMDL values and the associated percent reductions address the anthropogenic nutrient inputs contributing to the exceedances of the chlorophyll *a* criterion.

Table 4.1. Reductions required in existing TN and TP concentrations to meet water quality targets for Lakes Davis, Wade, and Weldona

ID = Insufficient data

Year	Lake Davis TN AGMs (mg/L)	Lake Davis TP AGMs (mg/L)	Lake Wade TN AGMs (mg/L)	Lake Wade TP AGMs (mg/L)	Lake Weldona TN AGMs (mg/L)	Lake Weldona TP AGMs (mg/L)
2011	2.01	0.11	ID	ID	1.92	0.13
2012	1.61	0.10	1.35	0.11	2.10	0.18
2013	1.45	0.12	1.20	0.08	ID	ID
2014	ID	ID	1.11	0.10	ID	ID
2015	1.08	0.07	0.94	0.07	0.99	0.05
2016	1.20	0.08	0.95	0.08	1.05	0.06
2017	1.13	0.13	1.11	0.07	0.77	0.12
2018	1.28	0.10	0.99	0.09	0.96	0.09
2019	1.03	0.07	0.74	0.05	0.86	0.06
2020	1.15	0.08	0.82	0.10	0.90	0.07
Maximum	**2.01**	**0.13**	**1.35**	**0.11**	**2.10**	**0.18**
TMDL Target	**1.05**	**0.03**	**1.05**	**0.03**	**1.05**	**0.03**
% Reduction	**48**	**78**	**22**	**74**	**50**	**83**

Chapter 5: Determination of Loading Allocations

5.1 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:

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

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

$$\mathbf{TMDL \cong \sum WLAs_{wastewater} + \sum WLAs_{NPDES\ Stormwater} + \sum LAs + MOS}$$

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 within 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). Stormwater reductions are included in both the MS4 WLA and LA, as applicable. However, in determining the overall stormwater reductions needed, DEP does not differentiate between the MS4 WLA and LA, and instead applies the same overall reductions to both as if the two categories were a single category source, unless otherwise specified.

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, which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure; see 40 Code of Federal Regulations (CFR) § 130.2(i). The TMDLs for Lakes Davis, Wade, and Weldona are expressed in terms of in-lake nutrient concentration targets and the percent reductions of existing in-lake concentrations necessary to meet the targets (see **Table 5.1**). They

are based on the generally applicable NNC in Subsection 62-302.531(2), F.A.C. The minimum TN and TP NNC values were applied to establish the percent reduction targets for the in-lake TN and TP concentrations. The restoration goal is to achieve the generally applicable chlorophyll *a* criterion of 20 µg/L for the lakes, expressed as an AGM not to be exceeded more than once in any consecutive 3-year period. This threshold protects each lake's designated use.

Table 5.1 lists the TMDLs for Lakes Davis, Wade, and Weldona. These are based on the generally applicable NNC in Subparagraph 62-302.531(2)(b)1., F.A.C.

Table 5.1. TMDL components for nutrients in Lakes Davis, Wade, and Weldona (WBIDs 3168Y4, 3168W3, and 3168Y8)

Note: MOS is implicit.
NA = Not applicable
[1] The TMDLs are based on the generally applicable NNC. The minimum TN and TP NNC values shown are used to calculate the percent reductions.
[2] The required percent reductions listed in this table represent the reductions of in-lake concentrations and do not directly reflect reductions in source loadings.

Waterbody (WBID)	Parameter	TMDL Target (mg/L)[1]	WLA Wastewater (% reduction)	WLA NPDES Stormwater (% reduction)[2]	LA (% reduction)[2]
Lake Davis (3168Y4)	TN	1.05	NA	48	48
Lake Davis (3168Y4)	TP	0.03	NA	78	78
Lake Wade (3168W3)	TN	1.05	NA	22	22
Lake Wade (3168W3)	TP	0.03	NA	74	74
Lake Weldona (3168Y8)	TN	1.05	NA	50	50
Lake Weldona (3168Y8)	TP	0.03	NA	83	83

5.2 Load Allocation

To achieve the LA in Lake Davis, a 48 % reduction in current TN in-lake concentration and a 78 % reduction in current TP in-lake concentration have been identified. To achieve the LA in Lake Wade, a 22 % in current TN in-lake concentration and a 74 % reduction in current TP in-lake concentrations have been identified. To achieve the LA in Lake Weldona, a 50 % in current TN in-lake concentration and a 83 % reduction in current TP in-lake concentrations have been identified.

The TMDLs are based on the percent reduction in in-lake concentrations. The needed reduction from anthropogenic inputs will be calculated based on more detailed source information when a restoration plan is developed.

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**).

5.3 Wasteload Allocation

5.3.1 NPDES Wastewater Discharges

As noted in **Chapter 4**, no active NPDES-permitted wastewater facilities in the Lakes Davis, Wade, and Weldona Watersheds discharge either into the waterbodies or their watersheds. Therefore, a WLA for wastewater discharges is not applicable.

5.3.2 NPDES Stormwater Discharges

The MS4 permittees in the Lakes Davis, Wade, and Weldona Watersheds are the City of Orlando, Orange County, and FDOT District Five. The Phase I NPDES MS4 permits are FLS000014 (City of Orlando) and FLS000011 (Orange County, FDOT District Five). Nonpoint sources across the watersheds, including MS4 permittees, are responsible for making sufficient reductions in TN and TP to achieve the in-lake reductions of 48 % TN and 78 % TP in Lake Davis, 22 % TN and 74 % TP in Lake Wade, and 50 % TN and 83 % TP in Lake Weldona. The stormwater reductions for the TMDLs are those necessary (along with other sources) to meet the applicable NNC for the lakes.

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.

5.4 Margin of Safety (MOS)

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 quality of the receiving waterbody (CWA, Section 303(d)(1)(c)). Considerable uncertainty is usually inherent in estimating nutrient loading from nonpoint sources, as well as in predicting water quality response. The effectiveness of management activities (e.g., stormwater management plans) in reducing loading is also subject to uncertainty.

Consistent with the recommendations of the Allocation Technical Advisory Committee (DEP 2001), an implicit MOS was used in the development of the TMDLs because of the conservative assumptions that were applied. The conservative factors used in this TMDL are that reductions were calculated from the highest measured AGM TN and TP values to achieve the low end of the TN and TP criteria range within the generally applicable NNC to calculate the percent reductions. However, these conservative measures are only components of the MOS and are not intended to change the frequency or duration of the applicable NNC.

Chapter 6: Implementation Plan Development and Beyond

6.1 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 respond to the permit conditions that reflect target concentrations, reductions, or WLAs 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).

6.2 BMAPs

Information on the development and implementation of BMAPs is contained 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.

6.3 Implementation Considerations for the Waterbody

Existing nutrient reduction and management infrastructure and plans should be included in any future pollutant mitigation strategies. 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 additional associated remediation projects on surface water quality. Approaches for addressing these other factors should be included in

comprehensive management plans for the waterbodies. Additionally, the current water quality monitoring of the lakes should continue and be expanded, as necessary, during the implementation phase to ensure that adequate information is available for tracking restoration progress. Consideration should be given to expanding monitoring to include likely sources of nutrients to the waterbodies to better guide restoration activities.

While the low-end TN and TP applicable NNC were used to establish percent reduction targets for the in-lake TN and TP concentrations, the NNC remain the relevant water quality standards. If the chlorophyll *a* NNC threshold (20 ug/L) is achieved, the NNC set the applicable TN and TP criteria as the measured concentrations subject to the stated maximum and minimum concentrations. Stakeholders should focus on nutrient control strategies that help decrease in-lake nutrient concentrations sufficient to reduce chlorophyll *a* levels below the applicable NNC. Once each lake consistently meets the NNC over the assessment period, it can be assumed that the TMDLs are being met.

References

City of Orlando. 2019. Lake water quality report. Orlando, FL: City of Orlando Public Works Department, Streets and Stormwater Division, Stormwater Compliance Section.

Florida Department of Environmental Protection. 2001. A report to the Governor and the Legislature on the allocation of total maximum daily loads in Florida. Tallahassee, FL: Bureau of Watershed Management.

———. 2012. Development of numeric nutrient criteria for Florida lakes, spring vents, and streams. Technical support document. Tallahassee, FL: Division of Environmental Assessment and Restoration, Standards and Assessment Section.

———.2021. Statewide annual report. Tallahassee, FL: Division of Environmental Assessment and Restoration, Water Quality Restoration Program.

Griffith, G.E., D.E. Canfield, Jr., C.A. Horsburgh, and J.M. Omernik. 1997. Lake regions of Florida. EPA/R-97/127. Corvallis, OR: U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory.

Scott, T.M. 2001. Text to accompany the geologic map of Florida. Tallahassee, FL: Florida Geological Survey.

U.S. Census Bureau. 2019. QuickFacts Orange County, Florida.

———.2020. QuickFacts Orlando City, Florida; Orange County, Florida.

U.S. Geological Survey. 1996. Hydrogeologic conditions and simulation of ground-water flow in the greater Orlando metropolitan area, east-central Florida. Tallahassee, FL.

Viessman, W., Jr., G.L. Lewis, and J.W. Knapp. 1989. Introduction to hydrology. Third edition. New York: Harper Collins.

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.