FINAL

Nutrient TMDLs for Lochloosa Lake (WBID 2738A) and Cross Creek (WBID 2754)

and Documentation in Support of the Development of Site-Specific Numeric Interpretations of the Narrative Nutrient Criterion

Wayne Magley, Ph.D.
Water Quality Evaluation and TMDL Program
Division of Environmental Assessment and Restoration
Florida Department of Environmental Protection

May 2017

2600 Blair Stone Road
Tallahassee, FL 32399-2400

Acknowledgments

Map production assistance was provided by Benjamin Mittler of Watershed Data Services with the Florida Department of Environmental Protection (DEP) Division of Environmental Assessment and Restoration. Staff from the Florida Fish and Wildlife Conservation Commission provided historical vegetation survey information and a field tour. A special thanks to David Clapp, Dale Smith, and Tom Jobes from the St. Johns River Water Management District, who spent considerable time and effort to provide DEP staff with a calibrated hydrodynamic and water quality Hydrological Simulation Program–Fortran model for the Lochloosa watershed and address technical details of the modeling effort.

Editorial assistance was provided by Xueqing Gao, Douglas Gilbert, Daryll Joyner, Ken Weaver, Kaitlyn Summerfield, Erin Rasnake, and Linda Lord.

For additional information on the watershed management approach and impaired waters in the Ocklawaha Basin, contact:

Mary Paulic
Florida Department of Environmental Protection
Water Quality Restoration Program Watershed Planning and Coordination Section
2600 Blair Stone Road, Mail Station 3565
Tallahassee, FL 32399-2400
Email: Mary Paulic
Phone: (850) 245–8580

Access to all data used in the development of this report can be obtained by contacting:

Wayne Magley
Florida Department of Environmental Protection
Water Quality Evaluation and TMDL Program
Watershed Evaluation and TMDL Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
Email: Wayne Magley
Phone: (850) 245–8463

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Chapter 1: Introduction

1.1 Purpose of Report

This report describes the analysis carried out to develop nutrient total maximum daily loads (TMDLs) for Lochloosa Lake and Cross Creek to assess the impact of proposed nutrient reductions on the lake's Trophic State Index (TSI) and chlorophyll *a* level. Lochloosa Lake (WBID 2738A), located in Central Florida in Alachua County (**Figure 1.1**), was verified as impaired for nutrients during the Cycle 1 assessment for the Ocklawaha Basin based on elevated TSI values and was included on the Verified List of impaired waters adopted by Secretarial Order on August 28, 2002.

Cross Creek (WBID 2754) was also included on the Verified List for dissolved oxygen (DO). In the Cycle 2 assessment, the continued nutrient impairment of Lochloosa Lake was confirmed. Lochloosa Lake Outlet (WBID 2738) was verified impaired for nutrients based on chlorophyll *a* levels in the Cycle 2 assessment. Cross Creek was placed on the Cycle 2 Verified List for both DO and nutrients. The Cycle 2 Verified List was adopted by Secretarial Order on May 19, 2009.

In the Cycle 3 Delist List adopted by Secretarial Order on February 12, 2013, the Lochloosa Lake Outlet was delisted for nutrients based on a flaw in the analysis that used a station which was not representative of the WBID.

According to Section 303(d) of the federal Clean Water Act (CWA) and the Florida Watershed Restoration Act (FWRA), Chapter 403.067, Florida Statutes (F.S.), the Florida Department of Environmental Protection (DEP) is required to submit to the U.S. Environmental Protection Agency (EPA) on a recurring basis lists of surface waters that do not meet applicable water quality standards (impaired waters). The methodologies used by the state for the determination of impairment are established in Chapter 62-303, Identification of Impaired Surface Waters Rule (IWR), Florida Administrative Code (F.A.C.).

Once a waterbody or waterbody segment has been verified as impaired and referenced in the Secretarial Order Adopting the Verified List of Impaired Waters, work on establishing the TMDL begins. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water quality–based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (EPA 1991).

These TMDLs will constitute the site-specific numeric interpretations of the narrative nutrient criterion set forth in Paragraph 62-302.530(47)(b), F.A.C., that will replace the otherwise applicable numeric nutrient criteria (NNC) in Subsection 62-302.531(2), F.A.C., for these particular waterbodies.

1.2 Identification of Waterbody

For assessment purposes, DEP has divided the Ocklawaha Basin into water assessment areas with a unique waterbody identification (WBID) number for each waterbody segment. Lochloosa Lake was WBID 2738 in the Cycle 1 assessment. Following the Cycle 2 assessment, the lake was renumbered WBID 2738A. WBID 2738 was assigned to Lochloosa Lake Outlet, which is a stream segment. Cross Creek is WBID 2754.

Lochloosa Lake is a 5,663-acre lake in the southeast corner of Alachua County (**Figure 1.1**). Cross Creek is a freshwater stream 1.5 miles long, connecting Lochloosa Lake with Orange Lake, with 95 % of the flow in the creek coming from the outflow from Lochloosa Lake. Lochloosa Lake is a highly eutrophic or hypereutrophic lake with very low water clarity and an abundance of aquatic plants. Most of Lochloosa Lake is surrounded by the Lochloosa Wildlife Conservation Area, which covers more than 10,300 acres, and an adjacent 16,600-acre conservation easement, for a total of 27,000 acres.

Lochloosa Lake is located in the area known as the Central Lowlands and the Alachua Prairie subprovince of the Northern Peninsula Slopes physiographic region (**Figure 1.2**). Much of the watershed is dominated by poorly drained soils, combined with a relatively low elevation gradient surrounding the lake, leading to sheetflow and poorly defined channels. The major sources of water to the lake include Lochloosa Creek and Hawthorne Creek, as well as surface runoff, subsurface flow, and direct rainfall. Major outlets of the lake include Cross Creek (which leads to Orange Lake, an Outstanding Florida Water [OFW]), and Lochloosa Slough (which leads to Orange Creek) (**Figure 1.3**).

The area around Lochloosa Lake is sparsely populated, with just the small community of Lochloosa situated on the eastern shore and the historic community of Cross Creek located along Cross Creek. The Lochloosa Lake drainage basin only contains 3,020 people, including about half of the city of Hawthorne.

Lochloosa Lake and Cross Creek are part of the Orange Creek Planning Unit. Planning units are groups of smaller watersheds (WBIDs) that are part of a larger basin unit, in this case the Ocklawaha Basin. The Orange Creek Planning Unit consists of 105 WBIDs. **Figure 1.4** shows the locations of these WBIDs in the planning unit, including the Lochloosa Lake and Cross Creek watersheds.

1.3 Background

This report is part of the DEP watershed management approach for restoring and protecting state waters under TMDL Program requirements. The watershed approach looks at waterbodies in a larger geographic context of 52 river basins. It is implemented by organizing the basins into 5 groups, with an individual basin group evaluated during a given single year; all basins are assessed during a 5-year cycle. The TMDL Program implements the requirements of the 1972 federal CWA and the 1999 FWRA (Chapter 99-223, Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, specifically its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards, as set by the state. They provide important water quality restoration goals that will guide restoration activities.

This TMDL report will be followed by the development and implementation of a restoration plan designed to reduce the nutrient levels in Lochloosa Lake and Cross Creek. These activities will solicit and include the active participation of local citizen groups, as well as local and regional political entities such the St. Johns River Water Management District (SJRWMD), municipal governments, businesses, and other stakeholders. DEP will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for the impaired waterbodies.

Figure 1.1. Location of the Lochloosa Lake (WBID 2738A) and Cross Creek (WBID 2754) watersheds in Alachua County and major geopolitical and hydrologic features in the area

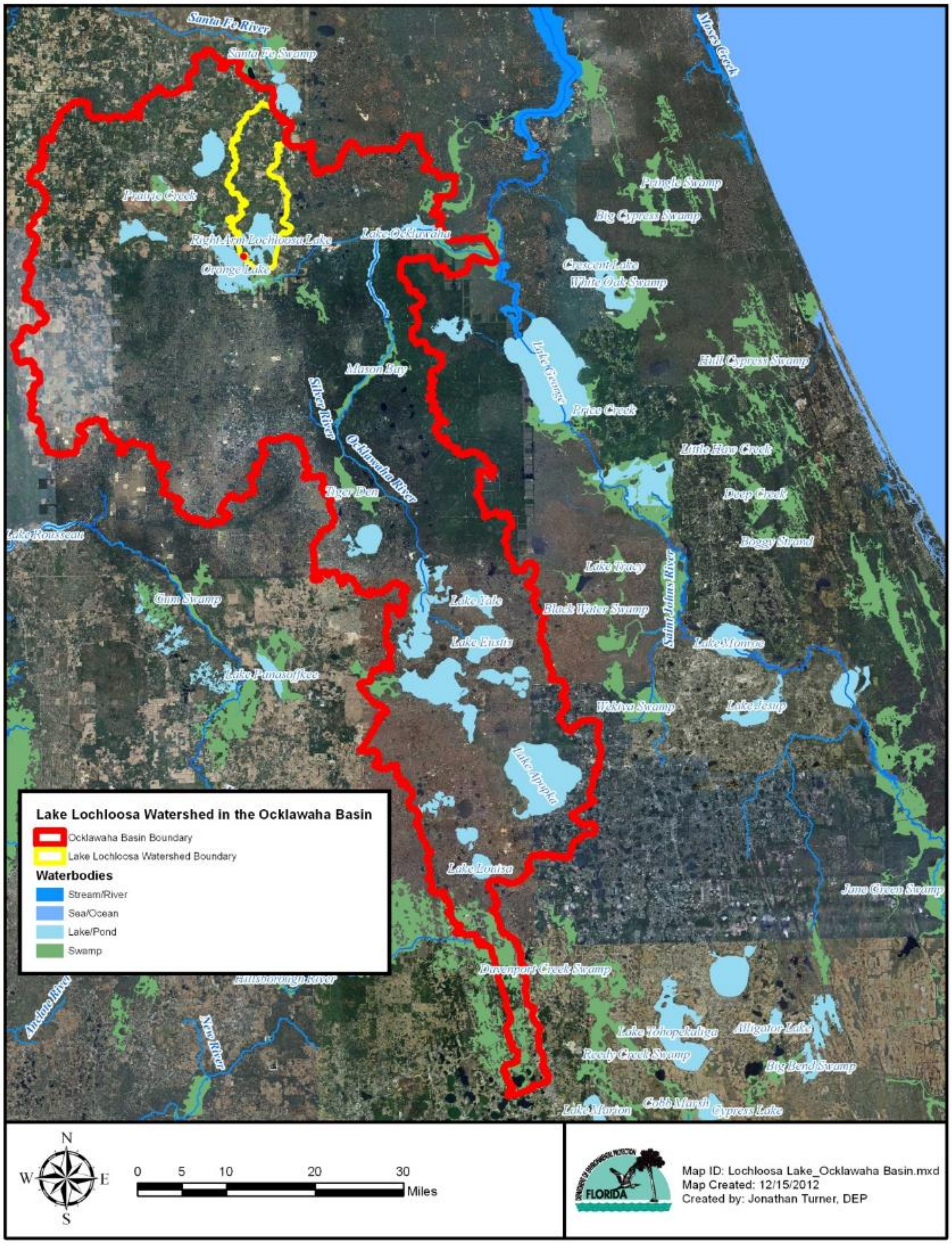


Figure 1.2. Location of the Lochloosa Lake (WBID 2738A) and Cross Creek (WBID 2754) watersheds in the Ocklawaha Basin and major geopolitical and hydrologic features in the area

Figure 1.3. Location of the Lochloosa Lake tributary inflows and outflows

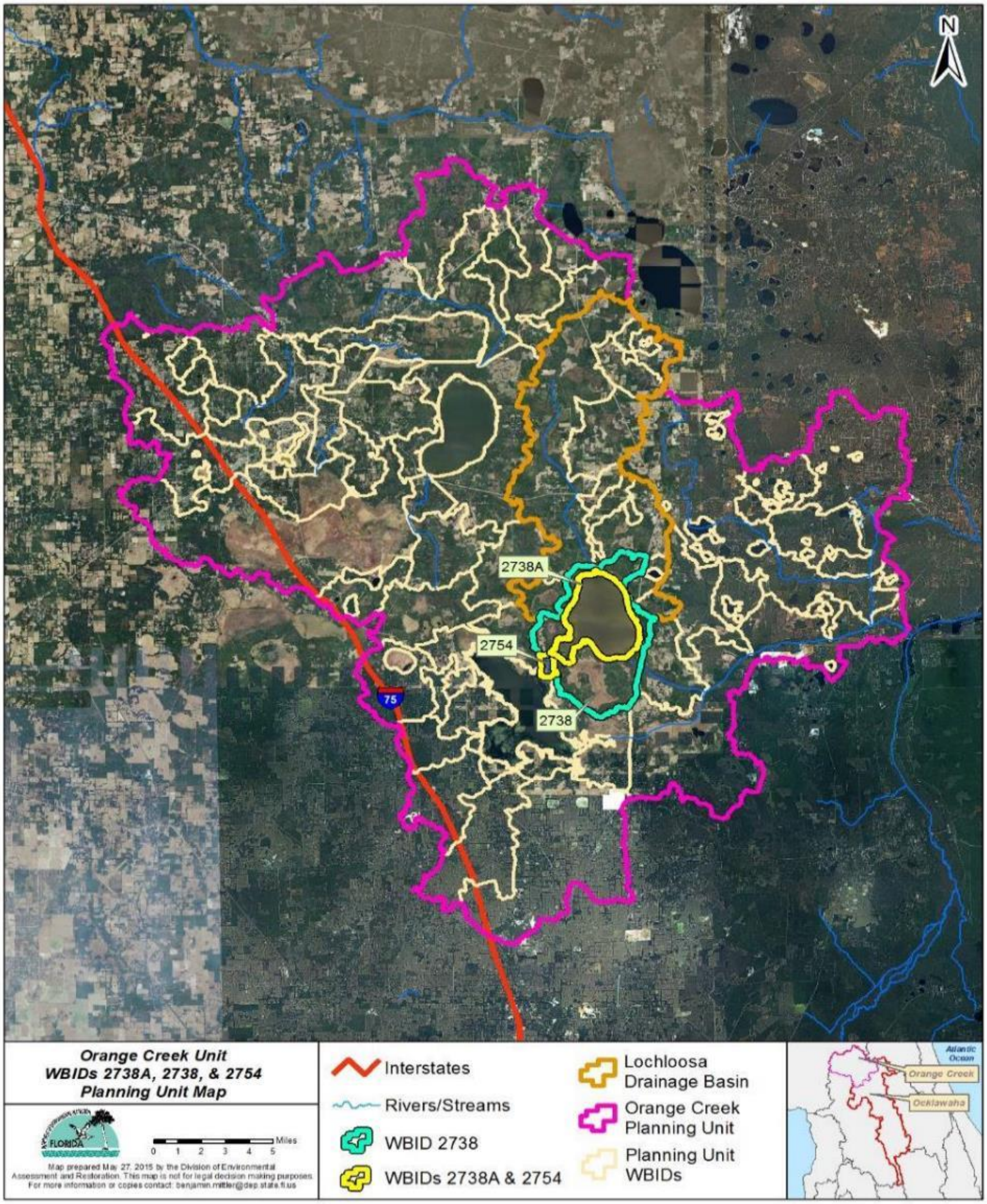


Figure 1.4. Location of the Lochloosa Lake (WBID 2738A), Lochloosa Lake Outlet (WBID 2738), and Cross Creek (WBID 2754) watersheds in the Orange Creek Planning Unit

Chapter 2: Description of Water Quality Problem

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal CWA requires states to submit to the EPA lists of surface waters that do not meet applicable state 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 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.

Florida placed 41 waterbodies in the Ocklawaha Basin on the 1998 303(d) list of impaired waters. However, the FWRA (Section 403.067, F.S.) stated that all Florida 303(d) lists created before the adoption of the FWRA were for planning purposes only and directed DEP to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After an extended rulemaking process, the Environmental Regulation Commission adopted the new methodology as Chapter 62-303, F.A.C. (Identification of Impaired Surface Waters Rule, or IWR), in April 2001. The rule was modified in 2006, 2007, 2012, and 2013

2.2 Information on Verified Impairment

DEP used the IWR to assess water quality impairments in Lochloosa Lake. The lake was verified as impaired for nutrients based on elevated annual average TSI values during the Cycle 1 verified period for the Group 1 basins (January 1, 1995–June 30, 2002). When the Cycle 1 assessment was performed, the IWR methodology used the water quality variables total nitrogen (TN), total phosphorus (TP), and chlorophyll *a* (a measure of algal mass, corrected and uncorrected) in calculating annual TSI values and in interpreting Florida's narrative nutrient threshold. The TSI is calculated based on concentrations of TP, TN, and chlorophyll *a*. The TSI threshold (60 for lakes with color higher than 40 platinum cobalt units [PCU]) was exceeded in multiple years during the verified period and was sufficient to identify the lake as impaired for nutrients.

In the Cycle 2 verified period (January 1, 2000–June 30, 2007), the annual mean TSI values continued to exceed the listing thresholds. The impairment was reaffirmed in the Cycle 3 verified period (January 1, 2005–June 30, 2012) (**Table 2.1**).

Table 2.1. Summary of annual average TSI values for Lochloosa Lake (WBID 2738A), 1995–2011

Year	Mean Color (PCU)	Annual Mean TSI	Exceedance
1995		64.6	Yes
1996		65.9	Yes
1997	66.4	69.7	Yes
1998	235	76.7	Yes
1999	60	84.7	Yes
2000	56.7	88.5	Yes
2001	86.3	84.4	Yes
2002	45		
2003	121	56.4	No
2004	191	61.5	Yes
2005	306	56.6	No
2006	101	65	Yes
2007	36	74	Yes
2008	98	84	Yes
2009	82	63	Yes
2010	39	44	Yes
2011	36		

Cross Creek was verified as impaired both for nutrients based on exceedances of annual average corrected chlorophyll *a* over the 20 micrograms per liter (µg/L) assessment threshold and for low DO (less than 5 milligrams per liter [mg/L]) in the Cycle 1 assessment. The impairment was reaffirmed in the Cycle 2 assessment. No chlorophyll *a* data were available for the Cycle 3 verified period to assess Cross Creek for nutrients. However, the DO impairment was reaffirmed (**Table 2.2**).

Florida adopted NNC for lakes, spring vents, and streams in 2011 that were approved by the EPA in 2012. Pursuant to Chapter 2013-71, Laws of Florida, the criteria went into effect on October 27, 2014. It is envisioned that these standards, in combination with the related bioassessment tools, will facilitate the assessment of designated use attainment for the state's waters and provide a better means to protect them from the adverse effects of nutrient overenrichment. The lake NNC, which are set forth in Subparagraph 62-302.531(2)(b)1., F.A.C., are expressed as annual geometric mean (AGM) values for chlorophyll *a*, TN, and TP, further described in **Chapter 3**.

Table 2.2. Summary of DO assessment data for Cross Creek (WBID 2754) during the Cycle 1 verified period (January 1, 1995–June 30, 2002), Cycle 2 verified period (January 1, 2000–June 30, 2007), and Cycle 3 verified period (January 1, 2005–June 30, 2012)

BOD = Biochemical oxygen demand
N = Nitrogen
P = Phosphorus

Parameter	Cycle 1	Cycle 2	Cycle 3
Total number of samples	42	45	63
IWR-required number of exceedances for the Verified List	8	8	10
Number of observed exceedances	22 (52.4 %)	22 (48.9 %)	28 (44.4 %)
Number of observed nonexceedances	20	23	35
Number of seasons during which samples were collected	4	4	4
Highest observation (mg/L)	9.6	9.95	9.95
Lowest observation (mg/L)	1.2	0.36	0.36
Median observation (mg/L)	4.81	5.44	5.62
Mean observation (mg/L)	5.03	5.09	5.63
Median value for BOD observations (mg/L)	2.8 (6)	No data	No data
Median value for TN observations (mg/L)	1.83 (41)	1.92 (44)	1.92 (62)
Median value for TP observations (mg/L)	0.066 (42)	0.11 (44)	0.108 (62)
Possible causative pollutant by IWR	Nutrients (N and P), BOD	Undetermined	TN

Although DEP has not formally assessed the data for Lochloosa Lake using the NNC, based on an analysis of the data from 2000 to 2012 in IWR Database Run 49, the preliminary results indicated that the lake would not attain the lake NNC for chlorophyll *a*, TN, and TP and thus remains impaired for nutrients (long-term color > 40 PCU). This time frame represents the Cycle 2 and Cycle 3 verified periods. **Table 2.3** lists the preliminary AGM values for chlorophyll *a*, TN, and TP from 1988 to 2013.

In Florida waterbodies, nitrogen and phosphorus are most often the limiting nutrients. The limiting nutrient is defined as the nutrient(s) that limit plant growth (both macrophytes and algae) when it is not available in sufficient quantities. 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, have supported 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 supports this idea, as statistically significant relationships were found between chlorophyll *a* values and both nitrogen and phosphorus concentrations (DEP 2012a).

Table 2.3. Summary of AGMs for TN, TP, and chlorophyll *a* for Lochloosa Lake (WBID 2738A)

ID = Insufficient data to calculate geometric means per the requirements of Chapter 62-303, F.A.C.
Note: Values shown in boldface type and shaded yellow are greater than the new NNC for lakes. Subparagraph 62-302.531(2)(b)1., 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)
1988	12.88	1.06	0.069
1989	12.19	1.05	0.052
1990	17.04	0.70	0.052
1991	**46.42**	**1.86**	**0.072**
1992	ID	ID	**0.063**
1993	13.94	1.90	0.062
1994	**39.08**	**2.02**	**0.056**
1995	**28.64**	**1.43**	**0.051**
1996	**40.54**	**1.55**	**0.052**
1997	**45.36**	**1.76**	**0.051**
1998	**77.73**	**1.97**	**0.068**
1999	**144.30**	**2.57**	**0.069**
2000	**187.76**	**5.41**	**0.100**
2001	**150.09**	**4.26**	**0.085**
2002	**26.19**	**2.83**	0.048
2003	13.28	1.55	0.037
2004	15.13	1.65	0.067
2005	7.93	1.58	0.108
2006	**24.48**	**1.35**	**0.111**
2007	**55.58**	**2.13**	**0.081**
2008	**133.19**	**3.38**	**0.071**
2009	**47.82**	**2.07**	**0.058**
2010	**ID**	**2.31**	**0.054**
2011	**95.55**	**3.84**	**0.090**
2012	ID	ID	ID
2013	**22.62**	**1.94**	**0.052**

Cross Creek is in the Peninsular Nutrient Region, and so TN and TP measurements from IWR Database Run 49 were analyzed for comparison with the stream NNC for the Peninsular Nutrient Region (see **Chapter 3**). TN and TP thresholds for streams in the Peninsular Nutrient Region are AGMs of 1.54 and 0.12 mg/L, respectively, not to be exceeded more than once in a 3-year period.

Table 2.4 summarizes the calculated geometric means. The results suggest that TN thresholds were exceeded during the 2004–09 period and TP thresholds were exceeded during the 2005–08 period. Data insufficiency from 2010 to 2012 precluded the calculation of AGMs and further assessment over that period.

Table 2.4. Summary of AGMs for TN and TP for Cross Creek (WBID 2754)

ID = Insufficient data to calculate geometric means per the requirements of Chapter 62-303, F.A.C.
Note: Values shown in boldface type and shaded are greater than the new NNC for streams. Subparagraph 62-302.531(2)(c)2., F.A.C., states that the applicable numeric interpretations for TN and TP shall not be exceeded more than once in any consecutive three-year period.

Year	TN (mg/L)	TP (mg/L)
1994	**2.07**	0.105
1995	**1.59**	0.061
1996	**1.86**	0.039
1997	**1.86**	0.067
1998	**1.79**	0.081
2001	ID	ID
2003	ID	ID
2004	**1.55**	0.077
2005	1.49	0.118
2006	**1.56**	**0.139**
2007	**2.21**	**0.135**
2008	**2.85**	0.097
2009	**2.42**	0.067
2010	ID	ID
2011	ID	ID
2012	ID	ID

Updated DO criteria were also adopted in Class I, Class II, Class III, and Class III-Limited Waters (Rule 62-303.533, F.A.C.) in August 2013 and approved by the EPA in 2013. Cross Creek is in the Peninsula bioregion, and the criterion specifies that no more than 10 % of the daily average percent DO saturation values (DOSAT) shall be below 38 %. **Table 2.5** lists the number of DOSAT measurements and corresponding percent exceedances (below the criterion) for Cross Creek by year. Over the 1994–2011 period, there were 37 exceedances out of 126 measurements (29 %). In 10 of the 14 years, the exceedance rate was greater than 10 %.

Table 2.5. Summary of DOSAT monitoring data and exceedances by year for Cross Creek (WBID 2754)

Year	DOSAT Measurements	DOSAT Exceedances	% Exceedance
1988	1	0	0.00
1989	3	0	0.00
1990	1	0	0.00
1994	7	3	42.86
1995	14	4	28.57
1996	11	5	45.45
1997	12	2	16.67
1998	5	1	20.00
2003	3	1	33.33
2004	12	5	41.67
2005	12	7	58.33
2006	12	1	8.33
2007	10	0	0.00
2008	12	3	25.00
2009	9	5	55.56
2010	3	0	0.00
2011	4	0	0.00

The data for the Cycle 1, Cycle 2, and Cycle 3 IWR assessments of WBIDs 2738A and 2754 come from stations sampled by DEP (21FLA…, 21FLCEN…, 21FLGW…), Alachua County (21FLACEP…), the SJRWMD (21FLSJWM…), the Florida Game and Freshwater Fish Commission) (renamed the Florida Fish and Wildlife Conservation Commission [FWC]) (21FLGFWF…), and Florida LakeWatch (21FLKWAT…). **Figure 2.1** shows the sampling locations. The individual water quality measurements used in this analysis came from the IWR Run 49 Database and are available on request. **Appendix C** (Lochloosa Lake) and **Appendix E** (Cross Creek) provide water quality results for the period of record for variables relevant to this TMDL development effort, collected by all sampling entities.

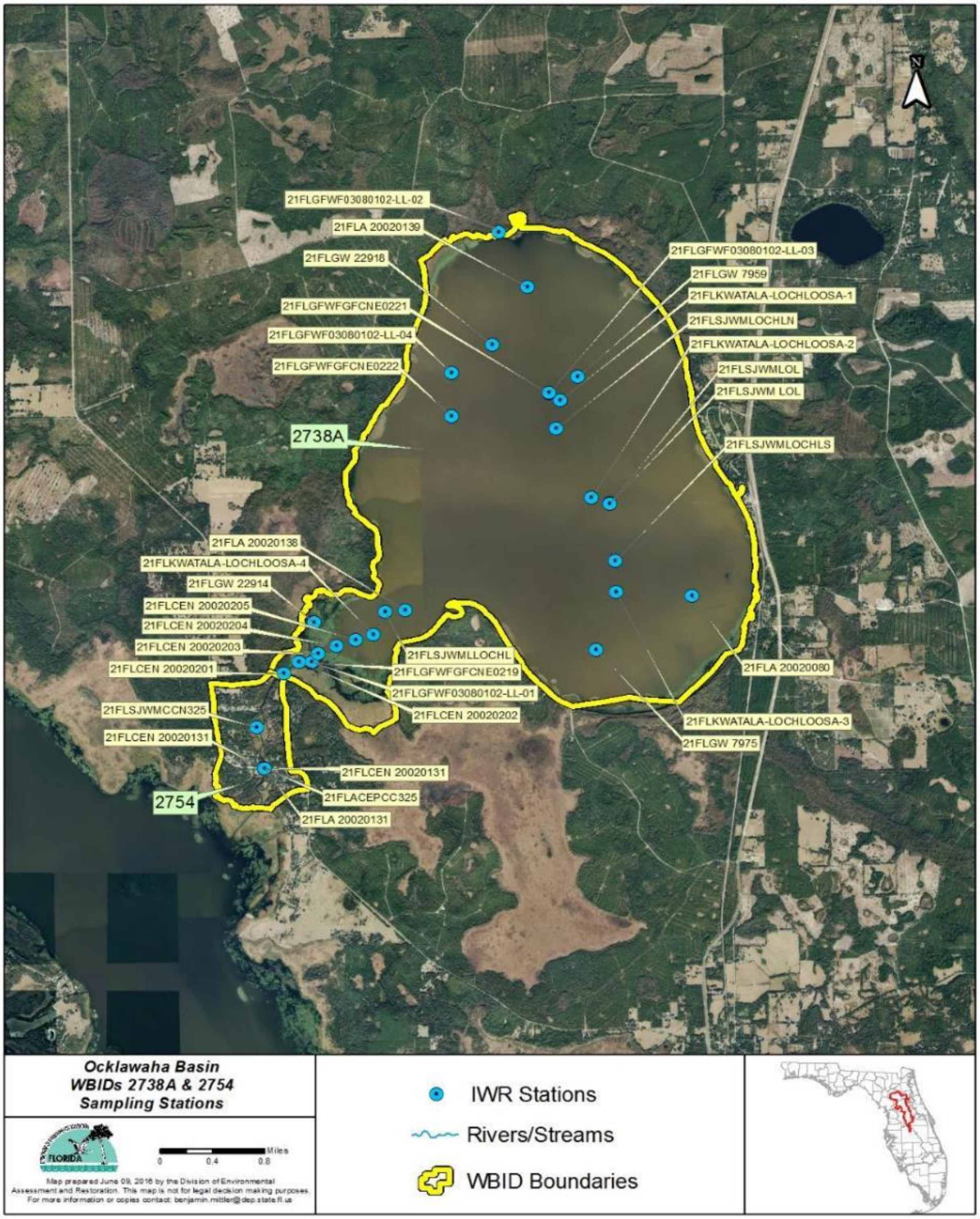


Figure 2.1. Location of IWR water quality monitoring stations in Lochloosa Lake and Cross Creek

Chapter 3. Description of Applicable Water Quality Standards and Targets

3.1 Classification of the Waterbody and Criterion Applicable to the TMDL

Florida's surface waters are protected for six designated use classifications, as follows:

Class I	**Potable water supplies**
Class II	**Shellfish propagation or harvesting**
Class III	**Fish consumption; recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife**
Class III-Limited	**Fish consumption; recreation or limited recreation; and/or propagation and maintenance of a limited population of fish and wildlife**
Class IV	**Agricultural water supplies**
Class V	**Navigation, utility, and industrial use (there are no state waters currently in this class)**

Lochloosa Lake and Cross Creek are Class III (freshwater) waterbodies, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criterion applicable to the verified impairments (nutrients) for these waters is the state of Florida's nutrient criterion in Paragraph 62-302.530(47)(b), F.A.C.. Florida has adopted lake criteria for TN, TP, and chlorophyll *a* (Subparagraph 62-302.531[2][b]1, F.A.C.) and stream criteria for TN and TP (Paragraph 62-302.531[2][c], F.A.C.).

The NNC went into effect on October 27, 2014. DEP has not formally assessed the data for Lochloosa Lake or Cross Creek using these criteria. However, based on a preliminary analysis of the available data, Lochloosa Lake would not attain the NNC and is expected to remain listed as verified impaired for nutrients under the new criteria. There are insufficient floral data to assess Cross Creek under the stream NNC.

The Class III water quality criterion applicable to the verified DO impairment for Cross Creek specifies that no more than 10 % of the daily average percent DO saturation values (DOSAT) shall be below 38 % (Subparagraph 62-303.533[1][a]2., F.A.C.).

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

The NNC for inland waters were adopted in Florida on December 8, 2012, and became effective on October 27, 2014. The nutrient TMDLs presented in this report, upon adoption into Chapter 62-304, F.A.C., will constitute site-specific numeric interpretations of the narrative nutrient criterion set forth in Paragraph 62-302.530(47)(b), F.A.C., that will replace the otherwise applicable NNC in Subsection 62-302.531(2), F.A.C., for Lochloosa Lake and Cross Creek. **Appendix J** summarizes the relevant TMDL information that supports establishing the TMDL and associated nutrient targets as the site-specific numeric interpretations of the narrative nutrient criterion, including information demonstrating that the TMDL provides for the attainment and maintenance of water quality standards in downstream waters (pursuant to Subsection 62-302.531[4], F.A.C.).

The targets used in TMDL development are designed to restore surface water quality to meet a waterbody's designated use. Criteria are based on scientific information used to establish specific levels of water quality constituents that protect aquatic life and human health for particular designated use classifications. In this case, the nutrient TMDLs constitute site-specific numeric interpretations of the narrative nutrient criterion and are designed to protect surface water designated use.

NNC rule language for lakes in Paragraph 62-302.531(2)(b), F.A.C., states:

> 1. For lakes, the applicable numeric interpretations of the narrative nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., for chlorophyll *a* are shown in the table below. The applicable interpretations for TN and TP will vary on an annual basis, depending on the availability of chlorophyll *a* data and the concentrations of nutrients and chlorophyll *a* in the lake, as described below. The applicable numeric interpretations for TN, TP, and chlorophyll *a* shall not be exceeded more than once in any consecutive three year period.
>
> a. If there are sufficient data to calculate the annual geometric mean chlorophyll *a* and the mean does not exceed the chlorophyll *a* value for the lake type in the table below, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the table below. However, for lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 0.49 mg/L TP streams threshold for the region; or
>
> b. If there are insufficient data to calculate the annual geometric mean chlorophyll *a* for a given year or the annual geometric mean chlorophyll *a* exceeds the values in the table below for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table below (see **Table 3.1)**.

Table 3.1. Chlorophyll *a*, TN, and TP criteria for Florida lakes (Subparagraph 62-302.531[2][b]1., F.A.C.)

$CaCO_3$ = Calcium carbonate
[1] For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 0.49 mg/L TP streams threshold for the region.

Long-Term Geometric Mean Lake Color and Alkalinity	AGM Chlorophyll *a*	Minimum Calculated AGM TP NNC	Minimum Calculated AGM TN NNC	Maximum Calculated AGM TP NNC	Maximum Calculated AGM TN NNC
>40 PCU	20 µg/L	0.05 mg/L	1.27 mg/L	0.16 mg/L[1]	2.23 mg/L
≤ 40 PCU and > 20 mg/L $CaCO_3$	20 µg/L	0.03 mg/L	1.05 mg/L	0.09 mg/L	1.91 mg/L
≤ 40 PCU and ≤ 20 mg/L $CaCO_3$	6 µg/L	0.01 mg/L	0.51 mg/L	0.03 mg/L	0.93 mg/L

Based on the long-term geometric mean color of 88 PCU (289 observations), Lochloosa Lake is a high-color lake, and the generally applicable chlorophyll *a* criterion for the lake is an AGM of 20 µg/L. According to **Table 2.4**, for years when the 20 µg/L annual chlorophyll *a* was exceeded, the applicable TN and TP criteria of 1.27 and 0.05 mg/L, respectively, were exceeded in multiple years (highlighted with boldface type and yellow shading in the table). Because it does not intend to abate natural background conditions, DEP compared those criteria with possible nutrient conditions—established through a paleolimnological reconstruction of past conditions and a model-based prediction of natural background conditions—to ensure that the proposed criteria are not lower than background conditions (**Section 5.4**).

The paleolimnological reconstruction (**Section 5.4.1**) was based on 5 cores and provided a range in natural background conditions for both chlorophyll *a* and TP. Diatom-inferred limnetic chlorophyll *a* concentrations ranged between 8.4 and 43.6 µg/L, with a median value of 20 µg/L. Two of the 5 cores indicated historical levels above 20 µg/L. Sediment analyses of myxoxanthophyll and oscillaxanthin pigments indicated the presence of cyanobacteria throughout the historical record. However, a chlorophyll *a* concentration could not be inferred for this component (and other nondiatom groups) of the phytoplankton community.

As a result, the diatom-inferred limnetic chlorophyll *a* concentrations likely underestimate the historical phytoplankton community to an unknown extent and were not used in target development. The diatom-inferred limnetic TP concentration in 5 five cores ranged between 0.048 and 0.059 mg/L (median of 0.053 mg/L) with historical concentrations in 3 of the 5 cores above 0.05 mg/L.

Modeling of natural background conditions (**Section 5.4.2**) indicated that both chlorophyll *a* and TP were higher than the generally applicable chlorophyll *a* and TP criteria of 20 µg/L and 0.05 mg/L, respectively, but that natural background TN concentrations were lower than the TN criterion.

DEP also conducted other analyses to examine whether these TN and TP targets are reasonable. The results supported the TN and TP targets used in this TMDL analysis. **Chapter 5** of this report provides details regarding the paleolimnological study, modeled background condition, and other analyses.

Table 3.2 summarizes the generally applicable NNC (based on the minimum values for TN and TP), inferred TP and chlorophyll *a* concentrations from the paleolimnological study, and model-simulated TN, TP, and chlorophyll *a* background concentrations. DEP selected the model-estimated natural background concentrations for TN and TP as the targets for TMDL development, with the magnitude at the 80th percentile of model-estimated AGMs (1.15 and 0.055 mg/L, respectively). The statistical derivation of the 80th percentile is consistent with a 1 in 3-year exceedance rate, as documented in *Overview of Approaches for Numeric Nutrient Criteria Development in Marine Waters* (DEP 2012b). The 80th percentiles of modeled background TN and TP concentrations were chosen as the targets for Lochloosa Lake to ensure that the TMDL attains the natural background condition, while accounting for the natural variation of the nutrient concentrations in ambient waters. The modeled 80th percentile background TP was consistent with the range in inferred TP concentrations based on the paleolimnological study.

As described in **Section 5.6**, TMDL loads were calculated that would meet these TN and TP concentration targets every year. The TMDL TN and TP loads of 78,163 kilograms per year (kg/yr) and 4,505 kg/yr, respectively, expressed as a long-term (7-year) average of annual loads for Lochloosa Lake, not to be exceeded (**Table 6.1**) constitute site-specific numeric interpretations of the narrative nutrient criterion set forth in Paragraph 62-302.530(47)(b), F.A.C., that will replace the otherwise applicable TN and TP NNC in Subsection 62-302.531(2), F.A.C., for Lochloosa Lake. The site-specific numeric interpretation for chlorophyll *a* is 38 µg/L, expressed as a long-term (7-year) average of the AGMs not to be exceeded. This value was the average of the chlorophyll AGMs for the model simulations that achieved the in-lake TN and TP targets each year over the 2004–10 period.

Appendix A provides basic definitions for three water quality variables: chlorophyll *a*, TN, and TP.

Table 3.2. Comparison of NNC with TN and TP targets for Lochloosa Lake

* Long-term average AGM

Approach	TN Target (mg/L)	TP Target (mg/L)	Chlorophyll *a* Target (µg/L)
NNC Lake Criteria	1.27	0.05	20
Paleolimnological		0.049–0.059	
80th Percentile Modeled Natural Background Condition	1.15	0.055	38*
Target	1.15	0.055	38*

The nutrient standard for streams in Paragraph 62-302.531(2)(c), F.A.C., states:

> (c) For streams, if a site specific interpretation pursuant to paragraph 62-302.531(2)(a) or (2)(b), F.A.C., has not been established, biological information shall be used to interpret the narrative nutrient criterion in combination with Nutrient Thresholds. The narrative nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., shall be interpreted as being achieved in a stream segment where information on chlorophyll a levels, algal mats or blooms, nuisance macrophyte growth, and changes in algal species composition indicates there are no imbalances in flora or fauna, and either:
>
> 1. The average score of at least two temporally independent SCIs performed at representative locations and times is 40 or higher, with neither of the two most recent SCI scores less than 35, or
>
> 2. The nutrient thresholds set forth in the table below (see **Table 3.3**) are achieved.

Cross Creek was assessed under the Peninsular Nutrient Region listed in **Table 3.3**. As described in **Section 5.6**water quality in Cross Creek is dominated by lake outflow with the lake contributing over ninety-five percent of the nutrient load to Cross Creek, thus targets developed for the lake will determine NNC for the creek as natural condition. The TMDL TN and TP loads of 32,514 and 1,601 kg/yr, respectively expressed as a long-term (7-year) average of annual loads not to be exceeded, will constitute site-specific numeric interpretations of the narrative nutrient criterion for Cross Creek. The site-specific numeric interpretation for chlorophyll *a* is 38 µg/L, expressed as a long-term (7-year) average of the AGMs not to be exceeded.

Cross Creek is a short (1.5 mile) stream segment that connects Lochloosa Lake and Orange Lake. As described by Clapp, D., and D.R. Smith. 2015, over ninety percent of the time, lake levels in Lochloosa Lake fluctuate between 53.5 ft NAVD88 and 58.4 ft NAVD88. The elevation of the bottom of Cross Creek is 52.8 ft NAVD88 and flow in Cross Creek becomes restricted when lake water elevations of approximately 53.5 ft NAVD88 in Lake Lochloosa. Once water level falls below 52.8 ft NAVD88, the two lakes become isolated from one another. Given the short length and the influence of Lochloosa Lake on conditions in Cross Creek typical stream characteristics are not present. Consequently, the evaluation of stream floral and faunal metrics as described in Implementation of Florida's Numeric Nutrient Standard (DEP, April 2013) are inappropriate for Cross Creek. Therefore, the chlorophyll *a* target is most representative of the waterbody which will replace all other default stream floral metrics and be protective of the designated use.

Table 3.3. TN and TP criteria for Florida streams (Subparagraph 62-302.531[2][c]2., F.A.C.)

[1]These values are AGM concentrations not to be exceeded more than once in any three calendar years.

Nutrient Watershed Region	TP Nutrient Threshold[1]	TN Nutrient Threshold[1]
Panhandle West	0.06 mg/L	0.67 mg/L
Panhandle East	0.18 mg/L	1.03 mg/L
North Central	0.30 mg/L	1.87 mg/L
Peninsular	0.12 mg/L	1.54 mg/L
West Central	0.49 mg/L	1.65 mg/L
South Florida	No numeric nutrient threshold. The narrative criterion in Paragraph 62-302.530(47)(b), F.A.C., applies.	No numeric nutrient threshold. The narrative criterion in Paragraph 62-302.530(47)(b), F.A.C., applies.

Chapter 4: Assessment of Sources

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant sources within categories, source subcategories, or individual sources of pollutants in the impaired waterbody and the amount of pollutant loadings 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 failing 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 B** for background information on the federal and state stormwater programs).

To be consistent with CWA definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) **and** stormwater systems requiring an NPDES stormwater permit when allocating the pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges 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 Potential Sources of Nutrient Loads within the Lochloosa Lake (WBID 2738A) and Cross Creek (WBID 2754) Watershed Boundaries

4.2.1 Point Sources

4.2.1.1 Wastewater Point Sources

There are no NPDES-permitted wastewater facilities in the Lochloosa Lake or Cross Creek watersheds.

4.2.1.2 Municipal Separate Storm Sewer System (MS4) Permittees

Alachua County has a Phase II-C MS4 permit (FLR04E005), and the Florida Department of Transportation (FDOT) District 2 has an MS4 permit (FLR04E018) that covers the urbanized area of Alachua County. Based on the 2010 Topologically Integrated Geographic Encoding and Referencing (TIGER) Census urbanized area coverage data (**Figure 4.1**), no portion of the Lochloosa or Cross Creek watersheds are within the urban area. Neither MS4 permit covers these watersheds. Alachua County maintains a geographic information system (GIS)–based inventory of structures (367; primarily pipe/culverts) and ponds (3) in the Lochloosa watershed (Sara Yorty, Alachua County Public Works, personal communication, October 2014).

4.2.2 Land Uses and Nonpoint Sources

4.2.2.1 2009 SJRWMD Land Use

Lochloosa Lake (WBID 2738A) encompasses an area of 5,663 acres (**Figure 4.2**). Ninety-five percent (~5,360 acres) of the WBID is designated as lake, with the remaining 5 % (~300 acres) wetland areas. **Table 4.1** lists the 2009 land use categories within the Lochloosa Lake WBID boundary.

Cross Creek (WBID 2754) covers an area of 322 acres (**Figure 4.2**). Of this area, 30 % (~97 acres) is designated as wetlands, 3 % (~11 acres) as freshwater streams, and 16 % (~52 acres) as upland forests. Urban areas cover 45 % (~145 acres), with 20 % (~63 acres) being low density residential, 16 % (~53 acres) being medium density residential, 4 % (~13 acres) being high density residential, and 5 % (~16 acres) being urban and built-up area. **Table 4.2** lists the 2009 land use categories found within the Cross Creek WBID boundary.

The Lochloosa watershed drains an area of 56,186 acres (**Figure 4.3**). The largest land use in the watershed, at 50 % (27,978 acres), is upland forests. The next leading land use is wetlands, with 23 % (12,972 acres), and freshwater areas, with 10 % (~5,667 acres). Urban built-up and residential land uses comprise less than 5 % (~2,730 acres) of the watershed area. **Table 4.3** lists the 2009 land use categories found within the Lochloosa drainage basin boundary.

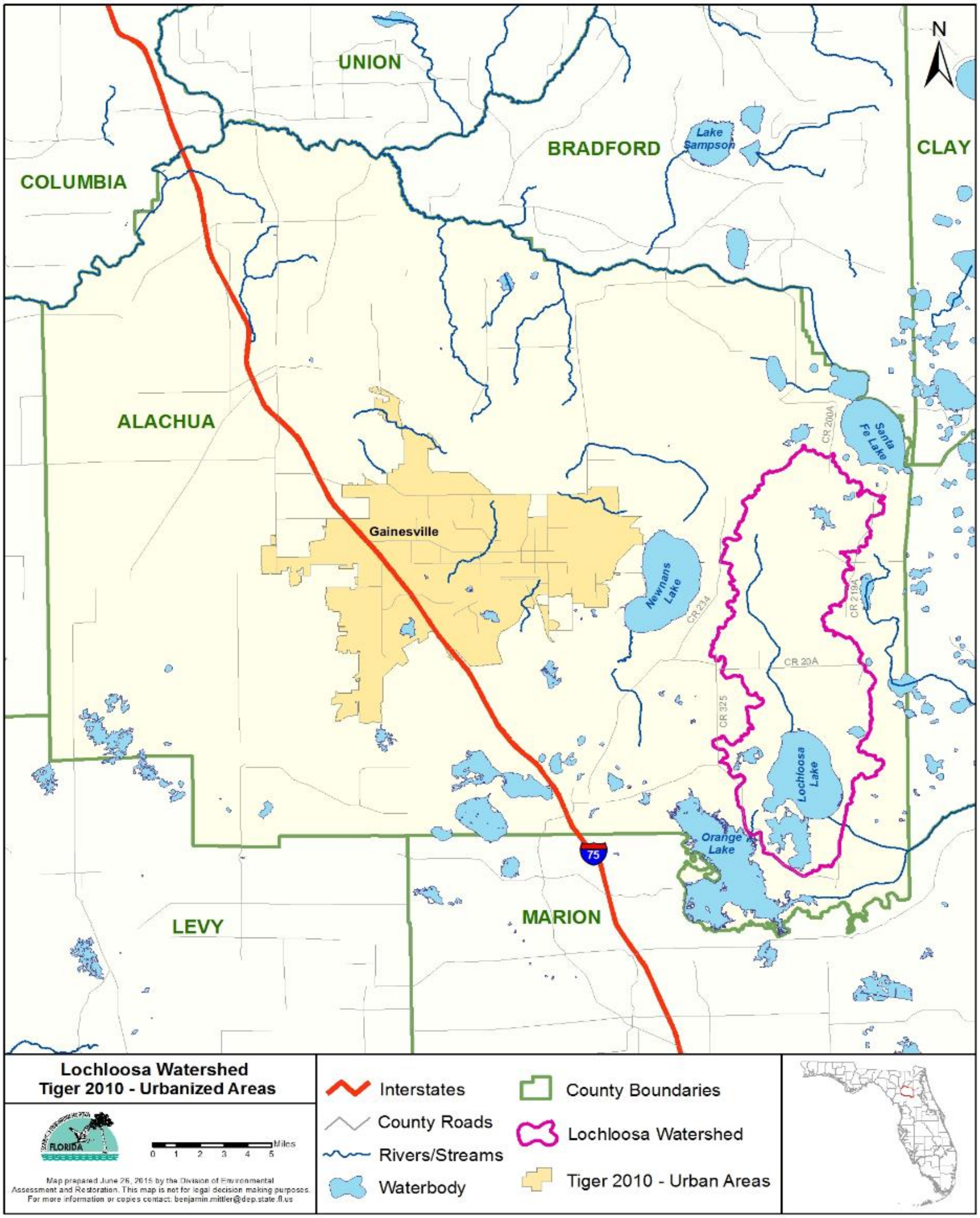


Figure 4.1. Urbanized areas in Alachua County based on TIGER 2010 Census information

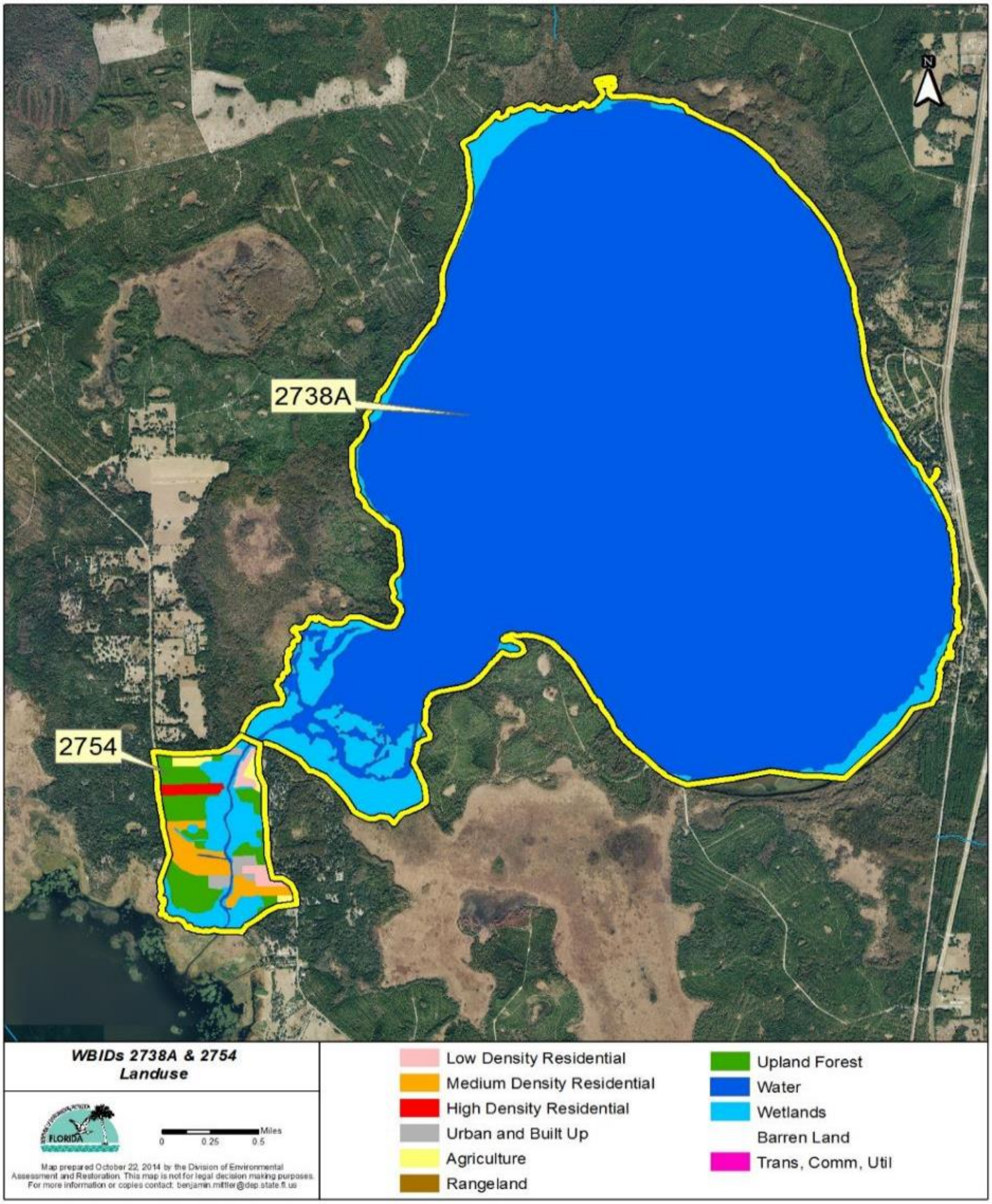


Figure 4.2. Principal land uses within the Lochloosa Lake and Cross Creek WBID boundaries

Table 4.1. Classification of 2009 SJRWMD land use categories within the Lochloosa Lake (WBID 2738A) WBID boundary

Level 1 Code	Lochloosa Lake (WBID 2738A) Land Use	Acres	% Acreage
1000	Urban and Built up	0	0.0
	Low Density Residential	0.80	<0.1
	Medium Density Residential	0.17	<0.1
	High Density Residential	0	0.0
2000	Agricultural	0	0.0
3000	Rangeland	0	0.0
4000	Upland Forest	1.02	<0.1
5000	Water	5,363	94.7
6000	Wetlands	298.8	5.3
7000	Barren Land	0	0.0
8000	Transportation, Communication, and Utilities	0	0.0
	TOTAL	**5,663.8**	**100**

Table 4.2. Classification of 2009 SJRWMD land use categories within the Cross Creek (WBID 2754) WBID boundary

Level 1 Code	Cross Creek (WBID 2754) Land Use	Acres	% Acreage
1000	Urban and Built up	16.1	5.0
	Low Density Residential	62.6	19.4
	Medium Density Residential	53.2	16.5
	High Density Residential	12.7	4.0
2000	Agricultural	18.3	5.7
3000	Rangeland	0	0.0
4000	Upland Forest	51.8	16.1
5000	Water	10.5	3.3
6000	Wetlands	96.6	30.0
7000	Barren Land	0	0.0
8000	Transportation, Communication, and Utilities	0	0.0
	TOTAL	**321.9**	**100**

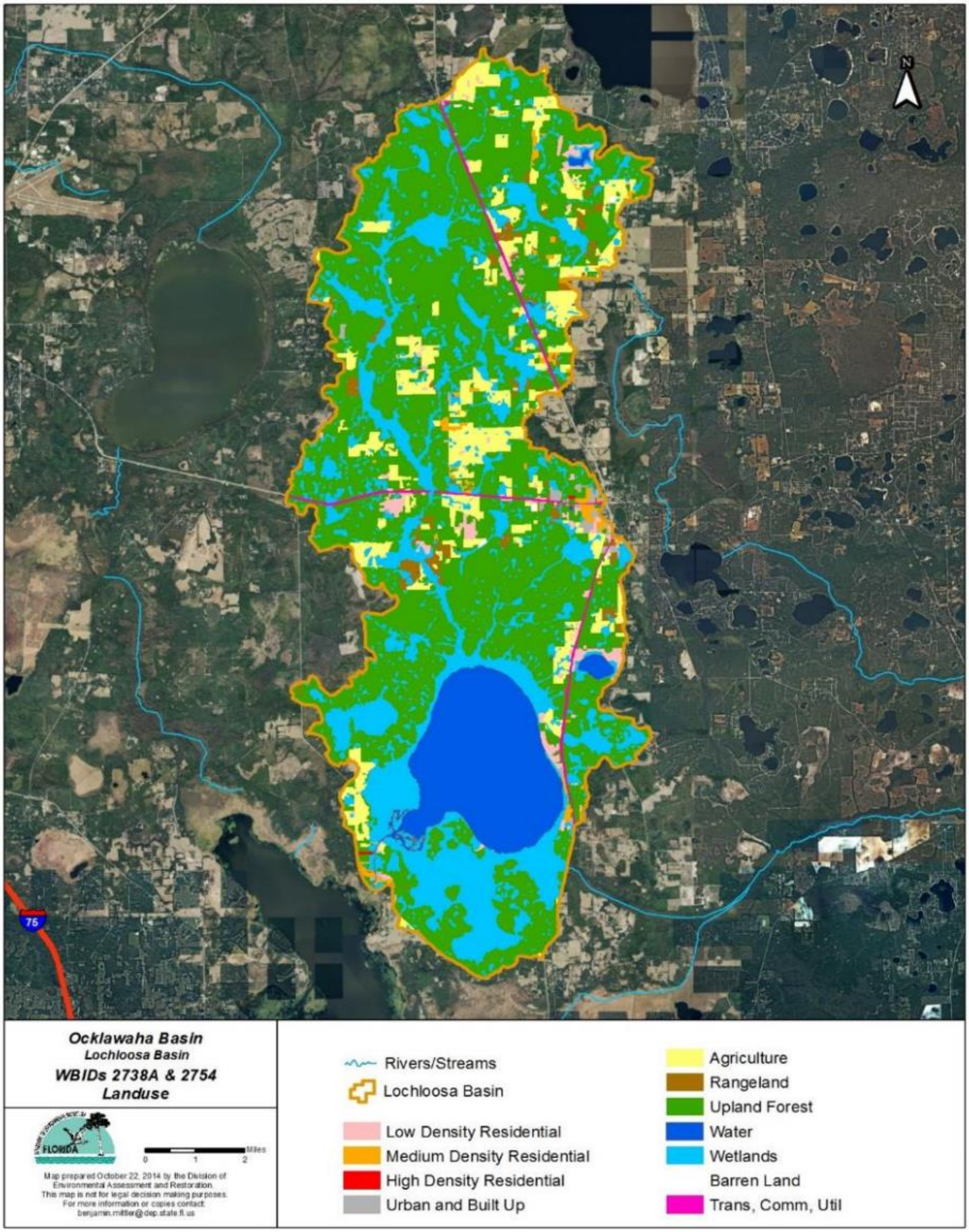


Figure 4.3. Principal land uses in the Lochloosa watershed

Table 4.3. Classification of 2009 SJRWMD land use categories in the Lochloosa watershed

Level 1 Code	Lochloosa Lake Watershed Land Use	Acres	% Acreage
1000	Urban and Built up	220.0	0.4
	Low Density Residential	2,330.1	4.2
	Medium Density Residential	162.9	0.3
	High Density Residential	18.5	<0.1
2000	Agricultural	5,616.1	10.0
3000	Rangeland	623.2	1.1
4000	Upland Forest	27,978.1	49.8
5000	Water	5,667.5	10.1
6000	Wetlands	12,973.0	23.1
7000	Barren Land	48.3	<0.1
8000	Transportation, Communication, and Utilities	548.4	1.0
	TOTAL	**56,186**	**100**

4.2.2.2 Population

The 2010 U.S. Census Bureau block data were used to estimate the human population in the Lochloosa watershed. Total population data for Census blocks covering the Lochloosa watershed were clipped using GIS to estimate the population in the basin based on the fraction of the block contained in the basin. This yielded a population of 3,020 in the Lochloosa watershed. Based on an average of 2.32 persons per household in Alachua County, there were 875 occupied residential units in the watershed.

4.2.2.3 Septic Tanks

Onsite sewage treatment and disposal systems (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.

When not functioning properly, however, OSTDS can be a source of nutrients (nitrogen and phosphorus), pathogens, and other pollutants to both groundwater and surface water. Based on the Florida Department of Health (FDOH) November 2013 GIS coverage of OSTDS, there were 146 septic tanks located in the watershed.

Available FDOH permit records for the installation of new septic systems start around 1971, and estimates prior to 1970 were based on 1970 Census information. To obtain information on the number and location of OSTDS in every county in Florida, FDOH contracted with EarthSTEPS, LLC and GlobalMind (2009) to develop a *Statewide Inventory of Onsite Sewage Treatment and*

Disposal Systems in Florida. The study used the Florida Department of Revenue 2008 tax roll and GIS information on the location of sewered parcels and parcels with permitted OSTDS. Logistic regression models were developed for each county to compute the probability of OSTDS on all the improved parcels for which independent information on wastewater disposal methods were not available.

There were 2,751 parcels in the Lochloosa watershed, based on the 2014 property appraiser records. The Lochloosa subwatershed shapefile was combined with the GIS shapefile of estimated OSTDS based on the EarthSTEPS and GlobalMind report (2009) to compare the FDOH OSTDS distribution. **Figure 4.4** illustrates the locations of OSTDS based on the EarthSTEPS and GlobalMind analysis. **Table 4.4** summarizes the estimated septics from EarthSTEPS and GlobalMind, along with the November 2013 FDOH coverage. The table also includes a simple estimate for the shortest distance between a septic tank in each subwatershed to Lochloosa Lake.

Table 4.4. Comparison of estimated septic tanks in the Lochloosa subwatersheds

Subwatershed	EarthSTEPS and GlobalMind	FDOH (November 2013)	Shortest Distance to Lake (meters)
16	51	9	16,625
17	134	12	13,639
18	119	21	7,168
19	167	27	6,035
20	117	11	3,846
21	119	14	3,581
22	0	0	NA
23	151	5	3,714
24	59	18	1,369
25	7	0	112
26	4	0	4,280
27	181	19	75
28	114	10	900
Total	**1,223**	**146**	

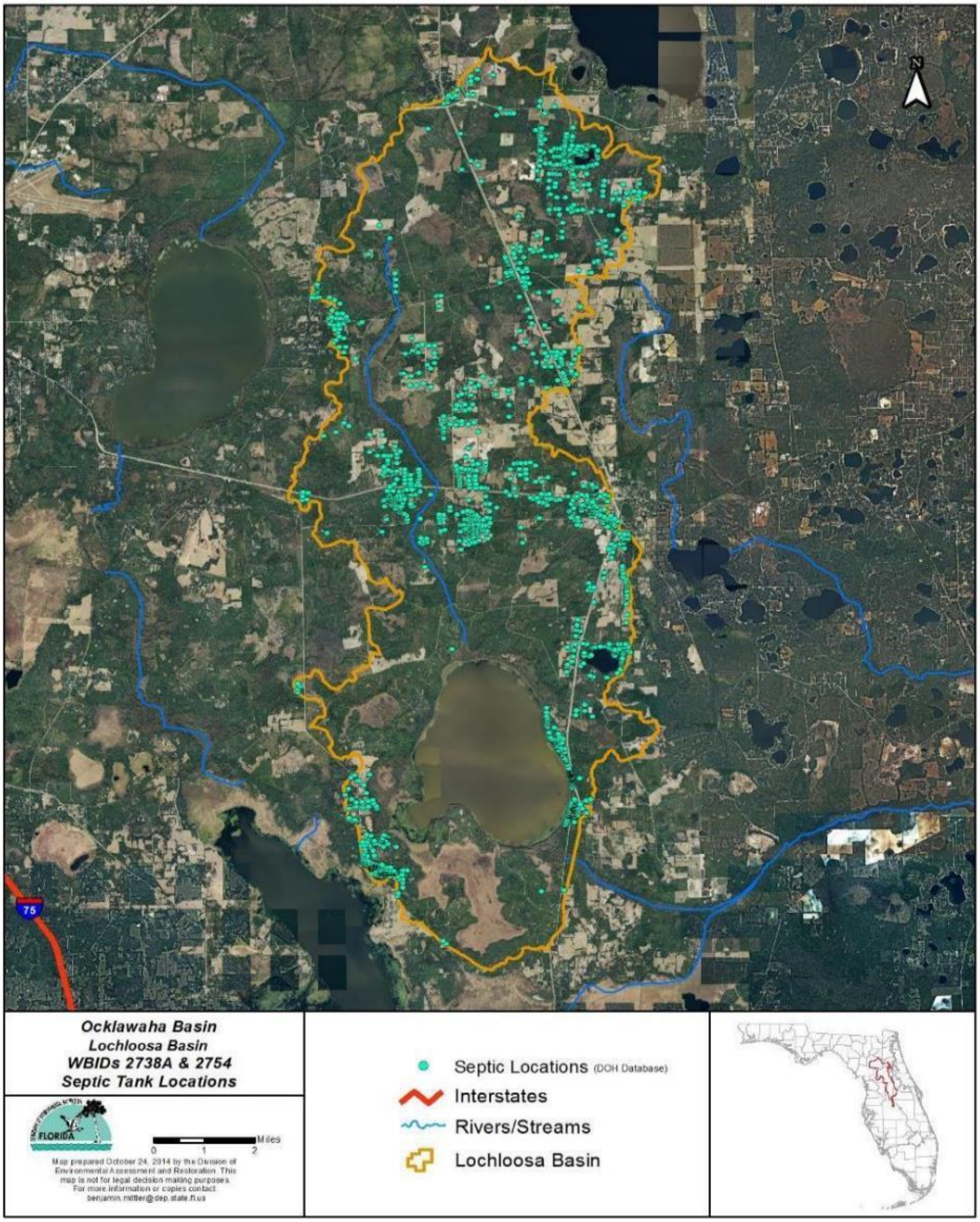


Figure 4.4. EarthSTEPS LLC and GlobalMind septic tank locations in the Lochloosa watershed

Buffers of 200, 500, and 1,000 meters around surface waterbodies in the Lochloosa Lake watershed were created to estimate the number of septic systems in each buffer zone using the EarthSTEPS and GlobalMIND estimated septics. There were 92 septic systems located within a 200-meter buffer, 117 within 500 meters, and 134 within 1,000 meters.

Using an estimate of 70 gallons/day/person (EPA 1999), and septic tank effluent TN and TP concentrations of 57 and 10 mg/L, respectively (Toor et al. 2011; Lusk et al. 2011), potential annual groundwater loads of TN and TP were calculated for septics within each of the buffer areas. This is a screening-level calculation, and soil types, the age of the system, vegetation, proximity to a receiving water, and other factors will influence the degree of attenuation of this load (**Table 4.5**).

Table 4.5. Estimated nitrogen and phosphorus annual loadings from septic tanks in the Lochloosa watershed for different buffer areas around Lochloosa Lake

[1] U.S. Census Bureau
[2] EPA 2001

Number of Households on Septic	Number of People Per Household[1]	Gallons Per Person Per Day[2]	TN in Drainfield (mg/L)	TP in Drainfield (mg/L)	Annual TN Load (lbs/yr)	Annual TP Load (lbs/yr)
92 (200 meters)	2.32	70	57	10	2,593	455
117 (500 meters)	2.32	70	57	10	3,300	579
134 (1,000 meters)	2.32	70	57	10	3,778	663

4.2.3 Groundwater–Surface Water Interaction Study of Lochloosa Lake

In some areas of the SJRWMD, the Floridan aquifer is at or near the land surface and is vulnerable to nutrient loading from surface runoff. In 2006, the DEP Groundwater Protection Section—with assistance from the DEP Watershed Monitoring Section, Florida State University's Oceanography Department, and the SJRWMD—completed a study examining the groundwater pathways through which nutrients enter Lochloosa Lake. Groundwater samples were collected from 16 locations around the lake, and elevated phosphorus was detected in samples from most locations.

The study was conducted during spring and summer 2006, and the results indicated that both the surficial and intermediate aquifers were sources of the pore water beneath Lochloosa Lake. Median orthophosphate concentrations for the Floridan, intermediate, and surficial aquifers were 0.17, 0.54, and 0.35 mg/L, respectively, in the immediate vicinity of the lake. The median orthophosphate concentration in pore water samples beneath the lake was 0.345 mg/L. Radon–222 levels indicated higher groundwater seepage along the northern and northwestern edges of the lake. The method does not account for groundwater seepage out of the lake, which was likely in certain areas or periods of the year. During the study period, potential phosphorus loading via groundwater to the lake could be as high as 100 pounds per day. It was expected that groundwater discharge would fluctuate seasonally and with rainfall.

The SJRWMD has mapped the recharge rate to the Floridan aquifer. Average annual recharge rates to the Floridan were calculated based on an analysis of the hydraulic pressure differences between the water table and the Floridan potentiometric surface (using average water level data from 1998 to 2003), and on estimates of the vertical hydraulic conductivity and thickness of the intermediate confining unit. Recharge to the Floridan aquifer occurs in areas where the water table elevation is higher than the potentiometric surface elevation of the Floridan. Springs occur in areas where the Floridan potentiometric elevation is above the land surface. **Table 4.6** summarizes the groundwater recharge rate back to the Floridan aquifer for the Lochloosa Lake watershed area. **Figure 4.5** illustrates recharge rates in the Lochloosa watershed for 2005.

4.2.4 Atmospheric Deposition

The National Atmospheric Deposition Program (NADP) National Trends Network (NTN) monitors precipitation chemistry at a network of 250 sites across the country. Ammonia and nitrate are among the constituents measured at these sites. The NADP Bradford Forest (FL03) site, located in Bradford County 31 miles north-northwest from Lochloosa Lake, has been operational since 1978. Precipitation-weighted mean annual concentrations for ammonium (NH_4) and nitrate (NO_3) from the Bradford Forest NADP site were downloaded, and concentrations were converted to mg N/L for both NH_4 and NO_3 (**Table 4.7**).

Table 4.6. Summary of groundwater recharge into the Floridan aquifer in the Lochloosa watershed

Groundwater Recharge Rate	Area (Acres)	%
Discharge Area	8,611.1	15.6
0 – 4 in/yr	14,309.6	26.0
4 – 8 in/yr	14,292.9	25.9
8 – 12 in/yr	10,203.7	18.5
12 – 20 in/yr	6,240.2	11.3
More than 20 in/yr	1,484.8	2.7
Total	**55,142.3**	**100**

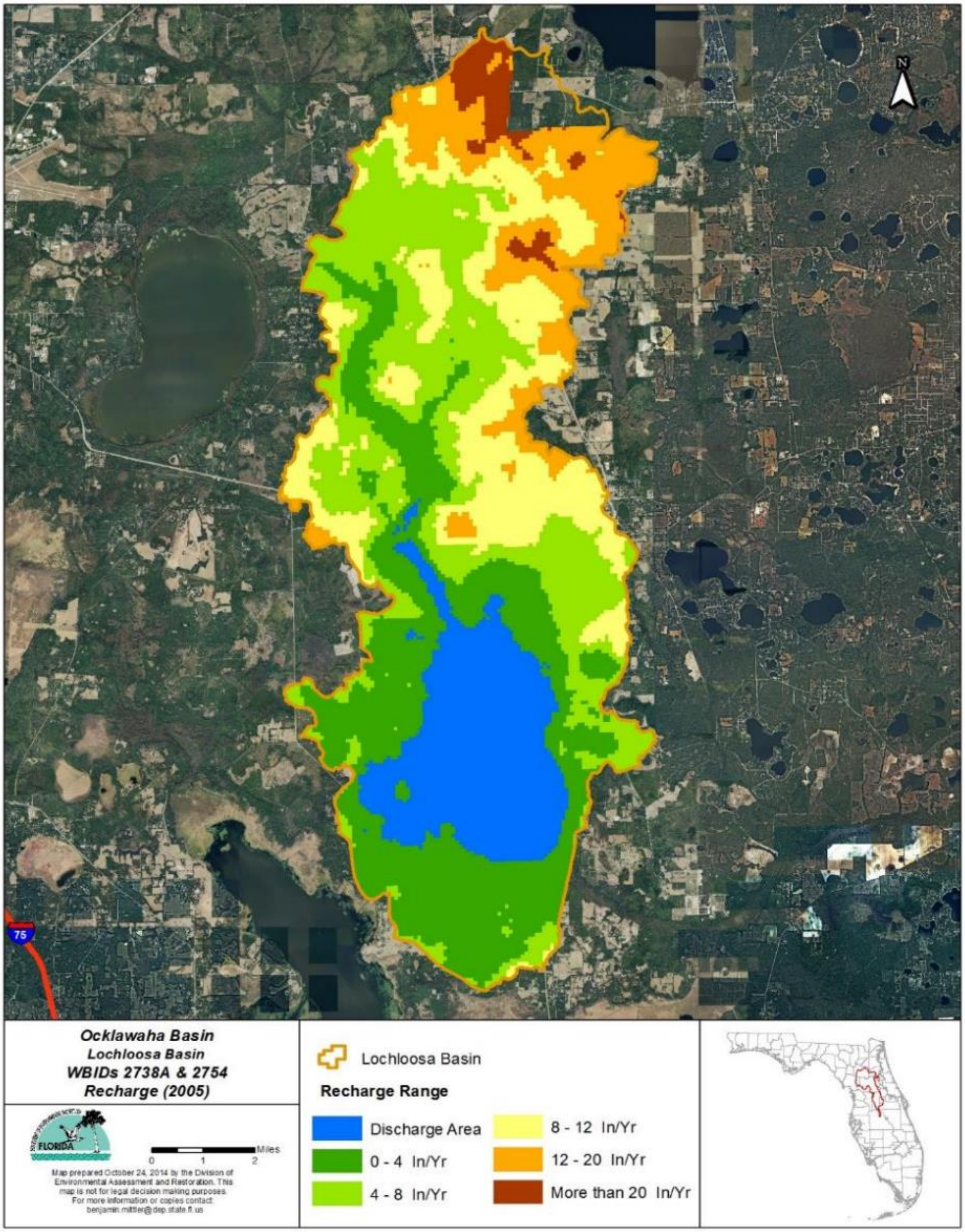


Figure 4.5. Recharge rates in the Lochloosa watershed, 2005

Table 4.7. Summary of Bradford Forest weighted mean annual wet deposition ammonium and nitrate concentrations

[1] Precipitation weighted mean concentrations

Site ID	Year	NH_4 (mg N/L)[1]	NO_3 (mg N/L)[1]	$NH_4 + NO_3$ (mg N/L)
FL03	1978	0.026	0.098	0.124
FL03	1979	0.047	0.106	0.153
FL03	1980	0.093	0.153	0.246
FL03	1981	0.151	0.186	0.338
FL03	1982	0.078	0.150	0.229
FL03	1983	0.078	0.146	0.224
FL03	1984	0.107	0.179	0.287
FL03	1985	0.054	0.165	0.219
FL03	1986	0.058	0.209	0.267
FL03	1987	0.081	0.146	0.228
FL03	1988	0.040	0.131	0.171
FL03	1989	0.205	0.187	0.392
FL03	1990	0.126	0.201	0.327
FL03	1991	0.065	0.158	0.224
FL03	1992	0.074	0.164	0.238
FL03	1993	0.088	0.201	0.290
FL03	1994	0.064	0.166	0.229
FL03	1995	0.105	0.152	0.257
FL03	1996	0.067	0.149	0.216
FL03	1997	0.055	0.123	0.178
FL03	1998	0.140	0.197	0.337
FL03	1999	0.088	0.165	0.252
FL03	2000	0.089	0.189	0.279
FL03	2001	0.092	0.193	0.284
FL03	2002	0.092	0.203	0.295
FL03	2003	0.078	0.171	0.248
FL03	2004	0.063	0.132	0.195
FL03	2005	0.070	0.141	0.211
FL03	2006	0.075	0.130	0.205
FL03	2007	0.066	0.134	0.200
FL03	2008	0.046	0.131	0.177
FL03	2009	0.085	0.122	0.206
FL03	2010	0.069	0.127	0.196
FL03	2011	0.150	0.145	0.295
FL03	2012	0.055	0.093	0.148
FL03	2013	0.080	0.122	0.202
FL03	2014	0.078	0.128	0.206
Average		**0.083**	**0.154**	**0.237**

Dr. Rolland Fulton of the SJRWMD provided a summary of wet and dry deposition measurements in the Lake Apopka Basin to support DEP's TMDL analyses in several lakes in the Ocklawaha Basin. The 3 sites with measurements were located 36 miles south-southeast of Lochloosa Lake. Wet and dry deposition measurements from April 1991 to January 2013 were averaged and summarized (**Table 4.8**).

Assuming a lake surface area of 5,363 acres and a long-term average annual rainfall of 49.68 inches, precipitation would contribute 36,960 lbs TN and 1,268 lbs TP annually. Dry deposition would contribute another 52,148 lbs TN and 1,147 lbs TP to the lake.

Table 4.8. Summary of wet and dry deposition rates from SJRWMD monitoring sites in the Apopka Basin

* N = Number of samples
TKN = Total Kjeldahl nitrogen
Lbs/ac/yr = Pounds per acre per year

Parameter	Wet Deposition N*	Wet Deposition (mg/L)	Dry Deposition N*	Dry Deposition (lbs/ac/yr)
NH_3 + NH_4 Total	746	0.199	212	0.234
NOXT or NOXD	807	0.261	370	0.437
TKN	845	0.339	386	8.913
TN	775	0.612	362	9.724
TP	845	0.021	386	0.214

Chapter 5: Determination of Assimilative Capacity

5.1 Determination of Loading Capacity

5.1.1 Data Used in the Determination of the TMDL

Since 1987 water quality measurements of chlorophyll and nutrients have been collected at 28 stations in Lochloosa Lake (**Figure 2.1**). Nine of the stations were only sampled once, and four stations reported only uncorrected chlorophyll *a* results. **Table 5.1** contains summary information on each of the stations (N represents the number of corrected chlorophyll or chlorophyll *a* observations). **Table 5.2** provides a statistical summary of chlorophyll *a* observations at the 15 stations with multiple sampling dates, and **Appendix C** contains historical chlorophyll *a*, corrected chlorophyll, temperature (TEMPC), TN, and TP available observations from sampling sites in WBID 2738A from 1987 to 2013. **Table 5.2** includes the 25th percentile (25th) and 75th percentile (75th) values.

Figure 5.1 displays the historical chlorophyll *a* observations over time. The simple linear regression of chlorophyll *a* versus sampling date in **Figure 5.1** was significant at an alpha (α) level of 0.05 (R^2 = 0.058) and indicated an increasing trend in chlorophyll *a*. As seen in **Figure 5.1**, chlorophyll levels increased sharply during the 1998–2001 period relative to concentrations over the 1988–97 period. Concentrations during the 2002–06 period were similar to those over the 1988–97 period before increasing again over the 2007–09 period.

There were 19 stations in Lochloosa Lake with multiple measurements of TN. **Table 5.3** lists summary statistics for TN measurements at these stations, and observations are graphed in **Figure 5.2**. The simple linear regression of TN versus sampling date in **Figure 5.2** was significant at an alpha (α) level of 0.05 (R^2 = 0.051) and indicated an increasing trend in TN. Temporal patterns in TN concentrations were similar to those seen in chlorophyll *a*.

Table 5.1. Sampling stations in Lochloosa Lake

* Uncorrected chlorophyll measurements

Station	STORET ID	Station Owner	Years with Data	Number of Samples
LOCHLOOSA LAKE CARAWAY LANDING AT CREEK MOUTH	21FLGFWFGFCNE0220	Florida Game and Freshwater Fish Commission	1987–96	36
LOCHLOOSA LAKE MIDDLE OF LAKE	21FLGFWFGFCNE0222	Florida Game and Freshwater Fish Commission	1987–96	35
LITTLE LOCHLOOSA LAKE MOUTH OF CROSS CREEK	21FLGFWFGFCNE0219	Florida Game and Freshwater Fish Commission	1987–96	35
LOCHLOOSA LAKE E. SHR APPX 200 YDS S. OF BOAT R.	21FLGFWFGFCNE0221	Florida Game and Freshwater Fish Commission	1987–96	35
LITTLE LOCHLOOSA LAKE AT MOUTH OF CROSS CREEK	21FLGFWF03080102-LL-01	Florida Game and Freshwater Fish Commission	1996–2000	18
LOCHLOOSA LAKE CARAWAY LANDING AT CREEK MOUTH	21FLGFWF03080102-LL-02	Florida Game and Freshwater Fish Commission	1996–2000	19
ALACHUA-LOCHLOOSA-1	21FLKWATALA-LOCHLOOSA-1	Florida LakeWatch	1993–2011	152*
LITTLE LOCHLOOSA LAKE; SOUTHWEST OF LOCHLOOSA LAKE	21FLSJWMLLOCHL	SJRWMD	1997–98	13
LOCHLOOSA LAKE EAST SHORE 200 YARDS OFF BOAT RAMP	21FLGFWF03080102-LL-03	Florida Game and Freshwater Fish Commission	1996–2000	19
ALACHUA-LOCHLOOSA-2	21FLKWATALA-LOCHLOOSA-2	Florida LakeWatch	1993–2011	152*
ALACHUA-LOCHLOOSA-3	21FLKWATALA-LOCHLOOSA-3	Florida LakeWatch	1993–2011	152*
ALACHUA-LOCHLOOSA-4	21FLKWATALA-LOCHLOOSA-4	Florida LakeWatch	1993–2011	152*
LOCHLOOSA LAKE; SOUTH CENTER	21FLSJWMLOCHLS	SJRWMD	1997–98	14
L LOCHLOOSA .5M E BANK W OF BT R	21FLA 20020080	DEP	1975–97	5
LOCHLOOSA LAKE; NORTH CENTER	21FLSJWMLOCHLN	SJRWMD	1997–2011	92
LAKE LOCHLOOSA AT LITTLE LAKE LOCHLOOSA	21FLA 20020138	DEP	1988–89	4
LAKE LOCHLOOSA NEAR NORTH SHORE	21FLA 20020139	DEP	1988–89	4
CENTER LAKE LOCHLOOSA	21FLSJWMLOL	SJRWMD	1986–2013	127
LOCHLOOSA LAKE OTLT @ CROSS CREEK 300M UPSTREAM OF LOCHLOOSA LAKE	21FLCEN 20020201	DEP	2006	1

Station	STORET ID	Station Owner	Years with Data	Number of Samples
LOCHLOOSA LAKE OTLT@LOCHLOOSA LAKE 200M DOWNSTREAM OF CROSS CREEK	21FLCEN 20020203	DEP	2006	1
LOCHLOOSA LAKE MID LAKE	21FLGFWF03080102-LL-04	Florida Game and Freshwater Fish Commission	1996–2000	18
LAKE LOCHLOOSA OTLT @CROSS CREEK 50M UPSTREAM OF LOCHLOOSA LAKE	21FLCEN 20020202	DEP	2006	1
LOCHLOOSA LAKE OTLT@LOCHLOOSA LAKE 450M DOWNSTREAM OF CROSS CREEK	21FLCEN 20020204	DEP	2006	1
LOCHLOOSA LAKE OTLT@LOCHLOOSA LAKE 700M DOWNSTREAM OF CROSS CREEK	21FLCEN 20020205	DEP	2006	1
SJ1-LL-2047 LITTLE LOCHLOOSA LAKE	21FLGW 22914	DEP	2004	1
SJ1-LL-2056 LOCHLOOSA LAKE	21FLGW 22918	DEP	2004	1
SJD-LL-1035 LOCHLOOSA LAKE	21FLGW 7975	DEP	2000	1
SJD-LL-1019 LOCHLOOSA LAKE	21FLGW 7959	DEP	2000	1

Table 5.2. Summary statistics for Lochloosa stations with multiple chlorophyll *a* measurements

Station	N	Minimum	25th	Median	Mean	75th	Maximum
21FLA 20020080	5	1.6	5.4	9.0	25.5	36.5	92.4
21FLA 20020138	4	3.7	4.4	10.0	13.1	21.7	28.4
21FLA 20020139	4	6.1	11.9	22.1	21.7	31.5	36.5
21FLGFWF03080102-LL-01	18	8.0	32.0	78.5	89.8	125.8	227.5
21FLGFWF03080102-LL-02	18	8.0	47.3	111.6	115.5	152.4	272.3
21FLGFWF03080102-LL-03	19	19.2	60.9	123.4	119.6	154.4	239.5
21FLGFWF03080102-LL-04	18	27.2	54.5	135.8	135.1	181.0	285.2
21FLGFWFGFCNE0219	34	6.4	9.6	19.2	26.5	40.1	76.9
21FLGFWFGFCNE0220	34	3.2	8.0	16.0	25.0	32.1	171.4
21FLGFWFGFCNE0221	33	3.2	9.6	21.1	27.2	32.1	180.4
21FLGFWFGFCNE0222	35	3.1	16.7	24.1	33.4	33.2	219.5
21FLSJWMLLOCHL	13	16.7	29.8	53.1	64.4	92.7	150.2
21FLSJWMLOCHLN	92	2.7	18.5	41.5	58.0	93.2	237.3
21FLSJWMLOCHLS	14	12.7	25.4	61.2	66.0	94.8	131.1
21FLSJWMLOL	129	0.5	20.5	52.9	72.4	118.7	265.3

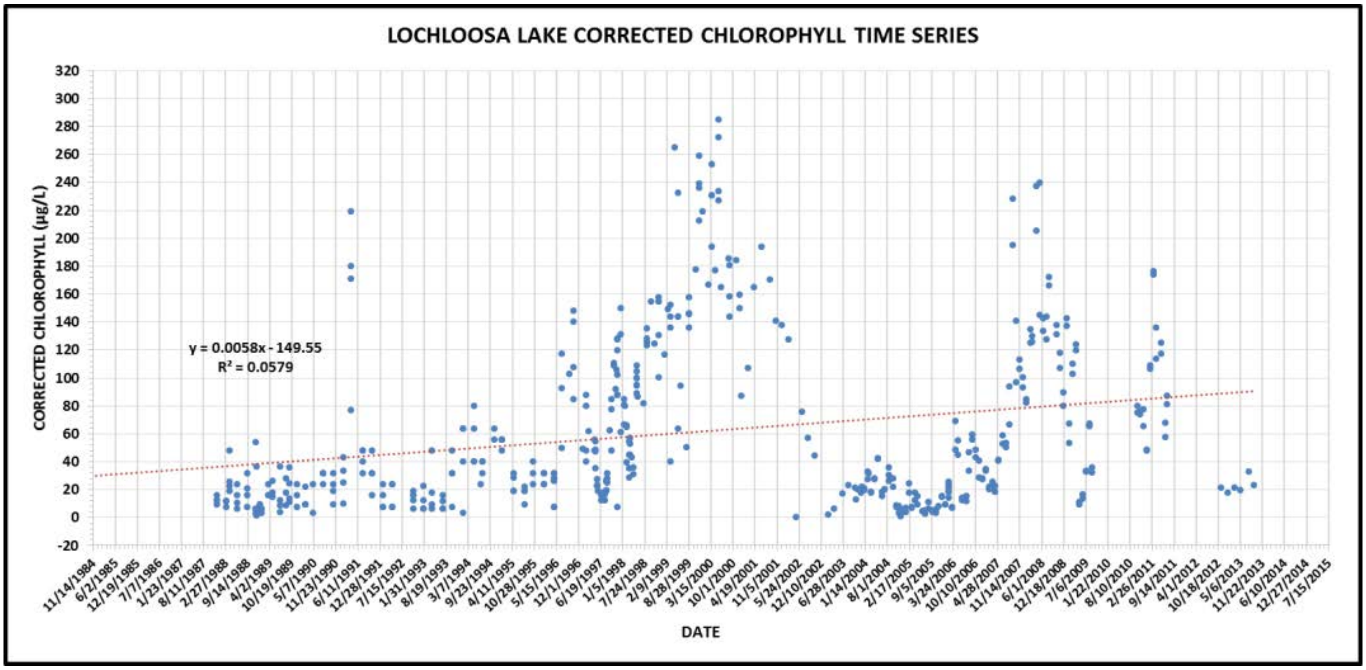


Figure 5.1. Chlorophyll *a* time series for Lochloosa Lake

Table 5.3. Summary statistics for Lochloosa stations with multiple TN measurements

Station	N	Minimum	25th	Median	Mean	75th	Maximum
21FLA 20020080	8	0.98	1.15	2.04	2.69	3.00	8.16
21FLA 20020138	4	0.99	1.06	1.18	1.19	1.31	1.39
21FLA 20020139	4	1.02	1.04	1.10	1.13	1.22	1.29
21FLGFWF03080102-LL-01	17	0.46	1.81	2.07	2.67	3.32	8.83
21FLGFWF03080102-LL-02	19	0.67	1.64	2.54	3.11	4.30	7.55
21FLGFWF03080102-LL-03	19	0.73	2.14	2.74	3.24	3.65	7.31
21FLGFWF03080102-LL-04	18	1.24	2.01	2.81	3.13	3.82	7.08
21FLGFWFGFCNE0219	34	0.21	0.97	1.29	1.39	1.70	2.77
21FLGFWFGFCNE0220	37	0.11	1.01	1.35	1.39	1.69	3.06
21FLGFWFGFCNE0221	33	0.24	1.06	1.38	1.45	1.90	2.81
21FLGFWFGFCNE0222	30	0.18	1.10	1.41	1.47	1.91	3.26
21FLKWATALA-LOCHLOOSA-1	153	0.68	1.43	1.95	2.25	2.80	6.49
21FLKWATALA-LOCHLOOSA-2	153	0.74	1.48	1.99	2.28	2.86	6.12
21FLKWATALA-LOCHLOOSA-3	152	0.74	1.43	2.01	2.27	2.91	6.28
21FLKWATALA-LOCHLOOSA-4	152	0.84	1.40	1.96	2.22	2.72	6.95
21FLSJWMLLOCHL	13	0.73	1.33	1.73	1.71	2.10	2.63
21FLSJWMLOCHLN	94	0.99	1.51	1.78	2.28	3.27	4.85
21FLSJWMLOCHLS	14	0.88	1.22	1.69	1.81	2.27	2.97
21FLSJWMLOL	128	1.06	1.62	2.15	2.69	3.54	7.57

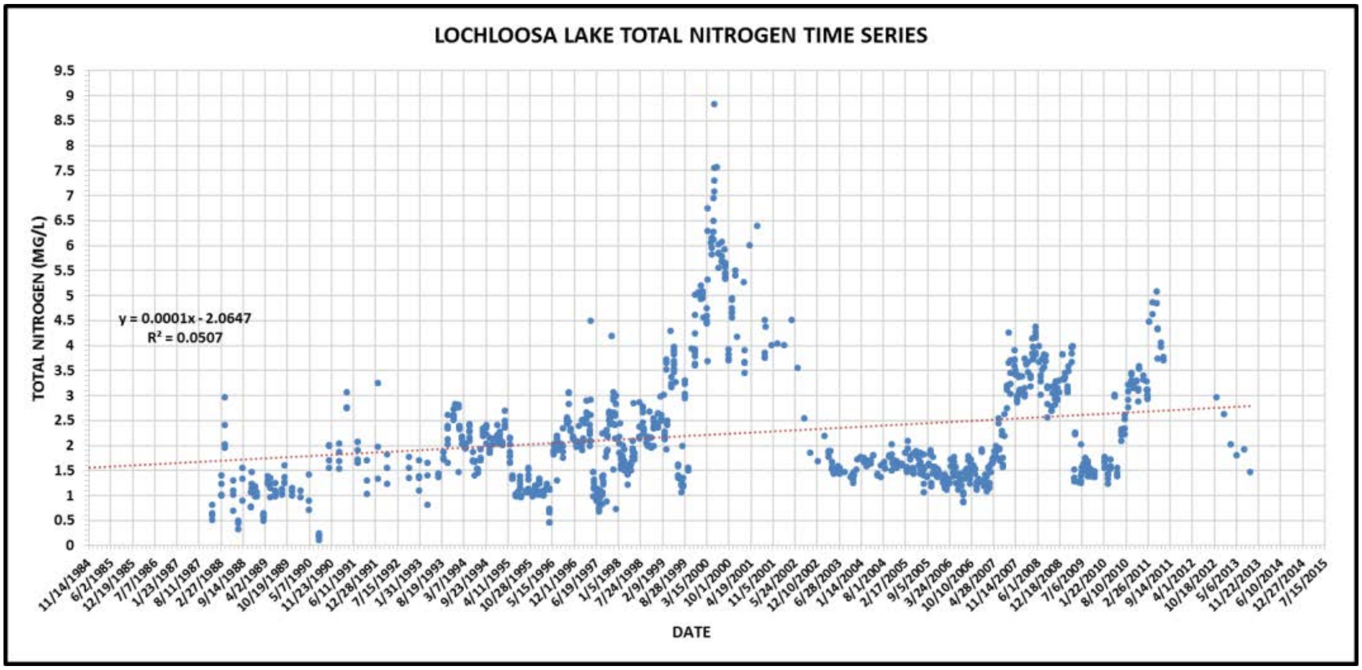


Figure 5.2. TN time series for Lochloosa Lake

There were 19 stations in Lochloosa Lake with multiple measurements of TP. **Table 5.4** provides summary statistics for TP measurements at these stations, and observations are graphed in **Figure 5.3**. The simple linear regression of TP versus sampling date in **Figure 5.3** was significant at an alpha (α) level of 0.05 ($R^2 = 0.043$) and indicated an increasing trend in TP. Although there were temporal patterns in TP concentrations, they were not as pronounced as those seen in the chlorophyll *a* and TN time series.

The state-adopted NNC for lakes presented in **Chapter 3** are related to the long-term geometric mean color and alkalinity of a lake. The long-term geometric means for color and alkalinity in Lochloosa Lake were 88 PCU and 29.7 mg/L as $CaCO_3$, respectively. **Figures 5.4** and **5.5** show time series graphs of color and alkalinity, respectively. Secchi disk depth measurements provide a measure of water transparency, and depths are related to water turbidity. Reduced transparency influences both phytoplankton growth in the water column and rooted aquatic vegetation. **Figure 5.6** displays a time series of Secchi depth measurements in Lochloosa Lake. **Table 5.5** summarizes the distribution of key water quality parameters in Lochloosa Lake based on measurements over the 1958–2013 period.

Table 5.4. Summary statistics for Lochloosa stations with multiple TP measurements

Station	N	Minimum	25th	Median	Mean	75th	Maximum
21FLA 20020080	8	0.010	0.045	0.065	0.068	0.087	0.140
21FLA 20020138	4	0.030	0.040	0.065	0.066	0.092	0.105
21FLA 20020139	4	0.050	0.056	0.071	0.086	0.116	0.150
21FLGFWF03080102-LL-01	18	0.042	0.062	0.082	0.094	0.104	0.297
21FLGFWF03080102-LL-02	19	0.049	0.076	0.101	0.107	0.126	0.238
21FLGFWF03080102-LL-03	19	0.016	0.063	0.088	0.088	0.115	0.179
21FLGFWF03080102-LL-04	19	0.046	0.060	0.075	0.085	0.104	0.157
21FLGFWFGFCNE0219	39	0.029	0.052	0.062	0.069	0.083	0.163
21FLGFWFGFCNE0220	39	0.026	0.054	0.075	0.094	0.119	0.300
21FLGFWFGFCNE0221	38	0.026	0.049	0.060	0.063	0.075	0.134
21FLGFWFGFCNE0222	38	0.029	0.052	0.059	0.062	0.068	0.108
21FLKWATALA-LOCHLOOSA-1	153	0.019	0.048	0.061	0.067	0.080	0.182
21FLKWATALA-LOCHLOOSA-2	153	0.022	0.046	0.060	0.068	0.081	0.186
21FLKWATALA-LOCHLOOSA-3	153	0.021	0.048	0.061	0.067	0.079	0.180
21FLKWATALA-LOCHLOOSA-4	151	0.025	0.050	0.064	0.069	0.082	0.172
21FLSJWMLLOCHL	13	0.001	0.040	0.070	0.063	0.079	0.114
21FLSJWMLOCHLN	94	0.001	0.061	0.078	0.085	0.102	0.197
21FLSJWMLOCHLS	14	0.010	0.052	0.071	0.065	0.080	0.106
21FLSJWMLOL	128	0.029	0.057	0.077	0.082	0.101	0.203

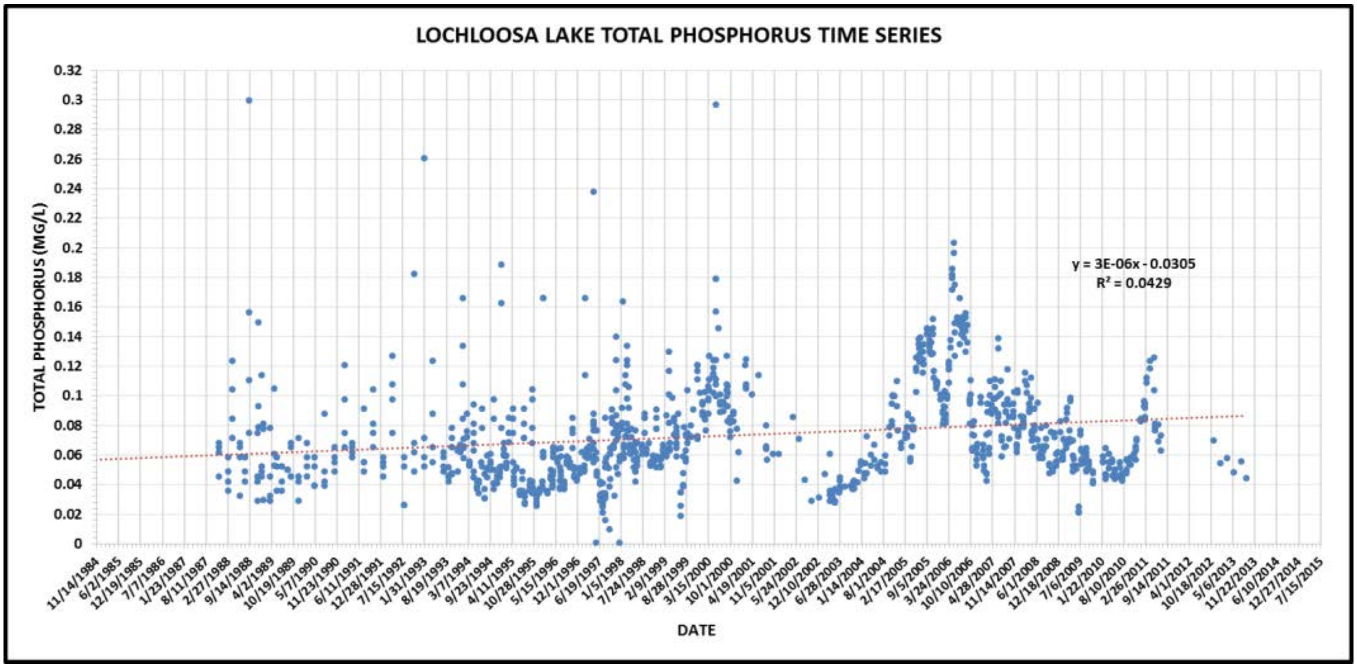


Figure 5.3. TP time series for Lochloosa Lake

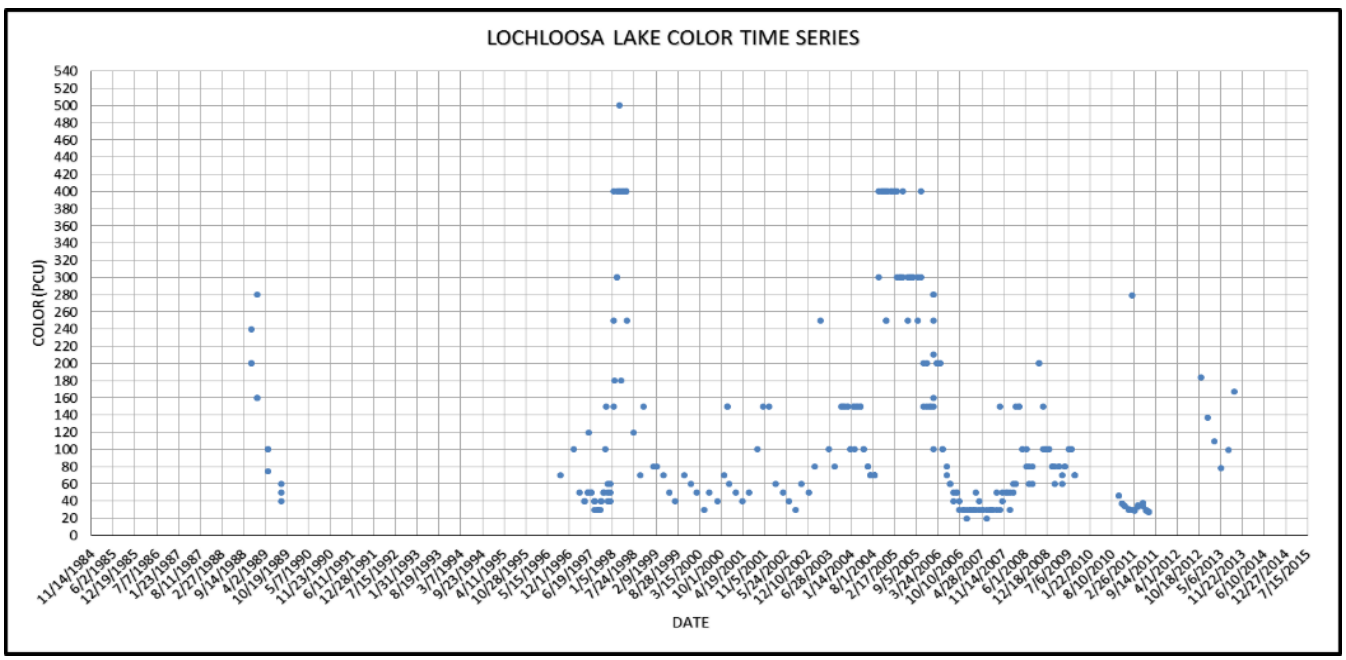


Figure 5.4. Color time series for Lochloosa Lake

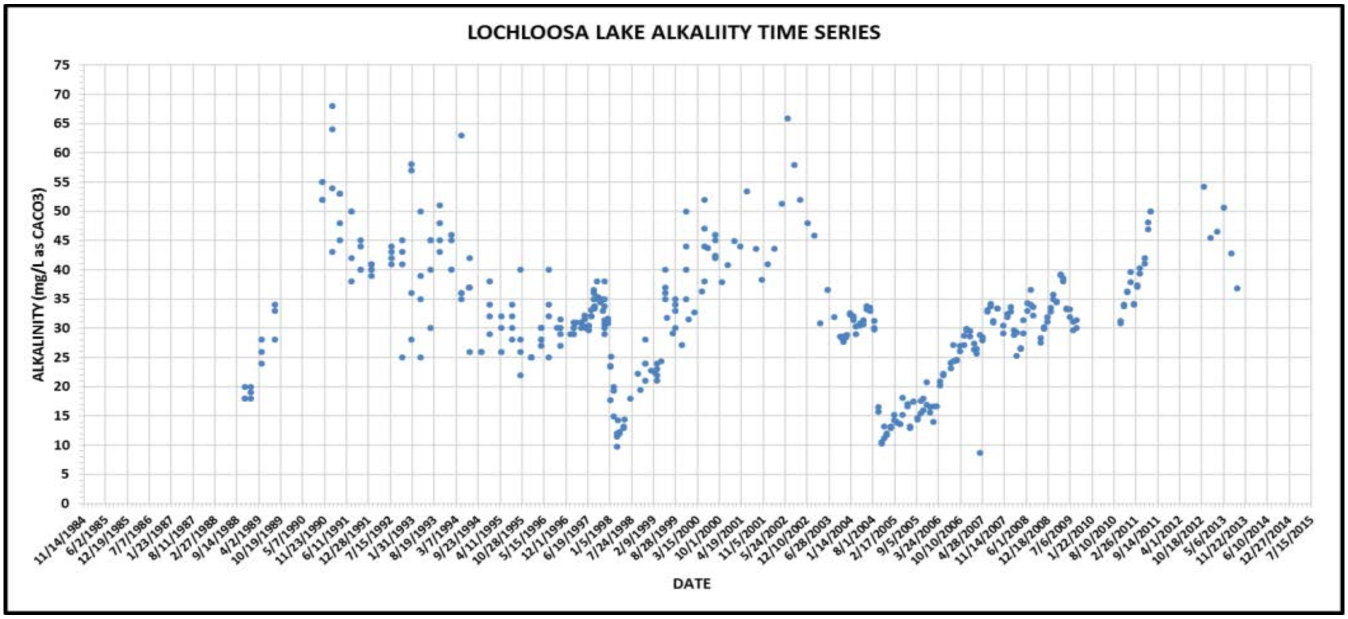


Figure 5.5. Alkalinity time series for Lochloosa Lake

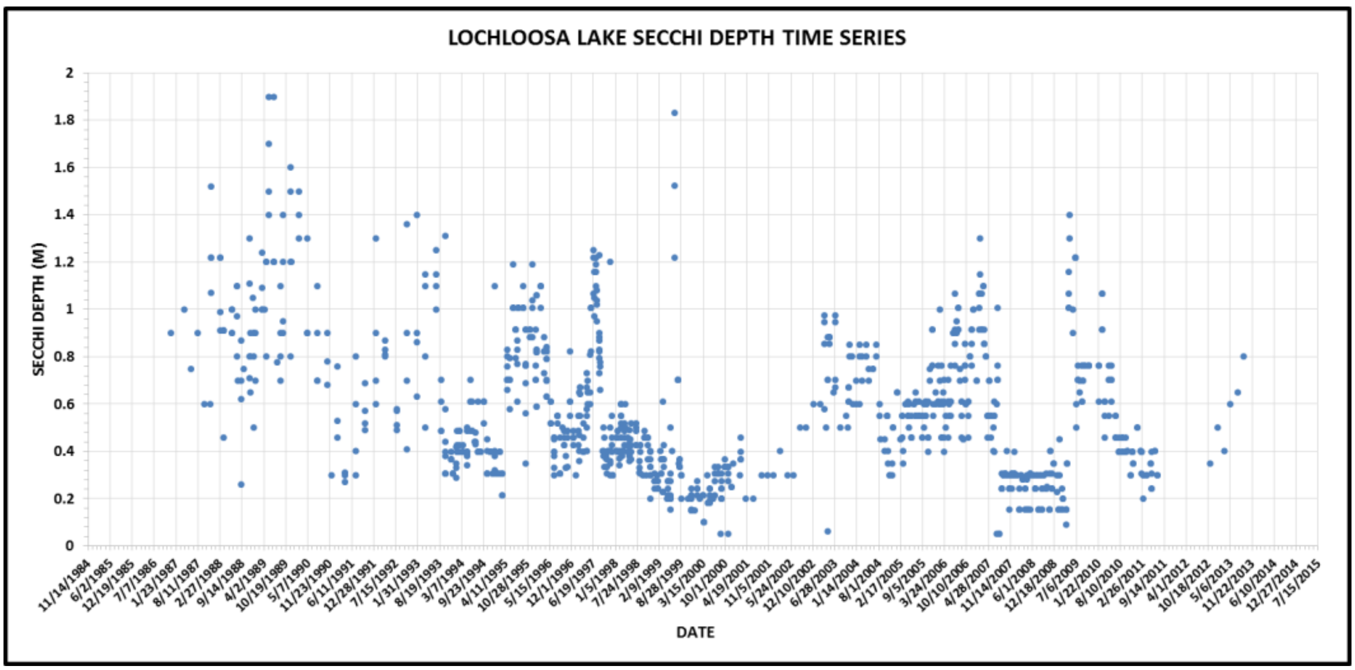


Figure 5.6. Secchi depth time series for Lochloosa Lake

Table 5.5. Summary statistics for key water quality parameters in Lochloosa Lake

InorgN = Inorganic nitrogen
InorgP = Inorganic phosphorus
NTU = Nephelometric turbidity units

Parameter	N	Min	25th	Median	Mean	75th	Max
Alkalinity (mg/L as $CaCO_3$)	413	8.7	25.3	31.3	31.6	37.0	68.0
BOD (mg/L)	23	0.5	0.8	2.3	2.7	4.3	7.5
Uncorrected chlorophyll *a* (µg/L)	856	0.5	30.2	67.5	85.5	122.4	353.0
Corrected chlorophyll *a* (µg/L)	479	0.5	17.8	33.9	61.3	93.1	285.2
Chloride (mg/L)	359	4	9	11	11	13	26
Color (PCU)	289	15	46	80	125	150	500
Conductance (µmhos/cm)	408	47	94	112	115	128	1195
DO (mg/L)	515	1.01	7.02	8.50	8.41	9.84	15.00
DOSAT (%)	477	11.90	84.51	96.45	94.88	105.76	185.19
NH_4 (mg/L)	491	0.01	0.02	0.04	0.10	0.14	1.40
NO_3O_2 (mg/L)	276	0.00	0.01	0.01	0.08	0.06	0.62
pH (su)	518	5.20	7.00	7.65	7.70	8.50	9.90
Secchi Depth (m)	1115	0.05	0.34	0.50	0.57	0.76	1.90
Water Temp (^{0}C)	549	8.00	17.76	24.00	23.06	28.00	35.00
Total Nitrogen (mg/L)	1092	0.11	1.41	1.88	2.24	2.83	8.83
Total Organic Carbon (mg/L)	253	1.5	21.3	25.6	25.9	30.1	56.7
Total Phosphorus (mg/L)	1117	0.001	0.051	0.065	0.073	0.088	0.300
Total Suspended Solids (mg/L)	268	1	7	14	17	24	130
Turbidity (NTU)	499	0.9	5.5	10.0	14.3	20.0	82.0
Inorganic P (mg/L)	503	0.001	0.010	0.012	0.024	0.026	0.326
TN/TP Ratio	1090	2.2	21.2	32.3	35.1	43.7	987.0
InorgN/InorgP Ratio*	447	0.1	1.9	4.6	13.1	14.0	394.0

In addition to algal biomass measurements, the SJRWMD collected samples at Station 21FLSJWMLOL for phytoplankton species enumeration from October 1995 to July 2009. Phytoplankton taxa were identified to species level if possible. Total biovolume was calculated for each sample, and the relative fraction in each phytoplankton division was calculated (**Figure 5.7**). Cyanophyta (blue-greens) dominated in most of the samples, with a median of 79.6 %, and comprised more than 50 % of the algal biovolume in 89 of 125 sampling events (71 %) (**Table 5.6**). Chlorophyta (greens) and diatoms each exceeded 50 % of the total biovolume on 7 sampling events.

Total biovolumes associated with each phytoplankton division on each sampling event were paired with the chlorophyll *a*, TN, and TP measurements. Linear regressions of chlorophyll *a* versus phytoplankton division biovolume, in which the division was represented in at least 25 % of the samples, were completed. Only the regression with the Cyanophyta division was significant at an α level of 0.05 ($N = 108$, $r^2 = 0.32$, $p = 0.0000$). Similarly, only the linear regression of the Cyanophyta division biovolume with TN was significant at α level of 0.05 (N = 105, r^2 = 0.35, p = 0.0000). None of the regressions of phytoplankton division biovolumes versus TP was significant at α level of 0.05. Cyanophyta biovolume is plotted versus the paired chlorophyll *a* measurement in **Figure 5.8**. As seen in **Figure 5.9**, above a chlorophyll *a* concentration of 30 µg/L, the Cyanophyta division dominated the total biovolume. **Figure 5.10** shows the relationship between TN and Cyanophyta biovolume.

The Florida Fish and Wildlife Conservation Commission (FWC) is responsible for managing aquatic vegetation in Florida's waters. Hydrilla (*Hydrilla verticillata*), water lettuce (*Pistia stratiotes*), and water hyacinth (*Eichhornia crassipes*) are 3 non-native species of aquatic vegetation that are being managed in the lake. **Figures 5.11** through **5.13** (provided by Ryan Hamm**,** FWC**)** illustrate the estimated acreages of these 3 species present in the lake and the acres treated each year. Treatments may occur throughout the year, while visual estimates are typically conducted in October and early spring. **Appendix D** summarizes the results of aquatic vegetation assessments conducted by Florida LakeWatch and the FWC in Lochloosa Lake from 2009 to 2014. The lake area covered by aquatic vegetation ranged between 3 % and 41 %. The lake volume filled with vegetation ranged between 0.3 % and 8 %.

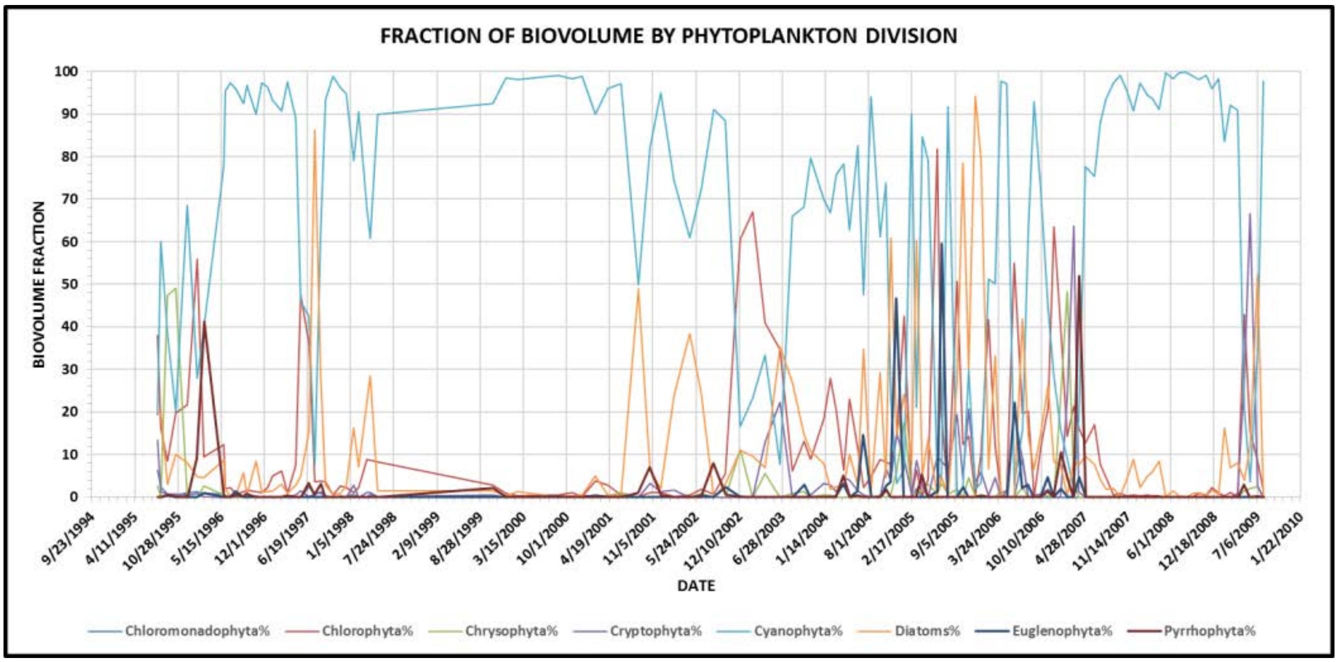


Figure 5.7. Composition of algal species based on biovolume by division

Table 5.6. Summary statistics for percent of total biovolume by division in phytoplankton samples collected over the 1995–2009 period

Statistics	Chloromonado-phyta	Chloro-phyta	Chryso-phyta	Crypto-phyta	Cyano-phyta	Diatoms	Eugleno-phyta	Pyrrho-phyta
N	125	125	125	125	125	125	125	125
Minimum	0.00	0.02	0.00	0.00	0.67	0.00	0.00	0.00
Maximum	9.29	81.72	49.04	66.68	99.79	94.17	59.55	51.89
Mean	0.30	11.67	2.05	3.54	67.29	12.35	1.47	1.32
Std. Dev.	1.08	16.70	7.84	9.53	33.25	18.34	7.12	6.09
1st	0.00	0.05	0.00	0.00	1.62	0.00	0.00	0.00
5th	0.00	0.13	0.00	0.00	3.40	0.20	0.00	0.00
10th	0.00	0.27	0.00	0.00	7.79	0.40	0.00	0.00
20th	0.00	0.62	0.00	0.00	28.15	0.91	0.00	0.00
25th	0.00	0.85	0.00	0.00	41.86	1.40	0.00	0.00
30th	0.00	1.11	0.00	0.00	51.24	1.85	0.00	0.00
40th	0.00	2.28	0.00	0.06	69.25	3.04	0.00	0.00
50th	0.00	4.16	0.00	0.21	79.60	5.27	0.00	0.00
60th	0.00	8.31	0.02	0.64	90.55	7.86	0.00	0.00
70th	0.00	12.30	0.35	1.39	93.61	10.12	0.00	0.00
75th	0.10	14.70	0.57	2.17	95.35	14.50	0.00	0.00
80th	0.21	19.77	1.01	3.41	96.48	19.94	0.02	0.33
90th	0.80	40.37	2.75	9.13	98.34	33.24	2.44	2.22
95th	1.38	51.74	7.48	20.19	98.93	54.29	3.80	5.77
99th	7.11	70.72	48.53	64.39	99.74	88.21	49.95	43.90

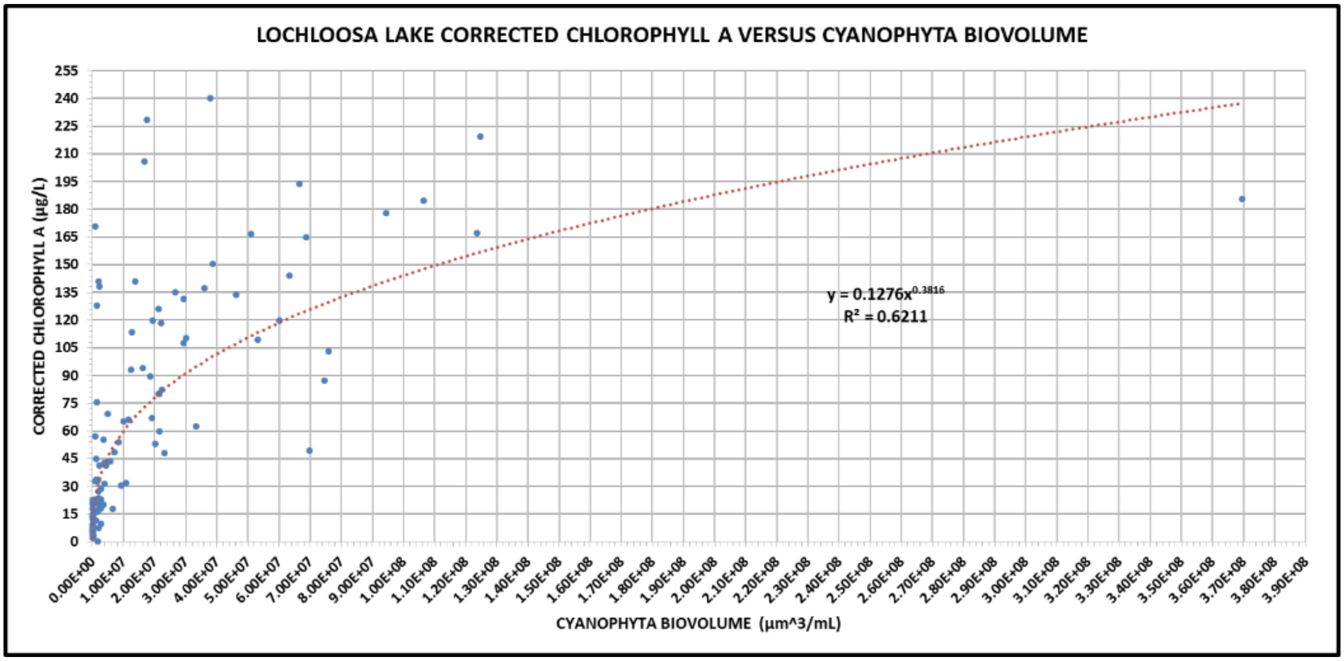


Figure 5.8. Cyanophyta biovolume versus corrected chlorophyll

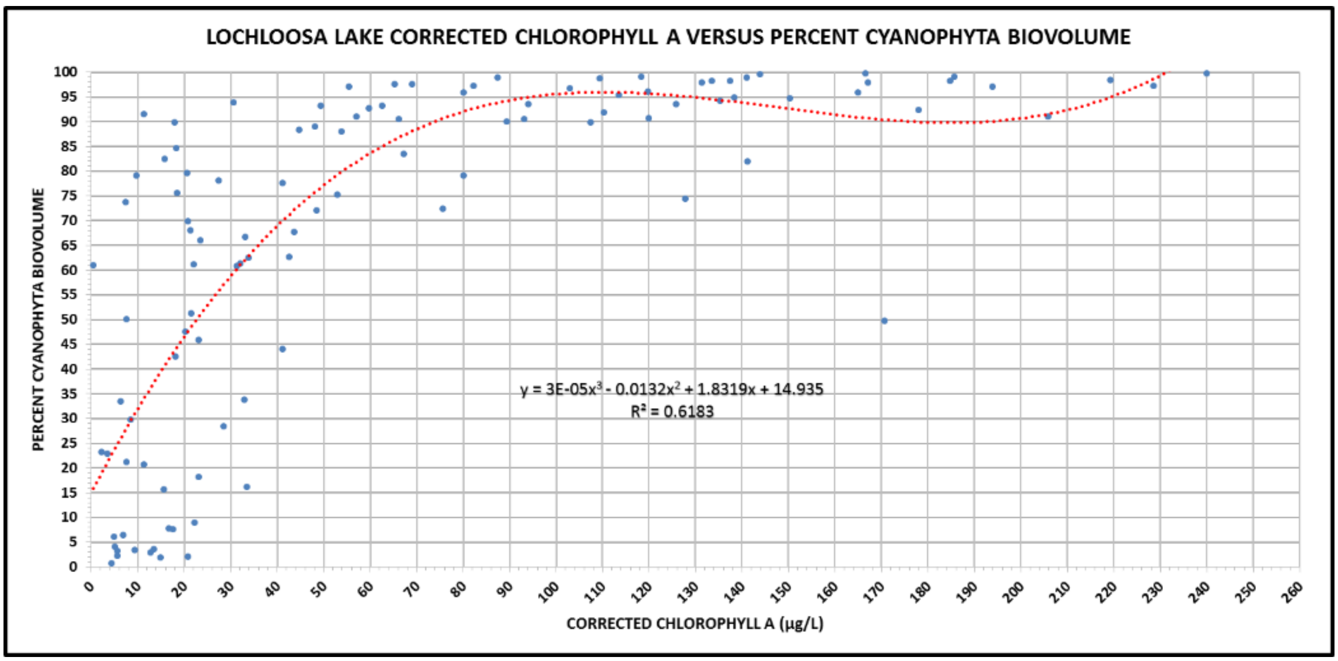


Figure 5.9. Percent Cyanophyta biovolume versus corrected chlorophyll

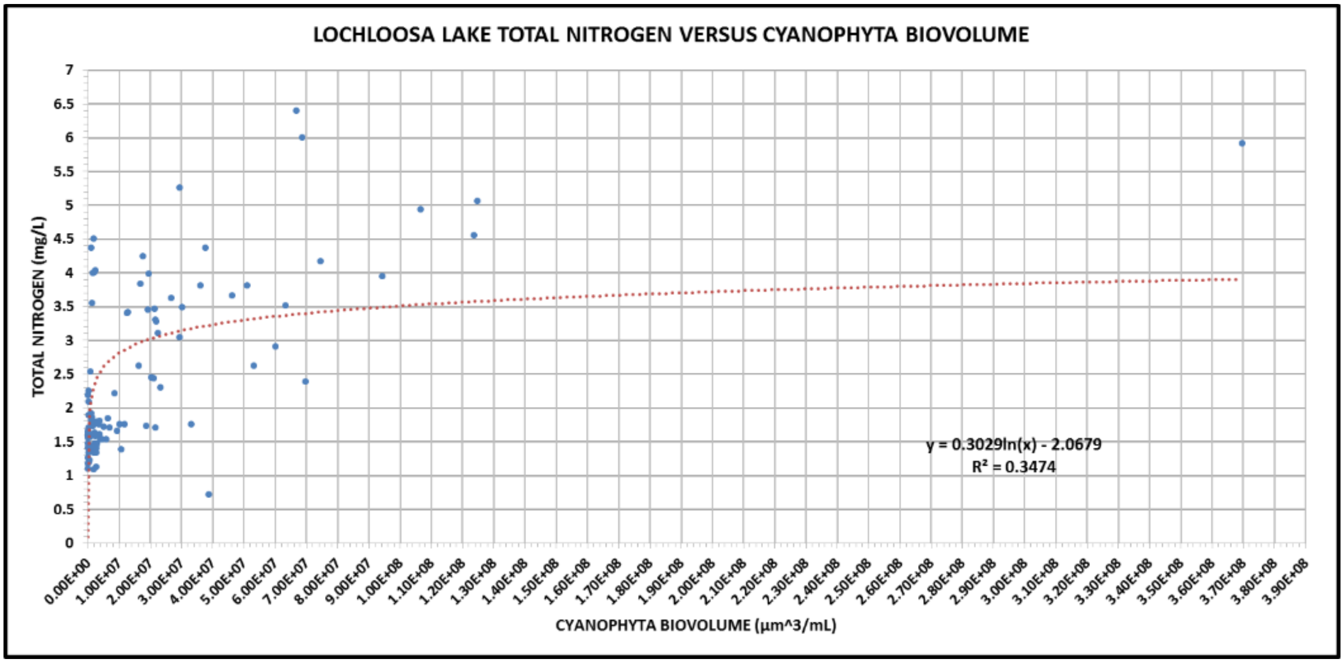


Figure 5.10. Cyanophyta biovolume versus TN

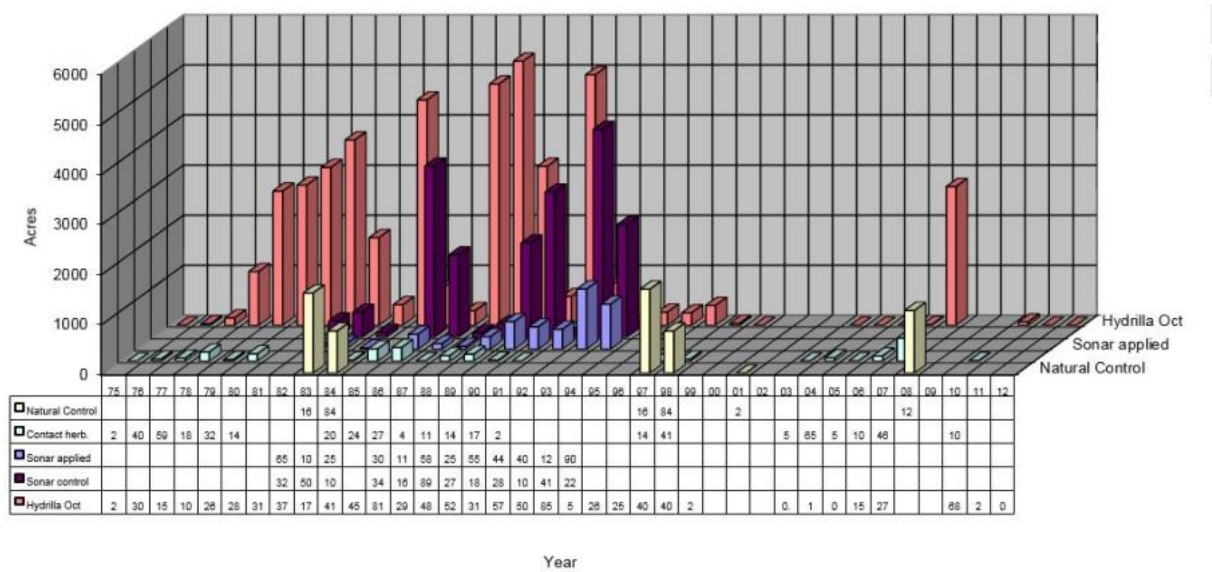
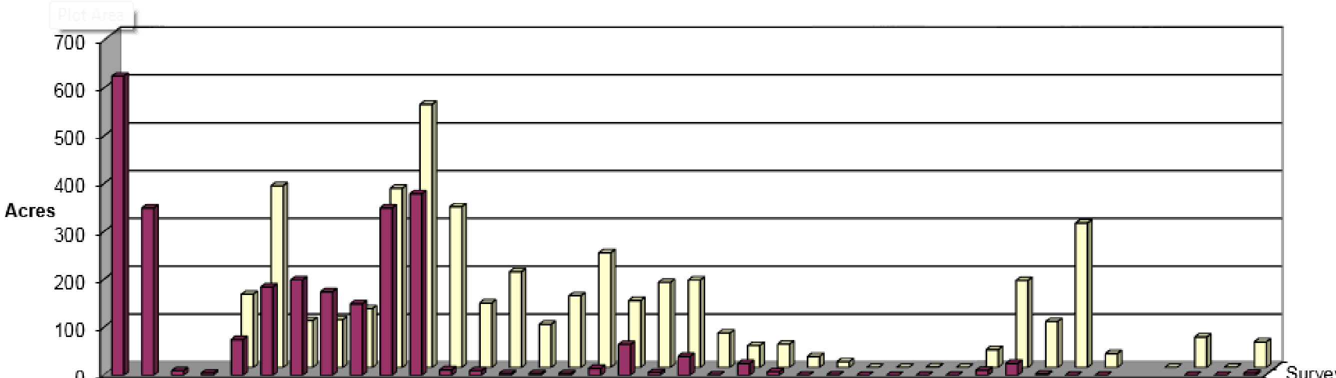


Figure 5.11. Hydrilla history in Lochloosa Lake

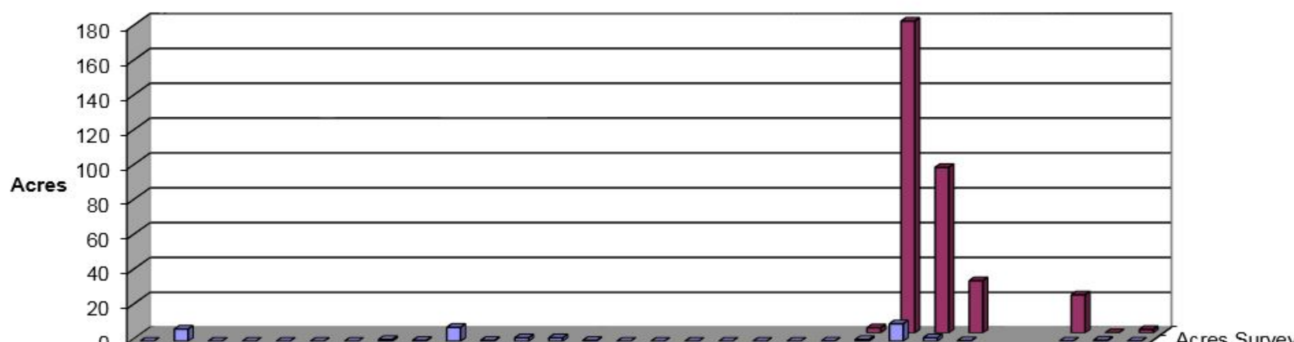


	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
Survey	62	35	10	5	75	18	20	17	15	35	38	12	10	4	4	4	15	65	6
Control					15	38	98	10	12	37	55	33	13	20	90	15	24	14	17

	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12
Survey	40	1	25	8	1	1	0	0	0	0	11	25	3	0	0			0	0	5
Control	18	72	46	49	23	12	0	0	1	0	37	18	96	30	29		0	63	1	54

Year

Figure 5.12. Water hyacinth history in Lochloosa Lake



	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97
Acres Survey	0	7	0	0	0	0	0	1	0.5	8	0.5	2	2	0.5	0
Acres Control															

	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12
Acres Survey	0	0	0	0	0	0.1	1	10	2	0.3			0.1	0.6	0.1
Acres Control							3	179	95	30			22	0.1	2

Year

Figure 5.13. Water lettuce history in Lochloosa Lake

Since Cross Creek connects Lochloosa Lake with Orange Lake and the watershed of Cross Creek is small, conditions in Cross Creek are highly influenced by water quality in Lochloosa Lake. **Tables 2.2** and **2.3** summarize chlorophyll and DO assessments for Cross Creek. **Appendix E** includes key water quality parameters in Cross Creek and a figure showing sampling locations.

The remainder of this document focuses on Lochloosa Lake and the development of targets necessary to restore designated uses. As described later in this chapter, water quality conditions in Cross Creek are dominated by conditions in Lochloosa Lake, and thus water quality improvements in the lake should directly impact Cross Creek.

5.2 Analysis of Water Quality

Water quality for Lochloosa Lake for the 1988–2013 period was processed to calculate AGMs in accordance with the data sufficiency requirements described in Subsection 62-302.531(6), F.A.C. **Table 5.7** provides AGMs for key water quality parameters. AGMs for chlorophyll *a*, TN, and TP are plotted in **Figures 5.14** through **5.16**. Annual rainfall from the City of Gainesville was added to the dataset (**Appendix F**). To evaluate the longer term effects of below-average rainfall years, an annual rainfall deficit was calculated based on the long-term average (49.68 inches). The deficit is positive if the annual rainfall is less than the long-term average (**Figure 5.17**). The cumulative effect of deficits was calculated by summing over a 3-year (current year and 2 previous years), a 5-year (current year and the 4 previous years), and a 7-year (current year and the 6 previous years) period. For example, over the 1999–2003 and the 2006–13 periods, the calculated 3-year rainfall deficit has been positive, and, during those 2 periods, only 2002 and 2012 had rainfall above the long-term average.

Appendix G contains a pairwise Spearman correlation matrix of water quality and rainfall parameters. Correlations between chlorophyll *a* and turbidity, total suspended solids (TSS), TN, Secchi depth (SD), annual precipitation, 1-year rainfall deficit, and the 3-year rainfall deficit (as well as the 2-year and 4-year rainfall deficits) were all significant at an alpha (α) level of 0.05. The simple linear regression of chlorophyll *a* versus TN explained nearly 76 % of the variance in the AGM of chlorophyll *a* (**Figure 5.18**). For the variance in the AGMs of chlorophyll *a*, 15 % was explained by the AGMs of TP (**Figure 5.19**). There was an inverse relationship between the chlorophyll *a* AGMs and annual precipitation (**Figure 5.20**). As the magnitude of the 3-year rainfall deficit increased, the chlorophyll *a* AGM also increased (**Figure 5.21**).

Table 5.7. AGMs for key water quality parameters in Lochloosa Lake, 1988–2013

*INORGP = Inorganic phosphorus
**COND = Conductivity

Year	Chl*a* (µg/L)	TN (mg/L)	TP (mg/L)	NO_3O_2 (mg/L)	NH_4 (mg/L)	INORGP* (mg/L)	COND** (umhos/cm)	COLOR (PCU)	TURBIDITY (NTU)	TSS (mg/L)	SECCHI (m)
1988	12.88	1.06	0.069		0.041	0.012			17.0		0.85
1989	12.19	1.05	0.052		0.050	0.011			9.5		1.07
1990	17.04	0.70	0.052		0.063	0.005			10.6		0.89
1991	46.42	1.86	0.072		0.108	0.019			23.1		0.46
1992			0.063		0.059	0.026			14.0		0.73
1993	13.94	1.90	0.062		0.104	0.016			14.0		0.57
1994	39.08	2.02	0.056		0.151	0.014			7.2		0.42
1995	28.64	1.43	0.051		0.223	0.017			4.2		0.67
1996	40.54	1.55	0.052		0.088	0.009			4.1		0.58
1997	45.36	1.76	0.051	0.008	0.021	0.012	112.9	48.1	7.8	15.9	0.59
1998	77.73	1.97	0.068	0.009	0.040	0.008	81.5	270.9	13.5	12.8	0.41
1999	144.30	2.57	0.069	0.009	0.080	0.010	119.8	62.6	17.1	24.2	0.31
2000	187.76	5.41	0.100	0.010	0.123	0.014	145.8	64.1	25.0	36.3	0.22
2001	150.09	4.26	0.085	0.014	0.034	0.109	157.8	78.0	22.8	21.9	0.31
2002	26.19	2.83	0.048	0.019	0.034	0.056	166.5	47.0	11.4	20.1	0.42
2003	13.28	1.55	0.037	0.029	0.030	0.013	114.1	133.7	5.4	7.7	0.66
2004	15.13	1.65	0.067	0.057	0.028	0.019	96.5	158.2	4.5	8.0	0.56
2005	7.93	1.58	0.108	0.331	0.047	0.048	81.1	293.2	2.5	5.3	0.56
2006	24.48	1.35	0.111	0.038	0.016	0.040	97.6	87.8	5.9	9.0	0.67
2007	55.58	2.13	0.081	0.015	0.023	0.012	125.0	35.9	11.3	21.4	0.45
2008	133.19	3.38	0.071	0.015	0.021	0.012	116.5	90.1	25.8	25.8	0.24
2009	47.82	2.07	0.058	0.029	0.039	0.012	120.8	81.6	11.4	13.1	0.49
2010		2.31	0.054								0.52
2011	95.55	3.84	0.090	0.014	0.041	0.014	155.9	35.9	30.2	29.0	0.34
2013	22.62	1.94	0.052	0.026	0.044	0.010	159.6	114.2	7.2	9.5	0.57

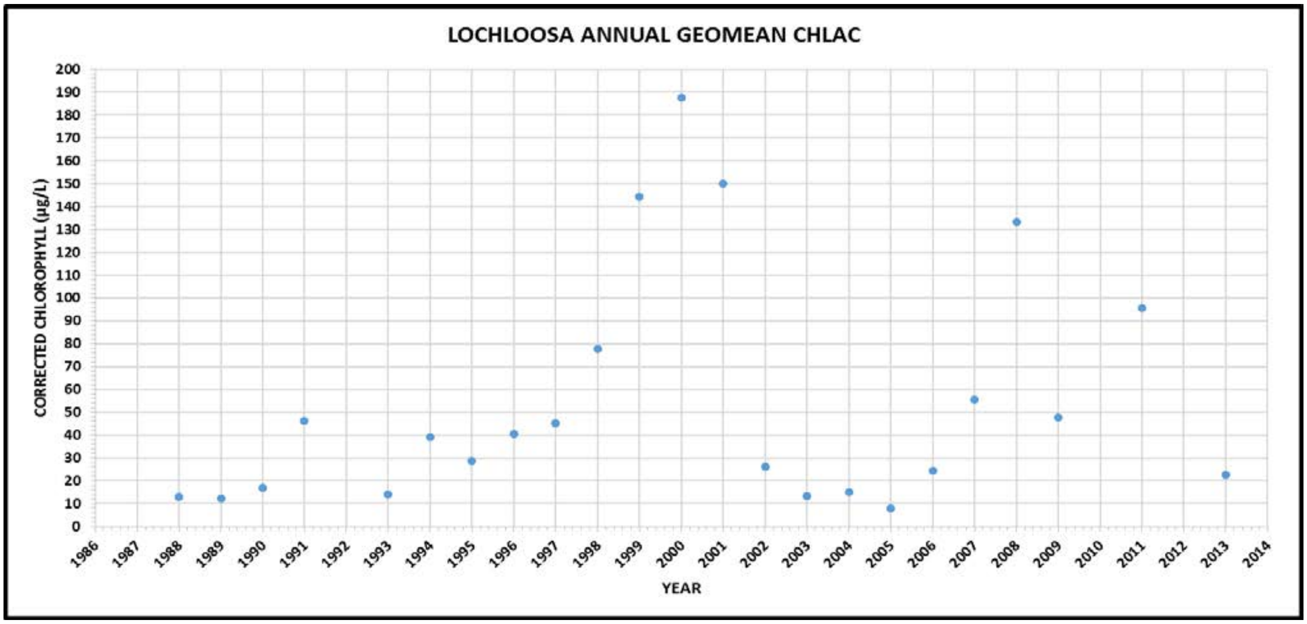


Figure 5.14. Lochloosa Lake AGM chlorophyll *a*

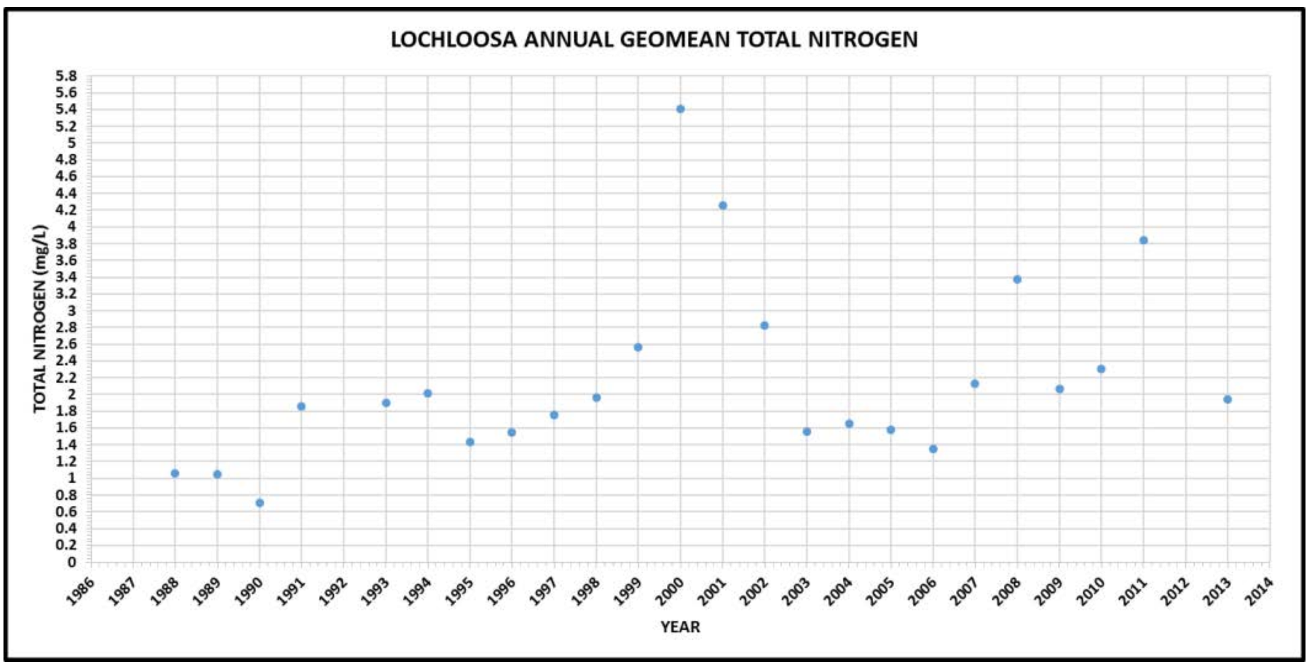


Figure 5.15. Lochloosa Lake AGM TN

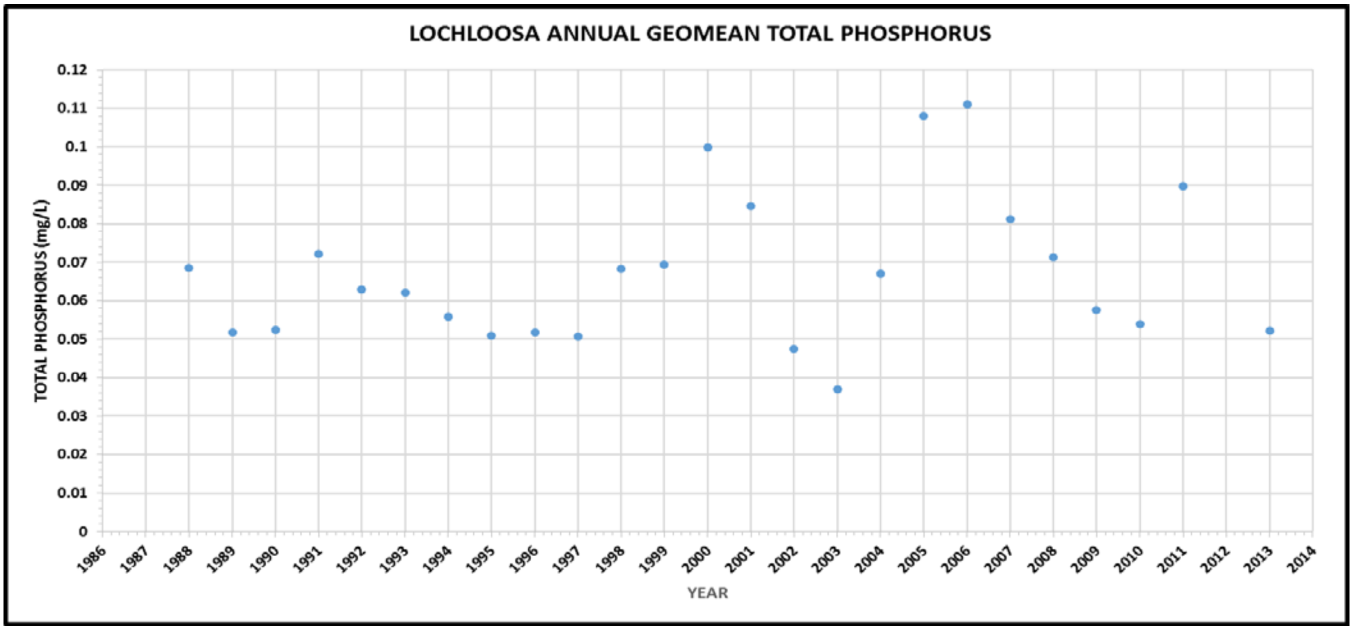


Figure 5.16. Lochloosa Lake AGM TP

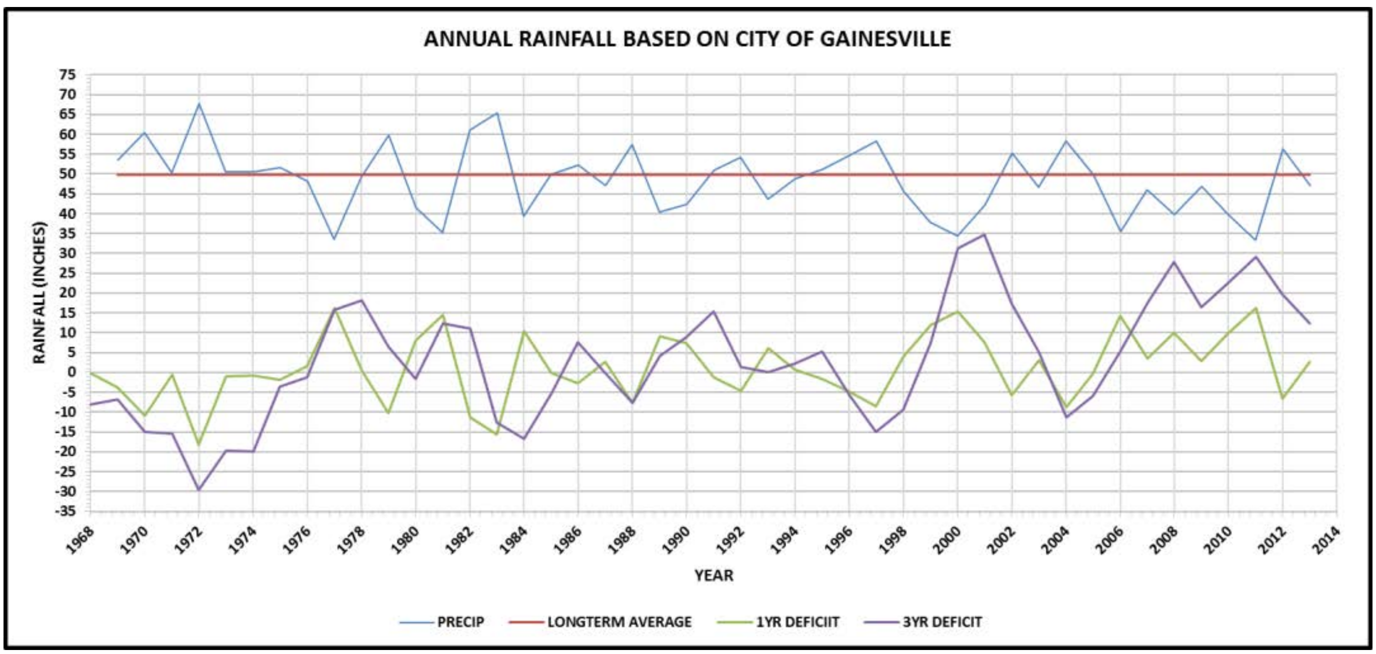


Figure 5.17. Annual rainfall and deficits for the Lochloosa Lake watershed

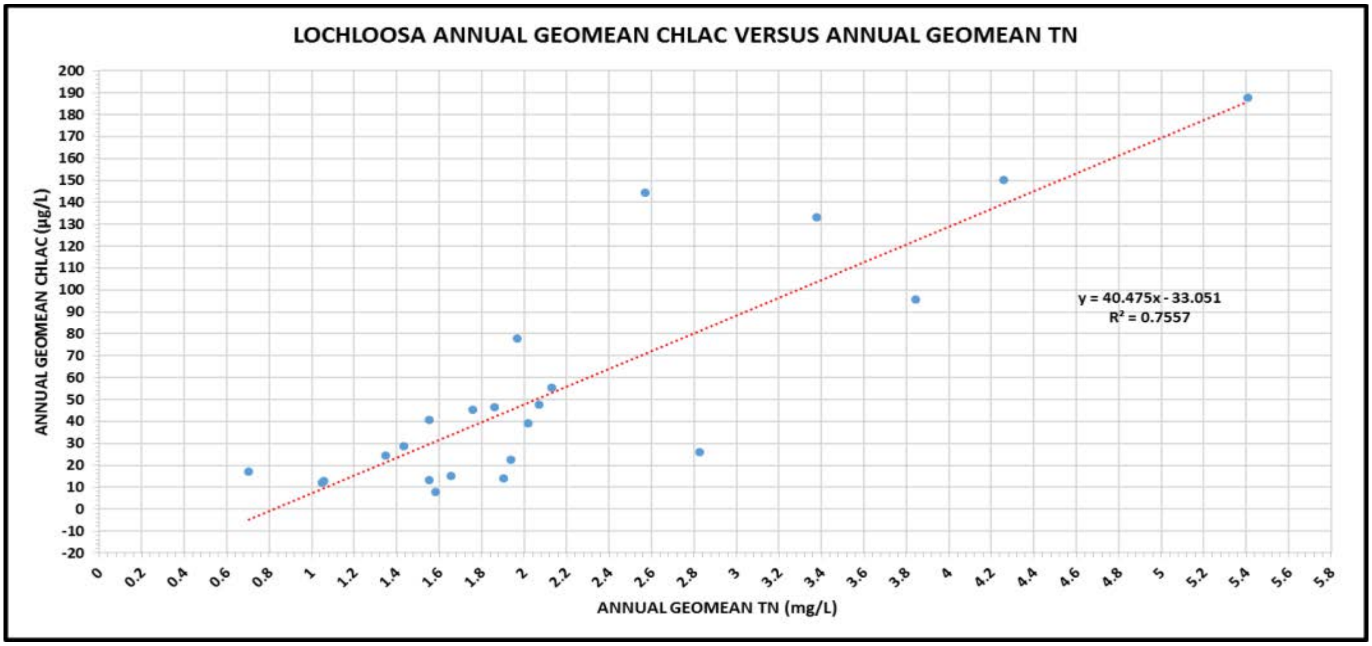


Figure 5.18. Lochloosa Lake AGM chlorophyll *a* versus AGM TN

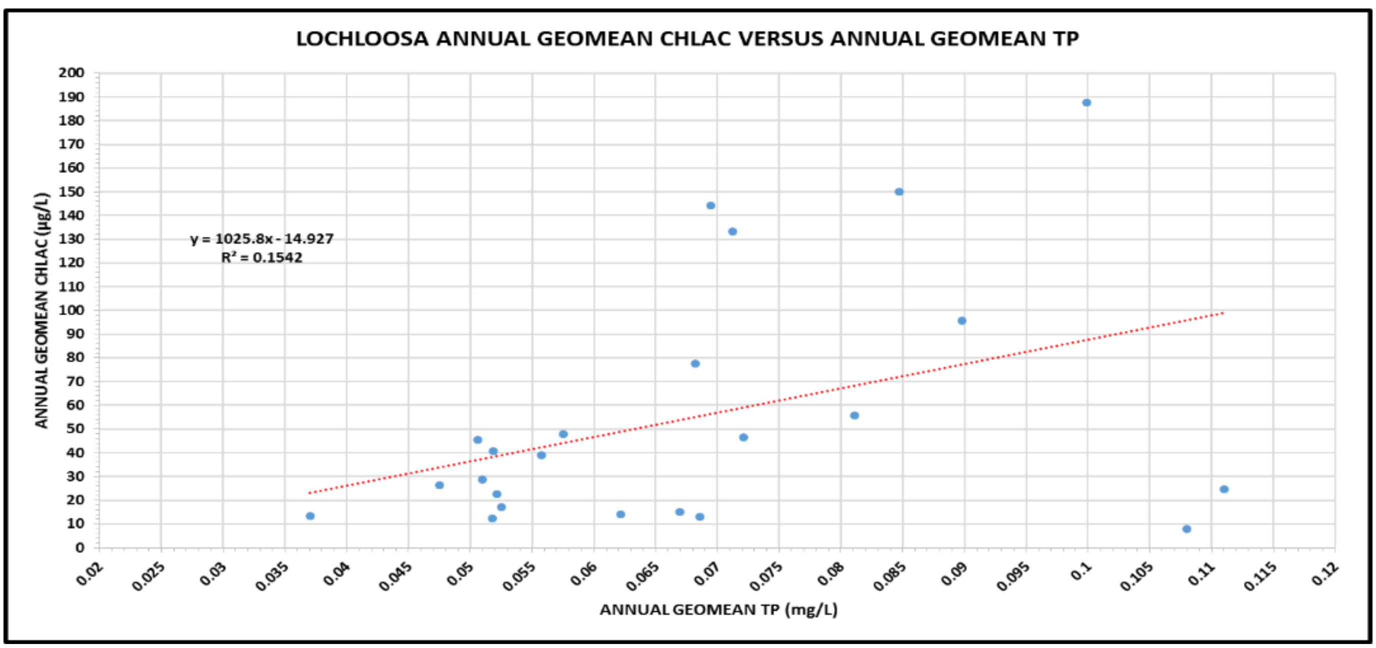


Figure 5.19. Lochloosa Lake AGM chlorophyll *a* versus AGM TP

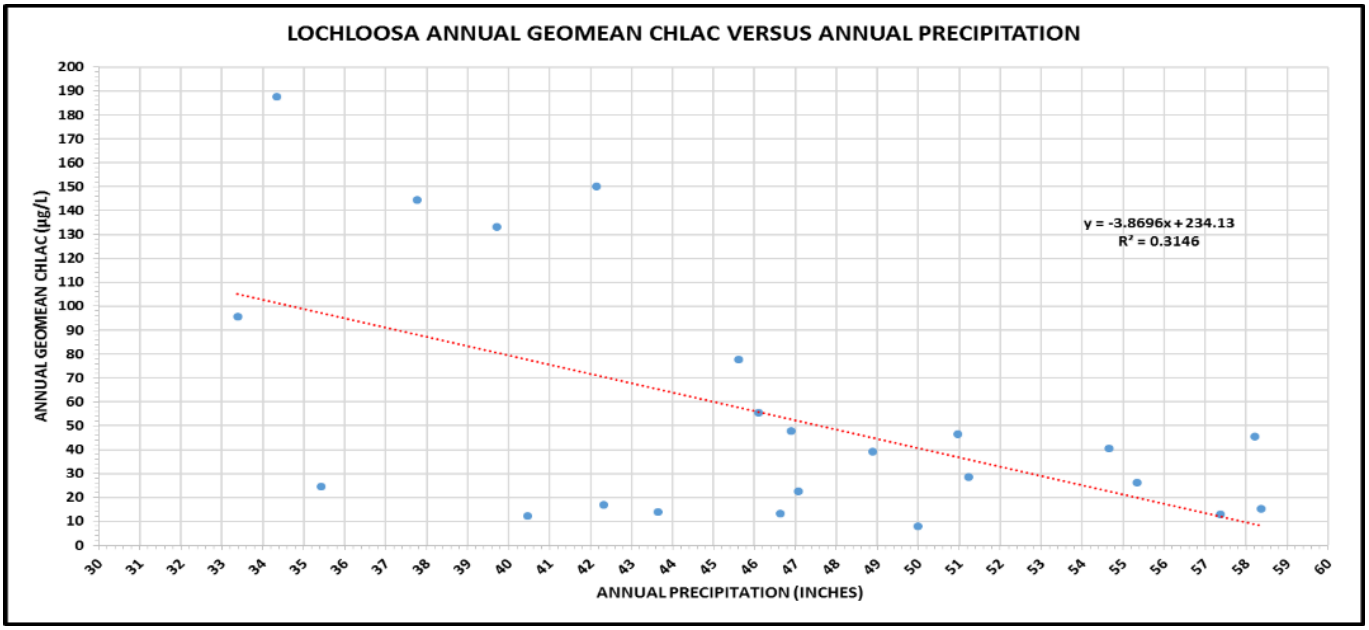


Figure 5.20. Lochloosa Lake AGM chlorophyll *a* versus annual precipitation

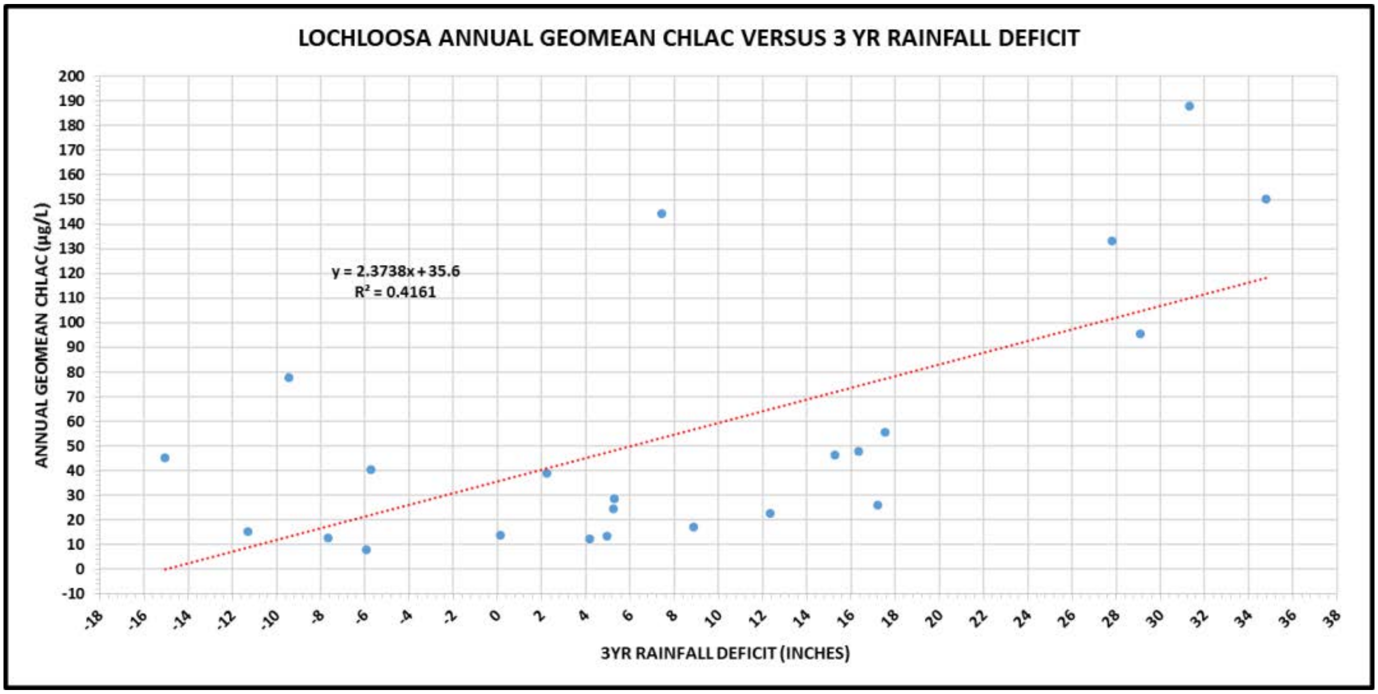


Figure 5.21. Lochloosa Lake AGM chlorophyll *a* versus three-year rainfall deficit

5.3 Analysis of Sediment Nutrient Storage and Loading

As part of the effort to develop pollutant load reduction goals (PLRGs) for Lochloosa Lake, the SJRWMD funded a study to estimate nutrient storage in the sediments and measure internal nutrient loading rates from the sediments to the water column (Brenner et al. 2009). Results from the study were also published in the *Journal of Paleolimnology* (Kenney et al. 2014).

A sediment thickness map of the lake was constructed by measuring sediment distribution and thickness at 85 sites in the lake (mean sediment thickness was 167.7 centimeters [cm]). This information was used to select 20 sites where sediment cores were collected for a detailed study of sediment physical and chemical stratigraphy. At these sites, an additional set of cores was collected for porewater analyses. As described later in **Section 5.4.1**, cores at 5 of the 20 sites were collected for detailed paleolimnological analysis.

In general, bioavailable P in the sediment can be defined as the sum of immediately available P and potential P that can be transformed into an available form by naturally occurring physical, chemical, and biological processes (Wang et al. 2009). Nonapatite inorganic phosphorus (NAIP) is considered bioavailable. Aluminum (Al) and iron (Fe) bound phosphate is potentially bioavailable, depending on sediment redox levels, pH, and temperature. Organic P could become bioavailable through microbial remineralization.

Table 5.8 summarizes the results of surface sections of the 20 sediment cores and the 5 paleo cores for NaOH-Phosphorus (NaOH-P) and TP. On average, 28 % of the TP in the surface sections was readily bioavailable.

Twenty cores were also collected in Lochloosa Lake for porewater analysis. **Table 5.9** summarizes porewater concentrations of soluble reactive phosphorus (SRP), total soluble phosphorus (TSP), and total soluble nitrogen (TSN) in the top section of each core. In comparison, the median lake concentrations of inorganic P, NO_3O_2, and NH_4 were 0.012, 0.01, and 0.04 mg/L, respectively (**Table 5.5**).

The resuspension of surface sediments with bioavailable nutrients and elevated porewater concentrations of SRP, TSP, and TSN relative to the overlying water column represent internal nutrient sources that can maintain and fuel algal blooms in lakes.

Table 5.8. NaOH-P and TP in surface sections of Lochloosa Lake cores

Core ID	Depth (cm)	NaOH-P (mg/g)	TP (mg/g)	NaOH-P/TP Ratio
LOO-3ES	0-4	0.549	1.639	33.50
LOO-3GS	0-4	0.398	1.587	25.08
LOO-4FS	0-4	0.32	1.314	24.35
LOO-4HS	0-4	0.009	0.013	69.23
LOO-5DS	0-4	0.4	1.7	23.53
LOO-5FS	0-4	0.4	1.709	23.41
LOO-5HS	0-4	0.505	1.684	29.99
LOO-6ES	0-4	0.612	1.661	36.85
LOO-6GS	0-4	0.511	1.819	28.09
LOO-6IS	0-4	0.317	1.634	19.40
LOO-7FS	0-4	0.5	1.442	34.67
LOO-7HS	0-4	0.457	1.878	24.33
LOO-8DS	0-4	0.373	1.243	30.01
LOO-8GS	0-4	0.549	1.916	28.65
LOO-8JS	0-4	0.447	1.739	25.70
LOO-9IS	0-4	0.397	1.616	24.57
LOO-10BS	0-4	0.433	1.564	27.69
LOO-10HS	0-4	0.404	1.673	24.15
LOO-10JS	0-4	0.401	1.574	25.48
LOO-11CS	0-4	0.303	1.308	23.17
LOO-4FP	0-4	0.298	1.312	22.71
LOO-7FP	0-4	0.359	1.203	29.84
LOO-7HP	0-4	0.347	1.387	25.02
LOO-8JP	0-4	0.27	0.766	35.25
LOO-10BP	0-4	0.3	1.457	20.59
	Minimum	**0.009**	**0.013**	**19.40**
	Maximum	**0.612**	**1.916**	**69.23**
	Average	**0.394**	**1.474**	**28.61**

Table 5.9. Porewater concentrations of SRP, TSP, and TSN in top sections of Lochloosa cores

Core ID	Depth (cm)	SRP (mg/L)	TSP (mg/L)	TSN (mg/L)
LOO-3EPW	0-4	0.024	0.063	5.31
LOO-3GPW	0-4	0.017	0.05	4.78
LOO-4FPW	0-4	0.054	0.125	3.9
LOO-4HPW	0-4	0.031	0.161	8.39
LOO-5DPW	0-4	0.015	0.044	4.89
LOO-5FPW	0-4	0.032	0.103	3.16
LOO-5HPW	0-4	0.008	0.044	4.68
LOO-6EPW	0-4	0.013	0.058	3.76
LOO-6GPW	0-4	0	0.03	2.63
LOO-6IPW	0-4	0	0.044	5.18
LOO-7FPW	0-4	0.011	0.052	2.63
LOO-7HPW	0-4	0.048	0.086	6.14
LOO-8DPW	0-4	0.003	0.047	3.78
LOO-8HPW	0-4	0.011	0.035	5.62
LOO-8JPW	0-4	0.023	0.037	4.25
LOO-9IPW	0-4	0.017	0.034	3.73
LOO-10BPW	0-4	0.022	0.081	5.86
LOO-10HPW	0-4	0.016	0.035	4.78
LOO-10JPW	0-4	0.014	0.026	4.31
LOO-11CPW	0-4	0.104	0.17	4.05
	Minimum	**0**	**0.026**	**2.63**
	Maximum	**0.104**	**0.17**	**8.39**
	Average	**0.023**	**0.066**	**4.59**

5.4 TMDL Development Process—Establishing Nutrient Targets

Chapter 3 described the generally applicable NNC. However, to avoid abating the natural condition, DEP examined the nutrient concentrations established using the paleolimnological reconstruction of past conditions and a model-based prediction of natural background conditions. Consistent with EPA technical guidance (EPA 2000), additional analyses were conducted to confirm that proposed site-specific nutrient targets (TN and TP) for the lake were appropriate.

5.4.1 Paleolimnological Assessment

As part of the study conducted in Lochloosa Lake by Brenner et al. (2009), cores at 5 sites were collected for detailed paleolimnological analysis. According to the study, the lake was eutrophic based on limnological data collected during the past several decades. Between 1991 and 2003, however, there has been a shift from a macrophyte-dominated system (areal coverage of aquatic vegetation decreasing from 70 % to 6 % and percent volume filled with higher plants decreasing from 22 % to 0.7 %) to an algal-dominated system. According to the recent history of macrophytes in Lochloosa Lake described by Joe Hinkle (EPA 2005), until hydrilla was introduced into the lake, there were very few acres of submerged plants. **Figures 5.11** through **5.13** summarize the 3 non-native species of aquatic vegetation being managed in the lake. There has been speculation that the application of herbicides to control exotics such as hydrilla, water hyacinth, and water lettuce prior to 1995 may have contributed to the shift.

The diatom-inferred limnetic TP concentration prior to 1900 from the 5 cores ranged between 48.56 and 58.95 µg/L, with a median value of 53.34 µg/L (**Table 5.10**). Diatom-inferred limnetic chlorophyll *a* concentrations ranged between 8.4 and 43.6 µg/L, with a median value of 20 µg/L (**Table 5.10**). Three of the 5 chlorophyll *a* concentrations were 20 µg/L or less, and the 43.6 µg/L value came from a core in an erosional zone of the lake that may have been truncated with respect to the other cores and reflected a shorter time record.

Brenner et al. (2009) also analyzed the five cores for chlorophyll derivatives (CD), percent native chlorophyll, total carotenoids (TC), and the cyanobacterial pigments myxoxanthophyll and oscillaxanthin. Myxoxanthophyll and oscillaxanthin pigments were used to assess the presence and relative importance of cyanobacteria. Myxoxanthophyll concentrations showed considerable fluctuations, suggesting that cyanobacteria were historically present in Lochloosa, though their abundance has varied through time. Similarly, the oscillaxanthin records for the Lochloosa cores were also quite variable, but indicated that Oscillatoriaceae has been present at low levels throughout the history of this lake.

Table 5.10. Diatom-inferred limnetic TP and chlorophyll *a*

a = Sites were erosional zones and could not be dated with 210Pb; values represented the bottom segment of core.

Core	Sample Depth (cm)	Estimated Date	Limnetic TP (µg/L)	Estimated Standard Error of TP Prediction (µg/L)	Limnetic Chlorophyll *a* (µg/L)	Estimated Standard Error of Chlorophyll *a* Prediction (µg/L)	Native Chlorophyll *a* (%)
4FP	108–112	a	55.3	1.66	43.6	3.6	6.30
7FP	108–112	a	58.95	1.67	20	3.2	11.38
7HP	48–52	1822	49.79	1.66	8.4	4	2.41
8JP	64–68	1886	48.56	1.68	37.6	4.2	33.86
10BP	108–112	Pre-1864	53.34	1.66	12.1	3.5	23.15
	Median		**53.34**	**1.66**	**20**	**3.6**	**11.38**

There was also a shift in the percentage of diatoms from planktonic to periphytic habitats. In the surface segment (0 to 4 cm) of each core, periphytic diatoms represented 58 % to 69 % of the diatom species. The 4-cm depth in sediment cores corresponded to the year 2007. In 4 of the 5 cores, periphytic diatom species comprised 24 % to 48 % of the diatom species in the bottom segment of the core. Diatoms were also characterized by trophic state preferences based on Whitmore (1989). Four of 5 cores showed a reduction in the eutrophic diatoms and an increase in the hypereutrophic diatoms moving up in the core. In the fifth core, the percentages in eutrophic and hypereutrophic trophic states were similar at the base and in the surface layer.

Table 5.11 summarizes the trophic state preferences of diatoms for the 5 sediment core segments referenced in **Table 5.10**. The median percentages of hypereutrophic and eutrophic diatom species at the sample depths of the 5 cores in **Table 5.10** were 11.21 % and 74.9 %, respectively. In comparison, the median percentages of hypereutrophic and eutrophic diatom species in the top segment of the 5 cores were 24.86 % and 52.32 %, respectively. Whitmore's (1989) autoecological categories for trophic status were based on TSI (average) from Huber et al. (1982): hypereutrophic (>75), eutrophic (50–75), mesotrophic (40–50), oligotrophic (25–40), and ultraoligotrophic (<25). According to Huber et al. (1982), hypereutrophic represented chlorophyll *a* subindex values above 57 µg/L, eutrophic represented chlorophyll *a* subindex values between 10 and 57 µg/L, and mesotrophic represented chlorophyll *a* subindex values between 5 and 10 µg/L.

Table 5.11. Trophic state preferences of diatoms in sediment core samples

a = Sites were erosional zones and could not be dated with 210Pb; values represented the bottom segment of core.

Core	Sample Depth (cm)	Hyper-eutrophic (%)	Eutrophic (%)	Meso-trophic (%)	Oligo-trophic (%)	Ultra-oligotrophic (%)	Unknown (%)
4FP	108-112 (a)	3.75	78.5	11.97	2.44	0	3.14
7FP	108-112 (a)	2.71	91.33	4.04	1.34	0	0.58
7HP	48-52	11.21	74.9	6.96	3.98	0	2.95
8JP	64-68	13.63	70.41	8.57	4.43	0	2.95
10BP	108-112	13	54.92	20.59	6.22	0	5.27
	Median	**11.21**	**74.9**	**8.57**	**3.98**	**0**	**2.95**

Both the cyanobacterial pigments myxoxanthophyll and oscillaxanthin were present throughout the historical record of all of the cores. However, it is not possible to infer a limnetic chlorophyll *a* associated with this component of the phytoplankton community. Presumably, other phytoplankton groups were historically present, in addition to diatoms and cyanobacteria, that are not reflected in the diatom-inferred historical limnetic chlorophyll *a*. Finally, the historical presence of both submerged and floating aquatic vegetation may have also influenced phytoplankton levels. Therefore, based on these considerations, a historical paleolimnological chlorophyll *a* concentration inferred only on diatoms was not used in the Lochloosa Lake nutrient TMDLs for target setting.

5.4.2 Water Quality Models

Water quality models represents the approach to developing nutrient targets. Two water quality models were used to simulate water quality conditions in Lochloosa Lake. A watershed model Hydrological Simulation Program–Fortran (HSPF) was used to simulate flows and pollutant loads to Lochloosa Lake from the watershed. A second model (BATHTUB) simulated in-lake nutrient and chlorophyll conditions based on watershed inputs, meteorological conditions, and the physical characteristics of the lake. The following section summarizes the modeling approach used to establish TN and TP targets under natural conditions.

5.4.2.1 HSPF Model

Under the Surface Water Improvement and Management (SWIM) Act, the SJRWMD identified the Orange Creek Basin (OCB) as a priority for restoration and in 2002 adopted a SWIM plan. In 2004, the SJRWMD contracted with BCI Inc. to provide services for the first watershed models that would support establishing PLRGs for the basin. The original HSPF model for the OCB was completed in 2008. The Water Supply Impact Study (WSIS) model completed in 2012 by the SJRWMD included the OCB and was considered an improvement over the 2008 HSPF model. The Environmental Science Bureau of the SJRWMD refined the OCB portion of the WSIS model and assisted DEP in developing the Lochloosa Lake TMDL by calibrating the model and simulating both current and natural background scenarios (Clapp and Smith 2015).

The natural background scenario represents the model prediction of water quality conditions under a reference condition. For the scenario, all urban, open, agricultural, pasture, rangeland, and forest regeneration (forestry) land uses in the Lochloosa watershed were converted to forest and/or wetland based on soil characteristics.

Figure 5.23 shows the subwatersheds used in the HSPF model to simulate hydrology and water quality conditions in the Lochloosa Lake watershed. **Table 5.12** identifies each subwatershed, area, and reach connection.

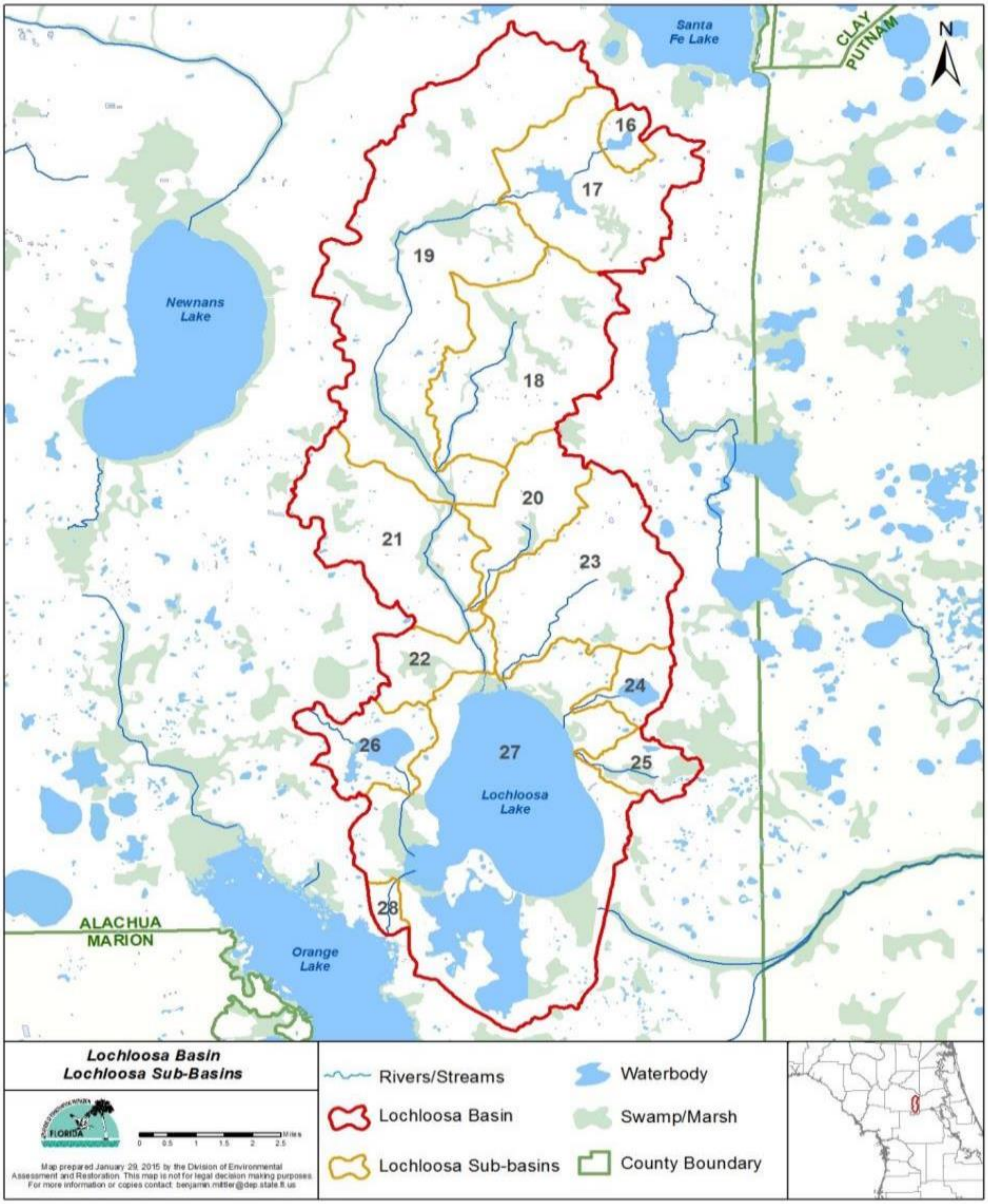


Figure 5.23. HSPF subwatersheds

Table 5.12. HSPF subwatershed characteristics

Subwatershed #	Name	Acres	Reach Connection
16	Lake Elizabeth Creek	556.7	Flows into Reach 17
17	Morans Prairie	4,584.5	Flows into Reach 19
18	Unnamed Slough North	5,746.0	Flows into Reach 19
19	Lochloosa Creek SR20	12,949.5	Flows into Reach 21
20	Unnamed Slough South	2,248.2	Flows into Reach 21
21	Lochloosa Creek South	4,603.3	Flows into Reach 22
22	Lochloosa Creek	1,444.2	Flows into Reach 27
23	West Hawthorne Branch	5,071.8	Flows into Reach 27
24	Lake Jeffords	887.7	Flows into Reach 27
25	Unnamed Drain	1,020.3	Flows into Reach 27
26	Watson Prairie	1,849.9	Flows into Reach 27
27	Lochloosa Lake	15,306.0	Flows into Reach 28
28	Cross Creek	321.3	Discharges to Orange Lake

5.4.3.2. BATHTUB Eutrophication Model

BATHTUB is a suite of empirically derived steady-state models developed by the U.S. Army Corps of Engineers (USACOE) 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 procedures for selection of the appropriate model for a particular lake are described in the *User's Manual*. The empirical prediction of lake eutrophication using this approach typically can be described as a two-stage procedure using the following two categories of models (Walker 1999):

- **Nutrient balance model**. This type of model relates in-lake nutrient concentration to the external nutrient loadings, morphometry, and hydraulics of the lake.

- **Eutrophication response model**. This type of model describes relationships among eutrophication indicators in the lake, including nutrient levels, chlorophyll *a*, transparency, and hypolimnetic oxygen depletion.

Figure 5.24 shows the scheme used by BATHTUB to relate the external loading of nutrients to the in-lake nutrient concentrations and the physical, chemical, and biological response of the lake 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 lake is the difference between nutrient loadings into the lake from various sources and the nutrients carried out through outflow and losses of nutrients through whatever decay processes occur inside the lake. Different limiting factors such as nitrogen, phosphorus, light, or flushing are considered in the selection of an appropriate chlorophyll model.

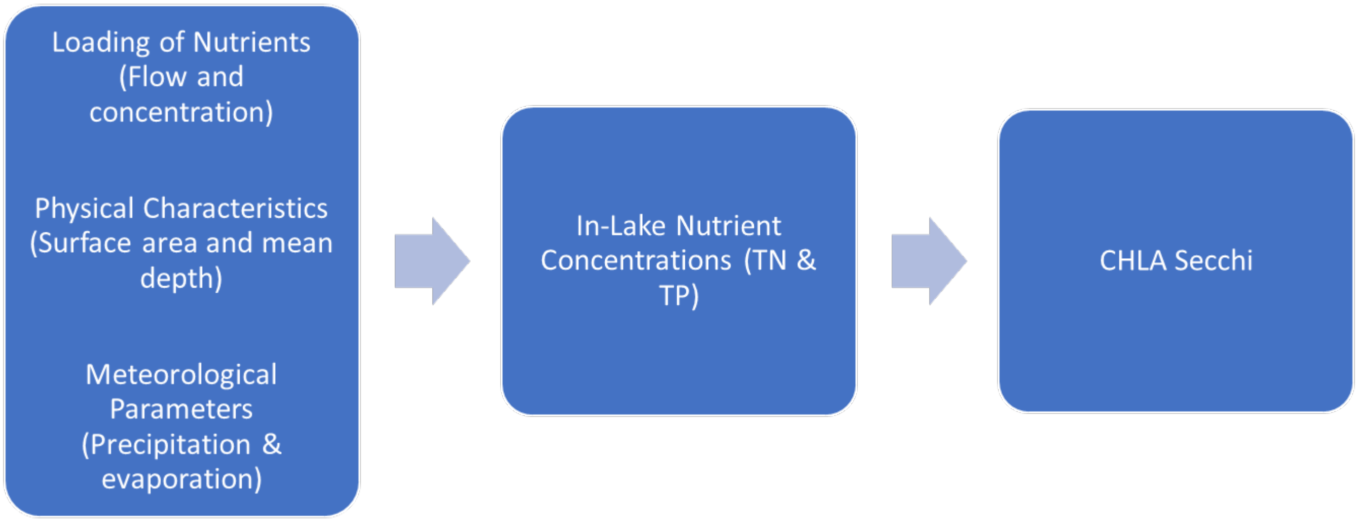


Figure 5.24. BATHTUB concept scheme

The BATHTUB model was set up to simulate in-lake TN, TP, and chlorophyll *a* concentrations each year over the 2004–11 period based on simulated TN and TP loads from the HSPF model. AGM concentrations for chlorophyll *a*, TN, and TP calculated from available water quality data were used to calibrate BATHTUB and guide the selection of nitrogen, phosphorus, and chlorophyll models.

Model Option 8, based on a relationship developed by Canfield and Bachmann (1981) for natural lakes, was selected to simulate phosphorus sedimentation. Bachmann's (1980) volumetric load (Option 4) was selected as the nitrogen sedimentation model. Chlorophyll Model 1 was selected; it included phosphorus, nitrogen, light, and flushing as potential limiting factors to algal production. Secchi depth was influenced by both chlorophyll and turbidity (Model Option 1).

Tables 5.13a through **5.13c** list the results from the preliminary application of these selected model options. Simulated AGM TP concentrations ranged between 43 % (2006) and 106 % (2008) of the observed average concentrations, with the average ratio of simulated to observed of 70 %. The ratio of simulated to observed AGM TN concentrations was 38 %, with individual years ranging between 22 % (2008) and 60 % (2006). After 2006, simulated AGM chlorophyll *a* concentrations were only 25 % of the observed AGM concentrations.

Table 5.13a. Preliminary TN calibration of BATHTUB model for 2004 to 2011

Year	TN Observed (µg/L)	TN Simulated (µg/L)	Ratio
2004	1,653	600	0.36
2005	1,583	778	0.49
2006	1,348	804	0.60
2007	2,129	754	0.35
2008	3,376	738	0.22
2009	2,071	791	0.38
2010	2,307	857	0.37
2011	3,843	996	0.26
		Average	**0.38**

Table 5.13b. Preliminary TP calibration of BATHTUB model for 2004 to 2011

Year	TP Observed (µg/L)	TP Simulated (µg/L)	Ratio
2004	67	42	0.63
2005	108	58	0.54
2006	111	48	0.43
2007	84	47	0.56
2008	71	75	1.06
2009	58	50	0.86
2010	54	50	0.93
2011	90	51	0.57
		Average	**0.70**

Table 5.13c. Preliminary chlorophyll *a* calibration of BATHTUB model for 2004 to 2011

Year	Chlorophyll *a* Observed (µg/L)	Chlorophyll *a* Simulated (µg/L)	Ratio
2004	15.1	12	0.79
2005	7.9	16	2.03
2006	24.5	17	0.69
2007	55.6	12	0.22
2008	133.2	15	0.11
2009	47.8	20	0.42
2010	74.7	17	0.23
2011	95.5	20	0.21
		Average	**0.59**

Annual simple mass balances for TN and TP for Lochloosa Lake were completed using the HSPF simulated nutrient inputs and lake volumes. Estimated AGM concentrations for TN and TP were compared with observed in-lake concentrations. In each of the years, the in-lake TN and TP concentrations were greater than the average inflow concentrations, suggesting internal cycling or contributions from sources not accounted for in the BATHTUB model.

The BATHTUB model includes an option for adding internal loading rates for nitrogen and phosphorus (milligrams per square meter per day [mg/m^2/day]) and represents mean values for the averaging period (in this case yearly). One of the elements of the Lochloosa Lake sediment study conducted by Brenner et al. (2009) was to estimate nutrient storage in the sediments and measure internal nutrient loading from the sediments to the water column. Although the study did not measure internal nutrient loading from the sediments, it did provide information on levels of soluble reactive phosphorus (SRP), total soluble phosphorus (TSP), and total soluble nitrogen (TSN) in the upper 4 cm of sediments. There were 0.9 mg SRP per square meter (m^2), 2.4 mg TSP/m^2, and 172.6 mg TSN/m^2 in the top 4 cm. They estimated that the TSP and TSN in the upper 4 cm of sediment represented 2.7 % and 4.9 % of the TP and TN, respectively, in the overlying water column.

In a study of Danish lakes, Jensen et al. (1992) found that the surface sediment iron to phosphorus (Fe:P) ratio explained 58 % of the variation in the rates of aerobic SRP release from the sediments. There was an inverse relationship between the Fe:P ratio and release of SRP. Above an Fe:P ratio of 15, decreasing amounts of SRP were released and at ratios below 10 SRP were not retained. Calculation of the Fe:P ratio in the upper 4 cm of the 20 sediment cores and the 5 porewater cores analyzed by Brenner et al. (2009) indicated that the ratio was below 10 in all but 1 core.

Ogdahl et al. (2014) conducted laboratory incubations of sediment cores collected at 4 sites during the spring, summer, and fall seasons from Mona Lake, Michigan, to estimate annual internal P load. They found both spatial and temporal variations, with the highest TP release rates during the summer. Anoxic rates were higher than oxic rates in all cases and were typically 5 to 10 times higher. The mean internal TP flux was less than 1.4 milligrams of P per square meter per day (mg P/m^2/day) in all oxic cores (median value 0.26 mg P/m^2/day), with a negative flux rate (sediments acting as a sink) at 3 of 4 sites during the fall. In the anoxic cores, flux rates reached as high as 15.56 mg P/m^2/day in the summer and as low as 0.80 mg P/m^2/day in the spring (median value 3.79 mg P/m^2/day).

Malecki et al. (2004) reported dissolved reactive phosphorus (DRP) flux rates from intact sediment cores collected at 4 locations over 3 seasons in the Lower St. Johns River Estuary. Sediment characteristics at the sites ranged from sandy mud to flocculent fluidlike sediments. DRP concentrations released under an anaerobic water column were significantly greater than the flux under the aerobic water column for all sites and seasons. Under aerobic conditions the

DRP flux averaged 0.13 $mg/m^2/day$ compared with 4.55 $mg/m^2/day$ under anaerobic conditions. Moore et al. (1998) measured spatial and temporal variations in average phosphorus flux from sediments in Lake Okeechobee that represented littoral, sand, and mud zones. Average fluxes from the littoral, sand, mud (M9 site) and mud (K8 site) were 0.79 ± 0.84, 0.02 ± 0.09, 0.13 ± 0.36, and 0.25 ± 0.15 mg $P/m^2/day$, respectively.

As part of their study, Malecki et al. (2004) also measured ammonium fluxes under aerobic and anaerobic conditions. Ammonium N concentrations released under an anaerobic water column were significantly greater than the flux under the aerobic water column for all sites and seasons. Ammonium fluxes under anaerobic conditions averaged 17.15 mg $NH_4/m^2/day$. Under aerobic conditions NH_4-N was released from the sediment. However, the concentration did not build up in the water column due to the immediate onset of nitrification.

In addition to internal nutrient cycling from sediments, there is another pathway for nitrogen addition to surface waters. Previously, **Figures 5.9** through **5.11** illustrated the relationships between cyanobacteria biovolumes and both chlorophyll *a* and TN concentrations in the lake. Species in the genera Anabaena, Aphanizomenon, and Cylindrospermopsis that are capable of nitrogen fixation were present in phytoplankton samples collected from Lochloosa Lake. For example, *Cylindrospermopsis raciborski*, a species that can fix nitrogen, was present in 92 % of the sampling events. Other species that can fix nitrogen, such as *Aphanizomenon flos-aquae* and *Anabaena* sp., occurred in 7 % to 10 % of the samples.

Nitrogen loading to Lochloosa due to nitrogen fixation (and internal loading) was estimated in the following manner. First, the difference between the AGM observed and model-simulated in-lake TN concentrations was multiplied by the sum of lake volume and outflow volume to estimate the difference between the simulated and observed annual loads. Next, this load was divided by the lake surface area and 365 days to obtain a loading rate in $mg/m^2/day$. Estimated rates ranged between 3.73 $mg/m^2/day$ (2006) and 30 $mg/m^2/day$ (2008). Gao (2006) estimated nitrogen fixation rates between 9.2 and 39.0 $mg/m^2/day$ for Lake Jesup. Annual rates are plotted versus AGM chlorophyll *a* concentrations in **Figure 5.25**. The linear regression between chlorophyll *a* and the nitrogen fixation rate was significant at an α level of 0.05.

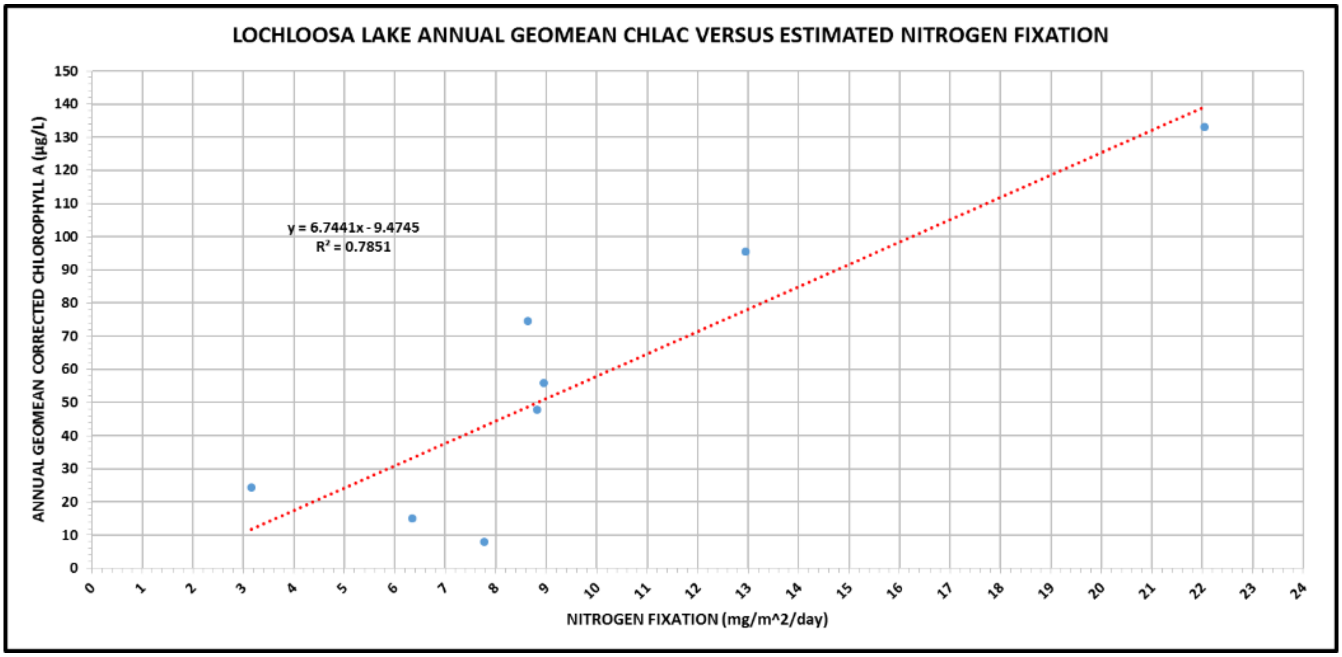


Figure 5.25. Estimated nitrogen fixation rates versus AGM chlorophyll *a* concentrations

Differences between the AGM observed and model-simulated in-lake TP concentrations were multiplied by the sum of lake volume and outflow volume to estimate the difference between the simulated and observed annual loads. Next, this load was divided by the lake surface area and 365 days to obtain a loading rate in mg/m^2/day. Estimated rates ranged between 0.007 mg/m^2/day (2010) and 0.56 mg/m^2/day (2005). The internal loading option in the BATHTUB model was used to add these additional TN and TP sources as internal loads.

Simulations were rerun after adding the estimated nitrogen and phosphorus rates as internal loads. Predicted lake concentrations are compared with the observed concentrations in **Tables 5.14a** through **5.14c**. The overall ratio between the observed and simulated annual lake TN concentrations increased from 38 % to 66 %. The overall ratio between the observed and simulated annual lake TP concentrations increased from 70 % to 85 %. Similarly, the overall ratio between the observed and simulated annual lake chlorophyll *a* concentrations increased from 59 % to 73 %.

Table 5.14a. BATHTUB model predictions of TN with incorporation of nitrogen and phosphorus internal loads

Year	TN Observed (µg/L)	TN Simulated (µg/L)	Ratio
2004	1,653	1,319	0.80
2005	1,583	1,122	0.71
2006	1,348	1,113	0.83
2007	2,129	1,291	0.61
2008	3,376	1,971	0.58
2009	2,071	1,314	0.63
2010	2,307	1,456	0.63
2011	3,843	2,006	0.52
		Average	**0.66**

Table 5.14b. BATHTUB model predictions of TP with incorporation of nitrogen and phosphorus internal loads

Year	TP Observed (µg/L)	TP Simulated (µg/L)	Ratio
2004	67	70	1.04
2005	108	78	0.72
2006	111	83	0.75
2007	84	60	0.71
2008	71	54	0.76
2009	58	53	0.91
2010	54	51	0.94
2011	90	83	0.92
		Average	**0.85**

Table 5.14c. BATHTUB model predictions of chlorophyll *a* with incorporation of nitrogen and phosphorus internal loads

Year	Chlorophyll *a* Observed (µg/L)	Chlorophyll *a* Simulated (µg/L)	Ratio
2004	15.1	15	0.99
2005	7.9	6	0.76
2006	24.5	20	0.82
2007	55.6	40	0.72
2008	133.2	99	0.74
2009	47.8	26	0.54
2010	74.7	67	0.90
2011	95.5	36	0.38
		Average	**073**

The BATHTUB model includes calibration factors as a means for adjusting model predictions to account for site-specific conditions. Calibration variables include TP, TN, and chlorophyll *a*, and calibration factors apply to sedimentation rates (default) or predicted concentrations. The calibration procedure was applied to TN and TP based on factors applied to sedimentation rates. **Tables 5.15a** through **5.15c** show the model results with the application of calibration factors for TN, TP, and chlorophyll *a*.

To develop TN and TP targets based on the BATHTUB modeling approach, the HSPF simulations for natural background conditions (Clapp and Smith 2015) were used for the 2004–11 period. The same TN and TP models used to simulate current conditions were used to simulate natural background conditions. Internal loads were set to zero and the calibration factors were applied. **Table 5.16** presents the results. The results from 2011 were not used in the target calculation since tributary inputs represented less than 1 % of the total input.

As discussed in the document *Overview of Approaches for Numeric Nutrient Criteria Development in Marine Waters* (DEP 2012b), statistically, a long-term 80th percentile is consistent with an exceedance frequency of no more than once in a three-year period long-term 80th percentile. The 80th percentile AGMs for TN and TP from the natural background simulations are 1,152 and 55 µg/L, respectively. AGM chlorophyll *a* concentrations for the 2004–10 period ranged between 13 and 80 µg/L, with a long-term average of 27 µg/L.

Table 5.15a. BATHTUB model predictions of TN with incorporation of calibration factors

Year	TN Observed (µg/L)	TN Simulated (µg/L)	Ratio
2004	1,653	1,653	1.00
2005	1,583	1,583	1.00
2006	1,348	1,348	1.00
2007	2,129	2,128	1.00
2008	3,376	3,376	1.00
2009	2,071	2,072	1.00
2010	2,307	2,307	1.00
2011	3,843	3,843	1.00
		Average	**1.00**

Table 5.15b. BATHTUB model predictions of TP with incorporation of calibration factors

Year	TP Observed (µg/L)	TP Simulated (µg/L)	Ratio
2004	67	67	1.00
2005	108	108	1.00
2006	111	111	1.00
2007	84	84	1.00
2008	71	71	1.00
2009	58	58	1.00
2010	54	54	1.00
2011	90	90	1.00
		Average	**1.00**

Table 5.15c. BATHTUB model predictions of chlorophyll *a* with incorporation of calibration factors

Year	Chlorophyll *a* Observed (µg/L)	Chlorophyll *a* Simulated (µg/L)	Ratio
2004	15.1	15	0.99
2005	7.9	8	1.01
2006	24.5	24	0.98
2007	55.6	56	1.01
2008	133.2	132	0.99
2009	47.8	48	1.00
2010	74.7	75	1.00
2011	95.5	96	1.01
		Average	**1.00**

Table 5.16. BATHTUB model predictions for natural background conditions with incorporation of calibration factors

Year	TP Simulated (µg/L)	TN Simulated (µg/L)
2004	36	942
2005	51	884
2006	57	942
2007	52	1,181
2008	49	958
2009	42	1,034
2010	56	3,034
2011	53	2,566
80th percentile (2004–10)	**55.2**	**1,152**

5.5 Evaluation of TN and TP Targets Based on Other Approaches

To evaluate whether setting the TN and TP concentrations at 1.09 and 0.052 mg/L, respectively, is reasonable, DEP also conducted other analyses for the TN and TP concentration target setting. These included lake region target analysis and morphologically similar lake analyses. The results provide a range of TN and TP concentration targets. If the TN and TP concentration targets established using the 80th percentile background condition is within the range, the target concentrations would be considered reasonable.

5.5.1 Central Valley Lake Region Assessment

Griffith *et al*. (1997) defined 47 lake regions for Florida based on water quality data in conjunction with information on soils, physiography, geology, vegetation, climate, and land use/land cover. Lochloosa Lake is in the Central Valley Lake Region. According to Griffith et al. (1997), lakes in the Central Valley region are generally large, shallow, and eutrophic, with high levels of nitrogen, phosphorus, and chlorophyll. They tend to have abundant macrophytes or are green with algae. ArcGIS was used to identify lake WBIDs in the Central Valley Lake Region. TN and TP observations for these lakes were extracted from the IWR Run 49 Database. AGMs for TN and TP were calculated for each lake. The AGMs were used if there were a minimum of 4 sampling events in a year and at least 1 observation occurred during the May 1 through September 30 period.

During the development of NNC for lakes and estuaries, DEP presented a statistical approach based on the binomial distribution to calculate the upper 80th percentile prediction limit that would be expected with 90 % confidence not to be exceeded more than once in a 3-year period. The 80th percentile TN and TP concentrations were calculated for each lake with at least 7 AGMs (**Appendix H**).

According to the EPA guidance manual for lakes and reservoirs (EPA 2000), one approach to inferring a reference condition is to select a percentile from a distribution of known reference lakes (e.g., highest quality or least impacted lakes in the region). The other approach is to select a percentile from all lakes in the class or a random sample distribution of all lakes in the class. The percentile should be lower than that used in the first approach, since the sample is expected to contain at least some degraded lakes. In the example presented in the guidance manual and in other case studies, the EPA has recommended the use of the upper 75th percentile from a distribution of known reference lakes and the lower 25th percentile from a distribution of all lakes in a region or class.

Thirty-five lakes in the Central Valley met the data sufficiency requirements. Since a number of the lakes are not reference lakes, the lower 25th percentile concentration of the distribution was considered. The lower 25th percentiles for TN and TP were 1.049 and 0.039 mg/L, respectively, and would not be expected to be exceeded more than once in a 3-year period.

5.5.2 Lochloosa Lake TN and TP Target Concentrations Established Based on Morphologically Similar Lakes

In addition to color, alkalinity, and geological and topological factors, other important factors that influence the effect of nutrients in lakes include lake morphology and the relationship between watershed area and lake surface area. These factors mainly influence the water residence time of lakes, which in turn influences the sedimentation of nutrients and the time required for phytoplankton to take up nutrients and produce biomass.

Huber et al. (1982) collected information regarding lake surface area, lake mean depth, and the watershed area to lake surface area ratio for nearly 200 Florida lakes. To establish the target TN and TP concentrations for Lochloosa Lake, a set of lakes on Huber's lake lists with lake surface area, mean depth, and watershed area to lake surface areas similar to those of Lochloosa Lake were chosen using the following criteria:

1. Lakes with a surface area 0.1 to 10 times the Lochloosa Lake surface area.
2. Lakes with mean depth 0.5 to 2 times the Lochloosa Lake mean depth.
3. Lakes with a watershed area to lake surface area ratios 0.1 to 10 times the Lochloosa Lake watershed area to lake surface area ratio.

Based on GIS and lake bathymetry information, the lake surface area, mean depth, and watershed area to lake surface area ratio for Lochloosa Lake are 8,687 acres, 6.2 feet, and 6.5, respectively. Therefore, the criteria used to select the lakes used for TN and TP concentration target development included lakes with lake surface area ranging from 867 acres to 86,869 acres, mean depth ranging from 3.1 feet to 12.4 feet, and watershed area to lake surface area ratio ranging from 0.65 to 65.1. Once the lakes with similar characteristics to Lochloosa Lake were identified, the following steps were taken to establish the possible TN and TP concentration targets for Lochloosa Lake:

1. TN and TP concentrations of identified lake WBIDs were retrieved from IWR Database Run_49.
2. AGM TN and TP concentrations were calculated for each year for all WBIDs.
3. The 80th percentile AGM TN and TP concentrations for all WBIDs were then calculated using the following equation:

$$C = e^{\left(\sum_{1}^{n} \frac{LnAG}{n} + \left(t * \sqrt{SD^{2} - \frac{SD^{2}}{n}}\right)\right)}$$

Where,

> *C* is the TN and TP concentrations that are exceeded at a frequency of once in three years.
>
> *LnAG* is the natural log of the AGMs of TN and TP concentrations.
>
> *n* is the number of years that the AGMs of TN and TP concentrations can be calculated.
>
> *T* is the inverse of the student's t distribution.
>
> *SD* is the standard deviation of the natural log of the AGM.

Once the TN and TP concentrations exceeded in 1 of the 3 years were calculated for all WBIDs, the 25th percentiles of these TN and TP concentrations were calculated as the target TN and TP concentrations for Lochloosa Lake.

Table 5.17 shows the TN and TP concentrations that were exceeded in 1 out of 3 years for the lake WBIDs used in this calculation. The TN and TP target concentrations for Lochloosa Lake established using the lake morphology approach are 0.92 and 0.043 mg/L, respectively.

5.5.3 Conclusions from Other Approaches Regarding Selected TN and TP Targets

Section 5.4 described both a paleolimnological reconstruction of past conditions and a model-based prediction of natural background conditions, and indicated that the generally applicable chlorophyll *a* and TP criteria of 20 µg/L and 0.05 mg/L, respectively, would not be the most applicable criteria for Lochloosa Lake. The model-based prediction of natural background conditions was the basis for selecting TN and TP targets of 1.09 and 0.052 mg/L (not to be exceeded than once in a 3-year period), respectively, for Lochloosa Lake. Additional approaches presented in **Sections 5.5.1** and **5.5.2** provided TN and TP targets that were consistent with these targets.

Table 5.17. Waterbodies used in establishing TN and TP target concentrations based on morphology approach

WBID	Lake Name	Lake Surface Area (acres)	Mean Depth (feet)	Watershed Area to Lake Surface Area Ratio	TN Concentration Exceeded at 1-in-3-Year Frequency (mg/L)	TP Concentration Exceeded at 1–in-3-Year Frequency (mg/L)	Number of Years that TN AGM Can Be Calculated	Number of Years that TP AGM Can Be Calculated
1860D	Jackson	3,244	9.40	2.76	0.53	0.026	32	35
1521B	Eloise	1,172	9.73	3.07	1.64	0.113	30	32
1677C	Buffum	1,544	11.30	4.56	0.89	0.073	25	25
2339	Ocean Pond	1,793	8.40	4.68	0.71	0.128	14	18
2389	Doctors	3,202.4	9.84	5.00	1.45	0.175	30	32
3176	Alligator	3,401	7.70	5.01	0.82	0.027	37	40
1476	Mattie	1,813	9.80	5.19	1.55	0.168	17	17
3184	Marian	5,727	10.80	5.54	2.36	0.157	35	36
1497B	Parker	2,291	7.60	6.59	3.67	0.177	22	27
1480	Marion	2,968	4.55	7.70	2.03	0.069	33	38
1573E	Weohyakapka	7,555	5.24	7.92	0.91	0.053	32	35
2705B	Newnans	7,350	6.15	9.93	7.48	0.468	31	33
1532A	Pierce	3,736	7.20	10.09	1.85	0.056	33	35
2873C	Johns	2,411	8.00	10.64	1.21	0.050	23	23
2807A	Yale	4,030	11.73	10.74	1.70	0.038	42	46
1685D	Reedy	3,454	10.93	11.28	1.85	0.041	30	32
442	Iamonia	5,680	7.00	11.38	0.75	0.029	20	19
3259W	Trafford	1,485	5.08	11.46	2.63	0.211	34	37
3008B	South	1,103.3	3.62	11.69	1.65	0.062	5	5
2981	Jessup	7,792	5.40	12.81	3.92	0.353	44	39
1486A	Tarpon	2,534	8.20	15.15	1.15	0.081	42	46
3177	Gentry	1,797	7.20	15.88	1.00	0.048	28	29
3598D	Sampson	2,071	6.10	18.33	0.91	0.047	21	21
1623L	Hancock	4,541	4.70	18.46	8.84	0.785	34	37
2925A	Ashby	1,077	6.40	20.20	1.02	0.120	21	21
2839M	Louisa	3,660	10.40	21.16	1.45	0.041	38	40
1860B	Josephine	1,240	6.46	23.90	1.14	0.085	23	27
791N	Miccosukee	6,312	6.70	24.33	0.90	0.038	21	23
1685A	Arbuckle	3787	5.90	28.73	1.41	0.075	35	37
1347	Okahumpka	973	6.50	32.23	2.20	0.063	8	8
2831B	Dora	4437	12.26	34.04	4.20	0.128	42	45
2893V	Blue Cypress	6522	5.10	47.99	1.58	0.124	37	39
1351B	Panasoffkee	4821	6.90	55.76	0.95	0.041	24	27
553A	Deer Point (Deerpoint)	4989.3	9.96	55.80	0.57	0.028	17	25

5.6 Calculation of the TMDL

Once the nutrient targets were identified, the BATHTUB model was used to determine the allowable TN and TP loads that would meet the targets for each year. Anthropogenic land use concentrations based on the current condition scenario were incrementally reduced until the in-lake concentrations were achieved for each year. **Table 5.18** summarizes annual loads under current conditions and TMDL loads for TP. The results from 2011 were not used in the calculation of a long-term average TMDL load, since it represented a second consecutive low-rainfall year, and watershed loads represented less than 7 % of the input. The TMDL long-term average load represents a 49 % reduction from the long-term average load under current conditions.

Table 5.19 summarizes annual loads under current conditions and TMDL loads for TN. The results from 2011 were not used in the calculation of a long-term average TMDL load since it represented a second consecutive low-rainfall year and watershed loads represented less than 1 % of the input. The TMDL long-term average load represents a 62 % reduction from the long-term average load under current conditions.

Reductions to achieve the in-lake nutrient targets were made to both watershed and internal loads. Internal loads included nutrient fluxes from the sediment, sediment resuspension, uncertainties in source loads, and, in the case of nitrogen, additional nitrogen from nitrogen fixation. Porewater analysis of 20 cores found that soluble reactive phosphorus (SRP) concentrations in the upper 4 cm ranged from 0.000 to 0.104 mg/L, with a mean of 0.023 mg/L (Brenner et al. 2009). Similar analyses for TSN concentrations ranged from 2.63 to 8.39 mg/L, with a mean of 4.59 mg/L. Brenner et al. (2009) estimated that there was 0.9 mg SRP/m^2 in the uppermost 4 cm of sediment, equal to 1 % of the TP in the overlying water. The upper 4 cm of sediment contained 172.6 mg TSN/m^2 and was equal to 4.9 % of the TN in the overlying water. The suspension of even a few millimeters of bulk sediment into the water column could raise both TP and TN concentrations.

Partitioning the TMDL loads between the watershed and internal components indicates that the percent reductions in internal loads necessary to meet the TMDL are greater than the percent reduction in watershed loads. In the case of TP, the internal load reduction average is 1,842 kg (75 %) compared with a watershed load reduction of 3.010 kg (44 %). The internal TN load reduction average is 94,696 kg (78 %), while the watershed TN load reduction is 30,027 kg (64 %).

Table 5.18. TP TMDL loads to achieve the TP target for Lochloosa Lake

Year	Current Watershed TP Load (kg/yr)	Current Internal TP Load (kg/yr)	Atmospheric Deposition (kg/yr)	Total Current TP Load (kg/yr)	TMDL Watershed TP Load (kg/yr)	TMDL Internal TP Load (kg/yr)	Total TMDL TP Load (kg/yr)	% Reduction
2004	4.118	734	2,246	7,098	2,905	489	5,640	21
2005	6,017	7,865	2,442	16,324	1,970	2,163	6,138	62
2006	1,770	5,740	1,893	9,403	439	1,090	3,422	64
2007	2,405	1,723	1,793	5,921	1,533	603	3,929	34
2008	003,742	671	1,833	6,246	2,311	391	4,535	21
2009	2,831	422	1,767	5,020	2,569	380	4,716	6
2010	1,564	74	1,515	3,153	1,564	74	3,153	0
2011	238		1,182					
2004–10 Average	**3,207**	**2,461**	**1,927**	**7,595**	**1,899**	**741**	**4,505**	**41**

Table 5.19. TN TMDL loads to achieve the TN target for Lochloosa Lake

Year	Current Watershed TN Load (kg/yr)	Current Internal TN Load (kg/yr)	Atmospheric Deposition (kg/yr)	Total Current TN Load (kg/yr)	TMDL Watershed TN Load (kg/yr)	TMDL Internal TN Load (kg/yr)	Total TMDL TN Load (kg/yr)	% Reduction
2004	39,992	77,698	41,246	158,936	22,209	39,644	103,099	35
2005	66,152	109,261	43,425	218,838	37,033	56,316	136,774	37
2006	19,099	47,574	30,073	96,746	12,026	28,060	70,159	27
2007	26,791	92,848	31,003	150,642	10,603	18,526	60,132	60
2008	41,412	335,299	31,376	408,087	9,201	40,236	80,813	80
2009	32,974	93,028	30,663	156,665	10,462	21,862	62,987	60
2010	18,328	90,970	23,442	132,740	3,832	5,903	33,177	75
2011	1,486		17,862					
2004–10 Average	**34,964**	**120,954**	**33,033**	**188,951**	**15,052**	**30,078**	**78,163**	**59**

It is difficult to allocate internal load reductions to individual stakeholders. However, there may be opportunities for stakeholders to identify and participate in projects that would reduce internal nutrient cycling. In addition, actions that reduce watershed TP loads to the lake can indirectly benefit the internal load component by reducing phosphorus available for incorporation into algal biomass, including cyanobacterial species that fix nitrogen from the atmosphere and, in turn, decrease organic matter accumulating in the sediment.

Chlorophyll *a* AGMs were calculated in the BATHTUB model with the TMDL loads that attained the TN and TP in-lake targets. These AGMs ranged between 5 µg/L (2005) and 90 µg/L (2008) over the 2004–10 period (**Table 5.20**). The long-term average was 38 µg/L. Simulation results to natural background nutrient loads under the natural variability of condition over the 2004–10 period provides a long-term average chlorophyll *a* that is representative of a natural background and ecologically protective.

Table 5.20. Chlorophyll *a* AGMs under TMDL loads for Lochloosa Lake

Year	Corrected Chlorophyll *a* AGM with TMDL Nutrient Loads (µg/L)
2004	11
2005	5
2006	15
2007	35
2008	90
2009	41
2010	66
2004–10 Average	**38**

Cross Creek connects Lochloosa Lake and Orange Lake. Cross Creek had been previously verified impaired for nutrients (chlorophyll *a*) and DO. **Table 4.2** summarizes land uses in the Cross Creek WBID. As noted earlier, the Cross Creek watershed is very small, and the discharge from Lochloosa Lake dominates water quality in Cross Creek. **Table 5.21** summarizes annual TP loads to Cross Creek contributed from the immediate Cross Creek watershed and discharge from Lochloosa Lake under the current conditions and with the reductions under the Lochloosa TMDL. Under current conditions, the contribution from the immediate Cross Creek watershed averages less than 5 % of the total annual TP load to Cross Creek. The Cross Creek TP TMDL average reduction of 31 % is based on load reductions for Lochloosa Lake and resulting water quality changes in the discharge from Lochloosa Lake into Cross Creek.

Table 5.22 presents annual TN loads and the TMDL loads for Cross Creek. Nitrogen loads from the immediate Cross Creek watershed averaged less than 2 % of the total annual TN load to Cross Creek. The Cross Creek TN TMDL average reduction of 43 % is based on load reductions for Lochloosa Lake and resulting water quality changes in the discharge from Lochloosa Lake into Cross Creek.

The site-specific numeric nutrient targets of 4,505 kg/yr TP and 78,163 kg/yr TN for Lochloosa Lake are representative of natural background conditions in Lochloosa Lake and reflect the best water quality expected for Cross Creek, given that discharge from Lochloosa Lake to Cross Creek will contribute on average 95 % of the TP load and 97 % of the TN load in Cross Creek. Instream concentrations for TP and TN are expected to be 0.055 and 1.15 mg/L, respectively. The implementation of the nutrient TMDLs for Lochloosa Lake to achieve those criteria is expected to address the nutrient and DO impairments in Cross Creek, since this will represent natural background conditions.

Table 5.21. TP TMDL loads for Cross Creek

Year	Current Cross Creek Watershed TP Load (kg/yr)	Current from Lochloosa TP Load (kg/yr)	Total Current TP Load (kg/yr)	TMDL from Lochloosa TP Load (kg/yr)	Total Cross Creek TMDL TP Load (kg/yr)	% Reduction
2004	111	2,147	2,258	1,770	1,881	17
2005	137	3,988	4,125	2037	2,174	47
2006	54	3,123	3,177	1711	1,765	44
2007	72	1,903	1,975	1,256	1,328	33
2008	95	2,468	2,563	1,945	2,040	20
2009	72	1,156	1,228	1,108	1,180	4
2010	59	779	838	779	838	0
2004–10 Average	**86**	**2,223**	**2,309**	**1,515**	**1,601**	**31**

Table 5.22. TN TMDL loads for Cross Creek

Year	Current Cross Creek Watershed TN Load (kg/yr)	Current from Lochloosa TN Load (kg/yr)	Total Current TN Load (kg/yr)	TMDL from Lochloosa TN Load (kg/yr)	Total Cross Creek TMDL TN Load (kg/yr)	% Reduction
2004	1,093	52,858	53,951	36,757	37,850	30
2005	1,402	58,433	59,835	42,547	43,949	27
2006	508	41,583	42,041	35,508	36,016	14
2007	723	48,342	49,065	26,269	26,992	45
2008	956	117,785	118,741	40,649	41,605	65
2009	649	41,644	42,293	23,194	23,843	44
2010	495	33,556	34,051	16,850	17,345	49
2004–10 Average	**832**	**56,307**	**57,140**	**31,682**	**32,514**	**43**

The current applicable regional numeric threshold for streams in this nutrient region is 0.12 mg/L TP and 1.54 mg/L TN as AGMs not to be exceeded more than once in any 3-calendar-year period. The Cross Creek TMDL TN and TP targets established based on Lochloosa Lake site-specific information are more stringent than these regional stream nutrient thresholds. The generally applicable NNC for streams also require the achievement of balanced aquatic flora communities (Paragraph 62-302.531[2][c], F.A.C.) in addition to the nutrient thresholds. Because the TMDL TN and TP targets established for Cross Creek are related to the natural condition, the flora communities achieved with these TN and TP loads are considered natural condition and are therefore protective.

5.7 Critical Conditions/Seasonality

The 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 segment, which is better addressed on an annual basis; and (3) the methodology used to determine impairment is based on annual conditions (AGMs or arithmetic means).

Chapter 6: Determination of the TMDL

6.1 Expression and Allocation of the TMDL

A TMDL can be 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) that takes into account any uncertainty about the relationship between effluent limitations and water quality:

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

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

It should be noted that the various components of the 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 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).

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 is also different than 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 § 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 Lochloosa Lake and Cross Creek are expressed in terms of a long-term (7-year) average of annual loads, not to be exceeded (**Table 6.1**)**.** The TMDLs will constitute the site-specific numeric interpretation of the narrative nutrient criterion set forth in Paragraph 62-302.530(47)(b), F.A.C., that will replace the otherwise applicable TN and TP NNC in Subsection 62-302.531(2), F.A.C., for these particular waters. Based on these allowable loads, the site-specific numeric interpretation for chlorophyll *a* is 33 µg/L, expressed as a long-term (7-year) average of the AGMs not to be exceeded.

Table 6.1. TMDL components for Lochloosa Lake and Cross Creek

[1] The TMDL represents a long-term (7-year) average of annual loads, not to be exceeded. Dividing by 365 days yields daily TMDL loads of 214.1 kg TN/day and 12.3 kg TP/day, which complies with EPA requirements to express the TMDL on a daily basis.
[2] Reductions for Cross Creek are based on water quality improvements achieved for Lochloosa Lake that are reflected in the discharge from Lochloosa Lake to Cross Creek.
NA = Not applicable

WBID	Parameter	TMDL (kg/yr)[1]	WLA Wastewater (kg/yr)	WLA NPDES Stormwater (% Reduction)	LA (% Reduction)	MOS
2738A	TN	78,163	NA	NA	59	Implicit
2738A	TP	4,505	NA	NA	41	Implicit
2754	TN	32,514	NA	NA	43[2]	Implicit
2754	TP	1,601	NA	NA	31[2]	Implicit

6.2 Load Allocation (LA)

A TN load reduction for Lochloosa Lake of 59 % and a TP load reduction of 41 % are required from nonpoint sources. The reductions will result in in-lake AGM TP and TN concentrations of 0.055 and 1.15 mg/L, respectively, in every year. The long-term (7-year) average AGM in-lake chlorophyll *a* concentration is 38 µg/L, not to be exceeded. It should be noted that the load allocation includes loading from stormwater discharges that are not part of the NPDES Stormwater Program.

6.3 Wasteload Allocation (WLA)

6.3.1 NPDES Wastewater Discharges

There are no NPDES wastewater facilities that discharge directly to Lochloosa Lake or its watershed. As such, a WLA for wastewater discharges is not applicable.

6.3.2 NPDES Stormwater Discharges

Alachua County has a Phase II-C MS4 permit (FLR04E005) and FDOT District 2 has an MS4 permit (FLR04E018). Based on the 2010 TIGER Census data, none of the urbanized areas covered by the MS4s is in the Lochloosa watershed. 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 (MOS)

TMDLs must address uncertainty issues by incorporating an MOS into the analysis. 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 predicting water quality response. The effectiveness of management activities (e.g., stormwater management plans) in reducing loading is also subject to uncertainty.

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 because of the conservative assumptions that were applied. Additionally, the TMDL nutrient concentration targets are established as AGMs not to be exceeded in any year based on the development of site-specific alternative water quality targets developed using paleolimnological analyses and model simulations of a natural background condition.

Chapter 7: Next Steps: Implementation Plan Development and Beyond

7.1 Implementation Mechanisms

Following the adoption of a TMDL, implementation takes place through various measures. For bacteria impairments, the "Walk the Waterbody" process can be a good starting point to identify sources of fecal contamination. This process is based on the implementation guidance available from DEP and involves water quality sampling and analysis, the identification of potential sources through map analysis by stakeholders with local knowledge, field inspection to identify specific sources, the identification of corrective actions, and the implementation of those actions. In addition, the implementation of bacteria and other TMDLs may occur through specific requirements in NPDES wastewater and MS4 permits, and, as appropriate, through local or regional water quality initiatives or BMAPs.

Facilities with NPDES permits that discharge to the TMDL waterbody must respond to 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 that a permit holder prioritize and take action to address a TMDL unless the management actions are already defined in a BMAP. MS4 Phase II permit holders must also implement responsibilities defined in a BMAP.

7.2 Basin Management Action Plans

BMAPs are discretionary and are not initiated for all TMDLs. A BMAP is a TMDL implementation tool that integrates the appropriate management strategies applicable through existing water quality protection programs. DEP or a local entity may develop a BMAP that addresses some or all of the contributing areas to the TMDL waterbody.

Section 403.067, F.S. (FWRA) provides for the development and implementation of BMAPs. BMAPs are adopted by the DEP Secretary and are legally enforceable.

BMAPs describe the management strategies that will be implemented, funding strategies, project tracking mechanisms, and water quality monitoring, as well as the fair and equitable allocations of pollution reduction responsibilities to the sources in the watershed. BMAPs also identify mechanisms to address potential pollutant loading from future growth and development. The most important component of a BMAP is the list of management strategies to reduce the pollution sources, as these are the activities needed to implement the TMDL. The local entities that will conduct these management strategies are identified and their responsibilities are enforceable. Management strategies may include wastewater treatment upgrades, stormwater improvements, and agricultural BMPs. Additional information about BMAPs is available online.

7.3 Implementation Considerations for Lochloosa Lake

The first phase of the Orange Creek BMAP was adopted by Secretarial Order in May 2008. The second phase of the BMAP, adopted in July 2014, contains the management priorities for the second phase of the plan. For this second BMAP phase, new strategies for continuing water quality improvements in impaired waters that help in achieving the nutrient and fecal coliform TMDLs in the basin are proposed. However, the 2008 BMAP remains in effect, and projects adopted through it are still under Secretarial Order.

Over the next five years, the second phase of the BMAP focuses on identifying the nutrient sources that cause the impairment of the basin’s lakes (Newnans Lake, Orange Lake, and Lake Wauberg) and strategies to address those impairments, provides support for the restoration of Paynes Prairie, and continues the refinement and strengthening of protocols to address fecal coliform TMDLs in the urban creeks. In addition, the nutrient TMDL for Lochloosa Lake will be addressed during this second BMAP phase, and actions that respond to that TMDL will be identified and implemented. As discussed earlier, Lochloosa Lake is a tributary of Orange Lake.

The BMAP provides for phased implementation under Subparagraph 403.067(7)(a)1., F.S., and this adaptive management process will continue until the TMDLs are met. The phased BMAP approach allows for incrementally reducing loadings through the implementation of projects, while simultaneously monitoring and conducting studies to better understand water quality dynamics (sources and response variables) in each impaired waterbody. It also allows for actions to be taken in other waterbodies that will improve water quality in the TMDL waterbody. Subsequent five-year BMAP management phases will continue to evaluate progress and make adjustments or add new projects, as needed, to meet the TMDLs.

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Appendices

Appendix A: Water Quality Variable Definitions

Chlorophyll a

Chlorophyll is a green pigment found in plants and is an essential component in the process of converting light energy into chemical energy. Chlorophyll is capable of channeling the energy of sunlight into chemical energy through the process of photosynthesis. In photosynthesis, the energy absorbed by chlorophyll transforms carbon dioxide (CO_2) and water (H_2O) into carbohydrates and oxygen (O_2). The chemical energy stored by photosynthesis in carbohydrates drives biochemical reactions in nearly all living organisms. Thus, chlorophyll is at the center of the photosynthetic oxidation-reduction reaction between carbon dioxide and water.

There are several types of chlorophyll; however, the predominant form is chlorophyll *a*. The measurement of chlorophyll *a* in a water sample is a useful indicator of phytoplankton biomass, especially when used in conjunction with the analysis of algal growth potential and species abundance. The greater the abundance of chlorophyll *a*, typically the greater the abundance of algae. Algae are the primary producers in the aquatic web, and thus are very important in characterizing the productivity of lakes and streams. As noted earlier, chlorophyll *a* measurements are also used to estimate the trophic conditions of lakes and other lentic waters.

Total Nitrogen as N (TN)

TN is the sum of nitrate (NO_3), nitrite (NO_2), ammonia (NH_3), and organic nitrogen found in water. Nitrogen compounds function as important nutrients for many aquatic organisms and are essential to the chemical processes that occur between land, air, and water. The most readily bioavailable forms of nitrogen are ammonia and nitrate. These compounds, in conjunction with other nutrients, serve as an important base for primary productivity.

The major sources of excessive amounts of nitrogen in surface water are the effluent from wastewater treatment plants and runoff from urban and agricultural land areas. When nutrient concentrations consistently exceed natural levels, the resulting nutrient imbalance can cause undesirable changes in a waterbody's biological community and drive an aquatic system into an accelerated rate of aging known as eutrophication. Usually, the eutrophication process is observed as a change in the structure of the algal community and includes severe algal blooms that may cover large areas for extended periods. Large algal blooms are generally followed by a depletion in DO concentrations as a result of algal decomposition.

Total Phosphorus as P (TP)

Phosphorus is one of the primary nutrients that regulates algal and macrophyte growth in natural waters, particularly in fresh water. Phosphate, the predominant form of phosphorus found in the water column, can enter the aquatic environment in a number of ways. Natural processes transport phosphate to water through atmospheric deposition, groundwater percolation, and terrestrial runoff. Areas of the state where the Hawthorne Formation is exposed or near the surface can be a potential source of in-stream phosphorus. Municipal treatment plants, industries, agriculture, and domestic activities also contribute to phosphate loading through direct discharge and natural transport mechanisms. Receiving waters in areas of phosphate mining and fertilizer production can have very high levels of phosphorus as a result of the exposure and extraction of phosphorus-rich sediments.

High phosphorus concentrations are frequently responsible for accelerating the process of eutrophication of a waterbody. Once phosphorus and other important nutrients enter the ecosystem, they are extremely difficult to remove. They become tied up in biomass or deposited in sediments. Nutrients, particularly phosphates, deposited in sediments generally are redistributed to the water column. This type of cycling compounds the difficulty of halting the eutrophication process.

Appendix B: 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's 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.

Rule 62-40 also requires the state's water management districts to establish stormwater PLRGs and adopt them as part of a SWIM plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs 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 Clean Water Act 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," which includes 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 October 2000. DEP 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 C: Historical Observations in Lochloosa Lake, 1958–2013

Table C.1: Historical Chlorophyll *a*, Corrected Chlorophyll *a*, Color, TN, and TP Observations in Lochloosa Lake, 1958–2013

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
112WRD 02242400	10/7/1958			15		
112WRD 02242400	3/17/1959			45		
112WRD 02242400	1/4/1960			75		
112WRD 02242400	6/21/1960			45		
112WRD 02242400	8/17/1965			90		
112WRD 02242400	2/14/1966			50		
112WRD 02242400	5/25/1966			70		
112WRD 02242400	5/15/1967			50		
112WRD 02242400	8/22/1967				0.55	0.042
112WRD 02242400	5/9/1968			30		0.104
112WRD 02242400	5/5/1969			40		0.029
112WRD 02242400	4/28/1970			100		
112WRD 02242400	5/24/1971					0.049
21FLA 20020080	3/28/1977				8.16	0.040
21FLA 20020080	12/6/1977			50		
21FLA 20020080	11/28/1978			150	3.23	0.010
21FLA 20020080	9/5/1979			70	2.77	0.140
21FLGFWFGFCNE0219	12/7/1987		9.60		0.62	0.046
21FLGFWFGFCNE0220	12/7/1987		12.80		0.52	0.062
21FLGFWFGFCNE0221	12/7/1987		12.80		0.65	0.065
21FLGFWFGFCNE0222	12/7/1987		16.20		0.81	0.068
21FLGFWFGFCNE0219	2/29/1988		8.00		1.01	0.036
21FLGFWFGFCNE0220	2/29/1988		12.00		1.41	0.042
21FLGFWFGFCNE0221	2/29/1988		12.00		1.23	0.059
21FLGFWFGFCNE0222	2/29/1988		12.00		1.00	0.049
21FLGFWFGFCNE0221	4/4/1988		19.20		1.96	0.085
21FLGFWFGFCNE0222	4/4/1988		22.50		2.02	0.072
21FLGFWFGFCNE0220	4/4/1988		25.70		2.97	0.124
21FLGFWFGFCNE0219	4/4/1988		48.10		2.41	0.104
21FLGFWFGFCNE0220	6/13/1988		6.40		1.01	0.033
21FLGFWFGFCNE0222	6/13/1988		10.70		1.10	0.065
21FLGFWFGFCNE0219	6/13/1988		16.00		0.69	0.068
21FLGFWFGFCNE0221	6/13/1988		24.10		1.31	0.059
21FLGFWFGFCNE0219	8/2/1988				0.49	0.059
21FLGFWFGFCNE0220	8/2/1988				0.32	0.059
21FLGFWFGFCNE0221	8/2/1988				0.49	0.049
21FLGFWFGFCNE0222	8/2/1988				0.44	0.042

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLSJWMLOL	8/5/1988					
21FLGFWFGFCNE0220	9/6/1988		8.00		1.33	0.300
21FLGFWFGFCNE0219	9/6/1988		16.00		0.90	0.156
21FLGFWFGFCNE0221	9/6/1988		21.10		1.55	0.111
21FLGFWFGFCNE0222	9/6/1988		32.10			0.075
21FLGFWFGFCNE0222	11/21/1988		3.10			0.029
21FLGFWFGFCNE0221	11/21/1988		6.20		0.77	0.046
21FLGFWFGFCNE0219	11/21/1988		6.40		1.06	0.042
21FLGFWFGFCNE0220	11/21/1988		54.40		0.78	0.075
21FLA 20020080	11/29/1988		1.60	240	1.47	0.093
21FLA 20020138	11/29/1988		5.07	200	1.24	0.079
21FLA 20020139	11/29/1988		36.54	200	1.14	0.150
21FLGFWFGFCNE0221	1/3/1989		3.20		0.98	0.049
21FLGFWFGFCNE0222	1/3/1989		3.20		1.19	0.046
21FLGFWFGFCNE0219	1/3/1989		9.60		1.00	0.052
21FLGFWFGFCNE0220	1/3/1989		9.60		1.17	0.114
21FLA 20020138	1/17/1989		3.74	160	0.99	0.030
21FLA 20020139	1/17/1989		6.08	280	1.06	0.081
21FLA 20020080	1/17/1989		6.68	160	0.98	0.078
21FLGFWFGFCNE0220	3/20/1989		16.00		0.65	0.029
21FLGFWFGFCNE0221	3/20/1989		16.00		0.56	0.033
21FLGFWFGFCNE0222	3/20/1989		24.10		0.60	0.046
21FLGFWFGFCNE0219	3/20/1989				0.49	0.078
21FLA 20020138	4/24/1989		14.98	100	1.39	0.105
21FLA 20020080	4/24/1989		17.88	75	1.23	0.053
21FLA 20020139	4/24/1989		26.43	100	1.29	0.061
21FLGFWFGFCNE0219	5/15/1989				0.97	0.036
21FLGFWFGFCNE0220	5/15/1989				1.15	0.059
21FLGFWFGFCNE0221	5/15/1989				1.23	0.052
21FLGFWFGFCNE0222	5/15/1989				1.35	0.059
21FLGFWFGFCNE0221	7/3/1989		4.20		1.10	0.036
21FLGFWFGFCNE0220	7/3/1989		9.00		0.99	0.042
21FLGFWFGFCNE0222	7/3/1989		12.70		1.05	0.052
21FLGFWFGFCNE0219	7/3/1989		36.40		1.25	0.052
21FLA 20020080	8/28/1989		8.97	40	1.06	0.050
21FLA 20020139	8/28/1989		17.80	60	1.02	0.050
21FLA 20020138	8/28/1989		28.44	50	1.13	0.050
21FLGFWFGFCNE0221	9/25/1989		11.20		1.27	0.046
21FLGFWFGFCNE0219	9/25/1989		13.60		1.60	0.046
21FLGFWFGFCNE0220	9/25/1989		24.80		1.37	0.065
21FLGFWFGFCNE0222	9/25/1989		36.00		1.25	0.068

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLGFWFGFCNE0221	12/4/1989				1.08	0.042
21FLGFWFGFCNE0219	12/4/1989		8.00		1.00	0.029
21FLGFWFGFCNE0222	12/4/1989		16.00		1.16	0.046
21FLGFWFGFCNE0220	12/4/1989		24.10			0.072
21FLSJWMLOL	12/5/1989					
21FLGFWFGFCNE0219	2/19/1990		9.60		0.97	0.052
21FLGFWFGFCNE0220	2/19/1990		9.60		1.10	0.068
21FLGFWFGFCNE0221	2/19/1990		9.60			0.046
21FLGFWFGFCNE0222	2/19/1990		22.40			0.059
21FLGFWFGFCNE0219	4/30/1990					0.039
21FLGFWFGFCNE0221	4/30/1990				0.90	0.039
21FLGFWFGFCNE0220	4/30/1990		3.20		0.71	0.052
21FLGFWFGFCNE0222	4/30/1990		24.10		1.42	0.059
21FLGFWFGFCNE0220	7/30/1990		24.10		0.11	0.049
21FLGFWFGFCNE0219	7/30/1990		32.10		0.21	0.088
21FLGFWFGFCNE0221	7/30/1990		32.10		0.24	0.039
21FLGFWFGFCNE0222	7/30/1990		32.10		0.18	0.042
21FLGFWFGFCNE0219	10/29/1990		9.60		1.70	0.055
21FLGFWFGFCNE0221	10/29/1990		19.20		1.55	0.049
21FLGFWFGFCNE0222	10/29/1990		24.10		2.01	0.059
21FLGFWFGFCNE0220	10/29/1990		32.10		1.99	0.065
21FLGFWFGFCNE0219	1/31/1991		10.20		1.69	0.065
21FLGFWFGFCNE0220	1/31/1991		25.40		1.53	0.121
21FLGFWFGFCNE0222	1/31/1991		33.60		2.04	0.098
21FLGFWFGFCNE0221	1/31/1991		43.30		1.88	0.075
21FLGFWFGFCNE0219	4/8/1991		76.90		2.77	0.059
21FLGFWFGFCNE0220	4/8/1991		171.40		3.06	0.062
21FLGFWFGFCNE0221	4/8/1991		180.40		2.74	0.065
21FLGFWFGFCNE0222	4/8/1991		219.50			0.068
21FLGFWFGFCNE0221	7/22/1991		32.10		1.72	0.055
21FLGFWFGFCNE0219	7/22/1991		40.10		1.65	0.055
21FLGFWFGFCNE0220	7/22/1991		48.10		2.07	0.091
21FLGFWFGFCNE0222	7/22/1991		48.10		1.91	0.049
21FLGFWFGFCNE0220	10/14/1991		16.00		1.31	0.082
21FLGFWFGFCNE0221	10/14/1991		32.10			0.075
21FLGFWFGFCNE0222	10/14/1991		32.10		1.04	0.065
21FLGFWFGFCNE0219	10/14/1991		48.10		1.70	0.104
21FLGFWFGFCNE0219	1/21/1992		8.00			0.052
21FLGFWFGFCNE0221	1/21/1992		8.00		1.98	0.059
21FLGFWFGFCNE0220	1/21/1992		16.00		1.34	0.046
21FLGFWFGFCNE0222	1/21/1992		24.00		3.26	0.055

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLGFWFGFCNE0219	4/13/1992		8.00			0.098
21FLGFWFGFCNE0220	4/13/1992		8.00		1.24	0.127
21FLGFWFGFCNE0221	4/13/1992		24.10		1.55	0.075
21FLGFWFGFCNE0222	4/13/1992		24.10		1.82	0.108
21FLGFWFGFCNE0219	7/27/1992					0.059
21FLGFWFGFCNE0220	7/27/1992					0.026
21FLGFWFGFCNE0221	7/27/1992					0.026
21FLGFWFGFCNE0222	7/27/1992					0.052
21FLGFWFGFCNE0221	10/27/1992		6.40		1.35	0.049
21FLGFWFGFCNE0220	10/27/1992		12.80		1.77	0.183
21FLGFWFGFCNE0222	10/27/1992		16.00		1.55	0.062
21FLGFWFGFCNE0219	10/27/1992		19.20			0.068
21FLGFWFGFCNE0219	1/25/1993		6.40		1.10	0.052
21FLGFWFGFCNE0220	1/25/1993		6.40		1.35	0.261
21FLGFWFGFCNE0221	1/25/1993		12.80		1.39	0.072
21FLGFWFGFCNE0222	1/25/1993		22.50		1.71	0.059
21FLGFWFGFCNE0221	4/12/1993		6.80			0.065
21FLGFWFGFCNE0220	4/12/1993		9.30		1.66	0.124
21FLGFWFGFCNE0222	4/12/1993		18.00		1.40	0.088
21FLGFWFGFCNE0219	4/12/1993		48.40		0.81	0.055
21FLGFWFGFCNE0220	7/19/1993		6.40		1.37	0.049
21FLGFWFGFCNE0221	7/19/1993		6.40		1.38	0.052
21FLGFWFGFCNE0219	7/19/1993		12.10		1.44	0.062
21FLGFWFGFCNE0222	7/19/1993		16.00		1.43	0.059
21FLKWATALA-LOCHLOOSA-1	9/3/1993	43.00			1.75	0.045
21FLKWATALA-LOCHLOOSA-3	9/3/1993	49.00			1.73	0.042
21FLKWATALA-LOCHLOOSA-2	9/3/1993	54.00			1.88	0.052
21FLKWATALA-LOCHLOOSA-4	9/3/1993	59.00			1.88	0.046
21FLKWATALA-LOCHLOOSA-4	10/11/1993	77.00			2.02	0.048
21FLKWATALA-LOCHLOOSA-3	10/11/1993	84.00			2.35	0.047
21FLKWATALA-LOCHLOOSA-1	10/11/1993	88.00			2.40	0.047
21FLKWATALA-LOCHLOOSA-2	10/11/1993	91.00			2.37	0.047
21FLGFWFGFCNE0220	10/11/1993		8.00		1.65	0.065
21FLGFWFGFCNE0219	10/11/1993		32.10		2.34	0.078
21FLGFWFGFCNE0221	10/11/1993		32.10		2.13	0.065
21FLGFWFGFCNE0222	10/11/1993		48.10		2.61	0.072
21FLKWATALA-LOCHLOOSA-4	11/30/1993	93.00			2.57	0.063
21FLKWATALA-LOCHLOOSA-1	11/30/1993	98.00			2.51	0.049
21FLKWATALA-LOCHLOOSA-2	11/30/1993	107.00			2.73	0.064
21FLKWATALA-LOCHLOOSA-3	11/30/1993	113.00			2.62	0.063
21FLKWATALA-LOCHLOOSA-4	12/22/1993	78.00			2.75	0.066

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-3	12/22/1993	91.00			2.76	0.067
21FLKWATALA-LOCHLOOSA-1	12/22/1993	95.00			2.81	0.062
21FLKWATALA-LOCHLOOSA-2	12/22/1993	98.00			2.84	0.065
21FLGFWFGFCNE0220	1/18/1994		3.20		1.47	0.166
21FLGFWFGFCNE0219	1/18/1994		40.10		2.77	0.108
21FLGFWFGFCNE0221	1/18/1994		64.10		2.81	0.134
21FLGFWFGFCNE0222	1/18/1994		64.10			0.085
21FLKWATALA-LOCHLOOSA-3	1/25/1994	63.00			2.38	0.066
21FLKWATALA-LOCHLOOSA-4	1/25/1994	63.00			2.40	0.065
21FLKWATALA-LOCHLOOSA-2	1/25/1994	69.00			2.36	0.071
21FLKWATALA-LOCHLOOSA-1	1/25/1994	126.00			2.32	0.058
21FLKWATALA-LOCHLOOSA-4	2/21/1994	62.00			2.12	0.088
21FLKWATALA-LOCHLOOSA-1	2/21/1994	78.00			2.02	0.072
21FLKWATALA-LOCHLOOSA-3	2/21/1994	84.00			2.17	0.072
21FLKWATALA-LOCHLOOSA-2	2/21/1994	88.00			2.18	0.076
21FLKWATALA-LOCHLOOSA-4	3/21/1994	74.00			2.04	0.053
21FLKWATALA-LOCHLOOSA-1	3/21/1994	82.00			1.95	0.054
21FLKWATALA-LOCHLOOSA-2	3/21/1994	82.00			1.94	0.053
21FLKWATALA-LOCHLOOSA-3	3/21/1994	84.00			2.01	0.056
21FLKWATALA-LOCHLOOSA-4	4/25/1994	80.00			2.43	0.063
21FLKWATALA-LOCHLOOSA-3	4/25/1994	88.00			2.09	0.045
21FLKWATALA-LOCHLOOSA-1	4/25/1994	93.00			2.16	0.049
21FLKWATALA-LOCHLOOSA-2	4/25/1994	93.00			2.27	0.045
21FLGFWFGFCNE0220	4/25/1994		40.10		2.29	0.082
21FLGFWFGFCNE0221	4/25/1994		40.10		2.41	0.075
21FLGFWFGFCNE0219	4/25/1994		64.10		2.39	0.095
21FLGFWFGFCNE0222	4/25/1994		80.20			0.068
21FLKWATALA-LOCHLOOSA-3	5/25/1994	41.00			1.69	0.039
21FLKWATALA-LOCHLOOSA-2	5/25/1994	47.00			1.71	0.037
21FLKWATALA-LOCHLOOSA-4	5/25/1994	47.00			1.87	0.042
21FLKWATALA-LOCHLOOSA-1	5/25/1994	50.00			1.69	0.038
21FLKWATALA-LOCHLOOSA-4	6/10/1994	32.00			1.40	0.034
21FLKWATALA-LOCHLOOSA-2	6/10/1994	48.00			1.69	0.041
21FLKWATALA-LOCHLOOSA-1	6/10/1994	49.00			1.69	0.043
21FLKWATALA-LOCHLOOSA-3	6/10/1994	50.00			1.67	0.043
21FLGFWFGFCNE0219	7/1/1994		24.00		1.54	0.055
21FLGFWFGFCNE0222	7/11/1994		32.00		1.52	0.052
21FLGFWFGFCNE0220	7/11/1994		40.10		1.46	0.091
21FLGFWFGFCNE0221	7/11/1994		40.10			0.078
21FLKWATALA-LOCHLOOSA-2	8/1/1994	58.00			1.70	0.031
21FLKWATALA-LOCHLOOSA-3	8/1/1994	58.00			1.75	0.037

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-4	8/1/1994	69.00			1.71	0.031
21FLKWATALA-LOCHLOOSA-1	8/1/1994				1.92	0.047
21FLKWATALA-LOCHLOOSA-1	8/24/1994	103.00			2.20	0.045
21FLKWATALA-LOCHLOOSA-3	8/24/1994	107.00			2.29	0.051
21FLKWATALA-LOCHLOOSA-2	8/24/1994	108.00			2.26	0.050
21FLKWATALA-LOCHLOOSA-4	8/24/1994	113.00			2.34	0.060
21FLKWATALA-LOCHLOOSA-1	9/26/1994	64.00			2.04	0.061
21FLKWATALA-LOCHLOOSA-4	9/26/1994	90.00			2.41	0.050
21FLKWATALA-LOCHLOOSA-3	9/26/1994	103.00			2.23	0.056
21FLKWATALA-LOCHLOOSA-2	9/26/1994	118.00			2.37	0.054
21FLKWATALA-LOCHLOOSA-2	10/24/1994	45.00			1.87	0.041
21FLKWATALA-LOCHLOOSA-4	10/24/1994	47.00			1.93	0.050
21FLKWATALA-LOCHLOOSA-3	10/24/1994	52.00			1.86	0.041
21FLKWATALA-LOCHLOOSA-1	10/24/1994	54.00			1.85	0.037
21FLGFWFGFCNE0220	10/24/1994		56.10		1.99	0.098
21FLGFWFGFCNE0219	10/24/1994		64.10		2.16	0.085
21FLKWATALA-LOCHLOOSA-2	11/29/1994	69.00			2.09	0.046
21FLKWATALA-LOCHLOOSA-3	11/29/1994	80.00			2.03	0.041
21FLKWATALA-LOCHLOOSA-4	11/29/1994	80.00			2.04	0.045
21FLKWATALA-LOCHLOOSA-1	11/29/1994	94.00			2.09	0.045
21FLKWATALA-LOCHLOOSA-1	12/16/1994	93.00			2.05	0.049
21FLKWATALA-LOCHLOOSA-4	12/16/1994	96.00			2.16	0.052
21FLKWATALA-LOCHLOOSA-2	12/16/1994	99.00			2.05	0.045
21FLKWATALA-LOCHLOOSA-3	12/16/1994	100.00			2.10	0.048
21FLGFWFGFCNE0220	1/3/1995		48.10		2.19	0.189
21FLGFWFGFCNE0219	1/3/1995		56.10		2.06	0.163
21FLGFWFGFCNE0221	1/3/1995		56.10		2.42	0.078
21FLGFWFGFCNE0222	1/3/1995		56.10		2.21	0.052
21FLKWATALA-LOCHLOOSA-3	1/24/1995	57.00			2.27	0.068
21FLKWATALA-LOCHLOOSA-2	1/24/1995	60.00			2.19	0.061
21FLKWATALA-LOCHLOOSA-4	1/24/1995	62.00			2.17	0.064
21FLKWATALA-LOCHLOOSA-1	1/24/1995	68.00			2.23	0.060
21FLKWATALA-LOCHLOOSA-4	2/16/1995	48.00			2.07	0.060
21FLKWATALA-LOCHLOOSA-3	2/16/1995	53.00			2.02	0.053
21FLKWATALA-LOCHLOOSA-1	2/16/1995	55.00			2.01	0.055
21FLKWATALA-LOCHLOOSA-2	2/16/1995	56.00			2.02	0.051
21FLKWATALA-LOCHLOOSA-1	3/10/1995	111.00			2.36	0.069
21FLKWATALA-LOCHLOOSA-4	3/10/1995	111.00			2.70	0.085
21FLKWATALA-LOCHLOOSA-3	3/10/1995	114.00			2.50	0.075
21FLKWATALA-LOCHLOOSA-2	3/10/1995	123.00			2.41	0.075
21FLGFWFGFCNE0219	4/24/1995		19.20		2.16	0.091

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLGFWFGFCNE0222	4/24/1995		19.20		2.02	0.055
21FLGFWFGFCNE0221	4/24/1995		28.90		2.15	0.075
21FLGFWFGFCNE0220	4/24/1995		32.10		1.88	0.085
21FLKWATALA-LOCHLOOSA-1	4/28/1995	11.00			1.65	0.043
21FLKWATALA-LOCHLOOSA-2	4/28/1995	13.00			1.67	0.045
21FLKWATALA-LOCHLOOSA-4	4/28/1995	15.00			1.79	0.049
21FLKWATALA-LOCHLOOSA-3	4/28/1995	16.00			1.79	0.040
21FLKWATALA-LOCHLOOSA-1	5/22/1995	32.00			1.34	0.051
21FLKWATALA-LOCHLOOSA-2	5/22/1995	33.00			1.40	0.052
21FLKWATALA-LOCHLOOSA-3	5/22/1995	33.00			1.33	0.051
21FLKWATALA-LOCHLOOSA-4	5/22/1995	33.00			1.36	0.051
21FLKWATALA-LOCHLOOSA-1	6/22/1995	17.00			0.99	0.036
21FLKWATALA-LOCHLOOSA-2	6/22/1995	18.00			1.00	0.035
21FLKWATALA-LOCHLOOSA-3	6/22/1995	18.00			1.03	0.033
21FLKWATALA-LOCHLOOSA-4	6/22/1995	18.00			1.01	0.034
21FLKWATALA-LOCHLOOSA-4	7/12/1995	26.00			1.08	0.036
21FLKWATALA-LOCHLOOSA-3	7/12/1995	29.00			1.02	0.033
21FLKWATALA-LOCHLOOSA-2	7/12/1995	30.00			1.02	0.049
21FLKWATALA-LOCHLOOSA-1	7/12/1995	31.00			1.09	0.044
21FLGFWFGFCNE0221	7/31/1995		9.60		1.39	0.082
21FLGFWFGFCNE0219	7/31/1995		19.20		1.15	0.072
21FLGFWFGFCNE0222	7/31/1995		19.20		1.23	0.072
21FLGFWFGFCNE0220	7/31/1995		22.40		1.31	0.091
21FLKWATALA-LOCHLOOSA-2	8/8/1995	11.00			0.99	0.032
21FLKWATALA-LOCHLOOSA-1	8/8/1995	13.00			0.97	0.027
21FLKWATALA-LOCHLOOSA-3	8/8/1995	15.00			1.00	0.035
21FLKWATALA-LOCHLOOSA-4	8/8/1995	16.00			0.97	0.028
21FLKWATALA-LOCHLOOSA-1	9/19/1995	23.00			1.10	0.038
21FLKWATALA-LOCHLOOSA-4	9/19/1995	23.00			1.08	0.036
21FLKWATALA-LOCHLOOSA-2	9/19/1995	24.00			1.06	0.040
21FLKWATALA-LOCHLOOSA-3	9/19/1995	27.00			1.08	0.043
21FLKWATALA-LOCHLOOSA-4	10/13/1995	32.00			1.09	0.042
21FLKWATALA-LOCHLOOSA-1	10/13/1995	34.00			1.06	0.034
21FLKWATALA-LOCHLOOSA-2	10/13/1995	34.00			1.09	0.039
21FLKWATALA-LOCHLOOSA-3	10/13/1995	34.00			1.14	0.037
21FLGFWFGFCNE0220	10/16/1995				1.40	0.104
21FLGFWFGFCNE0219	10/16/1995		24.10		1.32	0.068
21FLGFWFGFCNE0221	10/16/1995		32.10		1.52	0.098
21FLGFWFGFCNE0222	10/16/1995		40.10		1.56	0.078
21FLKWATALA-LOCHLOOSA-2	11/20/1995	20.00			0.99	0.028
21FLKWATALA-LOCHLOOSA-3	11/20/1995	22.00			1.03	0.026

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-1	11/20/1995	24.00			1.02	0.031
21FLKWATALA-LOCHLOOSA-4	11/20/1995	24.00			1.03	0.034
21FLKWATALA-LOCHLOOSA-1	12/14/1995	27.00			1.14	0.034
21FLKWATALA-LOCHLOOSA-2	12/14/1995	27.00			1.16	0.036
21FLKWATALA-LOCHLOOSA-4	12/14/1995	27.00			1.17	0.035
21FLKWATALA-LOCHLOOSA-3	12/14/1995	28.00			1.20	0.037
21FLKWATALA-LOCHLOOSA-4	1/11/1996	28.00			1.09	0.042
21FLKWATALA-LOCHLOOSA-2	1/11/1996	30.00			1.08	0.039
21FLKWATALA-LOCHLOOSA-3	1/11/1996	32.00			1.02	0.037
21FLKWATALA-LOCHLOOSA-1	1/11/1996	33.00			1.08	0.042
21FLGFWF03080102-LL-02	1/22/1996				1.01	0.166
21FLGFWFGFCNE0220	1/22/1996				1.01	0.166
21FLGFWF03080102-LL-03	1/22/1996		24.00		1.28	0.062
21FLGFWFGFCNE0221	1/22/1996		24.00		1.28	0.062
21FLGFWF03080102-LL-01	1/22/1996		32.00		1.34	0.062
21FLGFWF03080102-LL-04	1/22/1996		32.00		1.24	0.059
21FLGFWFGFCNE0219	1/22/1996		32.00		1.34	0.062
21FLGFWFGFCNE0222	1/22/1996		32.00		1.24	0.059
21FLKWATALA-LOCHLOOSA-3	2/26/1996	17.00			1.05	0.035
21FLKWATALA-LOCHLOOSA-1	2/26/1996	18.00			1.03	0.034
21FLKWATALA-LOCHLOOSA-2	2/26/1996	18.00			1.00	0.034
21FLKWATALA-LOCHLOOSA-4	2/26/1996	20.00			1.10	0.036
21FLKWATALA-LOCHLOOSA-4	3/29/1996	31.00			1.13	0.045
21FLKWATALA-LOCHLOOSA-3	3/29/1996	33.00			1.18	0.044
21FLKWATALA-LOCHLOOSA-2	3/29/1996	34.00			1.17	0.046
21FLKWATALA-LOCHLOOSA-1	3/29/1996	36.00			1.23	0.050
21FLKWATALA-LOCHLOOSA-2	4/18/1996	34.00			1.11	0.038
21FLKWATALA-LOCHLOOSA-3	4/18/1996	35.00			1.12	0.040
21FLKWATALA-LOCHLOOSA-4	4/18/1996	35.00			1.14	0.043
21FLKWATALA-LOCHLOOSA-1	4/18/1996	39.00			1.13	0.046
21FLGFWF03080102-LL-02	4/22/1996		8.00		0.67	0.049
21FLGFWFGFCNE0220	4/22/1996		8.00		0.67	0.049
21FLGFWF03080102-LL-01	4/22/1996		26.70		0.46	0.062
21FLGFWFGFCNE0219	4/22/1996		26.70		0.46	0.062
21FLGFWF03080102-LL-03	4/22/1996		28.00		0.73	0.065
21FLGFWFGFCNE0221	4/22/1996		28.00		0.73	0.065
21FLGFWF03080102-LL-04	4/22/1996		32.00			0.059
21FLGFWFGFCNE0222	4/22/1996		32.00			0.059
21FLKWATALA-LOCHLOOSA-2	5/29/1996	70.00			1.88	0.057
21FLKWATALA-LOCHLOOSA-3	5/29/1996	91.00			1.90	0.055
21FLKWATALA-LOCHLOOSA-4	5/29/1996	91.00			2.02	0.064

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-1	5/29/1996	97.00			1.82	0.058
21FLKWATALA-LOCHLOOSA-3	6/24/1996	106.00			2.12	0.038
21FLKWATALA-LOCHLOOSA-4	6/24/1996	109.00			2.19	0.052
21FLKWATALA-LOCHLOOSA-1	6/24/1996	112.00			2.15	0.037
21FLKWATALA-LOCHLOOSA-2	6/24/1996	116.00			2.19	0.043
21FLGFWF03080102-LL-02	7/1/1996		49.70		1.30	0.065
21FLGFWF03080102-LL-01	7/1/1996		92.90		1.90	0.059
21FLGFWF03080102-LL-03	7/1/1996		117.70		2.02	0.049
21FLGFWF03080102-LL-04	7/1/1996				2.01	0.046
21FLKWATALA-LOCHLOOSA-1	7/29/1996	77.00			1.96	0.037
21FLKWATALA-LOCHLOOSA-3	7/29/1996	77.00			2.05	0.042
21FLKWATALA-LOCHLOOSA-4	7/29/1996	83.00			2.03	0.042
21FLKWATALA-LOCHLOOSA-2	7/29/1996	86.00			2.01	0.040
21FLKWATALA-LOCHLOOSA-1	8/21/1996	125.00			2.00	0.054
21FLKWATALA-LOCHLOOSA-3	8/21/1996	143.00			1.88	0.055
21FLKWATALA-LOCHLOOSA-4	8/21/1996	149.00			1.75	0.059
21FLKWATALA-LOCHLOOSA-2	8/21/1996				2.35	0.056
21FLSJWMLOL	9/10/1996	115.00	103.00	70		0.058
21FLKWATALA-LOCHLOOSA-3	9/25/1996	116.00			2.49	0.052
21FLKWATALA-LOCHLOOSA-2	9/25/1996	135.00			2.56	0.055
21FLKWATALA-LOCHLOOSA-4	9/25/1996	135.00			2.45	0.053
21FLKWATALA-LOCHLOOSA-1	9/25/1996	140.00			2.55	0.052
21FLGFWF03080102-LL-02	10/14/1996		84.90		2.48	0.078
21FLGFWF03080102-LL-01	10/14/1996		108.10		2.84	0.065
21FLGFWF03080102-LL-03	10/14/1996		140.20		3.07	0.075
21FLGFWF03080102-LL-04	10/14/1996		148.20		3.05	0.085
21FLKWATALA-LOCHLOOSA-4	10/28/1996	72.00			2.32	0.050
21FLKWATALA-LOCHLOOSA-2	10/28/1996	94.00			2.33	0.045
21FLKWATALA-LOCHLOOSA-1	10/28/1996	98.00			2.29	0.046
21FLKWATALA-LOCHLOOSA-3	10/28/1996				2.34	0.052
21FLKWATALA-LOCHLOOSA-3	11/21/1996	69.00			2.12	0.043
21FLKWATALA-LOCHLOOSA-2	11/21/1996	75.00			2.17	0.044
21FLKWATALA-LOCHLOOSA-4	11/21/1996	76.00			2.17	0.045
21FLKWATALA-LOCHLOOSA-1	11/21/1996	78.00			2.17	0.044
21FLKWATALA-LOCHLOOSA-2	12/23/1996	44.00			2.09	0.051
21FLKWATALA-LOCHLOOSA-3	12/23/1996	63.00			2.08	0.048
21FLKWATALA-LOCHLOOSA-4	12/23/1996	67.00			2.03	0.051
21FLKWATALA-LOCHLOOSA-1	12/23/1996	77.00			1.97	0.051
21FLSJWMLOL	1/8/1997	57.60	49.40	100	2.39	0.062
21FLKWATALA-LOCHLOOSA-1	1/31/1997	71.00			1.95	0.050
21FLKWATALA-LOCHLOOSA-3	1/31/1997	73.00			2.01	0.049

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-4	1/31/1997	74.00			2.08	0.053
21FLKWATALA-LOCHLOOSA-2	1/31/1997	76.00			2.07	0.053
21FLGFWF03080102-LL-02	2/10/1997		40.10		1.91	0.114
21FLGFWF03080102-LL-01	2/10/1997		48.10		2.07	0.166
21FLGFWF03080102-LL-03	2/10/1997		80.20		2.51	0.059
21FLGFWF03080102-LL-04	2/10/1997		88.20		2.52	0.062
21FLKWATALA-LOCHLOOSA-1	2/21/1997	83.00			2.13	0.061
21FLKWATALA-LOCHLOOSA-2	2/21/1997	85.00			2.10	0.059
21FLKWATALA-LOCHLOOSA-4	2/21/1997	85.00			2.14	0.064
21FLKWATALA-LOCHLOOSA-3	2/21/1997	88.00			2.10	0.061
21FLSJWMLOL	3/5/1997	63.50	61.80	50	2.44	0.058
21FLKWATALA-LOCHLOOSA-3	3/20/1997	107.00			2.90	0.060
21FLKWATALA-LOCHLOOSA-2	3/20/1997	121.00			2.53	0.066
21FLKWATALA-LOCHLOOSA-4	3/20/1997	123.00			2.66	0.071
21FLKWATALA-LOCHLOOSA-1	3/20/1997	128.00			2.57	0.063
21FLSJWMLLOCHL	4/24/1997	51.91	48.06	40	2.30	0.077
21FLSJWMLOCHLS	4/24/1997	60.28	56.07	40	2.27	0.080
21FLKWATALA-LOCHLOOSA-2	4/24/1997	61.00			1.99	0.055
21FLKWATALA-LOCHLOOSA-3	4/24/1997	63.00			2.09	0.057
21FLKWATALA-LOCHLOOSA-4	4/24/1997	77.00			2.09	0.059
21FLKWATALA-LOCHLOOSA-1	4/24/1997	91.00			2.22	0.064
21FLSJWMLOCHLN	4/24/1997			40	2.42	0.083
21FLGFWF03080102-LL-01	4/28/1997		35.20		2.10	0.082
21FLGFWF03080102-LL-02	4/28/1997		47.30		4.49	0.238
21FLGFWF03080102-LL-03	4/28/1997		48.90		2.91	0.088
21FLGFWF03080102-LL-04	4/28/1997		54.50		2.61	0.068
21FLSJWMLLOCHL	5/20/1997	25.13	23.03	50	1.48	0.058
21FLSJWMLOCHLS	5/20/1997	25.15	23.36	50	1.47	0.062
21FLSJWMLOCHLN	5/20/1997	29.35	27.59	50	0.99	0.001
21FLSJWMLOL	5/27/1997	21.50	19.20	120	1.32	0.077
21FLKWATALA-LOCHLOOSA-2	5/29/1997	36.00			1.14	0.046
21FLKWATALA-LOCHLOOSA-3	5/29/1997	42.00			1.15	0.046
21FLKWATALA-LOCHLOOSA-4	5/29/1997	42.00			1.25	0.049
21FLKWATALA-LOCHLOOSA-1	5/29/1997	46.00			1.17	0.047
21FLKWATALA-LOCHLOOSA-1	6/23/1997	13.00			0.90	0.032
21FLKWATALA-LOCHLOOSA-3	6/23/1997	14.00			0.93	0.029
21FLKWATALA-LOCHLOOSA-2	6/23/1997	15.00			0.90	0.033
21FLKWATALA-LOCHLOOSA-4	6/23/1997	17.00			0.95	0.033
21FLSJWMLOCHLN	6/25/1997	15.51	12.46	50	1.04	0.041
21FLSJWMLOCHLS	6/25/1997	17.52	16.47	50	1.05	0.042
21FLSJWMLLOCHL	6/25/1997	20.44	18.02	50	1.13	0.041

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-1	7/17/1997	12.00			0.68	0.025
21FLKWATALA-LOCHLOOSA-2	7/17/1997	14.00			0.74	0.027
21FLKWATALA-LOCHLOOSA-3	7/17/1997	15.00			0.74	0.031
21FLKWATALA-LOCHLOOSA-4	7/17/1997	16.00			0.84	0.034
21FLSJWMLOCHLS	7/22/1997	14.22	12.68	30	0.96	0.029
21FLSJWMLOCHLN	7/22/1997	14.25	12.68	40	1.02	0.021
21FLSJWMLLOCHL	7/22/1997	18.80	16.69	40	1.10	0.028
21FLSJWMLOL	7/22/1997			40	1.06	0.041
21FLGFWF03080102-LL-03	8/11/1997		19.20		2.25	0.016
21FLGFWF03080102-LL-02	8/11/1997		19.80		1.39	0.085
21FLGFWF03080102-LL-01	8/11/1997		25.60		1.36	0.052
21FLGFWF03080102-LL-04	8/11/1997		27.20		1.37	0.055
21FLKWATALA-LOCHLOOSA-3	8/13/1997	17.00			1.02	0.034
21FLKWATALA-LOCHLOOSA-2	8/13/1997	20.00			1.06	0.031
21FLKWATALA-LOCHLOOSA-4	8/13/1997	20.00			1.03	0.033
21FLKWATALA-LOCHLOOSA-1	8/13/1997	23.00			0.83	0.032
21FLSJWMLOCHLS	8/19/1997	28.55	25.37	30	1.22	0.052
21FLSJWMLOCHLN	8/19/1997	31.13	28.37	30	1.28	0.054
21FLSJWMLLOCHL	8/19/1997	36.64	32.04	30	1.40	0.058
21FLSJWMLOL	9/10/1997	66.00	62.60	30	1.77	0.051
21FLSJWMLLOCHL	9/22/1997	52.34	48.33	40	1.87	0.039
21FLSJWMLOCHLN	9/22/1997	83.27	77.61	40	2.31	0.061
21FLSJWMLOCHLS	9/22/1997	94.51	84.73	40	0.88	0.010
21FLKWATALA-LOCHLOOSA-4	9/29/1997	61.00			1.91	0.044
21FLKWATALA-LOCHLOOSA-1	9/29/1997	80.00			2.18	0.061
21FLKWATALA-LOCHLOOSA-3	9/29/1997	81.00			2.21	0.061
21FLKWATALA-LOCHLOOSA-2	9/29/1997	90.00			1.90	0.065
21FLSJWMLOCHLN	10/14/1997	116.52	110.81	50	2.52	0.085
21FLSJWMLLOCHL	10/14/1997	118.93	109.34	50	2.63	0.082
21FLSJWMLOCHLS	10/14/1997	126.86	108.94	50	2.68	0.091
21FLKWATALA-LOCHLOOSA-4	10/23/1997	130.00			2.43	0.065
21FLKWATALA-LOCHLOOSA-2	10/23/1997	149.00			2.54	0.075
21FLKWATALA-LOCHLOOSA-3	10/23/1997	150.00			2.54	0.067
21FLKWATALA-LOCHLOOSA-1	10/23/1997	161.00			2.53	0.075
21FLA 20020080	10/29/1997		92.40		2.60	0.081
21FLSJWMLOL	11/5/1997	134.00	106.00		4.19	0.033
21FLGFWF03080102-LL-01	11/17/1997		8.00		1.52	0.052
21FLGFWF03080102-LL-02	11/17/1997		88.20		2.43	0.140
21FLGFWF03080102-LL-03	11/17/1997		88.20		2.67	0.124
21FLGFWF03080102-LL-04	11/17/1997		128.30		3.06	0.104
21FLSJWMLOCHLN	11/18/1997	123.78	119.75	60	2.92	0.087

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLSJWMLOCHLS	11/18/1997	133.01	127.69	50	2.97	0.079
21FLSJWMLLOCHL	11/19/1997	106.47	102.39	40	2.44	0.070
21FLKWATALA-LOCHLOOSA-4	12/4/1997	57.00			2.15	0.047
21FLKWATALA-LOCHLOOSA-1	12/4/1997	127.00			2.59	0.080
21FLKWATALA-LOCHLOOSA-3	12/4/1997	127.00			2.42	0.072
21FLKWATALA-LOCHLOOSA-2	12/4/1997	128.00			2.64	0.075
21FLSJWMLOCHLN	12/16/1997	67.15	61.14	60	3.00	0.059
21FLSJWMLOCHLS	12/16/1997	141.22	131.10	50	2.84	0.056
21FLSJWMLLOCHL	12/16/1997	152.66	150.19	40	0.73	0.001
21FLSJWMLOCHLN	1/13/1998	73.05	66.71	400	1.86	0.092
21FLSJWMLOCHLS	1/13/1998	91.59	84.64	250	2.18	0.082
21FLSJWMLLOCHL	1/14/1998	86.83	80.63	150	2.04	0.078
21FLSJWMLOL	1/21/1998	107.00	80.10	180	2.44	0.164
21FLKWATALA-LOCHLOOSA-4	1/30/1998	81.00			1.54	0.058
21FLKWATALA-LOCHLOOSA-1	1/30/1998	83.00			1.81	0.065
21FLKWATALA-LOCHLOOSA-2	1/30/1998	88.00			1.74	0.061
21FLKWATALA-LOCHLOOSA-3	1/30/1998	92.00			1.63	0.067
21FLSJWMLOCHLN	2/10/1998	44.28	39.52	400	1.78	0.108
21FLSJWMLOCHLS	2/10/1998	69.71	65.25	300	2.00	0.073
21FLSJWMLLOCHL	2/10/1998	69.84	66.17	300	1.76	0.114
21FLKWATALA-LOCHLOOSA-3	2/24/1998	69.00			1.67	0.081
21FLKWATALA-LOCHLOOSA-1	2/24/1998	78.00			1.60	0.077
21FLKWATALA-LOCHLOOSA-2	2/24/1998	89.00			1.69	0.072
21FLKWATALA-LOCHLOOSA-4	2/24/1998	89.00			1.51	0.066
21FLGFWF03080102-LL-01	3/2/1998		28.90			0.098
21FLGFWF03080102-LL-02	3/2/1998		35.30		1.55	0.121
21FLGFWF03080102-LL-04	3/2/1998		44.90		1.57	0.124
21FLGFWF03080102-LL-03	3/2/1998		54.50		1.92	0.134
21FLSJWMLOCHLN	3/10/1998	50.74	44.95	500	1.56	0.077
21FLSJWMLLOCHL	3/10/1998	59.16	53.09	400	1.62	0.092
21FLSJWMLOCHLS	3/10/1998	65.24	57.18	400	1.58	0.106
21FLSJWMLOL	3/23/1998	59.80	43.60	180	1.54	0.067
21FLKWATALA-LOCHLOOSA-4	3/26/1998	44.00			1.22	0.063
21FLKWATALA-LOCHLOOSA-1	3/26/1998	50.00			1.42	0.064
21FLKWATALA-LOCHLOOSA-3	3/26/1998	53.00			1.43	0.061
21FLKWATALA-LOCHLOOSA-2	3/26/1998	58.00			1.44	0.061
21FLSJWMLOCHLN	4/7/1998	37.91	31.41	400	1.54	0.078
21FLSJWMLOCHLS	4/7/1998	41.11	36.18	400	1.50	0.072
21FLKWATALA-LOCHLOOSA-4	4/29/1998	75.00			1.50	0.066
21FLKWATALA-LOCHLOOSA-1	4/29/1998	76.00			1.62	0.064
21FLKWATALA-LOCHLOOSA-2	4/29/1998	76.00			1.65	0.057

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-3	4/29/1998	80.00			1.63	0.052
21FLGFWF03080102-LL-02	5/11/1998		94.90		1.94	0.049
21FLGFWF03080102-LL-01	5/11/1998		100.10		1.90	0.042
21FLGFWF03080102-LL-04	5/11/1998		100.10		1.89	0.049
21FLGFWF03080102-LL-03	5/11/1998		108.90		2.10	0.049
21FLSJWMLOCHLS	5/12/1998	96.42	94.79	400	1.79	0.069
21FLSJWMLLOCHL	5/12/1998	96.65	89.45	400	1.73	0.077
21FLSJWMLOCHLN	5/12/1998	108.60	104.58	400	1.78	0.062
21FLSJWMLOL	5/19/1998	96.70	86.80	250	2.84	0.056
21FLKWATALA-LOCHLOOSA-2	5/28/1998	58.00			1.76	0.056
21FLKWATALA-LOCHLOOSA-4	5/28/1998	65.00			1.82	0.068
21FLKWATALA-LOCHLOOSA-1	5/28/1998	68.00			1.72	0.058
21FLKWATALA-LOCHLOOSA-3	5/28/1998	73.00			1.85	0.053
21FLSJWMLOL	7/15/1998	87.60	81.90	120	2.87	0.064
21FLKWATALA-LOCHLOOSA-4	7/16/1998	141.00			2.15	0.064
21FLKWATALA-LOCHLOOSA-1	7/16/1998	148.00			2.17	0.066
21FLKWATALA-LOCHLOOSA-3	7/16/1998	150.00			2.17	0.061
21FLKWATALA-LOCHLOOSA-2	7/16/1998	154.00			2.38	0.067
21FLGFWF03080102-LL-03	8/10/1998		123.40		2.74	0.088
21FLGFWF03080102-LL-01	8/10/1998		125.80		2.47	0.085
21FLGFWF03080102-LL-02	8/10/1998		128.20		2.79	0.085
21FLGFWF03080102-LL-04	8/10/1998		135.40		2.67	0.075
21FLKWATALA-LOCHLOOSA-4	8/25/1998	148.00			2.34	0.064
21FLKWATALA-LOCHLOOSA-2	8/25/1998	167.00			2.25	0.063
21FLKWATALA-LOCHLOOSA-3	8/25/1998	175.00			2.33	0.064
21FLKWATALA-LOCHLOOSA-1	8/25/1998	178.00			2.30	0.061
21FLSJWMLOL	9/15/1998	166.00	155.00	70	2.06	0.068
21FLKWATALA-LOCHLOOSA-4	9/28/1998	133.00			1.99	0.053
21FLKWATALA-LOCHLOOSA-1	9/28/1998	160.00			2.12	0.055
21FLKWATALA-LOCHLOOSA-3	9/28/1998	163.00			2.18	0.053
21FLKWATALA-LOCHLOOSA-2	9/28/1998	167.00			2.14	0.054
21FLSJWMLOL	10/15/1998	132.78	124.96	150	2.69	0.056
21FLKWATALA-LOCHLOOSA-4	10/26/1998	130.00			1.99	0.055
21FLKWATALA-LOCHLOOSA-1	10/26/1998	148.00			1.95	0.054
21FLKWATALA-LOCHLOOSA-3	10/26/1998	161.00			2.16	0.057
21FLKWATALA-LOCHLOOSA-2	10/26/1998	163.00			1.99	0.060
21FLKWATALA-LOCHLOOSA-4	11/23/1998	159.00			2.34	0.052
21FLKWATALA-LOCHLOOSA-3	11/23/1998	186.00			2.55	0.059
21FLKWATALA-LOCHLOOSA-1	11/23/1998	191.00			2.35	0.057
21FLKWATALA-LOCHLOOSA-2	11/23/1998	194.00			2.40	0.058
21FLGFWF03080102-LL-01	11/23/1998		100.90		1.99	0.085

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLGFWF03080102-LL-03	11/23/1998		130.60		2.48	0.091
21FLGFWF03080102-LL-02	11/23/1998		154.60		2.54	0.078
21FLGFWF03080102-LL-04	11/23/1998		157.80		2.36	0.078
21FLKWATALA-LOCHLOOSA-2	12/28/1998	96.00			2.65	0.058
21FLKWATALA-LOCHLOOSA-3	12/28/1998	96.00			2.37	0.053
21FLKWATALA-LOCHLOOSA-4	12/28/1998	122.00			2.45	0.057
21FLKWATALA-LOCHLOOSA-1	12/28/1998	177.00			2.36	0.052
21FLSJWMLOL	1/19/1999	122.60	116.77	80	2.98	0.064
21FLKWATALA-LOCHLOOSA-3	1/25/1999	150.00			2.53	0.063
21FLKWATALA-LOCHLOOSA-4	1/25/1999	151.00			2.50	0.061
21FLKWATALA-LOCHLOOSA-1	1/25/1999	156.00			2.54	0.067
21FLKWATALA-LOCHLOOSA-2	1/25/1999	162.00			2.62	0.060
21FLSJWMLOL	2/19/1999	153.65	149.61	80	3.02	0.087
21FLKWATALA-LOCHLOOSA-4	2/25/1999	139.00			2.18	0.060
21FLKWATALA-LOCHLOOSA-2	2/25/1999	143.00			2.27	0.064
21FLKWATALA-LOCHLOOSA-3	2/25/1999	143.00			2.12	0.060
21FLKWATALA-LOCHLOOSA-1	2/25/1999	144.00			2.23	0.059
21FLGFWF03080102-LL-01	3/15/1999		40.10		1.93	0.082
21FLGFWF03080102-LL-04	3/15/1999		136.30		3.52	0.130
21FLGFWF03080102-LL-03	3/15/1999		144.30		3.66	0.117
21FLGFWF03080102-LL-02	3/15/1999		152.40		3.72	0.101
21FLKWATALA-LOCHLOOSA-3	3/24/1999	91.00			2.49	0.064
21FLKWATALA-LOCHLOOSA-4	3/24/1999	116.00			2.48	0.068
21FLKWATALA-LOCHLOOSA-2	3/24/1999	130.00			2.41	0.063
21FLKWATALA-LOCHLOOSA-1	3/24/1999	144.00			2.50	0.068
21FLSJWMLOL	4/20/1999	273.21	265.26	70	4.29	0.099
21FLKWATALA-LOCHLOOSA-2	4/30/1999	284.00			3.23	0.083
21FLKWATALA-LOCHLOOSA-3	4/30/1999	285.00			3.17	0.074
21FLKWATALA-LOCHLOOSA-1	4/30/1999	295.00			3.37	0.084
21FLKWATALA-LOCHLOOSA-4	4/30/1999	304.00			3.22	0.085
21FLGFWF03080102-LL-01	5/24/1999		64.10		3.54	0.068
21FLGFWF03080102-LL-02	5/24/1999		144.30		3.47	0.059
21FLGFWF03080102-LL-03	5/24/1999		144.30		3.63	0.065
21FLGFWF03080102-LL-04	5/24/1999		232.60		3.82	0.072
21FLKWATALA-LOCHLOOSA-4	5/25/1999	181.00			3.91	0.067
21FLKWATALA-LOCHLOOSA-3	5/25/1999	214.00			3.89	0.079
21FLKWATALA-LOCHLOOSA-1	5/25/1999	248.00			3.69	0.074
21FLKWATALA-LOCHLOOSA-2	5/25/1999	301.00			3.98	0.076
21FLSJWMLOL	6/10/1999	99.51	94.46	50	3.27	0.088
21FLKWATALA-LOCHLOOSA-1	7/1/1999	8.00			1.36	0.019
21FLKWATALA-LOCHLOOSA-4	7/1/1999	15.00			1.41	0.026

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-2	7/1/1999	30.00			1.59	0.035
21FLKWATALA-LOCHLOOSA-3	7/1/1999	30.00			1.63	0.035
21FLKWATALA-LOCHLOOSA-1	7/27/1999	15.00			1.21	0.040
21FLKWATALA-LOCHLOOSA-2	7/27/1999	19.00			1.06	0.039
21FLKWATALA-LOCHLOOSA-3	7/27/1999	20.00			1.25	0.048
21FLKWATALA-LOCHLOOSA-4	7/27/1999	23.00			1.24	0.059
21FLSJWMLOL	8/5/1999	57.13	50.25	40	1.99	0.079
21FLKWATALA-LOCHLOOSA-2	8/18/1999	105.00			1.18	0.058
21FLKWATALA-LOCHLOOSA-3	8/18/1999	106.00			1.22	0.056
21FLKWATALA-LOCHLOOSA-1	8/18/1999	111.00			1.19	0.063
21FLKWATALA-LOCHLOOSA-4	8/18/1999	124.00			1.36	0.074
21FLGFWF03080102-LL-04	8/30/1999		136.20		2.95	0.068
21FLGFWF03080102-LL-01	8/30/1999		145.80		3.24	0.104
21FLGFWF03080102-LL-02	8/30/1999		146.60		3.04	0.075
21FLGFWF03080102-LL-03	8/30/1999		157.80		3.31	0.072
21FLKWATALA-LOCHLOOSA-4	9/29/1999	160.00			1.50	0.080
21FLKWATALA-LOCHLOOSA-2	9/29/1999	173.00			1.56	0.072
21FLKWATALA-LOCHLOOSA-3	9/29/1999	182.00			1.56	0.073
21FLKWATALA-LOCHLOOSA-1	9/29/1999	183.00			1.51	0.073
21FLSJWMLOL	10/27/1999	187.07	178.05	70	3.95	0.091
21FLKWATALA-LOCHLOOSA-2	11/29/1999	251.00			3.86	0.071
21FLKWATALA-LOCHLOOSA-1	11/29/1999	253.00			3.60	0.073
21FLKWATALA-LOCHLOOSA-4	11/29/1999	254.00			3.79	0.073
21FLKWATALA-LOCHLOOSA-3	11/29/1999	257.00			3.64	0.071
21FLGFWF03080102-LL-01	12/1/1999		213.10		4.25	0.111
21FLGFWF03080102-LL-02	12/1/1999		236.30		4.61	0.117
21FLGFWF03080102-LL-03	12/1/1999		239.50		5.01	0.121
21FLGFWF03080102-LL-04	12/1/1999	-	259.50		3.93	0.121
21FLSJWMLOL	12/27/1999	230.96	219.25	60	5.07	0.102
21FLKWATALA-LOCHLOOSA-4	1/19/2000	222.00			4.97	0.089
21FLKWATALA-LOCHLOOSA-2	1/19/2000	243.00			5.20	0.094
21FLKWATALA-LOCHLOOSA-1	1/19/2000	245.00			4.99	0.096
21FLKWATALA-LOCHLOOSA-3	1/19/2000	245.00			4.94	0.087
21FLKWATALA-LOCHLOOSA-3	2/9/2000	190.00			5.09	0.087
21FLKWATALA-LOCHLOOSA-2	2/9/2000	192.00			5.01	0.088
21FLKWATALA-LOCHLOOSA-1	2/9/2000	196.00			5.08	0.084
21FLKWATALA-LOCHLOOSA-4	2/9/2000	196.00			4.95	0.103
21FLSJWMLOL	2/17/2000	170.96	167.08	50	4.56	0.077
21FLKWATALA-LOCHLOOSA-1	3/13/2000	276.00			4.44	0.097
21FLKWATALA-LOCHLOOSA-3	3/13/2000	279.00			4.59	0.098
21FLKWATALA-LOCHLOOSA-2	3/13/2000	282.00			4.75	0.088

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-4	3/13/2000	294.00			4.49	0.107
21FLGFWF03080102-LL-01	3/20/2000		194.00		3.69	0.127
21FLGFWF03080102-LL-02	3/20/2000		231.00		6.75	0.111
21FLGFWF03080102-LL-03	3/20/2000		231.00		6.30	0.104
21FLGFWF03080102-LL-04	3/20/2000		253.00		5.32	0.104
21FLSJWMLOL	4/24/2000	184.43	177.49	30	6.06	0.102
21FLKWATALA-LOCHLOOSA-4	4/27/2000	346.00			5.83	0.119
21FLKWATALA-LOCHLOOSA-3	4/27/2000	347.00			6.15	0.124
21FLKWATALA-LOCHLOOSA-2	4/27/2000	349.00			5.95	0.114
21FLKWATALA-LOCHLOOSA-1	4/27/2000	353.00			6.16	0.115
21FLKWATALA-LOCHLOOSA-3	5/17/2000	291.00			6.28	0.111
21FLKWATALA-LOCHLOOSA-1	5/17/2000	318.00			6.49	0.108
21FLKWATALA-LOCHLOOSA-4	5/17/2000	323.00			6.95	0.124
21FLKWATALA-LOCHLOOSA-2	5/17/2000	336.00			6.12	0.100
21FLGFWF03080102-LL-01	5/22/2000		227.50		8.83	0.297
21FLGFWF03080102-LL-03	5/22/2000		233.90		7.31	0.179
21FLGFWF03080102-LL-02	5/22/2000		272.30		7.55	0.179
21FLGFWF03080102-LL-04	5/22/2000		285.20		7.08	0.157
21FLSJWMLOL	6/15/2000	182.15	165.26	50	7.57	0.146
21FLKWATALA-LOCHLOOSA-3	6/27/2000	201.00			5.55	0.089
21FLKWATALA-LOCHLOOSA-2	6/27/2000	239.00			5.84	0.101
21FLKWATALA-LOCHLOOSA-4	6/27/2000	260.00			5.86	0.096
21FLKWATALA-LOCHLOOSA-1	6/27/2000	296.00			6.02	0.094
21FLKWATALA-LOCHLOOSA-2	7/31/2000	236.00			5.68	0.096
21FLKWATALA-LOCHLOOSA-4	7/31/2000	243.00			5.71	0.094
21FLKWATALA-LOCHLOOSA-3	7/31/2000	261.00			5.79	0.090
21FLKWATALA-LOCHLOOSA-1	7/31/2000	285.00			6.07	0.096
21FLSJWMLOL	8/25/2000	197.42	185.58	40	5.92	0.100
21FLGFWF03080102-LL-02	8/28/2000		144.20		5.37	0.127
21FLGFWF03080102-LL-03	8/28/2000		158.60		5.65	0.108
21FLGFWF03080102-LL-04	8/28/2000		181.00		5.45	0.104
21FLKWATALA-LOCHLOOSA-4	8/31/2000	222.00			5.59	0.107
21FLKWATALA-LOCHLOOSA-3	8/31/2000	226.00			5.58	0.102
21FLKWATALA-LOCHLOOSA-1	8/31/2000	236.00			5.44	0.083
21FLKWATALA-LOCHLOOSA-2	8/31/2000	244.00			5.34	0.093
21FLKWATALA-LOCHLOOSA-3	9/26/2000	184.00			3.71	0.072
21FLKWATALA-LOCHLOOSA-1	9/26/2000	192.00			3.92	0.076
21FLKWATALA-LOCHLOOSA-4	9/26/2000	210.00			3.74	0.082
21FLKWATALA-LOCHLOOSA-2	9/26/2000	226.00			3.83	0.085
21FLSJWMLOL	10/26/2000	194.55	184.71	70	4.95	0.089
21FLKWATALA-LOCHLOOSA-4	10/26/2000	201.00			4.66	0.088

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-1	10/26/2000	225.00			4.56	0.083
21FLKWATALA-LOCHLOOSA-3	10/26/2000	225.00			4.92	0.089
21FLKWATALA-LOCHLOOSA-2	10/26/2000	234.00			4.75	0.088
21FLGW 7975	11/29/2000		150.00	150	5.40	0.078
21FLGW 7959	11/29/2000		160.00	150	5.50	0.043
21FLSJWMLOL	12/14/2000	95.82	87.43	60	4.18	0.062
21FLSJWMLOL	2/13/2001	116.78	107.42	50	5.27	0.121
21FLKWATALA-LOCHLOOSA-3	2/21/2001	56.00			3.68	0.106
21FLKWATALA-LOCHLOOSA-4	2/21/2001	88.00			3.90	0.125
21FLKWATALA-LOCHLOOSA-1	2/21/2001	89.00			3.66	0.108
21FLKWATALA-LOCHLOOSA-2	2/21/2001	98.00			3.46	0.105
21FLSJWMLOL	4/11/2001	170.52	164.97	40	6.00	0.101
21FLSJWMLOL	6/12/2001	207.12	193.83	50	6.40	0.114
21FLKWATALA-LOCHLOOSA-3	8/23/2001	190.00			3.77	0.066
21FLKWATALA-LOCHLOOSA-4	8/23/2001	191.00			4.52	0.080
21FLKWATALA-LOCHLOOSA-1	8/23/2001	194.00			3.85	0.065
21FLKWATALA-LOCHLOOSA-2	8/23/2001	198.00			3.75	0.064
21FLSJWMLOL	8/30/2001	179.71	170.67	100	4.38	0.057
21FLSJWMLOL	10/22/2001	151.01	141.09	150	4.01	0.061
21FLSJWMLOL	12/13/2001	147.52	138.23	150	4.04	0.061
21FLSJWMLOL	2/13/2002	133.98	127.75	60	4.01	
21FLSJWMLOL	4/25/2002	0.50	0.50	50	4.51	0.086
21FLSJWMLOL	6/17/2002	83.04	75.63	40	3.55	0.071
21FLSJWMLOL	8/13/2002	58.07	57.07	30	2.54	0.044
21FLSJWMLOL	10/7/2002	48.72	44.70	60	1.86	0.029
21FLSJWMLOL	12/15/2002			50	1.69	0.032
21FLSJWMLOL	2/12/2003	4.18	2.21	80	2.20	0.047
21FLKWATALA-LOCHLOOSA-3	3/26/2003	19.00			1.89	0.033
21FLKWATALA-LOCHLOOSA-2	3/26/2003	33.00			1.84	0.029
21FLKWATALA-LOCHLOOSA-4	3/26/2003	50.00			1.88	0.036
21FLKWATALA-LOCHLOOSA-1	3/26/2003	76.00			1.77	0.061
21FLSJWMLOL	4/7/2003	10.54	6.37	250	1.90	0.029
21FLKWATALA-LOCHLOOSA-3	4/23/2003	9.00			1.53	0.034
21FLKWATALA-LOCHLOOSA-2	4/23/2003	11.00			1.58	0.032
21FLKWATALA-LOCHLOOSA-1	4/23/2003	12.00			1.68	0.034
21FLKWATALA-LOCHLOOSA-4	4/23/2003	14.00			1.52	0.031
21FLKWATALA-LOCHLOOSA-2	5/13/2003	10.00			1.48	0.028
21FLKWATALA-LOCHLOOSA-3	5/13/2003	10.00			1.49	0.028
21FLKWATALA-LOCHLOOSA-1	5/13/2003	11.00			1.43	0.029
21FLKWATALA-LOCHLOOSA-4	5/13/2003	14.00			1.45	0.037
21FLSJWMLOL	6/17/2003	20.96	17.65	100	1.59	0.035

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-1	6/30/2003	34.00			1.43	0.039
21FLKWATALA-LOCHLOOSA-2	6/30/2003	35.00			1.55	0.045
21FLKWATALA-LOCHLOOSA-4	6/30/2003	35.00			1.54	0.043
21FLKWATALA-LOCHLOOSA-3	6/30/2003	37.00			1.49	0.037
21FLSJWMLOL	8/14/2003	25.56	23.51	80	1.47	0.039
21FLSJWMLOCHLN	10/8/2003	24.46	21.31	150	1.37	0.039
21FLSJWMLOL	10/23/2003	14.54	12.86	150	1.43	0.037
21FLKWATALA-LOCHLOOSA-2	10/29/2003	22.00			1.26	0.037
21FLKWATALA-LOCHLOOSA-1	10/29/2003	33.00			1.33	0.042
21FLKWATALA-LOCHLOOSA-3	10/29/2003	36.00			1.43	0.038
21FLKWATALA-LOCHLOOSA-4	10/29/2003	-			1.32	0.037
21FLSJWMLOL	11/5/2003	22.45	20.56	150	1.40	0.038
21FLSJWMLOCHLN	11/5/2003			150	1.47	0.043
21FLSJWMLOCHLN	12/3/2003	19.30	17.69	150	1.52	0.042
21FLSJWMLOL	12/11/2003	25.77	22.09	150	1.72	0.050
21FLSJWMLOL	1/7/2004	25.66	20.70	100	1.73	0.054
21FLSJWMLOCHLN	1/7/2004	26.05	19.62	100	1.78	0.056
21FLSJWMLOCHLN	2/4/2004	29.85	27.38	150	1.68	0.048
21FLSJWMLOL	2/4/2004	36.21	33.14	150	1.75	0.044
21FLSJWMLOL	2/10/2004	32.43	32.14	100	1.67	0.055
21FLSJWMLOCHLN	3/3/2004	21.51	18.11	150	1.70	0.072
21FLSJWMLOL	3/3/2004	21.56	18.53	150	1.59	0.048
21FLSJWMLOL	4/6/2004	30.49	27.39	150	1.64	0.053
21FLSJWMLOCHLN	4/6/2004	31.74	28.42	150	1.71	0.060
21FLSJWMLOL	5/5/2004	43.64	42.57	100	1.81	0.057
21FLSJWMLOCHLN	5/5/2004	44.65	42.14	100	1.80	0.067
21FLSJWMLOL	6/10/2004	16.34	15.84	80	1.43	0.053
21FLSJWMLOCHLN	6/10/2004	20.26	18.79	80	1.41	0.051
21FLSJWMLOL	7/7/2004	20.31	20.19	70	1.61	0.049
21FLSJWMLOCHLN	7/7/2004	21.02	20.62	70	1.37	0.055
21FLSJWMLOCHLN	8/12/2004	27.00	26.47	70	1.59	0.054
21FLSJWMLOL	8/12/2004	32.31	30.67	70	1.67	0.060
21FLSJWMLOL	8/16/2004	36.14	35.93	70	1.54	0.049
21FLSJWMLOL	9/23/2004	24.21	22.00	400	1.77	0.079
21FLSJWMLOCHLN	9/23/2004	29.23	28.31	300	1.81	0.073
21FLKWATALA-LOCHLOOSA-1	10/14/2004	10.00			1.51	0.080
21FLKWATALA-LOCHLOOSA-4	10/14/2004	10.00			1.50	0.080
21FLKWATALA-LOCHLOOSA-2	10/14/2004	12.00			2.02	0.095
21FLKWATALA-LOCHLOOSA-3	10/14/2004	13.00			1.82	0.083
21FLSJWMLOCHLN	10/21/2004	10.66	8.91	400	1.67	0.100
21FLSJWMLOL	10/21/2004	11.31	7.46	400	1.63	0.100

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLSJWMLOL	11/11/2004	7.52	3.51	400	1.71	0.100
21FLSJWMLOCHLN	11/11/2004	10.63	8.39	400	1.64	0.100
21FLGW 22918	11/29/2004		0.85	250	1.69	0.093
21FLGW 22914	11/29/2004		1.70	250	1.55	0.110
21FLSJWMLOL	12/8/2004	7.00	5.57	400		
21FLSJWMLOCHLN	12/8/2004	7.14	5.53	400	1.63	0.077
21FLSJWMLOCHLN	1/12/2005	5.37	4.25	400	1.60	0.065
21FLSJWMLOL	1/12/2005	8.34	6.92	400	1.64	0.068
21FLSJWMLOL	2/15/2005	21.00	17.95	400	1.85	0.071
21FLSJWMLOCHLN	2/15/2005	25.19	24.40	400	1.85	0.075
21FLKWATALA-LOCHLOOSA-2	3/3/2005	11.00			1.53	0.072
21FLKWATALA-LOCHLOOSA-3	3/3/2005	11.00			1.53	0.074
21FLKWATALA-LOCHLOOSA-1	3/3/2005	12.00			1.58	0.072
21FLKWATALA-LOCHLOOSA-4	3/3/2005	13.00			1.47	0.079
21FLSJWMLOCHLN	3/9/2005	10.73	6.90	300	1.94	0.087
21FLSJWMLOL	3/9/2005	11.46	7.65	400	2.10	0.088
21FLSJWMLOCHLN	4/5/2005	14.28	12.34	300	1.72	0.058
21FLSJWMLOL	4/5/2005	21.10	18.26	300	1.80	0.056
21FLKWATALA-LOCHLOOSA-3	4/21/2005	32.00			1.55	0.084
21FLKWATALA-LOCHLOOSA-2	4/21/2005	43.00			1.45	0.078
21FLKWATALA-LOCHLOOSA-1	4/21/2005	45.00			1.84	0.079
21FLKWATALA-LOCHLOOSA-4	4/21/2005	47.00			1.53	0.066
21FLSJWMLOL	5/3/2005	15.13	9.67	400	1.44	0.079
21FLSJWMLOCHLN	5/3/2005	21.34	15.75	300	1.48	0.078
21FLKWATALA-LOCHLOOSA-4	5/26/2005	27.00			1.81	0.103
21FLKWATALA-LOCHLOOSA-2	5/26/2005	59.00			1.81	0.117
21FLKWATALA-LOCHLOOSA-3	5/26/2005	63.00			1.87	0.126
21FLKWATALA-LOCHLOOSA-1	5/26/2005	77.00			1.89	0.119
21FLSJWMLOCHLN	6/16/2005	5.19	4.43	300	1.74	0.138
21FLSJWMLOL	6/16/2005	5.85	4.84	250	1.60	0.135
21FLKWATALA-LOCHLOOSA-3	6/29/2005	8.00			1.54	0.132
21FLKWATALA-LOCHLOOSA-2	6/29/2005	9.00			1.67	0.132
21FLKWATALA-LOCHLOOSA-1	6/29/2005	10.00			1.54	0.128
21FLKWATALA-LOCHLOOSA-4	6/29/2005	10.00			1.43	0.123
21FLSJWMLOCHLN	7/5/2005	3.93	2.70	300	1.85	0.140
21FLSJWMLOL	7/5/2005	5.96	5.02	300	1.66	0.132
21FLKWATALA-LOCHLOOSA-2	7/29/2005	14.00			1.41	0.125
21FLKWATALA-LOCHLOOSA-1	7/29/2005	19.00			1.07	0.122
21FLKWATALA-LOCHLOOSA-4	7/29/2005	47.00			1.52	0.130
21FLKWATALA-LOCHLOOSA-3	7/29/2005	49.00			1.24	0.116
21FLSJWMLOCHLN	8/3/2005	8.17	6.78	300	1.57	0.122

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLSJWMLOL	8/3/2005	12.92	11.35	300	1.83	0.135
21FLKWATALA-LOCHLOOSA-2	8/31/2005	17.00			1.37	0.142
21FLKWATALA-LOCHLOOSA-1	8/31/2005	24.00			1.38	0.142
21FLKWATALA-LOCHLOOSA-4	8/31/2005	27.00			1.39	0.145
21FLKWATALA-LOCHLOOSA-3	8/31/2005	28.00			1.39	0.146
21FLSJWMLOL	9/14/2005	6.28	4.34	300	1.61	0.142
21FLSJWMLOCHLN	9/14/2005	7.35	5.54	250	1.64	0.144
21FLKWATALA-LOCHLOOSA-4	9/28/2005	15.00			1.85	0.133
21FLKWATALA-LOCHLOOSA-1	9/28/2005	18.00			1.91	0.135
21FLKWATALA-LOCHLOOSA-3	9/28/2005	18.00			1.82	0.138
21FLKWATALA-LOCHLOOSA-2	9/28/2005	19.00			1.89	0.130
21FLSJWMLOCHLN	10/12/2005	4.50	3.39	400	1.25	0.136
21FLSJWMLOL	10/12/2005	7.30	5.66	300	1.18	0.128
21FLKWATALA-LOCHLOOSA-4	10/25/2005	10.00			1.46	0.129
21FLKWATALA-LOCHLOOSA-1	10/25/2005	11.00			1.44	0.142
21FLKWATALA-LOCHLOOSA-2	10/25/2005	15.00			1.58	0.146
21FLKWATALA-LOCHLOOSA-3	10/25/2005	20.00			1.78	0.152
21FLSJWMLOL	11/7/2005	9.55	8.51	150	1.56	0.117
21FLSJWMLOCHLN	11/7/2005			200	1.58	0.112
21FLKWATALA-LOCHLOOSA-4	11/30/2005	10.00			1.37	0.105
21FLKWATALA-LOCHLOOSA-3	11/30/2005	12.00			1.43	0.107
21FLKWATALA-LOCHLOOSA-2	11/30/2005	13.00			1.43	0.109
21FLKWATALA-LOCHLOOSA-1	11/30/2005	14.00			1.54	0.110
21FLSJWMLOL	12/6/2005	18.79	14.82	150	1.47	0.108
21FLSJWMLOCHLN	12/6/2005	19.75	15.82	200	1.51	0.110
21FLSJWMLOL	1/4/2006	11.43	9.28	150	1.41	0.098
21FLSJWMLOCHLN	1/4/2006	11.81	9.30	150	1.42	0.101
21FLKWATALA-LOCHLOOSA-4	1/24/2006	14.00			1.28	0.090
21FLKWATALA-LOCHLOOSA-1	1/24/2006	18.00			1.41	0.081
21FLKWATALA-LOCHLOOSA-2	1/24/2006	18.00			1.32	0.090
21FLKWATALA-LOCHLOOSA-3	1/24/2006	18.00			1.26	0.088
21FLCEN 20020201	2/6/2006		14.44	160	1.15	0.084
21FLCEN 20020202	2/6/2006		18.34	210	1.27	0.088
21FLCEN 20020203	2/6/2006		22.05	280	1.20	0.093
21FLCEN 20020204	2/6/2006		23.81	100	1.30	0.100
21FLCEN 20020205	2/6/2006		25.67	280	1.30	0.100
21FLSJWMLOCHLN	2/8/2006	20.78	18.79	150	1.36	0.103
21FLSJWMLOL	2/8/2006	23.89	21.46	250	1.42	0.093
21FLKWATALA-LOCHLOOSA-4	2/20/2006	25.00			1.21	0.087
21FLKWATALA-LOCHLOOSA-3	2/20/2006	27.00			1.27	0.084
21FLKWATALA-LOCHLOOSA-2	2/20/2006	63.00			1.11	0.082

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-1	2/20/2006	114.00			1.20	0.088
21FLSJWMLOCHLN	3/8/2006	9.38	7.03	200	1.33	0.100
21FLSJWMLOL	3/8/2006	10.00	7.51	200	1.24	0.099
21FLKWATALA-LOCHLOOSA-1	3/20/2006	18.00			1.29	0.121
21FLKWATALA-LOCHLOOSA-3	3/20/2006	20.00			1.30	0.123
21FLKWATALA-LOCHLOOSA-2	3/20/2006	22.00			1.23	0.118
21FLKWATALA-LOCHLOOSA-4	3/20/2006	29.00			1.26	0.109
21FLSJWMLOCHLN	4/6/2006	55.32	48.99	200	1.58	0.133
21FLSJWMLOL	4/6/2006	72.92	69.06	200	1.72	0.138
21FLKWATALA-LOCHLOOSA-4	4/25/2006	25.00			1.38	0.172
21FLKWATALA-LOCHLOOSA-2	4/25/2006	44.00			1.67	0.186
21FLKWATALA-LOCHLOOSA-3	4/25/2006	45.00			1.47	0.180
21FLKWATALA-LOCHLOOSA-1	4/25/2006	58.00			1.72	0.182
21FLSJWMLOCHLN	5/4/2006	50.62	44.99	100	1.67	0.197
21FLSJWMLOL	5/4/2006	60.74	55.36	100	1.77	0.203
21FLKWATALA-LOCHLOOSA-4	5/18/2006	13.00			1.25	0.127
21FLKWATALA-LOCHLOOSA-1	5/18/2006	24.00			1.45	0.143
21FLKWATALA-LOCHLOOSA-3	5/18/2006	26.00			1.41	0.149
21FLKWATALA-LOCHLOOSA-2	5/18/2006	42.00			1.58	0.175
21FLSJWMLOL	6/8/2006	15.78	12.74	70	1.11	0.153
21FLSJWMLOCHLN	6/8/2006	19.52	14.19	80	1.20	0.153
21FLKWATALA-LOCHLOOSA-4	6/27/2006	46.00			1.25	0.148
21FLKWATALA-LOCHLOOSA-3	6/27/2006	57.00			1.22	0.150
21FLKWATALA-LOCHLOOSA-1	6/27/2006	65.00			1.33	0.135
21FLKWATALA-LOCHLOOSA-2	6/27/2006	82.00			1.43	0.166
21FLSJWMLOCHLN	7/13/2006	16.24	11.72	60	1.21	0.142
21FLSJWMLOL	7/13/2006	19.80	15.59	60	1.20	0.152
21FLKWATALA-LOCHLOOSA-3	7/26/2006	18.00			0.87	0.149
21FLKWATALA-LOCHLOOSA-4	7/26/2006	23.00			0.88	0.149
21FLKWATALA-LOCHLOOSA-1	7/26/2006	32.00			1.01	0.145
21FLKWATALA-LOCHLOOSA-2	7/26/2006	32.00			1.07	0.153
21FLSJWMLOL	8/9/2006	38.23	33.86	40	1.34	0.149
21FLSJWMLOCHLN	8/9/2006	51.02	47.08	50	1.50	0.140
21FLKWATALA-LOCHLOOSA-3	8/22/2006	61.00			1.42	0.144
21FLKWATALA-LOCHLOOSA-1	8/22/2006	63.00			1.45	0.130
21FLKWATALA-LOCHLOOSA-4	8/22/2006	66.00			1.48	0.156
21FLKWATALA-LOCHLOOSA-2	8/22/2006	67.00			1.53	0.153
21FLSJWMLOCHLN	9/6/2006	62.55	56.14	50	1.78	0.136
21FLSJWMLOL	9/6/2006	64.32	59.67	50	1.71	0.148
21FLKWATALA-LOCHLOOSA-4	9/27/2006	41.00			1.23	0.098
21FLKWATALA-LOCHLOOSA-3	9/27/2006	51.00			1.33	0.095

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-1	9/27/2006	59.00			1.42	0.081
21FLKWATALA-LOCHLOOSA-2	9/27/2006	66.00			1.55	0.097
21FLSJWMLOCHLN	10/5/2006	48.11	43.05	30	1.64	0.101
21FLSJWMLOL	10/5/2006	53.23	48.53	40	1.72	0.111
21FLKWATALA-LOCHLOOSA-4	10/25/2006	56.00			1.45	0.074
21FLKWATALA-LOCHLOOSA-3	10/25/2006	59.00			1.51	0.080
21FLKWATALA-LOCHLOOSA-1	10/25/2006	71.00			1.60	0.065
21FLKWATALA-LOCHLOOSA-2	10/25/2006	74.00			1.48	0.063
21FLSJWMLOCHLN	11/9/2006	31.71	28.76	30	1.43	0.074
21FLSJWMLOL	11/9/2006	46.27	41.12	30	1.54	0.083
21FLKWATALA-LOCHLOOSA-3	11/28/2006	33.00			1.12	0.053
21FLKWATALA-LOCHLOOSA-2	11/28/2006	37.00			1.18	0.057
21FLKWATALA-LOCHLOOSA-4	11/28/2006	38.00			1.20	0.066
21FLKWATALA-LOCHLOOSA-1	11/28/2006	42.00			1.27	0.065
21FLSJWMLOCHLN	12/7/2006	30.72	27.50	30	1.25	0.061
21FLSJWMLOL	12/7/2006	31.30	28.51	20	1.34	0.068
21FLSJWMLOL	1/8/2007	42.29	33.51	30	1.92	0.095
21FLSJWMLOCHLN	1/8/2007	43.75	34.84	30	1.88	0.099
21FLKWATALA-LOCHLOOSA-4	1/31/2007	20.00			1.18	0.063
21FLKWATALA-LOCHLOOSA-1	1/31/2007	26.00			1.31	0.059
21FLKWATALA-LOCHLOOSA-2	1/31/2007	28.00			1.24	0.058
21FLKWATALA-LOCHLOOSA-3	1/31/2007	34.00			1.26	0.067
21FLSJWMLOCHLN	2/8/2007	24.34	20.31		1.42	0.053
21FLSJWMLOL	2/8/2007	25.16	22.25		1.35	0.050
21FLKWATALA-LOCHLOOSA-3	2/27/2007	23.00			1.08	0.043
21FLKWATALA-LOCHLOOSA-4	2/27/2007	23.00			1.38	0.074
21FLKWATALA-LOCHLOOSA-1	2/27/2007	25.00			1.21	0.048
21FLKWATALA-LOCHLOOSA-2	2/27/2007	26.00			1.19	0.047
21FLSJWMLOL	3/8/2007	25.67	20.79	50	1.57	0.089
21FLSJWMLOCHLN	3/8/2007	30.59	25.70	30	1.54	0.095
21FLKWATALA-LOCHLOOSA-4	3/21/2007	32.00			1.21	0.075
21FLKWATALA-LOCHLOOSA-3	3/21/2007	33.00			1.15	0.061
21FLKWATALA-LOCHLOOSA-1	3/21/2007	34.00			1.26	0.065
21FLKWATALA-LOCHLOOSA-2	3/21/2007	36.00			1.25	0.065
21FLSJWMLOCHLN	4/3/2007	22.78	18.85	40	1.47	0.101
21FLSJWMLOL	4/3/2007	26.69	23.03	30	1.62	0.110
21FLKWATALA-LOCHLOOSA-4	4/18/2007	68.00			1.74	0.094
21FLKWATALA-LOCHLOOSA-1	4/18/2007	79.00			1.71	0.090
21FLKWATALA-LOCHLOOSA-2	4/18/2007	79.00			1.65	0.088
21FLKWATALA-LOCHLOOSA-3	4/18/2007	82.00			1.74	0.091
21FLSJWMLOL	5/2/2007	44.22	41.21		1.79	0.090

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLSJWMLOCHLN	5/2/2007	46.60	40.85		1.89	0.098
21FLKWATALA-LOCHLOOSA-3	5/16/2007	46.00			1.77	0.091
21FLKWATALA-LOCHLOOSA-1	5/16/2007	56.00			2.00	0.098
21FLKWATALA-LOCHLOOSA-4	5/16/2007	56.00			1.87	0.111
21FLKWATALA-LOCHLOOSA-2	5/16/2007	63.00			1.90	0.106
21FLSJWMLOL	6/14/2007	60.46	52.87	20	2.45	0.132
21FLSJWMLOCHLN	6/14/2007	63.18	58.74	30	2.54	0.139
21FLKWATALA-LOCHLOOSA-4	6/19/2007	40.00			1.70	0.082
21FLKWATALA-LOCHLOOSA-3	6/19/2007	45.00			1.74	0.086
21FLKWATALA-LOCHLOOSA-1	6/19/2007	52.00			1.94	0.088
21FLKWATALA-LOCHLOOSA-2	6/19/2007	59.00			1.93	0.100
21FLSJWMLOL	7/10/2007	54.96	53.80	30	2.22	0.102
21FLSJWMLOCHLN	7/10/2007	55.31	50.33	30	2.29	0.110
21FLKWATALA-LOCHLOOSA-3	7/17/2007	42.00				0.059
21FLKWATALA-LOCHLOOSA-4	7/17/2007	48.00			1.58	
21FLKWATALA-LOCHLOOSA-1	7/17/2007	50.00			1.63	0.070
21FLKWATALA-LOCHLOOSA-2	7/17/2007	57.00			1.75	0.073
21FLSJWMLOCHLN	8/7/2007	67.89	67.02	30	2.19	0.065
21FLSJWMLOL	8/7/2007	97.41	93.98	30	2.63	0.094
21FLKWATALA-LOCHLOOSA-4	8/27/2007	121.00			2.74	0.066
21FLKWATALA-LOCHLOOSA-1	8/27/2007	190.00			3.12	0.082
21FLKWATALA-LOCHLOOSA-2	8/27/2007	201.00			3.20	0.089
21FLKWATALA-LOCHLOOSA-3	8/27/2007	202.00			3.15	0.090
21FLSJWMLOCHLN	9/11/2007	202.24	195.29	50	3.66	0.097
21FLSJWMLOL	9/11/2007	238.37	228.55	30	4.25	0.118
21FLKWATALA-LOCHLOOSA-1	9/24/2007	128.00			3.03	0.071
21FLKWATALA-LOCHLOOSA-4	9/24/2007	153.00			3.23	0.086
21FLKWATALA-LOCHLOOSA-3	9/24/2007	166.00			3.70	0.094
21FLKWATALA-LOCHLOOSA-2	9/24/2007	179.00			3.45	0.086
21FLSJWMLOCHLN	10/11/2007	100.23	96.79	150		
21FLSJWMLOL	10/11/2007	144.87	140.98	30		
21FLKWATALA-LOCHLOOSA-2	10/30/2007	136.00			3.59	0.086
21FLKWATALA-LOCHLOOSA-1	10/30/2007	147.00			3.72	0.090
21FLKWATALA-LOCHLOOSA-4	10/30/2007	147.00			3.70	0.087
21FLKWATALA-LOCHLOOSA-3	10/30/2007	182.00			3.91	0.095
21FLSJWMLOCHLN	11/8/2007	112.07	106.67	40	3.50	0.078
21FLSJWMLOL	11/8/2007	116.46	113.48	50	3.43	0.103
21FLKWATALA-LOCHLOOSA-1	11/29/2007	95.00			2.87	0.062
21FLKWATALA-LOCHLOOSA-4	11/29/2007	97.00			2.97	0.067
21FLKWATALA-LOCHLOOSA-2	11/29/2007	108.00			2.90	0.065
21FLKWATALA-LOCHLOOSA-3	11/29/2007	110.00			3.00	0.067

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLSJWMLOL	12/10/2007	94.77	93.18	50	3.40	0.104
21FLSJWMLOCHLN	12/10/2007	103.43	100.79	50	3.38	0.102
21FLKWATALA-LOCHLOOSA-1	12/20/2007	93.00			3.07	0.074
21FLKWATALA-LOCHLOOSA-4	12/20/2007	100.00			3.09	0.077
21FLKWATALA-LOCHLOOSA-3	12/20/2007	109.00			3.03	0.073
21FLKWATALA-LOCHLOOSA-2	12/20/2007	113.00			3.12	0.077
21FLSJWMLOL	1/9/2008	82.53	82.24	50	3.11	0.079
21FLSJWMLOCHLN	1/9/2008	85.74	84.91	30	3.38	0.086
21FLKWATALA-LOCHLOOSA-1	1/30/2008	91.00			3.03	0.083
21FLKWATALA-LOCHLOOSA-4	1/30/2008	95.00			2.98	0.083
21FLKWATALA-LOCHLOOSA-3	1/30/2008	101.00			3.15	0.079
21FLKWATALA-LOCHLOOSA-2	1/30/2008	105.00			3.74	0.086
21FLSJWMLOCHLN	2/14/2008	129.13	125.30	60	3.66	0.116
21FLSJWMLOL	2/14/2008	137.98	135.22	50	3.63	0.110
21FLSJWMLOL	3/6/2008	129.58	125.89	150	3.46	0.107
21FLSJWMLOCHLN	3/6/2008	133.50	130.03	60	3.67	0.102
21FLKWATALA-LOCHLOOSA-3	3/26/2008	187.00			3.40	0.091
21FLKWATALA-LOCHLOOSA-1	3/26/2008	188.00			3.36	0.089
21FLKWATALA-LOCHLOOSA-2	3/26/2008	189.00			3.37	0.094
21FLKWATALA-LOCHLOOSA-4	3/26/2008	196.00			3.18	0.095
21FLSJWMLOL	4/9/2008	210.84	205.80	150	3.84	0.099
21FLSJWMLOCHLN	4/9/2008	249.60	237.27	150	4.14	0.113
21FLKWATALA-LOCHLOOSA-4	4/22/2008	213.00			3.76	0.076
21FLKWATALA-LOCHLOOSA-1	4/22/2008	252.00			3.72	0.070
21FLKWATALA-LOCHLOOSA-3	4/22/2008	259.00			3.98	0.075
21FLKWATALA-LOCHLOOSA-2	4/22/2008	261.00			3.98	0.074
21FLSJWMLOCHLN	5/8/2008	149.84	145.35	100	4.22	0.080
21FLSJWMLOL	5/8/2008	244.16	239.90	100	4.38	0.091
21FLKWATALA-LOCHLOOSA-4	5/14/2008	128.00			3.82	0.065
21FLKWATALA-LOCHLOOSA-2	5/14/2008	177.00			3.86	0.071
21FLKWATALA-LOCHLOOSA-3	5/14/2008	188.00			4.27	0.077
21FLKWATALA-LOCHLOOSA-1	5/14/2008	195.00			4.16	0.080
21FLSJWMLOL	6/12/2008	137.92	133.50	80	3.67	0.071
21FLSJWMLOCHLN	6/12/2008	147.36	142.79	100	4.00	0.096
21FLKWATALA-LOCHLOOSA-4	6/26/2008	128.00			3.02	0.060
21FLKWATALA-LOCHLOOSA-1	6/26/2008	130.00			3.28	0.058
21FLKWATALA-LOCHLOOSA-3	6/26/2008	145.00			3.38	0.066
21FLKWATALA-LOCHLOOSA-2	6/26/2008	148.00			3.41	0.060
21FLSJWMLOCHLN	7/10/2008	129.65	127.89	80	3.74	0.063
21FLSJWMLOL	7/10/2008	147.97	143.91	60	3.52	0.078
21FLKWATALA-LOCHLOOSA-1	7/28/2008	175.00			3.82	0.062

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-2	7/28/2008	182.00			3.74	0.058
21FLKWATALA-LOCHLOOSA-3	7/28/2008	183.00			3.58	0.063
21FLKWATALA-LOCHLOOSA-4	7/28/2008	186.00			3.57	0.064
21FLSJWMLOL	8/7/2008	172.68	166.47	80	3.81	0.066
21FLSJWMLOCHLN	8/7/2008	173.27	172.35	60	3.69	0.064
21FLKWATALA-LOCHLOOSA-1	8/29/2008	112.00			2.57	0.080
21FLKWATALA-LOCHLOOSA-4	8/29/2008	137.00			2.84	0.071
21FLKWATALA-LOCHLOOSA-2	8/29/2008	169.00			3.15	0.066
21FLKWATALA-LOCHLOOSA-3	8/29/2008	169.00			3.19	0.066
21FLKWATALA-LOCHLOOSA-4	9/30/2008	132.00			2.69	0.054
21FLKWATALA-LOCHLOOSA-2	9/30/2008	145.00			2.70	0.054
21FLKWATALA-LOCHLOOSA-3	9/30/2008	146.00			2.70	0.048
21FLKWATALA-LOCHLOOSA-1	9/30/2008	147.00			2.79	0.053
21FLSJWMLOL	10/9/2008	134.33	131.36	200	3.05	0.076
21FLSJWMLOCHLN	10/9/2008	142.54	138.04	200	3.19	0.076
21FLKWATALA-LOCHLOOSA-4	10/30/2008	95.00			2.82	0.049
21FLKWATALA-LOCHLOOSA-1	10/30/2008	142.00			2.93	0.050
21FLKWATALA-LOCHLOOSA-3	10/30/2008	142.00			3.00	0.049
21FLKWATALA-LOCHLOOSA-2	10/30/2008	153.00			3.08	0.050
21FLSJWMLOCHLN	11/11/2008	110.01	107.07	100	3.27	0.072
21FLSJWMLOL	11/11/2008	121.20	118.28	150	3.28	0.075
21FLKWATALA-LOCHLOOSA-4	11/25/2008	91.00			2.93	0.056
21FLKWATALA-LOCHLOOSA-1	11/25/2008	103.00			2.92	0.061
21FLKWATALA-LOCHLOOSA-3	11/25/2008	111.00			3.15	0.055
21FLKWATALA-LOCHLOOSA-2	11/25/2008	113.00			2.93	0.053
21FLSJWMLOL	12/9/2008	80.84	80.10	100	3.31	0.062
21FLSJWMLOCHLN	12/9/2008	89.48	89.71	100	3.07	0.056
21FLSJWMLOL	1/8/2009	141.25	137.51	100	3.82	0.083
21FLSJWMLOCHLN	1/8/2009	147.44	142.88	100	3.82	0.076
21FLKWATALA-LOCHLOOSA-4	1/27/2009	101.00			3.35	0.062
21FLKWATALA-LOCHLOOSA-1	1/27/2009	116.00			3.35	0.057
21FLKWATALA-LOCHLOOSA-3	1/27/2009	117.00			3.32	0.058
21FLKWATALA-LOCHLOOSA-2	1/27/2009	119.00			3.35	0.059
21FLSJWMLOCHLN	2/5/2009	58.60	53.40	80	3.38	0.071
21FLSJWMLOL	2/5/2009	73.47	67.15	80	3.46	0.071
21FLKWATALA-LOCHLOOSA-1	2/26/2009	100.00			3.19	0.067
21FLKWATALA-LOCHLOOSA-4	2/26/2009	106.00			3.08	0.084
21FLKWATALA-LOCHLOOSA-3	2/26/2009	109.00			3.06	0.065
21FLKWATALA-LOCHLOOSA-2	2/26/2009	118.00			3.11	0.067
21FLSJWMLOCHLN	3/4/2009	112.09	102.93	60	3.58	0.092
21FLSJWMLOL	3/4/2009	116.08	110.32	80	3.50	0.089

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-4	3/31/2009	158.00			3.67	0.077
21FLKWATALA-LOCHLOOSA-3	3/31/2009	179.00			3.84	0.069
21FLKWATALA-LOCHLOOSA-2	3/31/2009	197.00			3.97	0.071
21FLKWATALA-LOCHLOOSA-1	3/31/2009	202.00			3.96	0.069
21FLSJWMLOL	4/8/2009	124.87	119.88	80	3.99	0.099
21FLSJWMLOCHLN	4/8/2009	127.45	124.33	80	3.98	0.097
21FLKWATALA-LOCHLOOSA-3	4/28/2009	10.00			1.29	0.049
21FLKWATALA-LOCHLOOSA-1	4/28/2009	16.00			1.36	0.053
21FLKWATALA-LOCHLOOSA-4	4/28/2009	17.00			1.52	0.070
21FLKWATALA-LOCHLOOSA-2	4/28/2009	19.00			1.35	0.060
21FLSJWMLOCHLN	5/7/2009	12.88	9.70	60	2.23	0.051
21FLSJWMLOL	5/7/2009	14.65	11.30	70	2.25	0.057
21FLSJWMLOL	6/2/2009	17.32	13.46	80	1.26	0.051
21FLSJWMLOCHLN	6/2/2009	19.87	16.90	80	1.27	0.053
21FLKWATALA-LOCHLOOSA-2	6/23/2009	30.00			2.02	0.022
21FLKWATALA-LOCHLOOSA-4	6/23/2009	30.00			1.30	0.025
21FLKWATALA-LOCHLOOSA-3	6/23/2009	31.00			1.26	0.021
21FLKWATALA-LOCHLOOSA-1	6/23/2009	34.00			1.41	0.022
21FLSJWMLOL	7/7/2009	39.82	32.93	100	1.58	0.077
21FLSJWMLOCHLN	7/7/2009	40.72	33.86	100	1.50	0.074
21FLKWATALA-LOCHLOOSA-3	7/16/2009	51.00			1.53	0.064
21FLKWATALA-LOCHLOOSA-4	7/16/2009	55.00			1.58	0.057
21FLKWATALA-LOCHLOOSA-1	7/16/2009	56.00			1.64	0.063
21FLKWATALA-LOCHLOOSA-2	7/16/2009	64.00			1.48	0.054
21FLSJWMLOL	8/4/2009	68.21	65.35	100	1.76	0.055
21FLSJWMLOCHLN	8/4/2009	69.99	67.15	100	1.74	0.061
21FLKWATALA-LOCHLOOSA-1	8/27/2009	46.00			1.51	0.055
21FLKWATALA-LOCHLOOSA-4	8/27/2009	47.00			1.39	0.065
21FLKWATALA-LOCHLOOSA-3	8/27/2009	55.00			1.69	0.059
21FLKWATALA-LOCHLOOSA-2	8/27/2009	66.00			1.63	0.062
21FLSJWMLOL	9/1/2009	34.65	32.64	70	1.48	0.049
21FLSJWMLOCHLN	9/1/2009	38.88	36.05	70	1.48	0.050
21FLKWATALA-LOCHLOOSA-4	9/22/2009	36.00			1.38	0.056
21FLKWATALA-LOCHLOOSA-3	9/22/2009	47.00			1.46	0.055
21FLKWATALA-LOCHLOOSA-1	9/22/2009	49.00			1.40	0.054
21FLKWATALA-LOCHLOOSA-2	9/22/2009	52.00			1.53	0.051
21FLKWATALA-LOCHLOOSA-1	10/29/2009	39.00			1.37	0.048
21FLKWATALA-LOCHLOOSA-2	10/29/2009	40.00			1.44	0.043
21FLKWATALA-LOCHLOOSA-3	10/29/2009	41.00			1.47	0.041
21FLKWATALA-LOCHLOOSA-4	10/29/2009	42.00			1.48	0.049
21FLKWATALA-LOCHLOOSA-4	1/27/2010	36.00			1.56	0.056

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-2	1/27/2010	46.00			1.66	0.055
21FLKWATALA-LOCHLOOSA-1	1/27/2010	51.00			1.71	0.056
21FLKWATALA-LOCHLOOSA-3	1/27/2010	51.00			1.77	0.059
21FLKWATALA-LOCHLOOSA-2	2/23/2010	19.00			1.23	0.046
21FLKWATALA-LOCHLOOSA-1	2/23/2010	20.00			1.33	0.047
21FLKWATALA-LOCHLOOSA-3	2/23/2010	20.00			1.42	0.044
21FLKWATALA-LOCHLOOSA-4	2/23/2010	21.00			1.44	0.065
21FLKWATALA-LOCHLOOSA-4	3/23/2010	30.00			1.59	0.061
21FLKWATALA-LOCHLOOSA-1	3/23/2010	34.00			1.73	0.051
21FLKWATALA-LOCHLOOSA-2	3/23/2010	37.00			1.54	0.055
21FLKWATALA-LOCHLOOSA-3	3/23/2010	37.00			1.57	0.061
21FLKWATALA-LOCHLOOSA-2	4/27/2010	43.00			2.99	0.046
21FLKWATALA-LOCHLOOSA-3	4/27/2010	44.00			3.02	0.055
21FLKWATALA-LOCHLOOSA-1	4/27/2010	45.00			2.98	0.057
21FLKWATALA-LOCHLOOSA-4	4/27/2010	45.00				
21FLKWATALA-LOCHLOOSA-1	5/18/2010	32.00			1.56	0.050
21FLKWATALA-LOCHLOOSA-3	5/18/2010	32.00			1.38	0.044
21FLKWATALA-LOCHLOOSA-2	5/18/2010	33.00			1.45	0.048
21FLKWATALA-LOCHLOOSA-4	5/18/2010	33.00			1.40	0.050
21FLKWATALA-LOCHLOOSA-2	6/30/2010	87.00			2.09	0.045
21FLKWATALA-LOCHLOOSA-1	6/30/2010	89.00			2.28	0.046
21FLKWATALA-LOCHLOOSA-4	6/30/2010	89.00			2.32	0.055
21FLKWATALA-LOCHLOOSA-3	6/30/2010	94.00			2.21	0.052
21FLKWATALA-LOCHLOOSA-4	7/28/2010	97.00			2.22	0.046
21FLKWATALA-LOCHLOOSA-1	7/28/2010	105.00			2.35	0.043
21FLKWATALA-LOCHLOOSA-2	7/28/2010	111.00			2.53	0.045
21FLKWATALA-LOCHLOOSA-3	7/28/2010	113.00			2.62	0.048
21FLKWATALA-LOCHLOOSA-4	8/31/2010	116.00			2.76	0.048
21FLKWATALA-LOCHLOOSA-3	8/31/2010	135.00			2.92	0.050
21FLKWATALA-LOCHLOOSA-2	8/31/2010	140.00			3.09	0.057
21FLKWATALA-LOCHLOOSA-1	8/31/2010	142.00			3.22	0.057
21FLKWATALA-LOCHLOOSA-4	9/29/2010	133.00			3.28	0.054
21FLKWATALA-LOCHLOOSA-1	9/29/2010	137.00			3.30	0.057
21FLKWATALA-LOCHLOOSA-3	9/29/2010	141.00			3.45	0.056
21FLKWATALA-LOCHLOOSA-2	9/29/2010	144.00			3.42	0.057
21FLSJWMLOCHLN	10/13/2010	78.82	75.16	46	3.15	0.054
21FLSJWMLOL	10/13/2010	82.98	79.93	46	3.21	0.058
21FLSJWMLOL	11/9/2010	75.35	74.23	37	3.30	0.058
21FLSJWMLOCHLN	11/9/2010	78.83	75.96	37	3.29	0.061
21FLKWATALA-LOCHLOOSA-4	11/23/2010	82.00			2.88	0.065
21FLKWATALA-LOCHLOOSA-2	11/23/2010	90.00			3.10	0.066

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	Color (PCU)	TN (mg/L)	TP (mg/L)
21FLKWATALA-LOCHLOOSA-3	11/23/2010	92.00			3.13	0.063
21FLKWATALA-LOCHLOOSA-1	11/23/2010	94.00			3.13	0.057
21FLSJWMLOL	12/7/2010	70.09	65.80	34	3.54	0.071
21FLSJWMLOCHLN	12/7/2010	81.76	77.96	35	3.58	0.070
21FLSJWMLOL	1/11/2011	51.18	48.06	30	3.33	0.083
21FLSJWMLOCHLN	1/11/2011	51.97	48.46	30	3.40	0.084
21FLSJWMLOL	2/8/2011	113.22	106.80	29	3.29	0.097
21FLSJWMLOCHLN	2/8/2011	117.09	108.94	279	3.11	0.093
21FLKWATALA-LOCHLOOSA-1	2/16/2011	107.00			2.93	0.086
21FLKWATALA-LOCHLOOSA-2	2/16/2011	107.00			3.01	0.084
21FLKWATALA-LOCHLOOSA-3	2/16/2011	111.00			3.12	0.095
21FLKWATALA-LOCHLOOSA-4	2/16/2011	120.00			2.98	0.092
21FLSJWMLOL	3/8/2011	180.61	174.35	30	4.48	0.112
21FLSJWMLOCHLN	3/8/2011	184.41	176.89	29	4.47	0.109
21FLSJWMLOCHLN	4/5/2011	119.01	113.78	35	4.63	0.119
21FLSJWMLOL	4/5/2011	141.04	135.90	33	4.86	0.124
21FLSJWMLOCHLN	5/17/2011	122.19	117.75	38	4.85	0.104
21FLSJWMLOL	5/17/2011	129.13	125.27	34	5.09	0.126
21FLKWATALA-LOCHLOOSA-4	5/18/2011	78.00			3.74	0.079
21FLKWATALA-LOCHLOOSA-1	5/18/2011	118.00			4.35	0.077
21FLKWATALA-LOCHLOOSA-3	5/18/2011	128.00			4.33	0.077
21FLKWATALA-LOCHLOOSA-2	5/18/2011	137.00			4.33	0.081
21FLSJWMLOCHLN	6/21/2011	59.37	57.67	29	3.97	0.070
21FLSJWMLOL	6/21/2011	70.61	68.09	28	4.06	0.081
21FLSJWMLOL	7/13/2011	83.60	81.03	27	3.71	0.074
21FLSJWMLOCHLN	7/13/2011	89.32	87.18	28	3.77	0.063
21FLSJWMLOL	11/8/2012	26.47	21.52	184	2.96	0.070
21FLSJWMLOL	1/10/2013	21.73	18.11	137	2.63	0.055
21FLSJWMLOL	3/11/2013	25.17	21.84	109	2.03	0.058
21FLSJWMLOL	5/8/2013	20.85	19.49	78	1.81	0.048
21FLSJWMLOL	7/17/2013	33.54	32.93	100	1.92	0.056
21FLSJWMLOL	9/5/2013	26.40	23.32	167	1.47	0.045

Appendix D. Lake Vegetation Analyses

Source: The University of Florida Institute of Food and Agricultural Sciences, Florida LakeWatch, and the Program for Fisheries and Aquatic Sciences, in cooperation with the FWC School of Forest Resources and Conservation, Long-Term Fish, Plants, and Water Quality Monitoring Program: 2009

Lochloosa/Alachua

Aquatic plant data collected on September 8, 2009:

Percent area covered with aquatic vegetation (Percentage of Area Covered [PAC]) = 3.0

Percent of lake's volume filled with vegetation (Percentage Vegetation Index [PVI]) = 0.3

Average emergent plant biomass (kilograms of wet weight per square meter [kg wet wt/m^2]) = 7.5

Average floating-leaved plant biomass (kg wet wt/m^2) = 9.4

Average width of emergent and floating-leaved zone (feet) = 384.8

Average lake depth (meters) = 1.7

Table D.1: Frequency with which plant species occur in 10 evenly spaced transects around the lake

* Indicates non-native plant species.
Source: *Vegetation Analysis Report for Lochloosa Lake*, conducted on November 14, 2013, by FWC staff. The vegetation survey was conducted by Ryan Hamn and covered 5,594.87 acres. The estimated volume of the area covered in the survey was 31,678.1 acres of an estimated total lake volume of 32,859.55 acres.

Common Name	Plant Species	Frequency (%)
Coontail	*Ceratophyllum demersum*	100
Spatterdock	*Nuphar luteum*	100
Maidencane	*Panicum hemitomon*	100
Smartweed	*Polygonum hydropiperoides*	100
Pickerelweed	*Pontederia cordata*	100
Hydrilla*	*Hydrilla verticillata*	90
Frog's-bit	*Limnobium spongia*	90
Common salvinia	*Salvinia minima*	90
Bald cypress	*Taxodium distichum*	90
Buttonbush	*Cephalanthus occidentalis*	70
Egyptian paspalidium	*Paspalidium geminatum*	70
Alligator-weed*	*Alternanthera philoxeroides*	60
Water-lettuce*	*Pistia stratiotes*	60
American cupscale	*Sacciolepis striata*	60
Water-pennywort	*Hydrocotyle umbellata*	50
Soft rush	*Juncus effusus*	50
Common duckweed	*Lemna minor*	50
Water primrose	*Ludwigia* spp.	50
Sesbans	*Sesbania* spp.	50
Red maple	*Acer rubrum*	40
Cat-tail	*Typha* spp.	40
American lotus	*Nelumbo lutea*	30
Zigzag bladderwort	*Utricularia subulata*	30
Southern water-hemp	*Amaranthus australis*	20
Elephant-ear*	*Colocasia esculenta*	20
Parrot's-feather*	*Myriophyllum aquaticum*	20
	Panicum spp.	20
Common arrowhead	*Sagittaria latifolia*	20
Willow	*Salix* spp.	20
Floating water-hyacinth*	*Eichhornia crassipes*	10
Seashore marsh-mallow	*Kosteletzkya virginica*	10
Southern cutgrass	*Leersia hexandra*	10
Wax myrtle	*Myrica cerifera*	10
Southern naiad	*Najas guadalupensis*	10
Fragrant water-lily	*Nymphaea odorata*	10
Duck-potato	*Sagittaria lancifolia*	10
Tapegrass	*Vallisneria americana*	10

Table D.2. Glossary of terms for Tables D.2 through D.4

Term	Description
AOI	Area of Interest: Defines the individual transects or contiguous data samples as depicted by the color coding of each trip line. Separate areas of interest can be generated through the merging of multiple trips, appending data to a single sonar log, or lapses in time (greater than five minutes) in a sonar log.
BVp	Biovolume (Plant): Refers to the percentage of the water column taken up by vegetation when vegetation is present. Areas that do not have any vegetation are not taken into consideration for this calculation.
BVw	Biovolume (All water): Refers to the average percentage of the water column taken up by vegetation regardless of whether vegetation is present. In areas with no vegetation, a zero value is entered into the calculation, thus reducing the overall biovolume of the entire area covered by the survey.
PAC	Percent Area Covered: Refers to the overall surface area that has vegetation growing.
Grid	Geostatistical Interpolated Grid: Interpolated and evenly spaced values representing kriged (smoothed) output of aggregated data points. The gridded data is the most accurate summary of individual survey areas.
Point	Individual Coordinate Point: A single point represents a summary of sonar pings and the derived bottom and canopy depths. Individual point data create an irregularly spaced dataset that may have overlaps and/or gaps in the data, resulting in an increased potential for error.

Table D.3. Summary statistics from FWC vegetation survey, November 14, 2013

Type	PAC (%)	AVG BVp (%)	SD BVp (%)	Avg BVw (%)	SD BVw (%)	Depth Range (m)	Avg Depth (m)	Distance (km)	No. Points
Point	43.20	16.50	±21.5	7.10	±16.3	0.53–3.04	1.65	78.34	22,384
Grid	41.10	13.90	±11.8	5.70	±10.2	0–2.77	1.58		5,707

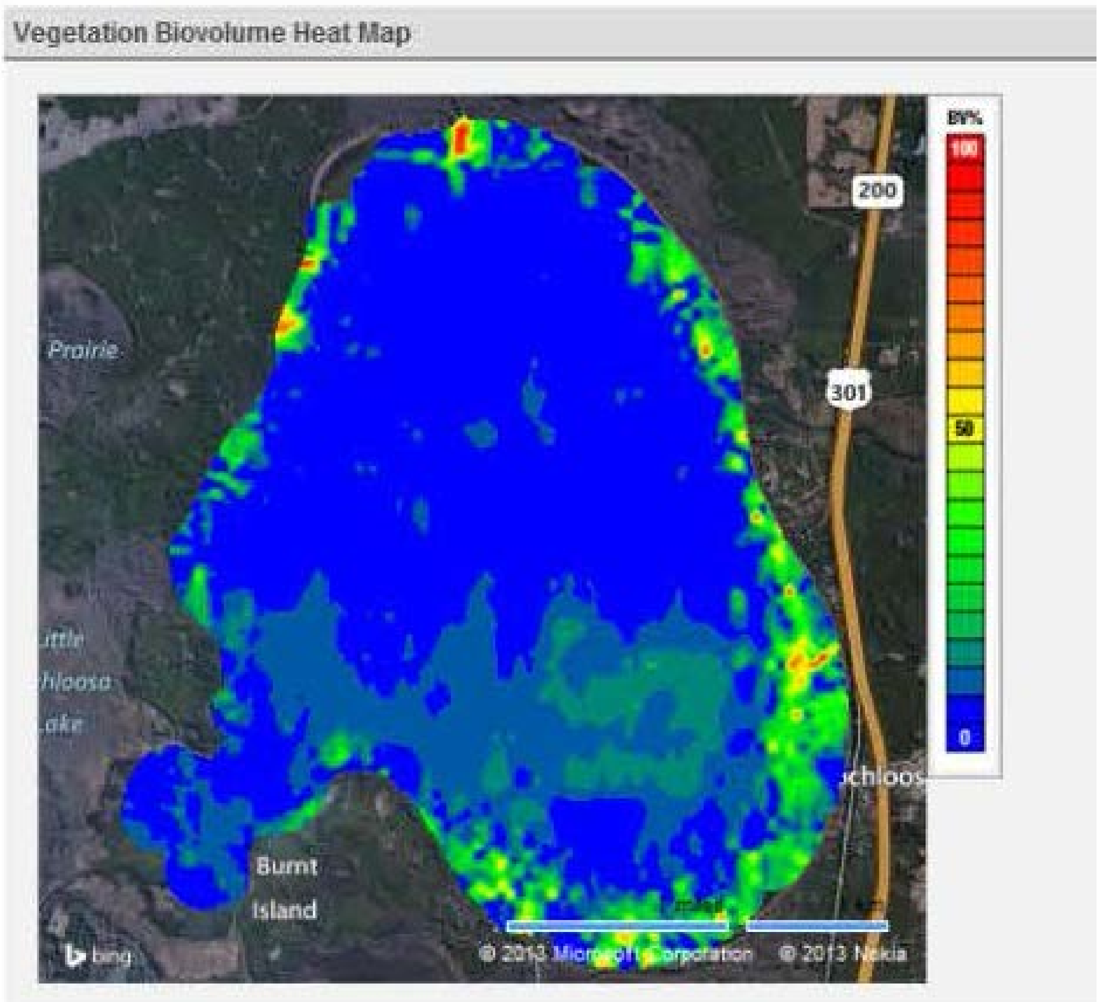

Figure D.1. Vegetation biovolume heat map for Lochloosa Lake, November 14, 2013

Source: *Vegetation Analysis Report for Lochloosa Lake*. The survey, conducted by Dean Jones, covered 5,490.87 acres. The estimated volume of the area covered in the survey was 42,114.10 acres of an estimated total lake volume of 44,416.72 acres.

Table D.4. Summary statistics from FWC vegetation survey, March 10, 2014

Type	PAC (%)	AVG BVp (%)	SD BVp (%)	Avg BVw (%)	SD BVw (%)	Depth Range (m)	Avg Depth (m)	Distance (km)	No. Points
Point	34.20	25.60	±32.7	8.70	±22.6	0.52–3.65	2.2	96.44	51,238
Grid	33.20	24.20	±21.6	8.00	±16.8	0–3.46	2.19		23,774

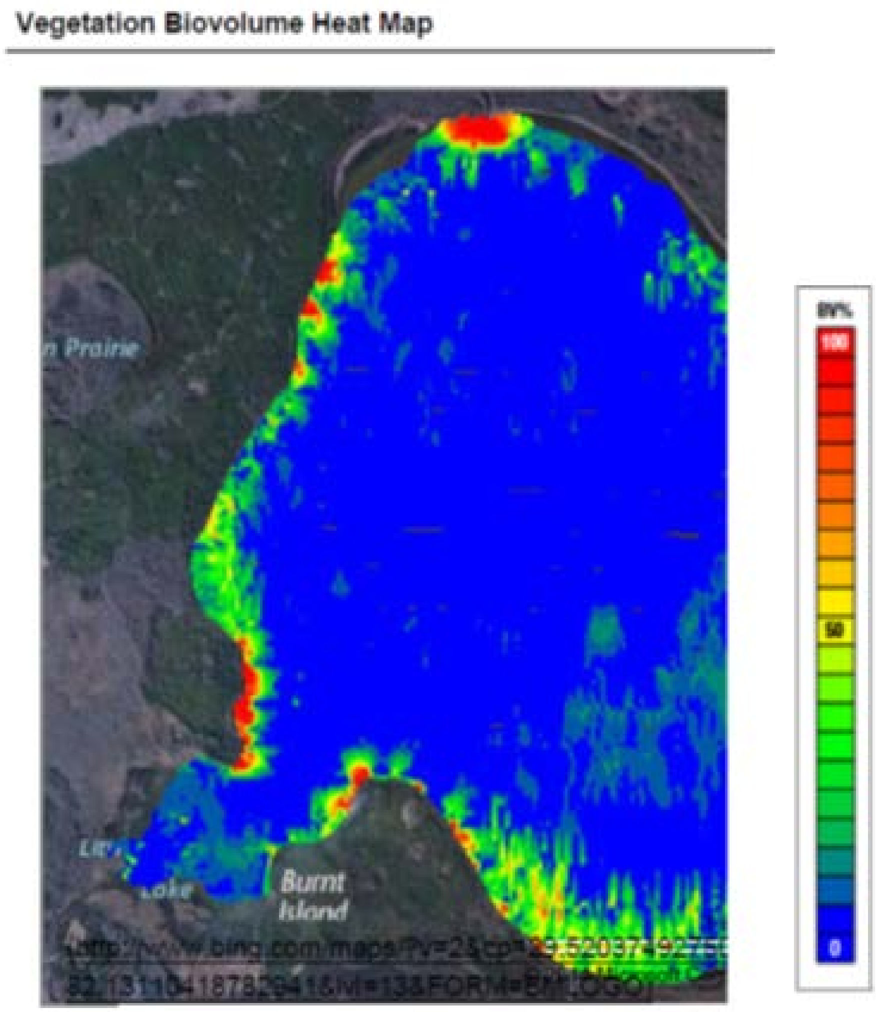

Figure D.2. Vegetation biovolume heat map for Lochloosa Lake, March 10, 2014

Source: *Vegetation Analysis Report for Lochloosa Lake*. The survey, conducted by Kevin Johnson, covered 5,280.28 acres. The estimated volume of the area covered in the survey was 39,647.67 acres of an estimated total lake volume of 43,483.12 acres.

Table D.5. Summary statistics from FWC vegetation survey, October 15, 2014

Type	PAC (%)	AVG BVp (%)	SD BVp (%)	Avg BVw (%)	SD BVw (%)	Depth Range (m)	Avg Depth (m)	Distance (km)	No. Points
Point	11.00	15.70	±23.6	1.70	±9.2	1.01–3.39	2.16	78.77	19,429
Grid	5.00	15.40	±14.8	0.80	±4.7	0–3.31	2.13		127,995

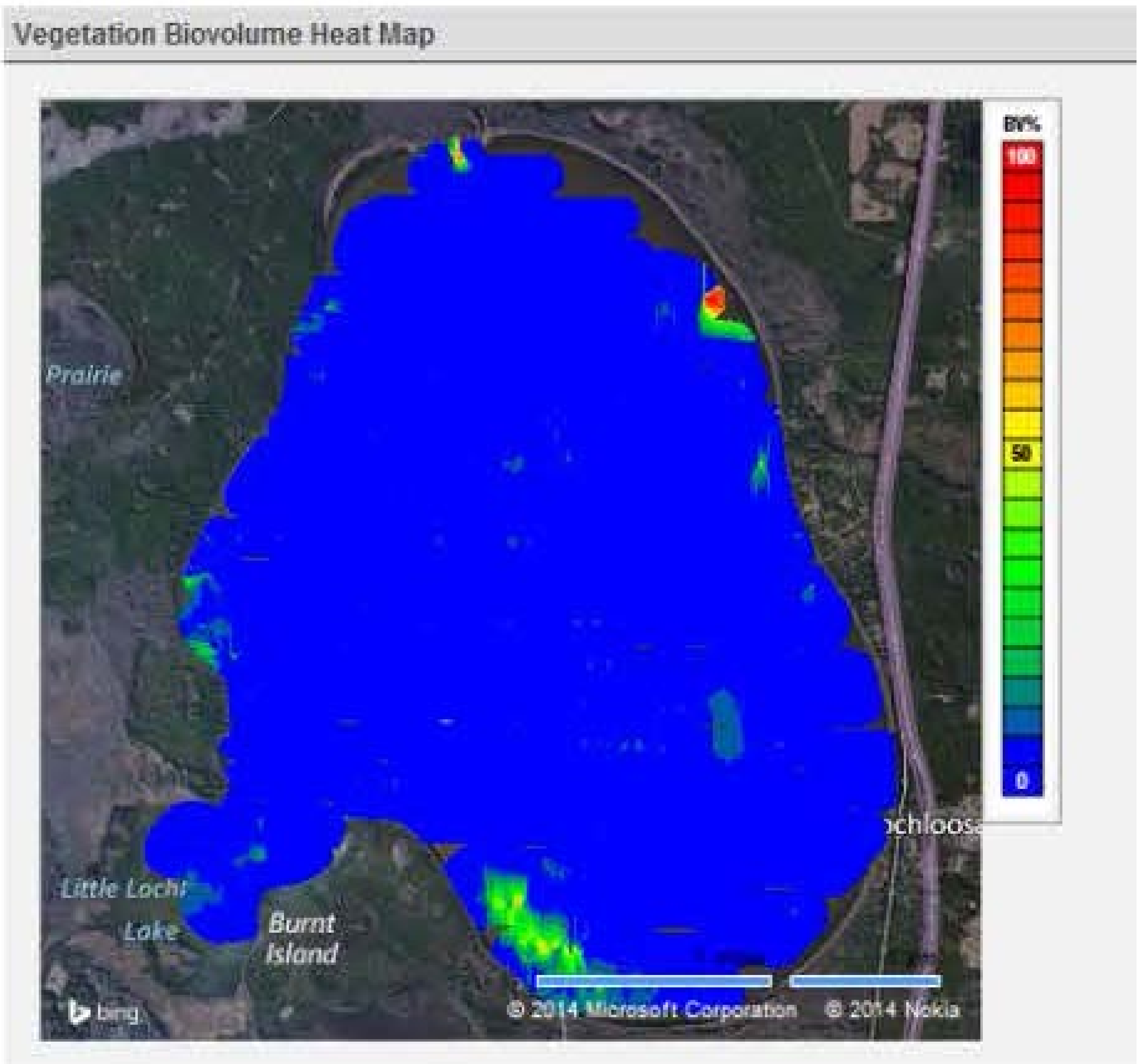

Figure D.3. Vegetation biovolume heat map for Lochloosa Lake, October 15, 2014

Source: *Vegetation Analysis Report for Lochloosa Lake.* The survey was conducted by FWC staff.

Appendix E: Historical Observations in Cross Creek, 1988–2012

Table E.1: Historical Chlorophyll *a*, Corrected Chlorophyll *a*, DO, DOSAT, TN, and TP Observations in Cross Creek, 1988–2012

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	DO (mg/L)	DOSAT (%)	TN (mg/L)	TP (mg/L)
21FLA 20020131	11/29/1988		3.74	6.20	63.92	1.09	0.142
21FLA 20020131	1/17/1989		5.53	5.20	53.61	0.96	0.030
21FLA 20020131	4/24/1989		19.26	4.30	50.59	1.19	0.079
21FLA 20020131	8/28/1989		25.62	6.40	82.06	0.89	0.050
21FLACEPCROSS CREEK2	1/22/1990			8.40	93.34	1.22	0.050
21FLSJWMCCN325	2/28/1994	19.00	14.70	5.27	55.15	2.07	0.105
21FLSJWMCCN325	3/22/1994	33.00	28.07	2.29	26.70	2.21	0.145
21FLSJWMCCN325	4/14/1994	31.23	23.52	1.61	19.36	1.84	0.119
21FLSJWMCCN325	5/17/1994	23.50	19.38	2.19	28.08	2.26	0.098
21FLSJWMCCN325	6/9/1994	32.36	26.20	5.51	70.73		0.087
21FLSJWMCCN325	7/7/1994	44.00	40.43	5.90	76.34	2.01	0.083
21FLSJWMCCN325	8/3/1994	54.77	46.78	3.66	48.12		0.112
21FLSJWMCCN325	1/26/1995	40.41	37.96	7.96	72.72	2.21	0.058
21FLSJWMCCN325	3/1/1995	34.82	31.81	9.61	102.97	1.93	0.077
21FLSJWMCCN325	3/29/1995	88.17	86.87	5.35	61.22	2.57	0.086
21FLACEPCROSS CREEK1	4/4/1995			4.20	47.73	1.87	0.057
21FLACEPCROSS CREEK2	4/4/1995			4.00	45.46	1.91	0.051
21FLSJWMCCN325	4/25/1995	12.84	10.96	4.49	52.62	2.52	0.106
21FLSJWMCCN325	6/8/1995	26.03	22.45	5.21	66.58	1.31	0.036
21FLACEPCROSS CREEK2	7/18/1995			1.30	16.67	1.33	0.088
21FLACEPCROSS CREEK1	7/18/1995			1.20	15.39	1.39	0.085
21FLSJWMCCN325	7/19/1995	24.24	20.05	7.38		1.34	0.078
21FLSJWMCCN325	8/10/1995	18.12	15.37	3.41	43.71	0.96	0.054
21FLSJWMCCN325	9/20/1995	18.27	15.77	2.98	35.05	1.30	0.075
21FLSJWMCCN325	10/18/1995	26.29	19.58	3.52	41.11	1.28	0.029
21FLSJWMCCN325	12/13/1995	16.97	13.35	7.29	71.15	1.30	0.032
21FLSJWMCCN325	1/24/1996	22.98	15.49	5.72	56.69	1.69	0.064
21FLSJWMCCN325	2/27/1996	33.05		5.65	63.49	1.34	0.077
21FLSJWMCCN325	5/1/1996	25.91	24.03	4.87	59.28	1.39	0.089
21FLSJWMCCN325	5/30/1996	20.41	17.80	1.83	23.12	1.42	0.060
21FLSJWMCCN325	6/26/1996	65.09	59.85	5.20		2.28	0.056
21FLSJWMCCN325	7/25/1996	29.33	24.56	2.26	17.30	2.24	0.001
21FLSJWMCCN325	8/27/1996	54.45	48.06	2.51	25.29		0.055
21FLSJWMCCN325	9/25/1996	26.70	22.16	1.22	15.03	1.83	0.050

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	DO (mg/L)	DOSAT (%)	TN (mg/L)	TP (mg/L)
21FLSJWMCCN325	10/22/1996	43.61	39.61	4.13	47.85	2.55	0.054
21FLSJWMCCN325	11/21/1996	30.11	23.50	3.64	40.07	2.33	0.024
21FLSJWMCCN325	12/18/1996	29.27	24.83	6.06	62.09	1.98	0.055
21FLSJWMCCN325	1/15/1997	41.35	36.71	7.42	72.03	2.42	0.059
21FLSJWMCCN325	2/18/1997	59.55	48.95	6.77	70.26	2.45	0.079
21FLSJWMCCN325	3/18/1997	84.84	72.98	4.75	53.60	2.09	0.080
21FLSJWMCCN325	4/24/1997	44.51	35.60	6.34	72.65	2.51	0.119
21FLSJWMCCN325	5/20/1997	32.84	28.70	4.41	70.36	1.72	0.074
21FLSJWMCCN325	6/25/1997	23.85	17.36	2.65	24.63	1.28	0.059
21FLSJWMCCN325	7/22/1997	41.72	35.38	2.70	35.36	1.39	0.095
21FLSJWMCCN325	8/20/1997	26.14	20.92	3.85		1.16	0.077
21FLSJWMCCN325	9/24/1997	21.24	16.38	3.56		1.76	0.056
21FLSJWMCCN325	10/15/1997			7.77	96.65	2.47	0.102
21FLSJWMCCN325	11/19/1997	34.79	31.77	8.50	87.36	2.01	0.064
21FLSJWMCCN325	12/16/1997	48.77	42.39	9.23	86.48	1.79	0.015
21FLSJWMCCN325	1/14/1998	65.59	58.34	9.10	95.63	2.12	0.090
21FLSJWMCCN325	2/10/1998	48.01	41.96	7.68	75.43	2.04	0.069
21FLSJWMCCN325	3/11/1998	24.40	20.41	6.33	64.86	1.54	0.075
21FLSJWMCCN325	4/8/1998	29.27	24.64	2.72	31.66	1.95	0.092
21FLSJWMCCN325	5/13/1998	61.78	52.33	6.71	85.33	1.42	0.082
21FLSJWMCCN325	10/7/2003			4.81	60.53	1.39	0.051
21FLSJWMCCN325	11/4/2003			3.44	41.34	1.36	0.041
21FLSJWMCCN325	12/2/2003			9.48	92.84	1.35	0.029
21FLSJWMCCN325	1/6/2004			4.09	42.72	1.57	0.051
21FLSJWMCCN325	2/3/2004			6.84	66.53	1.70	0.055
21FLSJWMCCN325	3/2/2004			7.65	80.37	1.53	0.043
21FLSJWMCCN325	4/7/2004			4.95	55.41	1.52	0.054
21FLSJWMCCN325	5/4/2004			3.95	47.98	1.68	0.070
21FLSJWMCCN325	6/8/2004			1.61	20.48	1.62	0.102
21FLSJWMCCN325	7/8/2004			3.53	45.28	1.33	0.066
21FLSJWMCCN325	8/11/2004			4.43	57.51	1.56	0.077
21FLSJWMCCN325	9/30/2004			1.59	19.68	1.59	0.116
21FLSJWMCCN325	10/20/2004			0.48	5.67	1.48	0.144
21FLSJWMCCN325	11/9/2004			1.25	13.94	1.48	0.127
21FLSJWMCCN325	12/7/2004			2.92	30.81	1.55	0.090
21FLSJWMCCN325	1/11/2005			2.70	28.28	1.43	0.089
21FLSJWMCCN325	2/8/2005			5.62	55.47	1.61	0.077
21FLSJWMCCN325	3/8/2005			5.86	62.34	1.37	0.075
21FLSJWMCCN325	4/6/2005			4.68	52.70	1.55	0.074
21FLSJWMCCN325	5/4/2005			2.75	32.77	1.54	0.098
21FLSJWMCCN325	6/14/2005			1.14	14.52	1.55	0.164

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	DO (mg/L)	DOSAT (%)	TN (mg/L)	TP (mg/L)
21FLSJWMCCN325	7/7/2005			0.92	11.95	1.37	0.152
21FLSJWMCCN325	8/2/2005			0.36	4.62	1.57	0.214
21FLSJWMCCN325	9/13/2005			1.28	15.85	1.55	0.168
21FLSJWMCCN325	10/4/2005			2.59	32.28	1.49	0.163
21FLSJWMCCN325	11/3/2005			6.03	67.22	1.50	0.123
21FLSJWMCCN325	12/7/2005			7.62	75.56	1.36	0.105
21FLSJWMCCN325	1/5/2006			6.49	65.40	1.45	0.104
21FLSJWMCCN325	2/9/2006			7.31	70.31	1.25	0.089
21FLSJWMCCN325	3/9/2006			5.44	58.61	1.33	0.102
21FLSJWMCCN325	4/5/2006			6.18	72.32	1.24	0.109
21FLSJWMCCN325	5/1/2006			9.75	115.66	1.46	0.147
21FLSJWMCCN325	6/6/2006			2.94	36.48	1.19	0.169
21FLSJWMCCN325	7/12/2006			3.31		1.62	0.251
21FLSJWMCCN325	8/10/2006			5.71		1.64	0.194
21FLSJWMCCN325	9/5/2006			9.95		1.66	0.141
21FLSJWMCCN325	10/4/2006			5.57	67.97	1.58	0.121
21FLSJWMCCN325	11/8/2006			8.67	97.70	1.74	0.113
21FLSJWMCCN325	12/6/2006			7.74	74.15	3.29	0.215
21FLSJWMCCN325	1/4/2007			7.55	83.23	1.49	0.108
21FLSJWMCCN325	2/6/2007			8.84	85.29	1.25	0.092
21FLSJWMCCN325	3/6/2007			7.97	79.60	3.00	0.200
21FLSJWMCCN325	4/5/2007			7.09	81.52	1.48	0.155
21FLSJWMCCN325	5/1/2007			8.76		1.79	0.136
21FLSJWMCCN325	6/11/2007			7.37		2.53	0.182
21FLSJWMCCN325	7/5/2007					3.31	0.244
21FLSJWMCCN325	8/6/2007			8.59		3.72	0.226
21FLSJWMCCN325	9/10/2007			8.96		2.89	0.136
21FLSJWMCCN325	10/10/2007			8.42			
21FLSJWMCCN325	11/7/2007			8.36	84.88	2.13	0.078
21FLSJWMCCN325	12/6/2007			9.54	96.47	2.15	0.064
21FLSJWMCCN325	1/8/2008			9.37	104.48	2.05	0.078
21FLSJWMCCN325	2/13/2008			7.90	85.15	2.46	0.152
21FLSJWMCCN325	3/5/2008			8.30	95.12	2.98	0.140
21FLSJWMCCN325	4/7/2008			3.67	43.21	3.19	0.104
21FLSJWMCCN325	5/7/2008			3.51	45.34	3.61	0.102
21FLSJWMCCN325	6/10/2008			4.64	61.30	2.16	0.126
21FLSJWMCCN325	7/8/2008			4.83	62.70	2.43	0.111
21FLSJWMCCN325	8/6/2008			5.16		3.05	0.080
21FLSJWMCCN325	9/8/2008			4.36	57.58	3.01	0.084
21FLSJWMCCN325	10/9/2008			4.06	50.86	3.20	0.096
21FLSJWMCCN325	11/13/2008			1.61	18.74	3.67	0.099

Station	Date	Chlorophyll *a* (µg/L)	Corrected Chlorophyll *a* (µg/L)	DO (mg/L)	DOSAT (%)	TN (mg/L)	TP (mg/L)
21FLACEPCC325	11/18/2008						
21FLSJWMCCN325	12/10/2008			2.16	24.08	2.94	0.045
21FLSJWMCCN325	1/6/2009			1.72	19.87	2.92	0.051
21FLSJWMCCN325	2/3/2009			4.08	41.61	3.44	0.061
21FLSJWMCCN325	3/5/2009			4.50	41.65	3.28	0.085
21FLACEPCC325	3/18/2009						
21FLSJWMCCN325	4/9/2009			4.05	40.67	3.35	0.025
21FLSJWMCCN325	5/6/2009			2.90	33.50	3.76	0.117
21FLSJWMCCN325	6/4/2009			3.13	39.60	2.24	0.142
21FLSJWMCCN325	7/9/2009			3.44	43.12	1.47	0.072
21FLSJWMCCN325	8/6/2009			2.23	28.85	1.53	0.059
21FLSJWMCCN325	9/3/2009			2.84	35.51	1.37	0.062
21FLACEPCC325	4/12/2010					1.50	0.130
21FLSJWMCCN325	10/11/2010			3.81	49.28	3.20	0.086
21FLSJWMCCN325	11/10/2010			6.24	59.18	2.78	0.051
21FLSJWMCCN325	12/6/2010			9.72	93.29	4.60	0.093
21FLSJWMCCN325	1/12/2011			9.35	92.76	3.11	0.063
21FLCEN 20020131	1/27/2011			8.85	83.11		
21FLSJWMCCN325	2/24/2011			7.97	91.51	3.43	0.131
21FLSJWMCCN325	3/9/2011			8.13	86.48		0.176
21FLSJWMCCN325	11/7/2012	17.82	13.83	0.00	0.00	3.22	0.115

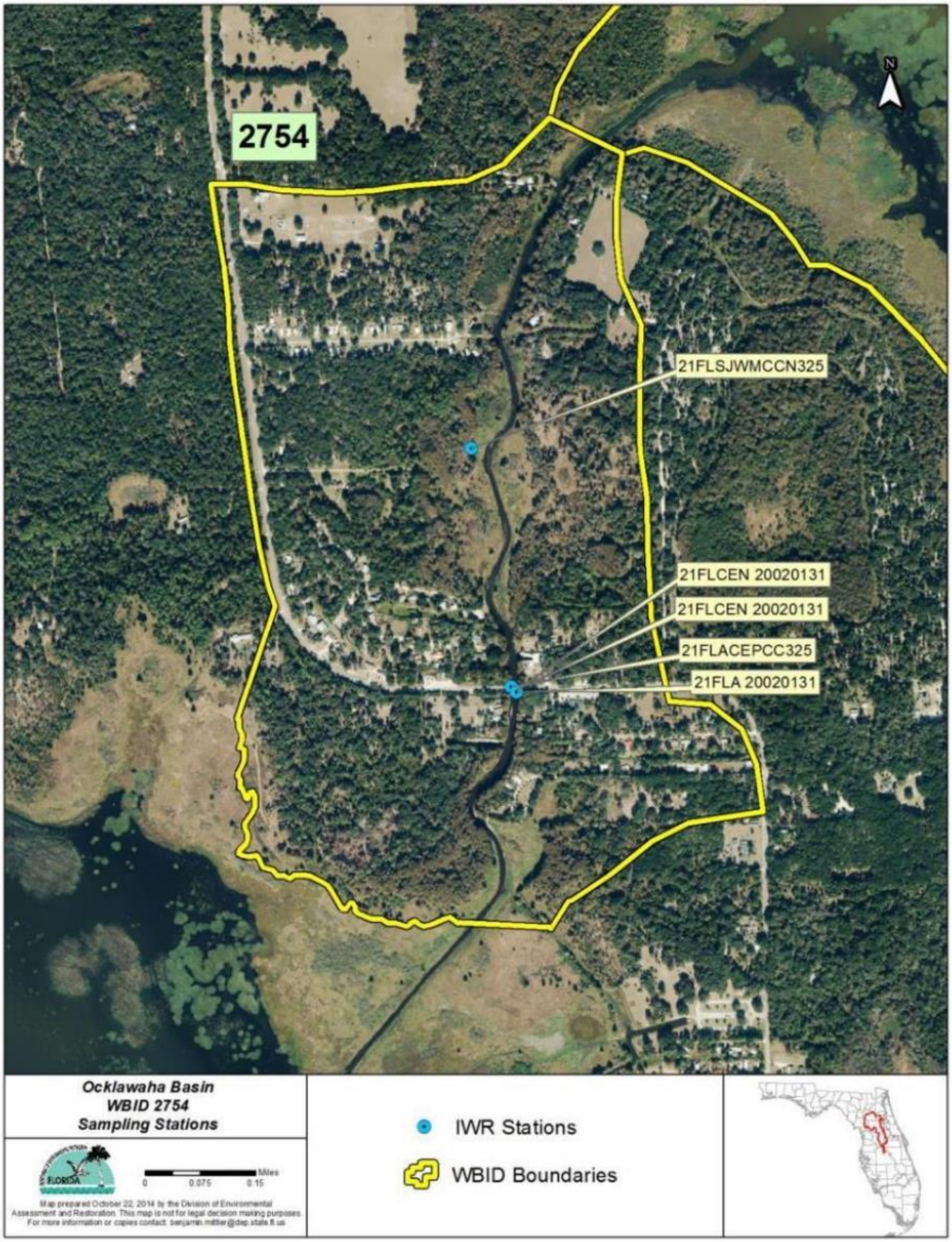

Figure E.1. Sampling locations in Cross Creek

Appendix F. Monthly and Annual Precipitation for Gainesville, FL, 1954–2013

Table F.1: Monthly and Annual Precipitation (inches) for Gainesville, FL, 1954–2013

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1954	1.12	1.64	2.58	3.05	3.54	3.81	3.75	5.02	4.79	2.7	1.44	1.8	**35.24**
1955	3.6	3.14	1.66	1.21	1.88	7.83	10.51	4.71	4.4	1.15	2.54	0.09	**42.72**
1956	3.14	4.19	0.84	2.78	4.51	9.67	7.24	6.81	3.05	5.57	0.16	0.02	**47.98**
1957	0.59	2.37	5.12	3.94	6.69	7.51	8.72	10.33	6.5	1.94	2.12	0.87	**56.7**
1958	4.1	3.8	7.15	5.68	5.54	4.91	7.62	8.98	1.56	3.91	3.36	3.25	**59.86**
1959	3.72	4.37	10.48	4.12	9.25	4.44	4	7.33	5.25	5.65	1.69	0.84	**61.14**
1960	2.51	3.76	7.48	2.73	1.37	12.8	9.4	7.63	6.38	6.12	0.12	2.64	**62.94**
1961	2.5	6.15	1.27	3.54	1.07	4.14	9.1	12.83	3.15	0.77	2.35	0.88	**47.75**
1962	1.66	1.87	2.69	1.79	2.19	8.35	7.04	8.62	6	3.28	1.92	1.69	**47.1**
1963	2.21	4.52	2.56	1.3	3.51	3.57	6.83	3.21	3.14	0.26	3.25	2.91	**37.27**
1964	8.87	6.61	1.87	4.23	1.61	4.86	10.59	14.15	13.04	2.15	2.4	6.57	**76.95**
1965	2.51	5.8	4.82	1.78	2.21	15.74	10.86	7.62	5.16	1.54	1.55	4.41	**64**
1966	3.58	6.18	1.93	1.85	8.92	7.26	4.46	5.11	12.25	1.44	0.59	1.13	**54.7**
1967	3.55	5.52	1.33	0.39	4.35	9.31	10.16	7.74	3.03	0.29	0.99	5.88	**52.54**
1968	0.67	2.36	2.23	0.18	3.15	5.95	9.45	12.27	5.21	4.25	3.09	1.02	**49.83**
1969	1.51	4.59	5.42	0.91	2.97	2.77	6.55	8.48	9.64	1.27	3.7	5.74	**53.55**
1970	4.32	7.92	7.55	2.98	6.93	6.53	7.36	10.8	1.87	1.97	0.15	2.15	**60.53**
1971	3	3.85	2.08	2.99	3.75	3.59	5.47	12.73	3.1	4.46	2.22	3.1	**50.34**
1972	4.98	3.31	7.51	2.89	9.19	10.22	3.16	12.99	1.12	0.99	7.27	4.15	**67.78**
1973	4.16	4.33	6.14	5.74	3.97	6.72	6.29	2.93	3.84	0.51	0.84	5.13	**50.6**
1974	0.25	2.58	2.39	1.17	5.68	10.05	7.95	7.2	7.27	0.91	1.03	4.03	**50.51**
1975	3.11	4.25	0.99	2.21	5.01	4.87	6.45	4.41	12.55	3.01	1.05	3.69	**51.6**
1976	1.2	1.49	1.46	3.19	6.65	11.37	4.59	2.84	5.36	2.21	2.78	4.97	**48.11**
1977	3.35	4.16	1.22	0.83	0.46	2.26	1.44	7.1	5.72	0.13	1.95	4.94	**33.56**
1978	6.2	4.98	4.52	0.64	3.45	3.9	10.36	9.64	0.25	0.47	0	4.79	**49.2**
1979	8.69	2.34	1.17	8.18	3.36	4.55	4.39	7.39	12.23	0.11	1.32	6.09	**59.82**
1980	6.2	1.88	2.97	4.18	5.08	2.29	8.66	3.18	3.71	1.7	1.43	0.28	**41.56**
1981	1.2	6.21	3.54	0.4	0.83	6.79	2.91	4.98	1.1	0.81	4.2	2.28	**35.25**
1982	5.41	5	5.42	8.73	3.11	8.74	6.76	6.18	7.1	1.56	1.62	1.47	**61.1**
1983	2.89	5.29	7.19	7.26	4.2	10.04	4.18	1.64	10.95	1.36	4.44	5.91	**65.35**
1984	1.19	4.76	3.24	3.26	6.92	2.88	6.15	3.36	2.4	1.79	2.86	0.44	**39.25**
1985	1.2	1.97	1.37	4.7	3.43	6.46	5.39	13.43	3.29	4.34	3.3	0.95	**49.83**
1986	6.27	5.35	3.55	0.63	0.98	5.65	6.74	8.54	3.1	3.89	3.96	3.65	**52.31**
1987	4.53	5.42	10.28	0.45	4.27	2.95	3.9	5.4	4.06	0.27	4.31	1.18	**47.02**
1988	5.11	4.75	7.78	1.35	3.24	3.3	2.07	12.07	11.97	0.81	3.32	1.61	**57.38**
1989	1.14	1.19	2.17	2.93	1.91	9.66	4.44	6.08	4.66	1.02	2.14	3.13	**40.47**
1990	1.97	3.54	1.82	2.78	0.86	11.27	6.41	4.08	2.99	3.16	1.84	1.61	**42.33**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1991	6.66	0.32	8.78	6.02	6.24	6.58	7.25	4.02	2.4	1.41	0.31	0.98	**50.97**
1992	5.2	3.48	4	3.78	1.99	12.86	1.52	8.55	4.37	5.74	2.06	0.73	**54.28**
1993	3.26	4.77	4.61	0.91	1.41	6.07	3.41	5.65	2	7.98	1.35	2.23	**43.65**
1994	9.01	0.43	2.65	1.51	3.83	4.6	7.66	6.14	5.98	5.1	0.7	1.28	**48.89**
1995	3.08	1.07	6.14	5.18	2.47	7.55	7.66	7.2	2.1	4.33	3.15	1.29	**51.22**
1996	2.24	0.77	11.13	2.74	2.01	6.15	11.1	4.78	2.43	5.32	1.51	4.47	**54.65**
1997	2	1.07	2.39	7.42	3.21	8.99	7.09	3.78	2.51	6.1	4.06	9.6	**58.22**
1998	3.7	11.58	3.15	0.08	0.94	2.81	7.1	7.57	7.44	0.16	0.24	0.85	**45.62**
1999	4.9	1.92	0.61	1.66	1.58	6.76	3.43	7.1	4.62	1.84	2.2	1.14	**37.76**
2000	3.19	0.65	2.14	1.12	0.51	6.12	5.4	3.73	8.46	0.92	1.51	0.6	**34.35**
2001	0.8	0.89	6.45	1	1.38	10.79	8.12	2.81	8.18	0.08	0.57	1.07	**42.14**
2002	4.03	1.02	1.74	0.74	2.67	7.34	10.99	6.87	6.82	2.65	3.95	6.51	**55.33**
2003	0.4	5.27	8.7	1.1	1.86	8.52	5.21	4.15	5.59	2.6	2.75	0.47	**46.62**
2004	1.58	5.53	2	1.11	0.46	7.06	3.99	14.32	16.45	2.61	1.99	1.27	**58.37**
2005	1.41	1.82	4.6	5.41	4.13	8.1	4.89	7.43	1.2	3.43	1.21	6.35	**49.98**
2006	3.43	5.08	0.32	3.5	0.63	4.79	5.51	2.77	3.11	2.58	0.94	2.77	**35.43**
2007	4	3.19	1.68	0.7	0.77	6.89	8.92	6.63	3.42	7.01	0.84	2.04	**46.09**
2008	3.79	3.15	4.36	1.05	0.62	5.3	5.61	9.22	0.53	3.66	1.54	0.89	**39.72**
2009	3.49	2.09	3.97	2.7	8.23	3.66	6.73	6.78	2.84	1.43	2.26	2.72	**46.9**
2010	4.54	3.87	3.25	2.99	3.08	8.99	5.45	4.9	1.35	0	0.56	0.69	**39.67**
2011	3.68	3.59	3.04	1.17	2.63	5.78	3.5	3.29	1.86	2.73	1.62	0.49	**33.38**
2012	0.85	1.06	3.36	0.91	6.9	16.34	2.74	9.95	6.26	0.89	0.05	6.93	**56.24**
2013	0.33	1.64	0.98	3.48	4.57	6.25	16.65	2.8	3.2	0.08	3.31	3.79	**47.08**
AVE	**3.30**	**3.60**	**3.90**	**2.72**	**3.47**	**6.92**	**6.52**	**6.97**	**5.07**	**2.44**	**2.03**	**2.74**	**49.68**

Appendix G. Spearman Correlation Matrix of AGMs for Lochloosa Lake, 1988–2013

Spearman Correlation Matrix

PARAMETER	TURBIDITY				
TURBIDITY	1.000				
TSS	0.929	1.000			
TP	0.426	0.250	1.000		
TN	0.641	0.918	0.343	1.000	
TEMP	0.103	0.196	-0.084	-0.103	1.000
SD	-0.546	-0.829	-0.452	-0.932	0.136
NO3O2	-0.700	-0.711	0.057	-0.589	-0.318
NH4	0.039	0.207	-0.101	-0.080	0.482
INORGP	-0.010	-0.115	0.269	0.214	0.055
DOSAT	0.570	0.479	0.517	0.462	0.123
DO	0.588	0.629	0.543	0.531	-0.218
COND	0.511	0.575	-0.161	0.671	0.279
COLOR	-0.539	-0.718	-0.029	-0.571	-0.086
CHLAC	0.623	0.911	0.371	0.784	-0.095
CHLA	0.837	0.900	0.421	0.716	0.202
PRECIP	-0.469	-0.621	-0.448	-0.400	0.202
V1YRDEFICIIT	0.469	0.621	0.448	0.400	-0.202
V3YRDEFICIT	0.542	0.750	0.276	0.678	-0.015
V5YRDEFICIT	0.400	0.282	0.026	0.559	-0.093
V7YRDEFICIT	-0.124	-0.296	0.124	0.275	-0.370
LAKEELEVATION	-0.653	-0.718	-0.163	-0.543	-0.209

PARAMETER	SD	NO3O2	NH4	INORGP	DOSAT
SD	1.000				
NO3O2	0.564	1.000			
NH4	0.021	-0.161	1.000		
INORGP	-0.131	0.394	-0.076	1.000	
DOSAT	-0.469	-0.225	0.086	0.117	1.000
DO	-0.597	-0.418	0.002	-0.114	0.844
COND	-0.361	-0.243	0.243	0.108	0.411
COLOR	0.311	0.500	0.054	-0.061	-0.107
CHLAC	-0.791	-0.775	-0.028	-0.057	0.342
CHLA	-0.749	-0.743	0.158	-0.272	0.472
PRECIP	0.375	0.357	-0.014	0.164	-0.529
V1YRDEFICIIT	-0.375	-0.357	0.014	-0.164	0.529
V3YRDEFICIT	-0.542	-0.214	0.002	0.137	0.513
V5YRDEFICIT	-0.357	0.182	-0.215	0.277	0.452
V7YRDEFICIT	-0.188	0.639	-0.274	0.321	0.337
LAKEELEVATION	0.256	0.157	-0.049	-0.088	-0.593

PARAMETER	DO	COND	COLOR	CHLAC	CHLA
DO	1.000				
COND	0.286	1.000			
COLOR	-0.239	-0.643	1.000		
CHLAC	0.559	0.400	-0.504	1.000	
CHLA	0.574	0.346	-0.457	0.867	1.000
PRECIP	-0.592	-0.196	0.304	-0.424	-0.692
V1YRDEFICIIT	0.592	0.196	-0.304	0.424	0.692
V3YRDEFICIT	0.500	0.761	-0.518	0.593	0.537
V5YRDEFICIT	0.293	0.746	-0.368	0.180	0.110
V7YRDEFICIT	0.263	0.243	0.161	-0.032	-0.313
LAKEELEVATION	-0.399	-0.843	0.693	-0.326	-0.451

PARAMETER	PRECIP	V1YRDEFICIIT	V3YRDEFICIT	V5YRDEFICIT	V7YRDEFICIT
PRECIP	1.000				
V1YRDEFICIIT	-1.000	1.000			
V3YRDEFICIT	-0.608	0.608	1.000		
V5YRDEFICIT	-0.335	0.335	0.729	1.000	
V7YRDEFICIT	-0.341	0.341	0.508	0.733	1.000
LAKEELEVATION	0.358	-0.358	-0.752	-0.668	-0.267

Pairwise Frequency Table

PARAMETER	TURBIDITY	TSS	TP	TN	TEMP
TURBIDITY	24				
TSS	15	15			
TP	24	15	25		
TN	23	15	24	24	
TEMP	24	15	24	23	24
SD	24	15	25	24	24
NO3O2	15	15	15	15	15
NH4	24	15	24	23	24
INORGP	24	15	24	23	24
DOSAT	24	15	24	23	24
DO	24	15	24	23	24
COND	15	15	15	15	15
COLOR	15	15	15	15	15
CHLAC	23	15	23	23	23
CHLA	19	15	20	20	19
PRECIP	19	15	25	24	24
V1YRDEFICIIT	24	15	25	24	24
V3YRDEFICIT	24	15	25	24	24
V5YRDEFICIT	24	15	25	24	24
V7YRDEFICIT	24	15	25	24	24
LAKEELEVATION	22	15	23	22	22

PARAMETER	SD	NO3O2	NH4	INORGP	DOSAT
SD	25				
NO3O2	15	15			
NH4	24	15	24		
INORGP	24	15	24	24	
DOSAT	24	15	24	24	24
DO	24	15	24	24	24
COND	15	15	15	24	15
COLOR	15	15	15	24	15
CHLAC	23	15	23	24	23
CHLA	20	15	19	24	19
PRECIP	25	15	24	24	24
V1YRDEFICIIT	25	15	24	24	24
V3YRDEFICIT	25	15	24	24	24
V5YRDEFICIT	25	15	24	24	24
V7YRDEFICIT	25	15	24	24	24
LAKEELEVATION	23	15	22	22	22

PARAMETER	DO	COND	COLOR	CHLAC	CHLA
DO	24				
COND	15	15			
COLOR	15	15	15		
CHLAC	23	15	15	23	
CHLA	19	15	15	19	20
PRECIP	24	15	15	23	20
V1YRDEFICIIT	24	15	15	23	20
V3YRDEFICIT	24	15	15	23	20
V5YRDEFICIT	24	15	15	23	20
V7YRDEFICIT	24	15	15	23	20
LAKEELEVATION	22	15	15	21	20

PARAMETER	PRECIP	V1YRDEFICIIT	V3YRDEFICIT	V5YRDEFICIT	V7YRDEFICIT
PRECIP	25				
V1YRDEFICIIT	25	25			
V3YRDEFICIT	25	25	25		
V5YRDEFICIT	25	25	25	25	
V7YRDEFICIT	25	25	25	25	25
LAKEELEVATION	23	23	23	23	23

Appendix H. Central Valley Lake Region 80th Percentile TN and TP AGMs

Table H.1: Central Valley Lake Region 80th percentile TN AGMs

WBID	Planning Unit	Lake	Years	80th Percentile TN AGM (mg/L)
2811	Lake Griffin	West Emeralda Marsh Conservation Area	16	3.65
1351B	Lake Panasoffkee	Lake Panasoffkee	21	0.99
2699A	Orange Creek	Lake Elizabeth	7	1.03
2705B	Orange Creek	Newnans Lake	24	4.49
2713B	Orange Creek	Redwater Lake	13	1.43
2713C	Orange Creek	Holdens Pond	8	1.16
2713D	Orange Creek	Little Orange Lake	23	1.10
2717A	Orange Creek	Haile Sink	12	0.71
2718B	Orange Creek	Bivans Arm	17	3.04
2729A	Orange Creek	McMeekin Lake	18	0.69
2738A	Orange Creek	Lochloosa Lake	23	2.98
2740B	Rodman Reservoir	Lake Ocklawaha	25	0.84
2741A	Orange Creek	Waubert Lake	22	2.29
2742A	Orange Creek	Star Lake	23	0.46
2749A	Orange Creek	Orange Lake	25	2.05
2771A	Rodman Reservoir	Lake Eaton	22	1.46
2775D	Rodman Reservoir	Lake Lou	11	1.11
2775F	Rodman Reservoir	Lake Charles	22	2.09
2781A	Rodman Reservoir	Halfmoon Lake	22	0.93
2782A	Rodman Reservoir	North Lake	10	0.70
2782C	Rodman Reservoir	Lake Bryant	7	1.45
2807A	Lake Griffin	Lake Yale	33	1.80
2814A	Lake Griffin	Lake Griffin	41	3.43
2817B	Lake Harris	Lake Eustis	34	2.58
2818B	Lake Griffin	Lake Unity	20	1.00
2819A	Lake Harris	Trout Lake	19	2.43
2825A	Lake Griffin	Silver Lake	7	1.99
2829A	Lake Griffin	Lake Lorraine	22	2.20
2831B	Lake Harris	Lake Dora	35	3.94
2832A	Lake Harris	Lake Denham	17	3.31
2834C	Lake Harris	Lake Beauclair	29	4.73
2835D	Lake Apopka	Lake Apopka	29	4.83
2837B	Lake Harris	Lake Carlton	18	3.78
2838A	Lake Harris	Lake Harris	29	2.03
2838B	Lake Harris	Little Lake Harris	26	2.17

Table H.2: Central Valley Lake Region 80th percentile AGMs

WBID	Planning Unit	Lake	Years	80th Percentile TP AGM (mg/L)
2811	Lake Griffin	West Emeralda Marsh Conservation Area	16	0.246
1351B	Lake Panasoffkee	Lake Panasoffkee	21	0.041
2705B	Orange Creek	Newnans Lake	23	0.219
2713B	Orange Creek	Redwater Lake	13	0.162
2713C	Orange Creek	Holdens Pond	8	0.072
2713D	Orange Creek	Little Orange Lake	23	0.083
2717A	Orange Creek	Haile Sink	10	0.620
2718B	Orange Creek	Bivans Arm	17	0.228
2720A	Orange Creek	Alachua Sink	7	1.855
2729A	Orange Creek	McMeekin Lake	18	0.024
2738A	Orange Creek	Lochloosa Lake	24	0.083
2740B	Rodman Reservoir	Lake Ocklawaha	26	0.051
2741A	Orange Creek	Wauberg Lake	22	0.146
2742A	Orange Creek	Star Lake	23	0.032
2749A	Orange Creek	Orange Lake	26	0.085
2771A	Rodman Reservoir	Lake Eaton	23	0.045
2775D	Rodman Reservoir	Lake Lou	11	0.019
2775F	Rodman Reservoir	Lake Charles	25	0.078
2781A	Rodman Reservoir	Halfmoon Lake	22	0.016
2782A	Rodman Reservoir	North Lake	10	0.022
2782C	Rodman Reservoir	Lake Bryant	7	0.031
2807A	Lake Griffin	Lake Yale	35	0.034
2814A	Lake Griffin	Lake Griffin	41	0.103
2817B	Lake Harris	Lake Eustis	34	0.055
2818B	Lake Griffin	Lake Unity	20	0.038
2819A	Lake Harris	Trout Lake	19	0.294
2825A	Lake Griffin	Silver Lake	7	0.030
2829A	Lake Griffin t	Lake Lorraine	22	0.043
2831B	Lake Harris	Lake Dora	36	0.106
2832A	Lake Harris	Lake Denham	17	0.107
2834C	Lake Harris	Lake Beauclair	33	0.194
2835D	Lake Apopka	Lake Apopka	32	0.176
2837B	Lake Harris	Lake Carlton	22	0.118
2838A	Lake Harris	Lake Harris	31	0.044
2838B	Lake Harris	Little Lake Harris	26	0.047

Appendix I. HSPF Subwatershed Land Use Figures and Land Use Loads under Current and Natural Background Scenarios

Land uses based on the SJRWMD 2009 land use coverage are presented for each sub-basin, along with model-predicted annual discharge, TN load, and TP load under current conditions associated with assigned land use categories in the HSPF model. HSPF model land use groupings (Clapp and Smith 2015, Appendix A) based on the Florida Land Use Cover and Classification System (FLUCCS) are presented for each subwatershed. Results are also presented for the natural background scenario in which anthropogenic land uses were converted to forest or wetland based on soil characteristics.

A special action in the model calculates a variable water/wetland area as a function of water level in the reach. With the exception of Reach 27, the time series of the variable area was not available, and thus the remaining subwatersheds include separate totals for water and wetland based on a fixed area.

Subwatershed 16: Elizabeth Creek

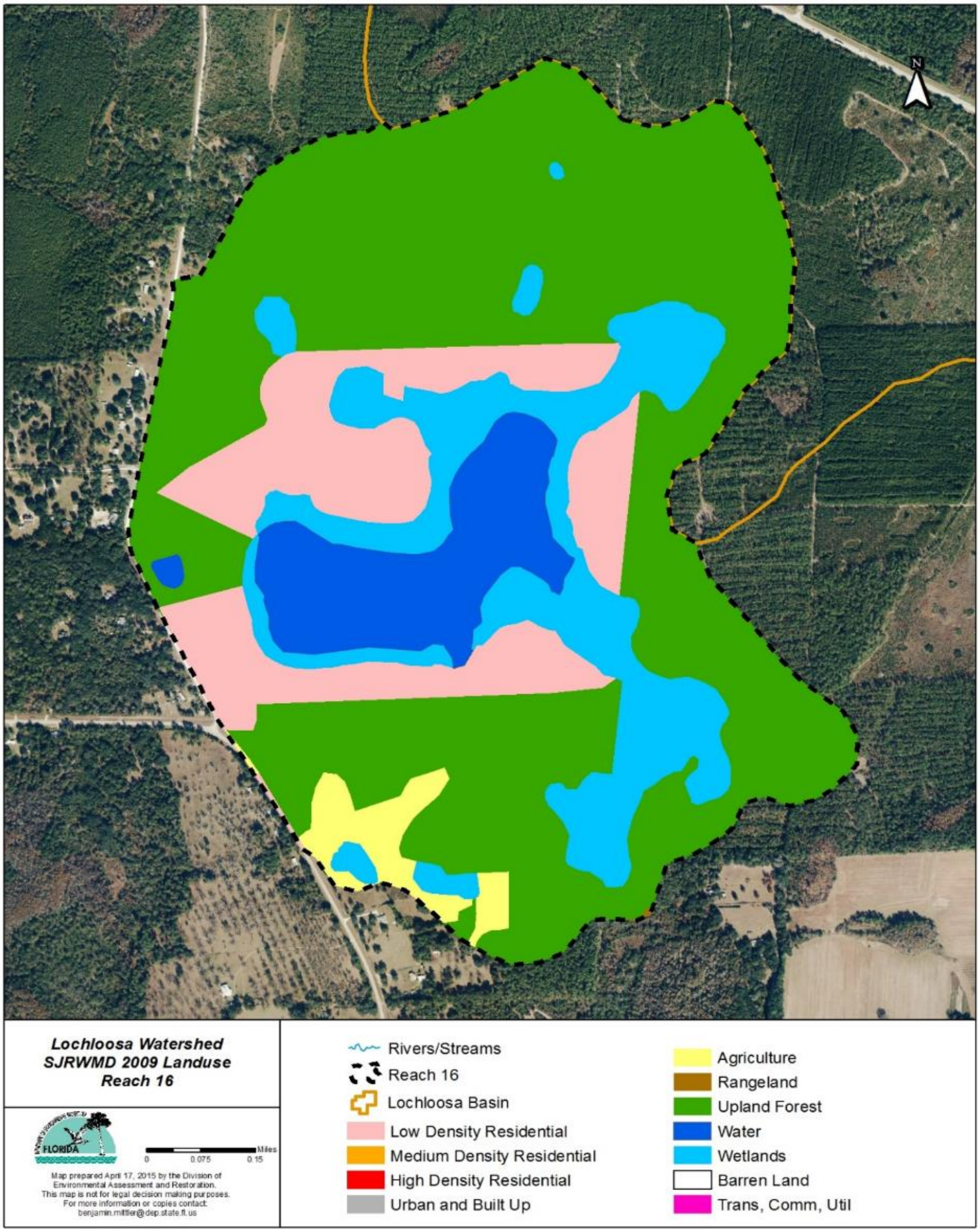

Figure I.1. Subwatershed 16 2009 land use

Table I.1. Subwatershed 16 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	86.79
1180	Rural residential	Low Density Residential	15.71
2110	Improved pastures (monocult, planted forage crops)	Agriculture General	12.60
2200	Tree crops	Agriculture Tree Crops	2.75
3300	Mixed upland nonforested/ Mixed rangeland	Rangeland	0.09
4110	Mixed upland nonforested/ Mixed rangeland	Forest	9.43
4340	Upland mixed coniferous/hardwood	Forest	88.96
4410	Coniferous pine	Forest	107.34
4430	Forest regeneration areas	Forest Regeneration	94.40
5200	Lakes	Water	48.06
5300	Reservoirs – pits, retention ponds, dams	Water	1.03
6170	Mixed wetland hardwoods	Wetlands	4.93
6210	Cypress	Wetlands	20.71
6250	Hydric pine flatwoods	Wetlands	18.53
6300	Wetland forested mixed	Wetlands	15.01
6410	Freshwater marshes	Wetlands	12.87
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	17.81
		SUM	**557.02**

Table I.2a. Annual TN load (lbs/yr) from land uses in Subwatershed 16 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	781.5	1,160.4	490.8	840.6	947.1	873.1	557.0	215.4	779.7
Pasture	104.9	181.5	70.4	130.8	147.1	127.1	82.2	32.3	121.8
Agriculture Trees	24.2	51.8	16.7	33.5	39.2	30.8	20.4	3.5	30.4
Rangeland	0.3	0.5	0.2	0.3	0.4	0.3	0.2	0.1	0.3
Forest	346.1	778.9	240.1	307.7	504.9	313.3	214.5	6.6	295.5
Water	58.3	181.3	38.5	43.9	95.7	103.5	80.8	1.3	67.5
Wetlands	159.3	506.3	104.6	121.1	265.5	355.3	222.9	3.4	180.9
Forest Regeneration	116.6	263.0	79.0	120.7	173.5	111.5	75.4	4.5	108.5
Wetlands Nonreach	9.2	31.4	6.8	16.0	20.0	25.3	12.8	0.2	14.2
SUM	**1,600.5**	**3,155.0**	**1,047.0**	**1,614.6**	**2,193.3**	**1,940.2**	**1,266.2**	**267.2**	**1,598.7**

Table I.2b. Annual TP load (lbs/yr) from land uses in Subwatershed 16 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	99.4	152.3	59.3	102.0	119.2	104.0	64.9	28.2	90.3
Pasture	12.7	23.3	8.0	15.0	18.0	14.2	8.8	3.2	13.5
Agriculture Trees	3.0	6.6	1.9	3.7	4.7	3.2	2.1	0.3	3.4
Rangeland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forest	26.0	60.2	17.6	22.3	37.4	22.2	15.1	0.4	21.4
Water	4.4	13.8	2.9	3.1	7.0	7.7	6.0	0.0	4.4
Wetlands	12.3	38.8	7.9	8.7	19.6	26.0	16.9	0.1	11.8
Forest Regeneration	8.6	20.2	5.8	8.7	12.7	7.8	5.3	0.3	7.8
Wetlands Nonreach	0.7	2.5	0.5	1.2	1.5	1.9	1.0	0.0	1.0
SUM	**167.2**	**317.7**	**103.8**	**164.6**	**220.2**	**187.1**	**120.1**	**32.6**	**153.6**

Table I.2c. Annual discharge (acre-feet/year [ac-ft/yr]) from land uses in Subwatershed 16 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	96.7	90.7	27.2	71.5	74.4	46.8	28.4	16.0	77.7
Pasture	7.5	6.6	1.3	5.1	5.4	2.6	1.5	0.3	5.8
Agriculture Trees	1.8	1.7	0.3	1.1	1.3	0.5	0.3	0.0	1.3
Rangeland	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1
Forest	92.4	80.5	13.9	47.7	57.5	22.7	13.9	0.4	44.0
Water	40.9	74.0	15.7	21.5	44.3	32.8	25.5	0.5	13.8
Wetlands	149.9	228.1	43.8	74.6	136.1	101.0	71.3	1.3	37.6
Forest Regeneration	34.2	29.6	5.2	18.5	21.8	8.8	5.4	0.2	19.6
Wetlands Nonreach	42.1	41.9	6.6	23.6	29.4	14.3	8.3	0.1	21.4
SUM	**465.6**	**553.1**	**114.0**	**263.8**	**370.2**	**229.5**	**154.6**	**18.9**	**221.2**

Table I.3a. Annual TN load (lbs/yr) from land uses in Subwatershed 16 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	580.8	1305.0	402.3	515.6	846.0	525.0	359.5	11.1	495.0
Water	58.3	181.3	38.5	43.9	95.7	103.5	80.8	1.3	67.5
Wetlands	198.4	630.5	130.3	150.9	330.6	442.5	277.7	4.2	225.3
Wetland Non-reach	9.2	31.0	6.7	8.9	18.8	24.7	12.7	0.2	13.4
SUM	**846.8**	**2147.8**	**577.8**	**719.2**	**1,291.1**	**1,095.7**	**730.6**	**16.7**	**801.1**

Table I.3b. Annual TP load (lbs/yr) from land uses in Subwatershed 16 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	24.4	52.1	16.0	20.6	33.7	21.1	14.5	0.5	19.5
Water	4.4	13.8	2.9	3.1	7.0	7.7	6.0	0.0	4.4
Wetlands	15.4	48.4	9.8	10.9	24.5	32.4	21.1	0.1	14.8
Wetland Nonreach	0.7	2.4	0.5	0.7	1.4	1.8	1.0	0.0	0.9
SUM	**45.0**	**116.7**	**29.2**	**35.2**	**66.5**	**62.9**	**42.6**	**0.7**	**39.5**

Table I.3c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 16 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	155.2	135.3	23.5	80.1	96.6	38.2	23.5	0.7	73.9
Water	40.9	74.0	15.7	21.5	44.3	32.8	25.5	0.5	13.8
Wetlands	186.7	284.0	54.5	92.9	169.5	125.7	88.8	1.6	46.9
Wetland Nonreach	38.9	39.0	6.1	20.9	26.7	13.0	7.7	0.1	17.1
SUM	**421.7**	**532.5**	**99.8**	**215.5**	**337.1**	**209.8**	**145.4**	**2.9**	**151.7**

Subwatershed 17: Morans Prairie

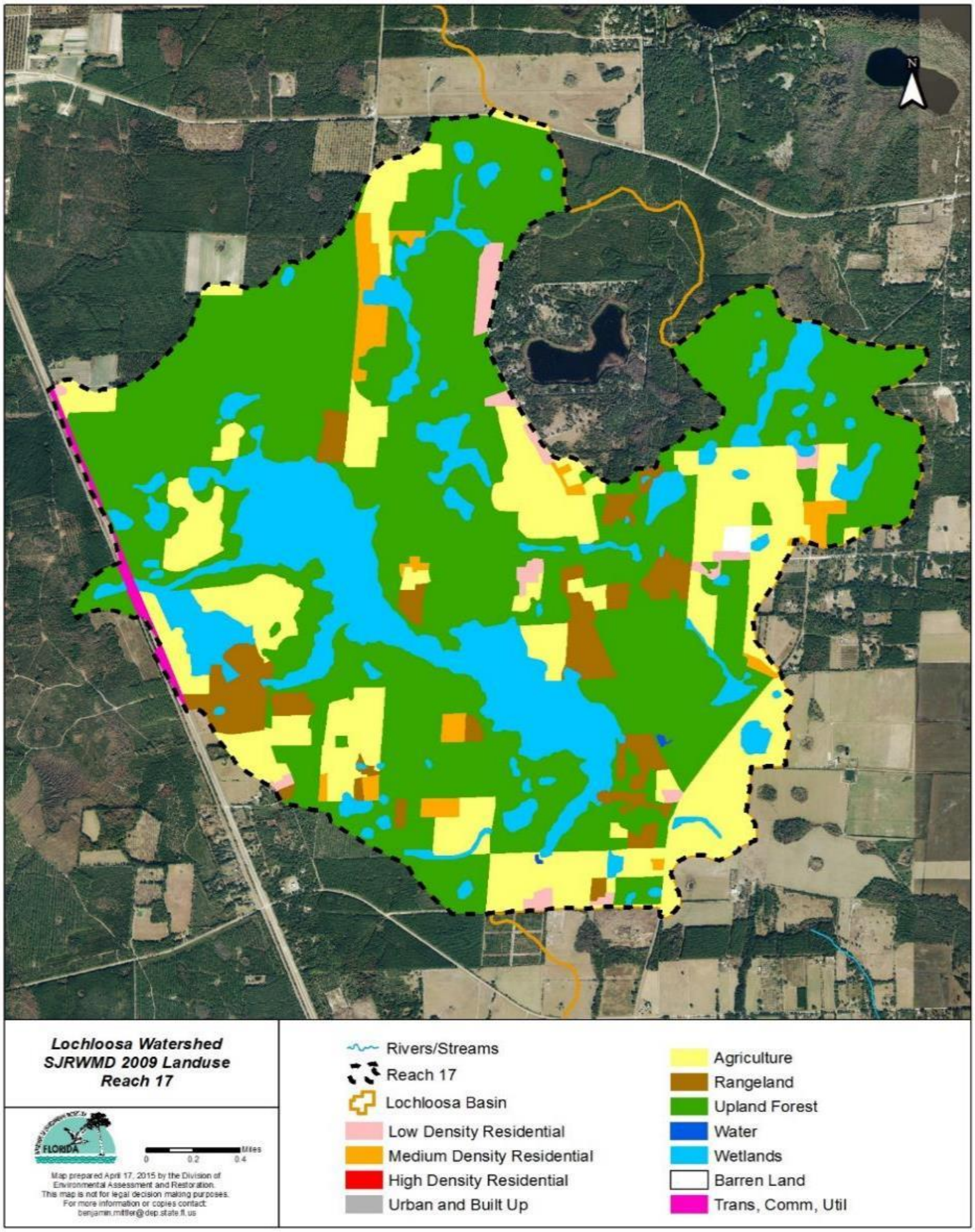

Figure I.2. Subwatershed 17 2009 land use

Table I.4. Subwatershed 17 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	62.70
1180	Rural residential	Low Density Residential	297.54
2110	Improved pastures (monocult, planted forage crops)	Pasture	444.01
2120	Unimproved pastures	Pasture	34.70
2130	Woodland pastures	Pasture	45.88
2140	Row crops	Agriculture General	21.76
2150	Field crops	Agriculture General	174.38
2200	Tree crops	Agriculture Tree Crops	216.00
2610	Fallow cropland	Agriculture General	67.64
3100	Herbaceous upland nonforested	Rangeland	29.22
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub)	Rangeland	45.47
3300	Mixed upland nonforested/ Mixed rangeland	Rangeland	40.39
4110	Pine flatwoods	Forest	234.66
4200	Upland hardwood forests	Forest	14.44
4340	Upland mixed coniferous/hardwood	Forest	615.44
4410	Coniferous pine	Forest	851.13
4430	Forest regeneration areas	Forest Regeneration	607.24
5300	Reservoirs – pits, retention ponds, dams	Water	1.76
6170	Mixed wetland hardwoods	Wetlands	34.59
6210	Cypress	Wetlands	405.77
6250	Hydric pine flatwoods	Wetlands	103.64
6300	Wetland forested mixed	Wetlands	60.31
6410	Freshwater marshes	Wetlands	34.72
6430	Wet prairies	Wetlands	12.94
6440	Emergent aquatic vegetation	Wetlands	0.80
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	96.98
7410	Rural land in transition without positive indicators of intended activity	Open Land and Barren Land	8.51
8140	Roads and highways (divided 4-lanes with medians)	Industrial and Commercial	24.29
		SUM	**4,586.91**

Table I.5a. Annual TN load (lbs/yr) from land uses in Subwatershed 17 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	450.1	715.7	224.5	437.4	565.5	478.3	312.7	92.4	476.8
Industrial/Commercial	361.1	491.7	185.6	321.4	394.4	358.0	240.6	95.2	339.1
Open Land	4.0	6.3	2.2	3.5	5.1	4.0	2.5	0.9	3.9
Pasture	3,090.4	5,882.1	1,711.1	3,666.1	4,646.1	3,656.7	2,311.5	657.7	3,884.1
Agriculture Crops	893.5	1,995.2	536.7	1,105.9	1,449.5	984.5	626.0	56.3	1,086.8
Agriculture Trees	920.0	2,096.6	559.9	1,152.3	1,504.5	1,027.1	659.0	57.7	1,132.0
Rangeland	433.7	869.2	249.7	445.0	654.5	466.2	286.5	62.1	504.7
Forest	1,734.4	3,964.6	1,211.6	1,102.7	2,312.4	1,244.8	727.5	28.6	1,532.7
Water	2.1	6.6	1.5	0.1	3.4	3.0	3.0	0.0	2.1
Wetlands	638.1	2,032.6	451.2	301.3	1,031.9	872.8	882.9	11.5	610.6
Forest Regeneration	462.2	1,063.2	313.3	338.2	650.6	346.7	213.7	10.1	438.6
Wetlands Nonreach	326.3	1,174.7	254.6	243.6	727.9	849.3	447.3	5.4	482.8
SUM	**9,315.8**	**20,298.7**	**5,702.0**	**9,117.4**	**13,945.8**	**10,291.3**	**6,713.0**	**1,078.0**	**10,494.1**

Table I.5b. Annual TP load (lbs/yr) from land uses in Subwatershed 17 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	57.3	92.4	29.5	49.9	70.6	55.9	36.2	13.1	55.0
Industrial/Commercial	43.3	54.5	27.7	38.9	43.4	42.4	32.5	22.2	39.2
Open Land	0.3	0.4	0.1	0.2	0.4	0.3	0.2	0.1	0.3
Pasture	374.3	743.2	208.8	387.9	563.2	396.8	243.3	64.0	430.3
Agriculture Crops	108.1	246.9	65.3	113.4	167.7	98.5	62.3	5.4	119.0
Agriculture Trees	111.9	261.8	68.7	118.6	174.9	103.1	66.0	5.5	124.4
Rangeland	31.8	65.2	18.4	30.8	48.0	32.5	19.8	4.2	35.5
Forest	126.2	299.6	90.0	77.6	166.8	85.5	49.7	1.8	109.4
Water	0.2	0.5	0.1	0.0	0.2	0.2	0.2	0.0	0.1
Wetlands	49.3	154.9	34.0	19.0	75.4	60.5	65.8	0.4	40.7
Forest Regeneration	33.2	79.8	23.1	23.6	46.8	23.6	14.5	0.6	31.1
Wetlands Nonreach	25.6	91.9	19.7	17.8	54.6	61.3	35.2	0.2	33.3
SUM	**961.3**	**2,091.1**	**585.4**	**877.8**	**1,412.0**	**960.6**	**625.7**	**117.5**	**1,018.1**

Table I.5c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 17 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	60.4	58.0	17.2	36.7	44.0	27.1	15.0	8.2	47.3
Industrial/Commercial	51.4	50.2	28.0	40.7	41.4	39.7	26.5	25.2	44.6
Open Land	1.1	1.0	0.2	0.6	0.8	0.4	0.2	0.1	0.8
Pasture	236.2	215.3	44.1	128.5	159.2	71.7	32.5	4.9	180.3
Agriculture Crops	69.5	63.6	13.0	32.1	42.9	18.0	8.0	0.5	46.7
Agriculture Trees	74.5	69.7	14.5	34.3	46.3	19.5	8.9	0.5	49.5
Rangeland	137.8	125.7	25.4	73.5	91.6	40.7	18.2	2.3	104.4
Forest	461.9	427.7	92.1	159.2	240.3	106.6	44.9	2.6	203.6
Water	1.4	2.7	0.6	0.0	1.4	0.8	0.9	0.0	0.4
Wetlands	565.2	898.4	190.3	33.5	436.9	236.4	253.4	4.6	129.5
Forest Regeneration	136.2	124.4	26.7	51.9	75.4	32.0	14.0	0.8	74.4
Wetlands Nonreach	1,247.9	1,348.8	258.1	495.5	833.4	424.9	208.9	2.1	665.7
SUM	**3,043.4**	**3,385.4**	**710.3**	**1,086.6**	**2,013.4**	**1,017.8**	**631.5**	**51.7**	**1,547.3**

Table I.6a. Annual TN load (lbs/yr) from land uses in Subwatershed 17 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	3,141.6	7,186.0	2,196.0	1,998.7	4,191.4	2,256.0	1,318.2	51.8	2,778.6
Wetlands	910.7	2,900.9	643.9	430.1	1,472.7	1,245.6	1,260.0	16.4	871.4
Wetland Nonreach	529.3	1,778.6	411.0	384.8	901.7	837.5	724.2	9.3	686.6
SUM	**4,581.6**	**11,865.6**	**3,250.9**	**2,813.5**	**6,565.8**	**4,339.1**	**3,302.4**	**77.4**	**4,336.5**

Table I.6b. Annual TP load (lbs/yr) from land uses in Subwatershed 17 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	228.8	543.3	163.2	140.7	302.4	155.0	90.1	3.3	198.3
Wetlands	70.3	221.1	48.5	27.2	107.6	86.4	93.9	0.6	58.0
Wetland Nonreach	41.3	138.0	31.6	27.3	66.9	58.5	55.1	0.3	46.7
SUM	**340.4**	**902.4**	**243.2**	**195.1**	**476.9**	**299.9**	**239.1**	**4.2**	**303.1**

Table I.6c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 17 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	836.2	773.9	166.5	288.3	434.8	192.6	81.0	4.6	368.8
Wetlands	806.7	1,282.2	271.6	47.8	623.5	337.4	361.6	6.6	184.9
Wetland Nonreach	1,610.5	1,762.0	343.7	449.4	922.9	424.1	266.0	3.8	627.7
SUM	**3,253.5**	**3,818.0**	**781.9**	**785.6**	**1,981.1**	**954.1**	**708.6**	**14.9**	**1,181.4**

Subwatershed 18: Unnamed Slough North

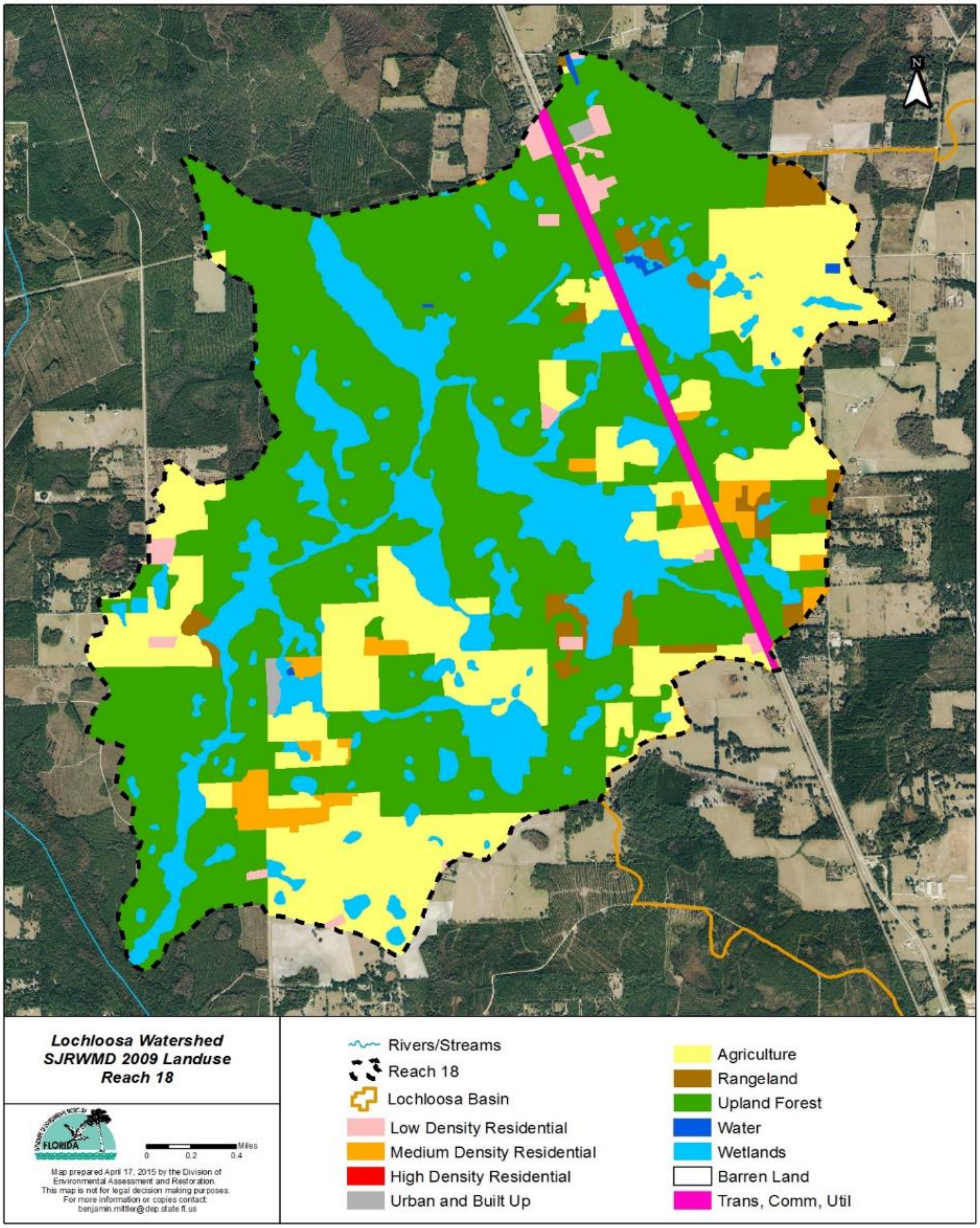

Figure I.3. Subwatershed 18 2009 land use

Table I.7. Subwatershed 18 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	69.87
1180	Rural residential	Low Density Residential	182.31
1400	Commercial and services	Industrial and Commercial	5.04
1700	Institutional	Industrial and Commercial	9.15
2110	Improved pastures (monocult, planted forage crops)	Pasture	754.87
2120	Unimproved pastures	Pasture	28.33
2130	Woodland pastures	Pasture	35.70
2140	Row crops	Agriculture General	14.47
2150	Field crops	Agriculture General	251.43
2200	Tree crops	Agriculture Tree Crops	128.90
2310	Cattle feeding operations	Agriculture General	12.96
2430	Ornamentals	Agriculture General	23.80
3100	Herbaceous upland nonforested	Rangeland	29.11
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub	Rangeland	23.12
3300	Mixed upland nonforested/ Mixed rangeland	Rangeland	38.59
4110	Pine flatwoods	Forest	99.25
4200	Upland hardwood forests	Forest	14.08
4340	Upland mixed coniferous/hardwood	Forest	457.57
4410	Coniferous pine	Forest	1,783.48
4430	Forest regeneration areas	Forest Regeneration	602.72
5300	Reservoirs – pits, retention ponds, dams	Water	10.13
6170	Mixed wetland hardwoods	Wetlands	237.39
6210	Cypress	Wetlands	282.99
6250	Hydric pine flatwoods	Wetlands	114.62
6300	Wetland forested mixed	Wetlands	146.58
6410	Freshwater marshes	Wetlands	20.60
6430	Wet prairies	Wetlands	14.77
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	268.24
8140	Roads and highways (divided 4-lanes with medians)	Industrial and Commercial	88.81
		SUM	**5,748.90**

Table I.8a. Annual TN load (lbs/yr) from land uses in Subwatershed 18 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	790.3	1,104.8	356.3	645.8	736.8	682.0	333.4	45.6	667.7
Industrial/Commercial	1,224.4	1,551.5	627.3	956.0	1,063.8	1,046.9	587.2	160.1	999.4
Pasture	4,653.7	7,005.2	2,037.9	4,135.5	4,693.3	4,138.7	1,707.5	209.0	4,317.5
Agriculture Crops	1,671.6	2,940.3	777.5	1,508.4	1,844.7	1,562.7	474.0	28.3	1,727.6
Agriculture Trees	870.7	1,559.1	411.3	791.3	973.9	821.5	253.9	15.1	909.7
Rangeland	203.5	319.1	89.8	151.5	197.6	164.7	60.4	5.6	166.7
Forest	3,010.2	6,281.2	1,907.3	1596.9	3,331.5	2,414.3	388.5	39.0	2,710.2
Water	12.1	39.7	9.6	3.5	20.1	21.9	15.9	0.1	11.2
Wetlands	526.9	1,856.3	417.4	363.1	883.8	988.1	689.5	4.2	481.3
Forest Regeneration	729.7	1,487.0	432.2	432.9	813.6	603.6	106.7	10.2	702.5
Wetlands Nonreach	1,204.9	3,372.5	714.3	1,026.5	1,550.1	2,052.1	1,166.6	4.5	1,383.9
SUM	**14,898.1**	**27,516.8**	**7,780.9**	**11,611.4**	**16,109.1**	**14496.5**	**5,783.6**	**521.7**	**14,077.7**

Table I.8b. Annual TP load (lbs/yr) from land uses in Subwatershed 18 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	103.8	149.0	46.3	73.5	94.5	82.1	39.5	10.2	77.6
Industrial/Commercial	139.4	168.6	87.3	114.1	120.9	123.2	85.7	54.4	115.3
Pasture	591.6	927.5	251.8	439.1	574.5	471.4	174.4	20.1	478.0
Agriculture Crops	213.3	386.6	97.3	152.1	217.4	167.0	46.2	2.6	187.7
Agriculture Trees	112.0	207.0	51.9	80.1	115.5	88.2	24.9	1.4	99.2
Rangeland	15.1	24.2	6.6	10.4	14.5	11.7	4.1	0.4	11.7
Forest	226.2	481.9	145.2	112.1	241.4	170.1	25.3	2.6	193.6
Water	0.9	3.0	0.7	0.2	1.5	1.5	1.2	0.0	0.8
Wetlands	41.0	141.8	31.5	25.6	66.2	68.4	52.8	0.1	32.5
Forest Regeneration	54.8	113.9	32.7	30.2	59.0	42.5	7.0	0.7	50.2
Wetlands Nonreach	93.8	265.5	55.4	75.0	119.1	147.7	91.3	0.1	96.6
SUM	**1,591.9**	**2,869.1**	**806.7**	**1,112.4**	**1,624.6**	**1,373.6**	**552.2**	**92.7**	**1,343.2**

Table I.8c. Annual Discharge (ac-ft/yr) from land uses in Subwatershed 18 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	98.6	78.3	26.9	54.5	63.6	43.0	15.4	9.3	62.9
Industrial/Commercial	162.6	144.8	85.7	120.0	117.6	118.5	68.5	67.0	127.9
Pasture	321.2	226.4	63.3	154.8	189.5	102.7	20.2	1.8	187.5
Agriculture Crops	116.3	79.8	23.2	48.7	65.1	31.6	5.6	0.3	58.3
Agriculture Trees	61.4	42.4	12.4	25.8	34.5	16.6	2.8	0.2	30.8
Rangeland	55.2	38.7	10.8	26.0	32.3	17.3	3.3	0.2	31.8
Forest	801.9	515.5	174.5	278.5	392.3	168.7	32.1	2.4	206.4
Water	10.3	15.7	3.9	0.4	8.7	4.7	4.2	0.1	2.1
Wetlands	573.7	767.7	171.0	103.5	422.0	236.1	182.0	1.7	90.3
Forest Regeneration	206.5	133.9	42.6	75.9	106.0	46.0	8.1	0.7	74.5
Wetlands Nonreach	2,541.7	2,356.3	584.2	1,047.0	1,650.8	984.9	364.1	1.9	904.6
SUM	**4,949.4**	**4,399.4**	**1,198.4**	**1,935.1**	**3,082.4**	**1,770.1**	**706.2**	**85.6**	**1,777.1**

Table I.9a. Annual TN load (lbs/yr) from land uses in Subwatershed 18 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	4,876.2	10,146.9	3,080.2	2,579.5	5,381.2	3,898.8	632.3	63.3	4,370.3
Wetlands	778.9	2,744.2	617.1	536.8	1,306.6	1460.8	1,019.3	6.2	711.5
Wetland Nonreach	1,212.6	4,362.4	981.5	865.9	2,059.4	2391.0	1,561.9	9.3	1,685.3
SUM	**6,867.7**	**17,253.5**	**4,678.8**	**3,982.2**	**8,747.2**	**7,750.6**	**3,213.6**	**78.8**	**6,767.1**

Table I.9b. Annual TP load (lbs/yr) from land uses in Subwatershed 18 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	365.1	776.8	234.1	180.8	389.2	274.1	41.0	4.3	311.9
Wetlands	60.7	209.7	46.6	37.9	97.8	101.1	78.0	0.2	48.1
Wetland Nonreach	95.1	338.1	75.4	63.0	156.4	169.2	120.0	0.3	115.2
SUM	**520.9**	**1,324.6**	**356.1**	**281.7**	**643.4**	**544.4**	**239.0**	**4.8**	**475.2**

Table I.9c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 18 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	1,302.7	845.1	285.1	452.0	639.2	276.9	54.4	4.1	335.8
Wetlands	848.1	1,134.8	252.7	153.0	623.9	349.0	269.0	2.6	133.5
Wetland Nonreach	2,737.4	2,533.1	665.9	761.2	1,667.7	841.3	427.7	3.2	558.4
SUM	**4,888.2**	**4,513.1**	**1,203.7**	**1,366.2**	**2,930.8**	**1,467.3**	**751.1**	**9.9**	**1,027.7**

Subwatershed 19: Lochloosa Creek SR20

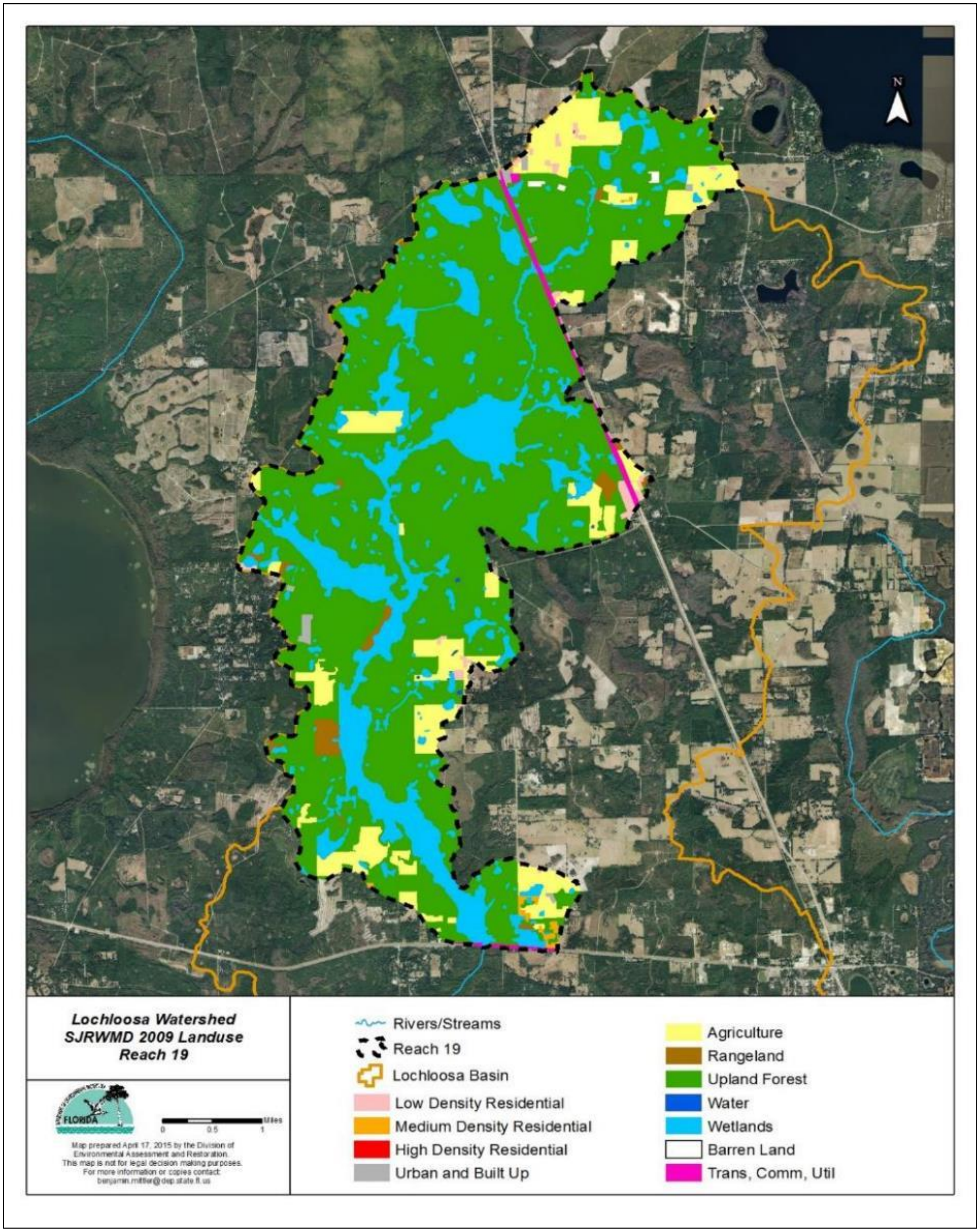

Figure I.4. Subwatershed 19 2009 land use

Table I.10. Subwatershed 19 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	87.43
1180	Rural residential	Low Density Residential	305.88
1200	Residential, medium density – 2–5 dwelling units/acre	Medium Density Residential	1.61
1400	Commercial and services	Industrial and Commercial	16.07
1480	Cemeteries	Industrial and Commercial	18.54
1510	Food processing	Industrial and Commercial	6.23
1700	Institutional	Industrial and Commercial	8.52
2110	Improved pastures (monocult, planted forage crops)	Pasture	445.40
2120	Unimproved pastures	Pasture	11.50
2130	Woodland pastures	Pasture	87.49
2140	Row crops	Agriculture General	59.28
2150	Field crops	Agriculture General	350.71
2160	Mixed crop	Agriculture General	4.23
2200	Tree crops	Agriculture Tree Crops	371.86
2500	Specialty farms	Agriculture General	6.52
2520	Dairies	Agriculture General	5.29
2610	Fallow cropland	Agriculture General	3.96
3100	Herbaceous upland nonforested	Rangeland	3.30
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub	Rangeland	6.78
3300	Mixed upland nonforested/ Mixed rangeland	Rangeland	120.84
4110	Pine flatwoods	Forest	135.78
4200	Upland hardwood forests	Forest	15.01
4340	Upland mixed coniferous/hardwood	Forest	282.36
4410	Coniferous pine	Forest	5,751.45
4430	Forest regeneration areas	Forest regeneration	2,177.31
5300	Reservoirs – pits, retention ponds, dams	Water	6.27
6170	Mixed wetland hardwoods	Wetlands	785.79
6210	Cypress	Wetlands	495.09
6250	Hydric pine flatwoods	Wetlands	225.27
6300	Wetland forested mixed	Wetlands	261.12
6410	Freshwater marshes	Wetlands	38.73
6430	Wet prairies	Wetlands	93.61
6440	Emergent aquatic vegetation	Wetlands	0.58
6460	Treeless hydric savanna/Mixed scrub-shrub wetland	Wetlands	635.71
7410	Rural land in transition without positive indicators of intended activity	Open Land and Barren Land	15.16
8140	Roads and highways (divided 4-lanes with medians)	Industrial and Commercial	109.42
8200	Communications	Open Land and Barren Land	5.10
8370	Surface water collection basins	Water	0.68
		SUM	**12,955.90**

Table I.11a. Annual TN load (lbs/yr) from land uses in Subwatershed 19 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	312.4	487.7	156.9	260.8	256.2	262.5	179.5	11.4	288.2
Medium Density Residential	21.0	30.8	10.5	17.2	16.8	17.7	12.3	1.3	19.2
Industrial/Commercial	1,888.1	2,618.8	964.9	1,492.6	1,465.9	1,613.9	1,173.6	170.2	1,675.4
Open Land	42.2	69.1	24.0	33.5	35.5	35.2	23.2	2.8	40.0
Pasture	3,366.9	6,037.4	1,785.2	3,236.2	3,154.4	2,922.9	1,904.6	93.7	3,482.1
Agriculture Crops	1,225.8	2,468.6	629.2	1,037.0	1,204.3	898.3	550.2	19.6	1,238.8
Agriculture Trees	1,652.5	3,408.8	860.6	1,426.9	1,657.3	1,227.5	770.1	26.8	1,704.0
Rangeland	273.9	486.5	139.7	209.7	225.1	196.0	127.4	5.4	244.0
Forest	5,763.2	12,098.4	3,458.1	2,739.7	4,774.4	2,448.9	1,115.1	72.5	4,833.4
Water	2.3	7.4	1.7	0.2	2.4	3.5	3.0	0.1	2.5
Wetlands	1,760.8	5,862.1	1,290.0	53.3	2,346.6	2,708.1	2,329.1	13.3	1,886.9
Forest Regeneration	2,347.7	4,908.1	1,354.3	1,195.4	2,008.9	1,097.4	536.3	35.4	2,082.2
Wetlands Nonreach	1,844.2	5,263.4	1,131.6	975.2	2,312.9	2,901.1	1,903.8	8.9	1,745.5
SUM	**20,501.0**	**43,747.2**	**11,806.8**	**12,677.6**	**19,460.7**	**16,333.0**	**10,628.5**	**461.3**	**19,242.1**

Table I.11b. Annual TP load (lbs/yr) from land uses in Subwatershed 19 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	41.8	63.0	20.2	29.5	30.8	30.2	20.9	3.8	33.6
Medium Density Residential	2.9	4.0	1.4	2.1	2.1	2.2	1.5	0.4	2.3
Industrial/Commercial	223.2	282.5	142.1	185.3	175.5	197.6	157.5	89.4	194.0
Open Land	3.2	5.1	1.7	2.3	2.5	2.4	1.6	0.2	2.8
Pasture	441.8	764.5	216.7	337.5	359.7	306.1	199.5	9.0	388.5
Agriculture Crops	160.3	304.3	77.5	104.3	133.1	87.2	54.3	1.9	136.9
Agriculture Trees	219.3	425.4	107.7	144.2	184.9	119.9	76.8	2.6	189.5
Rangeland	20.7	36.3	10.2	14.4	16.1	13.3	8.7	0.3	17.2
Forest	424.9	899.3	260.8	191.0	336.9	165.3	72.9	4.6	343.3
Water	0.2	0.5	0.1	0.0	0.2	0.2	0.2	0.0	0.2
Wetlands	136.4	442.8	96.9	1.9	165.1	177.8	176.5	0.4	128.5
Forest Regeneration	176.0	366.9	102.6	83.2	142.9	74.4	35.8	2.3	148.8
Wetlands Nonreach	145.4	409.7	87.3	69.2	172.5	205.4	148.8	0.3	123.4
SUM	**1,995.9**	**4,004.5**	**1,125.4**	**1,164.9**	**1,722.3**	**1,381.9**	**955.0**	**115.3**	**1,709.1**

Table I .11c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 19 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	43.5	37.2	11.6	20.9	20.2	14.1	8.3	4.3	29.4
Medium Density Residential	2.5	2.1	0.8	1.4	1.3	1.1	0.7	0.5	1.8
Industrial/Commercial	269.2	248.5	137.0	192.7	167.5	183.1	124.1	114.1	218.1
Open Land	11.1	8.7	2.1	5.2	4.7	2.6	1.2	0.1	7.8
Pasture	257.0	203.2	46.5	104.9	102.5	46.9	22.6	1.1	166.3
Agriculture Crops	98.5	79.4	18.4	32.5	34.8	14.9	8.0	0.5	53.7
Agriculture Trees	129.8	105.4	24.0	43.6	45.9	18.5	9.5	0.5	72.7
Rangeland	81.0	64.0	14.4	32.2	31.8	14.2	6.8	0.3	51.9
Forest	1534.4	1,225.2	302.6	391.9	402.0	167.7	93.0	7.6	500.1
Water	1.9	2.9	0.7	0.1	0.7	0.5	0.9	0.0	0.6
Wetlands	1,889.4	2,505.0	516.1	20.1	607.6	340.5	661.9	5.8	410.5
Forest Regeneration	659.5	513.2	121.5	185.7	189.1	71.7	35.7	2.7	285.6
Wetlands Nonreach	4,802.7	4,600.3	941.4	1,149.1	1,622.6	922.6	642.4	4.0	1,766.5
SUM	**9,780.4**	**9,595.1**	**2,137.0**	**2,180.2**	**3,230.6**	**1,798.3**	**1,615.0**	**141.6**	**3,565.0**

Table I.12a. Annual TN load (lbs/yr) from land uses in Subwatershed 19 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	9,101.5	19,171.4	5,478.1	4,341.9	7,567.1	3,876.6	1,759.2	114.0	7,666.8
Water	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.0	0.1
Wetlands	198.4	630.5	130.3	150.9	330.6	442.5	277.7	4.2	225.3
Wetland Nonreach	2,109.3	7,022.1	1,545.3	63.9	2,810.9	3,244.0	2,789.9	15.9	2260.2
SUM	**11,409.4**	**26,824.2**	**7,153.9**	**4,556.8**	**10,708.8**	**7,563.3**	**4,826.9**	**134.2**	**10,152.5**

Table I.12b. Annual TP load (lbs/yr) from land uses in Subwatershed 19 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	673.4	1,427.5	414.0	303.1	534.9	262.2	115.4	7.2	545.2
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wetlands	15.4	48.4	9.8	10.9	24.5	32.4	21.1	0.1	14.8
Wetland Nonreach	163.4	530.4	116.1	2.3	197.8	213.0	211.4	0.5	154.0
SUM	**852.1**	**2,006.4**	**540.0**	**316.3**	**757.1**	**507.6**	**347.9**	**7.9**	**713.9**

Table I.12c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 19 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	2,416.1	1,923.3	473.4	617.8	629.8	260.1	142.6	11.7	788.2
Water	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Wetlands	186.7	284.0	54.5	92.9	169.5	125.7	88.8	1.6	46.9
Wetland Nonreach	2,263.3	3,000.7	618.2	24.0	727.8	407.9	792.8	7.0	491.7
SUM	**4,866.1**	**5,208.1**	**1,146.1**	**734.8**	**1,527.2**	**793.8**	**1,024.3**	**20.3**	**1,326.8**

Subwatershed 20: Unnamed Slough South

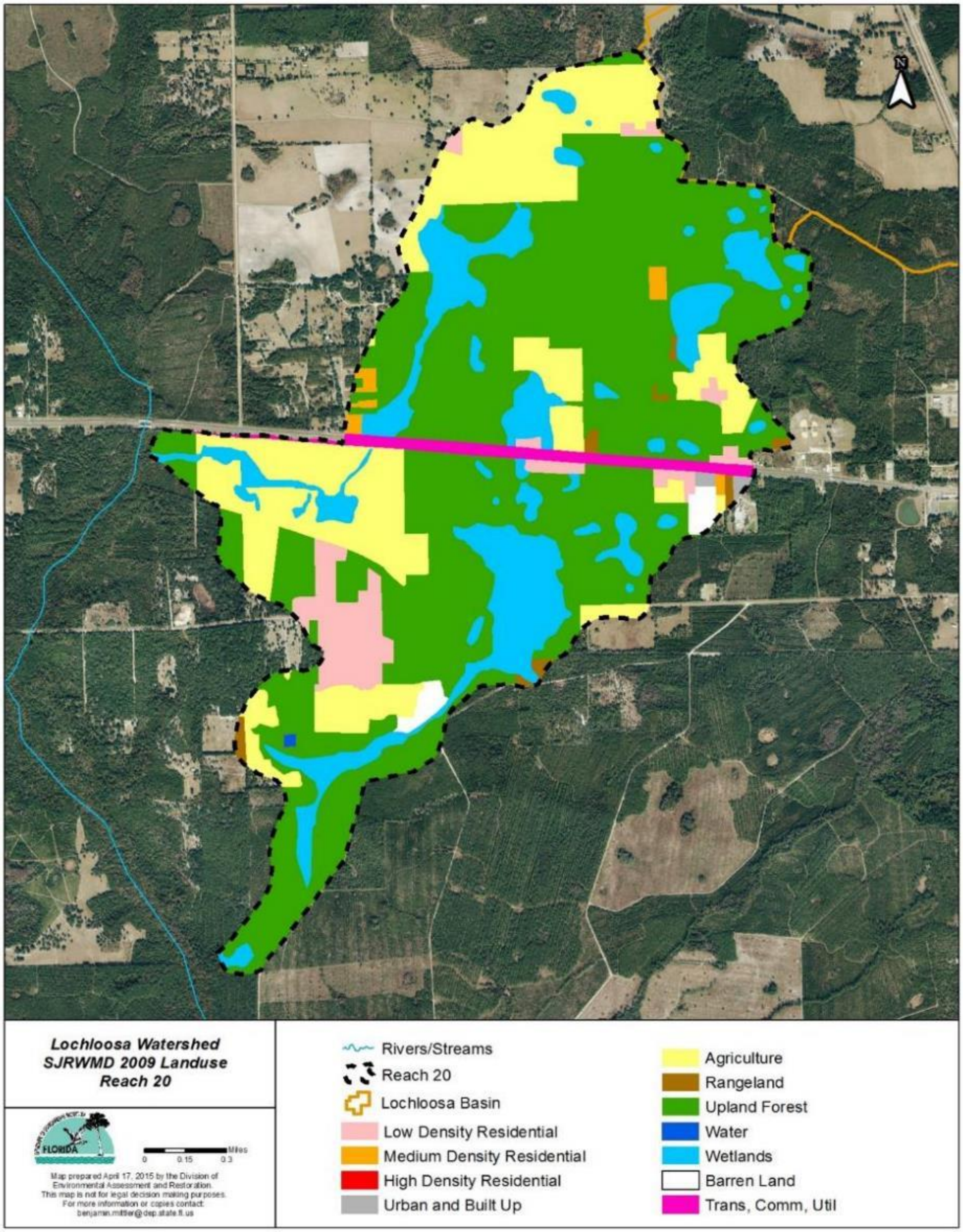

Figure I.5. Subwatershed 20 2009 land use

Table I.13. Subwatershed 20 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	101.40
1180	Rural residential	Low Density Residential	240.93
1550	Other light industrial	Industrial and Commercial	2.59
1700	Institutional	Industrial and Commercial	2.37
1860	Community recreational facilities	Open Land and Barren Land	0.27
2110	Improved pastures (monocult, planted forage crops)	Pasture	319.58
2120	Unimproved pastures	Pasture	3.60
2130	Woodland pastures	Pasture	76.30
2140	Row crops	Agriculture General	4.43
2150	Field crops	Agriculture General	56.99
2200	Fruit Orchards (Peaches are an example of a crop type that is typical for this category)	Agriculture Tree Crops	2.12
2520	Dairies	Agriculture General	20.92
3100	Herbaceous upland nonforested	Rangeland	6.28
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub	Rangeland	6.26
4110	Pine flatwoods	Forest	48.25
4200	Upland hardwood forests	Forest	6.41
4340	Upland mixed coniferous/hardwood	Forest	156.44
4410	Coniferous pine	Forest	508.64
4430	Forest regeneration areas	Forest Regeneration	274.28
5300	Reservoirs – pits, retention ponds, dams	Water	1.35
6170	Mixed wetland hardwoods	Wetlands	57.63
6210	Cypress	Wetlands	27.47
6250	Hydric pine flatwoods	Wetlands	20.06
6300	Wetland forested mixed	Wetlands	105.33
6410	Freshwater marshes	Wetlands	15.06
6430	Wet prairies	Wetlands	6.41
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	113.31
7410	Rural land in transition without positive indicators of intended activity	Open Land and Barren Land	20.81
8140	Roads and highways (divided 4-lanes with medians)	Industrial and Commercial	43.82
		SUM	**2,249.31**

Table I.14a. Annual TN load (lbs/yr) from land uses in Subwatershed 20 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	205.4	281.8	93.0	183.8	223.6	214.2	103.9	4.8	217.3
Industrial/Commercial	460.9	582.4	227.1	395.3	458.3	468.1	257.7	26.2	474.5
Open Land	42.2	58.5	22.6	36.1	50.6	45.2	19.4	2.0	48.3
Pasture	1,013.4	1,508.6	474.3	1,017.2	1,240.5	1,120.6	474.0	17.6	1,195.2
Agriculture Crops	299.7	499.8	157.7	308.1	418.8	361.8	117.2	3.5	395.0
Agriculture Trees	21.7	37.1	11.6	22.8	30.7	26.7	8.8	0.3	29.0
Rangeland	38.4	58.1	19.0	33.4	48.8	41.9	15.4	0.5	44.0
Forest	777.3	1,223.5	493.6	483.2	1,099.9	780.4	162.0	8.7	981.0
Water	1.5	4.4	1.3	0.8	2.6	3.4	2.2	0.0	2.4
Wetlands	162.8	507.2	137.8	112.1	314.5	363.1	226.5	1.2	245.2
Forest Regeneration	157.0	244.5	92.4	103.5	215.1	161.8	38.1	1.8	189.7
Wetlands Nonreach	400.3	1,007.2	239.8	547.9	683.8	769.9	395.0	2.0	572.2
SUM	**3,580.6**	**6,013.1**	**1,970.3**	**3,244.3**	**4,787.3**	**4357.1**	**1,820.3**	**68.7**	**4,393.9**

Table I.14b. Annual TP load (lbs/yr) from land uses in Subwatershed 20 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	27.4	36.2	12.5	21.1	30.0	26.8	12.5	2.2	27.1
Industrial/Commercial	54.8	64.7	34.4	47.2	52.3	54.4	37.1	20.2	53.1
Open Land	3.2	4.3	1.6	2.6	3.9	3.3	1.3	0.1	3.6
Pasture	130.5	187.4	59.3	109.8	161.1	134.1	49.8	1.7	143.8
Agriculture Crops	40.2	60.7	19.4	31.7	52.7	41.4	11.8	0.4	46.7
Agriculture Trees	2.9	4.5	1.4	2.3	3.9	3.1	0.9	0.0	3.4
Rangeland	2.9	4.3	1.4	2.3	3.7	3.1	1.1	0.0	3.2
Forest	59.3	90.4	36.5	34.1	82.0	55.6	10.9	0.6	72.2
Water	0.1	0.3	0.1	0.1	0.2	0.2	0.2	0.0	0.2
Wetlands	12.7	38.1	10.5	7.8	23.8	26.0	17.4	0.1	17.4
Forest Regeneration	11.7	17.8	6.8	7.2	15.9	11.4	2.5	0.1	13.9
Wetlands Nonreach	30.9	78.9	18.8	39.6	54.1	58.1	31.6	0.1	42.7
SUM	**376.7**	**587.6**	**202.7**	**305.8**	**483.6**	**417.4**	**177.1**	**25.5**	**427.2**

Table I.14c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 20 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	27.7	17.8	8.0	17.3	23.4	16.7	5.2	2.5	23.0
Industrial/Commercial	65.0	51.2	35.2	51.6	54.3	54.4	28.8	25.2	60.7
Open Land	10.3	5.3	2.1	6.7	8.9	5.5	0.9	0.1	9.1
Pasture	76.8	43.1	16.1	44.3	64.2	39.1	8.1	0.4	60.4
Agriculture Crops	21.5	10.9	4.3	11.4	17.4	10.0	1.6	0.1	15.9
Agriculture Trees	1.5	0.7	0.3	0.8	1.2	0.7	0.1	0.0	1.1
Rangeland	10.6	5.3	2.0	6.3	8.8	5.1	0.8	0.0	8.8
Forest	196.1	93.8	41.2	91.5	146.7	84.8	14.5	0.9	94.9
Water	1.1	1.4	0.5	0.1	1.5	0.9	0.6	0.0	0.7
Wetlands	157.6	174.7	55.9	25.9	174.8	112.0	59.4	0.5	72.0
Forest Regeneration	43.3	22.7	9.4	20.4	33.3	19.5	3.9	0.2	25.4
Wetlands Nonreach	1,085.5	713.7	242.5	630.6	989.8	639.7	146.9	0.8	720.8
SUM	**1,697.2**	**1,140.5**	**417.6**	**907.0**	**1,524.3**	**988.5**	**270.9**	**30.7**	**1,092.7**

Table I.15a. Annual TN load (lbs/yr) from land uses in Subwatershed 20 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	1,212.1	1,889.5	761.6	743.6	1696.1	1,204.7	254.4	13.8	1,505.9
Wetlands	228.2	711.0	193.2	157.2	440.9	509.0	317.6	1.7	343.7
Wetland Nonreach	450.5	1,446.9	389.4	327.3	980.7	1,055.6	621.9	3.1	798.6
SUM	**1,890.7**	**4,047.4**	**1344.2**	**1,228.1**	**3,117.7**	**2,769.3**	**1,193.9**	**18.6**	**2,648.2**

Table I.15b. Annual TP load (lbs/yr) from land uses in Subwatershed 20 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	**91.7**	**138.9**	**56.1**	**52.3**	**125.9**	**85.5**	**17.0**	**0.9**	**110.5**
Wetlands	**17.8**	**53.4**	**14.7**	**11.0**	**33.4**	**36.5**	**24.4**	**0.1**	**24.4**
Wetland Nonreach	**35.5**	**111.0**	**30.1**	**23.9**	**76.4**	**77.5**	**48.4**	**0.1**	**57.9**
SUM	**145.1**	**303.4**	**100.9**	**87.2**	**235.8**	**199.4**	**89.8**	**1.1**	**192.8**

Table I.15c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 20 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	309.6	153.1	66.5	142.3	231.6	135.5	25.1	1.5	149.2
Wetlands	220.9	244.9	78.4	36.4	245.1	157.1	83.2	0.7	101.0
Wetland Non Reach	1,266.6	781.9	299.2	524.0	1,117.3	655.8	179.3	1.3	606.2
SUM	**1,797.1**	**1,179.8**	**444.1**	**702.6**	**1,594.0**	**948.4**	**287.6**	**3.5**	**856.4**

Subwatershed 21: Lochloosa Creek South

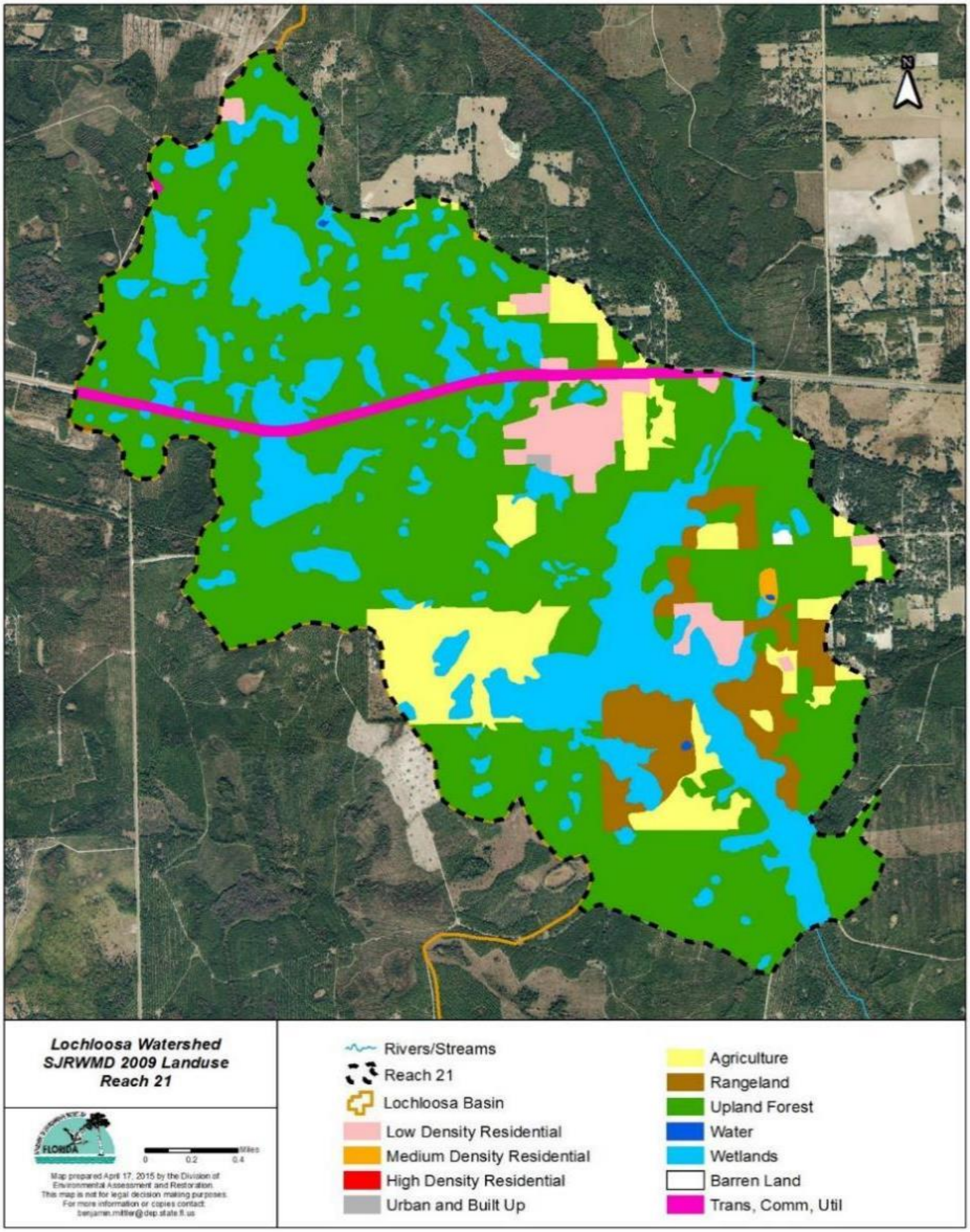

Figure I.6. Subwatershed 21 2009 land use

Table I.16. Subwatershed 21 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	158.27
1180	Rural residential	Low Density Residential	107.50
1860	Community recreational facilities	Open Land and Barren Land	4.03
2110	Improved pastures (monocult, planted forage crops)	Pasture	148.60
2120	Unimproved pastures	Pasture	162.47
2130	Woodland pastures	Pasture	232.47
2520	Dairies	Agriculture General	6.11
3100	Herbaceous upland nonforested	Rangeland	3.92
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub)	Rangeland	51.22
3300	Mixed upland nonforested/ Mixed rangeland	Rangeland	30.71
4110	Pine flatwoods	Forest	6.31
4340	Upland mixed coniferous/hardwood	Forest	496.96
4410	Upland mixed coniferous/hardwood	Forest	1,815.41
4430	Forest regeneration areas	Forest Regeneration	297.41
5300	Reservoirs – pits, retention ponds, dams	Water	2.26
6110	Bay swamps	Wetlands	21.59
6170	Mixed wetland hardwoods	Wetlands	264.74
6210	Cypress	Wetlands	91.58
6250	Hydric pine flatwoods	Wetlands	44.13
6300	Wetland forested mixed	Wetlands	323.55
6410	Freshwater marshes	Wetlands	43.77
6430	Wet prairies	Wetlands	30.41
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	174.87
7420	Borrow areas	Mining	2.95
8140	Roads and highways (divided 4-lanes with medians)	Industrial and Commercial	82.90
8200	Communications	Open Land and Barren Land	1.34
		SUM	**4,605.51**

Table I.17a. Annual TN load (lbs/yr) from land uses in Subwatershed 21 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	729.6	951.2	327.2	583.8	621.4	618.9	317.2	46.7	666.0
Industrial/Commercial	844.4	1,050.0	437.8	661.0	686.5	756.2	417.4	128.8	765.3
Mining	10.9	13.8	5.1	9.1	9.7	9.4	4.9	1.7	10.8
Open Land	24.6	31.5	12.6	18.8	21.9	20.4	9.7	2.9	23.5
Pasture	4,611.3	6,402.3	2,028.5	4,105.7	4,314.6	3,891.2	1,801.1	238.0	4,603.3
Agriculture Crops	59.7	93.4	27.9	60.5	62.4	47.5	18.7	0.8	67.7
Rangeland	907.2	1,243.0	406.4	695.3	818.3	693.4	293.2	26.6	863.8
Forest	2,821.9	4,515.5	1,627.7	2,285.2	2,765.6	1,688.0	405.8	27.4	3,236.4
Water	2.1	6.7	1.8	1.5	3.4	4.6	2.9	0.0	3.3
Wetlands	707.2	2,137.5	494.0	617.4	987.7	1,403.0	826.0	4.4	933.2
Forest Regeneration	505.8	817.4	283.6	448.6	514.8	324.3	86.4	5.0	593.6
Wetlands Nonreach	979.7	2,519.0	568.5	1,243.6	1,173.1	1,674.8	927.1	4.8	1,314.4
SUM	**12,204.4**	**19,781.3**	**6,221.0**	**10,730.6**	**11,979.3**	**11,131.7**	**5,110.5**	**487.3**	**13,081.2**

Table I.17b. Annual TP load (lbs/yr) from land uses in Subwatershed 21 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	99.2	120.9	42.9	67.6	79.9	73.4	38.1	9.7	83.4
Industrial/Commercial	97.6	112.9	61.6	78.6	79.8	87.8	60.4	39.5	86.0
Mining	1.6	1.8	0.6	1.1	1.3	1.1	0.6	0.2	1.4
Open Land	1.9	2.3	0.9	1.3	1.6	1.5	0.7	0.2	1.7
Pasture	611.9	792.7	254.6	452.7	532.2	437.1	189.7	23.1	562.7
Agriculture Crops	8.1	11.3	3.5	6.5	7.5	5.0	1.9	0.1	8.2
Rangeland	70.0	92.4	30.3	49.3	60.9	49.2	20.3	1.8	64.1
Forest	221.9	337.3	125.2	162.8	203.6	119.2	27.4	1.8	244.4
Water	0.2	0.5	0.1	0.1	0.3	0.3	0.2	0.0	0.2
Wetlands	55.7	161.8	37.8	45.2	74.5	101.8	64.4	0.2	67.2
Forest Regeneration	40.2	61.4	21.9	32.1	38.2	23.0	5.9	0.3	44.9
Wetlands Nonreach	76.2	195.5	44.5	90.6	90.5	125.5	73.8	0.2	97.2
SUM	**1,284.4**	**1,890.8**	**623.9**	**987.9**	**1,170.3**	**1,024.8**	**483.4**	**77.2**	**1,261.5**

Table I.17c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 21 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	94.9	61.2	25.5	55.4	56.7	37.4	13.6	8.6	75.0
Industrial/Commercial	116.3	92.5	60.2	87.6	79.5	82.2	44.6	46.0	102.4
Mining	1.3	0.7	0.2	0.7	0.8	0.4	0.1	0.0	1.0
Open Land	6.1	3.3	1.2	3.6	3.5	2.0	0.4	0.1	5.0
Pasture	318.7	177.3	60.0	173.4	177.8	93.7	18.9	1.5	247.0
Agriculture Crops	4.1	2.3	0.8	2.0	2.2	1.1	0.2	0.0	2.9
Rangeland	248.4	137.8	46.4	133.8	137.3	71.8	14.0	0.9	191.8
Forest	722.1	416.7	157.7	282.6	338.1	178.4	35.1	2.2	344.5
Water	2.0	2.4	0.7	0.6	1.6	1.1	0.8	0.0	1.1
Wetlands	715.4	815.5	217.5	305.3	504.6	381.0	221.4	1.7	316.1
Forest Regeneration	136.4	74.3	27.2	57.5	65.5	32.9	5.3	0.3	79.7
Wetlands Nonreach	1,968.1	1,592.9	458.7	1,019.3	1,183.2	829.6	294.8	2.0	1,053.5
SUM	**4,333.9**	**3,376.9**	**1,056.3**	**2,121.8**	**2,550.9**	**1,711.6**	**649.2**	**63.4**	**2,420.1**

Table I.18a. Annual TN load (lbs/yr) from land uses in Subwatershed 21 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	4,228.8	6,810.4	2,454.5	3,453.4	4,170.2	2,544.7	604.1	40.9	4,895.5
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wetlands	1,140.3	3,446.5	796.4	995.4	1,592.5	2,262.1	1,331.9	7.1	1,504.6
Wetland Nonreach	989.5	2,795.9	651.4	1,012.9	1,284.4	1,829.9	1,047.9	5.1	1,380.1
SUM	**6,358.7**	**13,052.8**	**3,902.3**	**5,461.7**	**7,047.1**	**6,636.8**	**2,983.9**	**53.1**	**7,780.2**

Table I.18b. Annual TP load (lbs/yr) from land uses in Subwatershed 21 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	334.3	510.1	189.4	246.4	307.8	180.1	41.0	2.8	370.3
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wetlands	89.8	260.9	60.9	72.9	120.1	164.2	103.9	0.3	108.4
Wetland Nonreach	78.0	214.6	50.8	74.3	97.8	134.3	82.2	0.2	101.0
SUM	**502.0**	**985.5**	**301.0**	**393.6**	**525.7**	**478.6**	**227.1**	**3.3**	**579.8**

Table I.18c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 21 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	1,074.4	612.5	232.1	421.6	500.8	262.9	48.4	3.0	514.1
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wetlands	1,153.5	1,314.9	350.8	492.2	813.6	614.3	356.9	2.8	509.6
Wetland Non Reach	1,990.0	1,589.9	473.3	838.8	1,134.2	733.7	297.9	2.0	917.7
SUM	**4,217.8**	**3,517.4**	**1,056.1**	**1,752.6**	**2,448.6**	**1,611.0**	**703.3**	**7.8**	**1,941.4**

Subwatershed 22: Lochloosa Creek

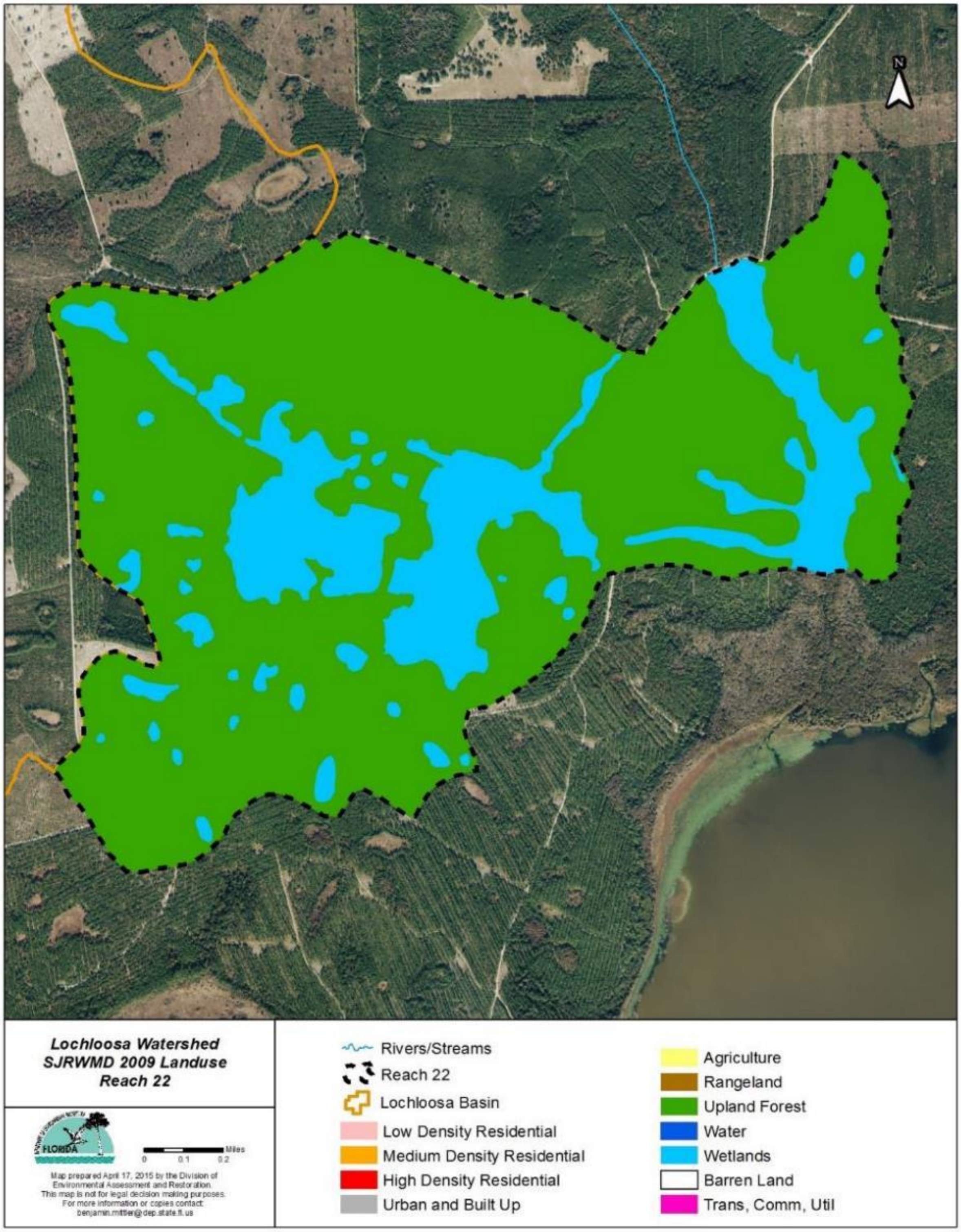

Figure I.7. Subwatershed 22 2009 land use

Table I.19. Subwatershed 22 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
4110	Pine flatwoods	Forest	109.61
4340	Upland mixed coniferous/hardwood	Forest	38.31
4410	Coniferous pine	Forest	690.66
4430	Forest regeneration areas	Forest Regeneration	303.72
6170	Mixed wetland hardwoods	Wetlands	94.56
6210	Cypress	Wetlands	52.16
6250	Hydric pine flatwoods	Wetlands	28.15
6300	Wetland forested mixed	Wetlands	81.54
6410	Freshwater marshes	Wetlands	4.61
6430	Wet prairies	Wetlands	19.60
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	22.00
		SUM	**1,444.93**

Table I.20a. Annual TN load (lbs/yr) from land uses in Subwatershed 22 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	1,221.6	2,072.8	644.2	718.8	1,081.3	746.9	438.8	7.3	981.3
Wetlands	125.5	324.5	77.4	116.9	153.5	228.8	147.1	1.1	53.3
Forest Regeneration	204.7	339.8	100.8	97.5	158.6	107.0	82.8	0.9	117.0
Wetlands Nonreach	402.4	891.9	209.2	329.6	419.4	624.6	398.5	2.7	376.7
SUM	**1,954.2**	**3,628.9**	**1,031.6**	**1,262.8**	**1,812.7**	**1,707.3**	**1,067.2**	**12.0**	**1,528.3**

Table I.20b. Annual TP load (lbs/yr) from land uses in Subwatershed 22 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	89.1	145.5	45.0	50.0	76.5	50.6	28.5	0.5	72.3
Wetlands	8.9	24.1	5.4	8.1	11.2	16.3	11.3	0.1	3.0
Forest Regeneration	12.6	20.3	6.0	6.1	9.8	6.5	4.7	0.1	7.7
Wetlands Nonreach	29.0	67.0	14.8	23.1	30.8	44.8	31.0	0.1	25.1
SUM	**139.5**	**256.9**	**71.2**	**87.2**	**128.3**	**118.2**	**75.6**	**0.7**	**108.0**

Table I.20c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 22 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	350.0	351.6	113.1	138.4	198.7	103.4	70.1	0.4	137.2
Wetlands	123.0	146.2	41.7	56.1	108.4	75.4	49.9	0.4	12.2
Forest Regeneration	68.8	94.4	28.1	26.0	43.3	25.3	22.8	0.1	27.2
Wetlands Nonreach	894.6	694.0	224.7	406.2	576.7	321.9	155.0	1.0	283.8
SUM	**1436.4**	**1,286.2**	**407.6**	**626.7**	**927.0**	**525.9**	**297.9**	**2.0**	**460.3**

Table I.21a. Annual TN load (lbs/yr) from land uses in Subwatershed 22 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	1,424.8	2,418.7	748.2	812.3	1,238.7	851.9	519.4	8.1	1,096.9
Wetlands	125.5	324.5	77.4	116.9	153.5	228.8	147.1	1.1	53.3
Wetland Nonreach	395.8	890.2	209.3	328.2	415.5	622.4	398.3	2.6	371.6
SUM	**1,946.1**	**3,633.3**	**1,034.9**	**1,257.3**	**1,807.7**	**1,703.1**	**1,064.8**	**11.7**	**1,521.8**

Table I.21b. Annual TP load (lbs/yr) from land uses in Subwatershed 22 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	101.5	166.2	51.2	55.7	86.2	56.9	33.1	0.6	79.9
Wetlands	8.9	24.1	5.4	8.1	11.2	16.3	11.3	0.1	3.0
Wetland Nonreach	28.5	66.9	14.8	23.0	30.5	44.6	31.0	0.1	24.6
SUM	**138.8**	**257.1**	**71.4**	**86.8**	**127.8**	**117.9**	**75.4**	**0.7**	**107.5**

Table I.21c. Annual discharge (acre-ft/yr) from land uses in Subwatershed 22 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	418.0	448.0	142.0	163.0	241.4	128.7	93.0	0.5	162.1
Wetlands	123.0	146.2	41.7	56.1	108.4	75.4	49.9	0.4	12.2
Wetland Nonreach	874.4	683.0	222.9	391.6	563.9	316.4	155.1	1.0	258.1
SUM	**1,415.5**	**1,277.2**	**406.6**	**610.7**	**913.6**	**520.5**	**298.0**	**2.0**	**432.4**

Subwatershed 23: West Hawthorne Branch

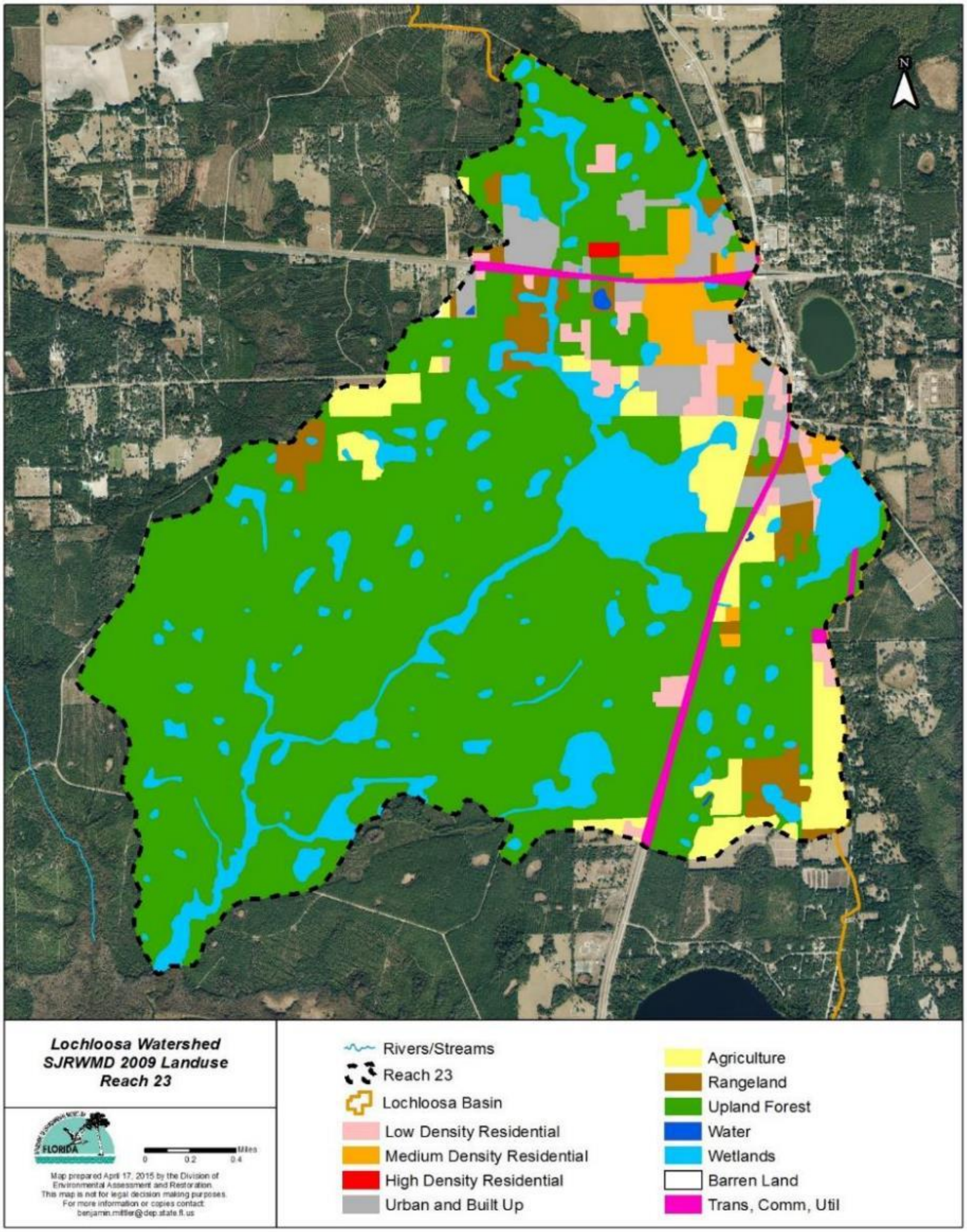

Figure I.8. Subwatershed 23 2009 land use

Table I.22. Subwatershed 23 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	112.37
1180	Rural residential	Low Density Residential	46.74
1200	Residential, medium density – 2–5 dwelling units/acre	Medium Density Residential	117.06
1300	Residential, high density – 6 or more dwelling units/acre	High Density Residential	5.80
1390	High density under construction	High Density Residential	12.66
1400	Commercial and services	Industrial and Commercial	59.17
1490	Commercial and services under construction	Industrial and Commercial	2.63
1550	Other light industrial	Industrial and Commercial	34.22
1700	Institutional	Industrial and Commercial	54.78
1860	Community recreational facilities	Open Land and Barren Land	31.08
1900	Open land	Open Land and Barren Land	18.54
2110	Improved pastures (monocult, planted forage crops)	Pasture	136.36
2120	Unimproved pastures	Pasture	3.96
2130	Woodland pastures	Pasture	22.97
2140	Row crops	Agriculture General	29.33
2150	Field crops	Agriculture General	73.84
2200	Tree crops	Agriculture Tree Crops	9.93
2410	Tree nurseries	Agriculture General	9.50
2430	Ornamentals	Agriculture General	13.84
3100	Herbaceous upland nonforested	Rangeland	15.23
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub)	Rangeland	64.53
3300	Mixed upland nonforested/Mixed rangeland	Rangeland	62.54
4110	Pine flatwoods	Forest	173.94
4200	Upland hardwood forests	Forest	1.04
4340	Upland mixed coniferous/hardwood	Forest	332.17
4410	Coniferous pine	Forest	1,662.33
4430	Forest regeneration areas	Forest Regeneration	1,172.36
5300	Reservoirs - pits, retention ponds, dams	Water	5.58
6110	Bay swamps	Wetlands	15.61
6170	Mixed wetland hardwoods	Wetlands	245.39
6210	Cypress	Wetlands	34.64
6250	Hydric pine flatwoods	Wetlands	87.37
6300	Wetland forested mixed	Wetlands	127.85
6410	Freshwater marshes	Wetlands	39.03
6430	Wet prairies	Wetlands	30.65
6440	Emergent aquatic vegetation	Wetlands	0.99
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	133.99
7410	Rural land in transition without positive indicators of intended activity	Open Land and Barren Land	0.86
8140	Roads and highways (divided 4-lanes with medians)	Industrial and Commercial	67.10
8310	Electrical power facilities	Industrial and Commercial	2.79
8320	Electrical power transmission lines	Open Land and Barren Land	3.43
8370	Surface water collection basins	Water	0.21
		SUM	**5,074.42**

Table I.23a. Annual TN load (lbs/yr) from land uses in Subwatershed 23 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	547.8	792.2	229.6	475.4	607.6	604.5	276.6	6.3	604.1
Medium Density Residential	671.2	915.6	274.5	560.6	710.2	722.0	349.8	12.5	722.7
High Density Residential	217.2	293.4	90.2	180.8	228.4	233.5	114.5	3.8	233.0
Industrial/Commercial	2,817.9	3,649.7	1,142.1	2,263.1	2,830.8	3,056.5	1,506.5	62.0	2,896.6
Open Land	72.0	108.1	34.8	59.3	87.3	83.2	33.9	1.3	83.8
Pasture	538.5	829.3	245.4	516.0	649.0	621.0	255.6	6.0	635.4
Agriculture Crops	1,205.0	2,024.8	659.2	1,101.2	1,620.6	1,560.1	524.1	13.7	1,510.9
Agriculture Trees	0.9	0.9	0.3	0.2	0.7	0.7	0.3	0.0	0.5
Rangeland	114.9	178.8	52.5	88.4	139.5	130.2	47.6	1.1	124.8
Forest	2,008.4	3,224.5	1,189.5	1,118.0	2,748.1	2,642.8	499.6	18.3	2,444.7
Water	0.8	2.0	0.7	0.2	0.9	1.4	1.1	0.1	0.7
Wetlands	386.1	1,302.3	347.0	9.9	637.2	892.5	613.0	2.2	371.5
Forest Regeneration	1,050.9	1,766.5	619.1	670.2	1476.1	1,418.3	302.2	10.8	1,306.7
Wetlands Nonreach	546.8	1,429.5	341.8	668.8	977.3	1,153.5	644.0	3.8	783.3
SUM	**10,178.4**	**16,517.7**	**5,226.8**	**7,712.3**	**12,713.7**	**13,120.4**	**5168.9**	**141.8**	**11,718.7**

Table I.23b. Annual TP load (lbs/yr) from land uses in Subwatershed 23 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	71.7	103.0	30.9	54.0	81.2	77.1	34.0	5.4	74.6
Medium Density Residential	58.2	74.5	29.8	49.2	58.9	61.1	35.2	13.6	59.8
High Density Residential	26.9	34.7	13.3	21.2	28.0	28.0	15.4	5.7	27.2
Industrial/Commercial	333.5	402.3	189.4	277.7	322.9	349.1	219.4	118.2	327.2
Open Land	5.4	8.1	2.5	4.2	6.7	6.1	2.4	0.1	6.2
Pasture	68.1	105.5	29.5	55.0	84.3	76.8	27.5	0.6	76.4
Agriculture Crops	157.9	252.5	74.6	111.7	203.1	189.7	53.6	1.4	179.9
Agriculture Trees	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1
Rangeland	8.4	13.2	3.7	6.1	10.4	9.4	3.2	0.1	9.1
Forest	154.2	242.0	86.3	78.9	205.3	193.8	34.1	1.2	181.7
Water	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0
Wetlands	29.0	94.1	24.2	0.5	45.8	62.1	46.1	0.1	26.7
Forest Regeneration	80.4	133.0	44.8	47.0	110.6	104.3	20.7	0.7	97.1
Wetlands Nonreach	40.8	107.1	24.2	45.6	74.4	83.0	50.1	0.2	55.4
SUM	**1,034.5**	**1,570.2**	**553.5**	**751.0**	**1,231.7**	**1,240.7**	**541.9**	**147.3**	**1,121.4**

Table I.23c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 23 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	70.8	45.3	19.4	39.7	58.1	46.0	12.7	6.2	59.9
Medium Density Residential	85.2	59.4	30.8	54.2	70.7	62.7	23.3	16.5	75.3
High Density Residential	22.0	16.8	10.3	15.7	18.3	18.2	8.3	7.0	20.1
Industrial/Commercial	400.2	318.3	203.4	297.1	333.2	347.1	167.3	146.7	369.4
Open Land	17.9	9.8	3.6	10.1	15.0	10.5	1.8	0.1	15.5
Pasture	39.1	22.2	7.7	19.0	31.7	21.8	4.2	0.1	30.9
Agriculture Crops	78.8	38.6	14.6	32.9	61.0	38.8	5.3	0.1	59.0
Agriculture Trees	0.4	0.4	0.1	0.1	0.3	0.3	0.1	0.0	0.2
Rangeland	33.0	19.2	6.6	15.4	26.6	18.5	3.8	0.1	25.4
Forest	504.2	243.5	98.7	142.1	350.5	221.6	41.3	1.4	238.7
Water	0.5	0.7	0.3	0.1	0.6	0.5	0.3	0.0	0.3
Wetlands	349.1	480.7	170.2	3.8	448.2	352.4	189.1	1.0	142.1
Forest Regeneration	284.8	140.1	54.8	92.7	207.3	129.6	22.8	0.7	168.8
Wetlands Nonreach	1,848.9	1,276.9	432.3	794.7	1,678.3	1,205.1	294.6	1.5	1,142.0
SUM	**3,734.9**	**2,671.9**	**1,052.8**	**1,517.6**	**3,299.9**	**2,473.2**	**774.8**	**181.4**	**2,347.6**

Table I.24a. Annual TN load (lbs/yr) from land uses in Subwatershed 23 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	3,660.7	5,882.0	2,170.2	2,040.5	5,013.7	4,821.7	910.1	33.3	4,461.5
Water	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.1
Wetlands	1,146.4	3866.5	1,030.3	29.4	1,891.8	2,649.8	1,820.1	6.5	1,102.8
Wetland Nonreach	604.8	2,049.1	535.8	427.1	1,324.4	1,455.2	958.4	3.3	1,008.9
SUM	**5,412.1**	**11,797.8**	**3,736.5**	**2,497.2**	**8,230.1**	**8,926.8**	**3688.7**	**43.2**	**6,573.4**

Table I.24b. Annual TP load (lbs/yr) from land uses in Subwatershed 23 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	281.2	441.7	157.6	144.1	374.7	353.6	62.2	2.2	331.8
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wetlands	86.2	279.4	71.9	1.4	135.8	184.3	136.9	0.3	79.3
Wetland Nonreach	26.3	87.3	23.1	18.4	56.9	61.7	41.5	0.4	43.4
SUM	**393.7**	**808.4**	**252.6**	**163.9**	**567.5**	**599.6**	**240.6**	**2.9**	**454.4**

Table I.24c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 23 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	918.1	441.9	179.3	258.9	638.1	402.7	74.5	2.5	434.6
Water	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1
Wetlands	1,036.3	1,427.1	505.2	11.3	1,330.8	1,046.3	561.5	2.9	422.0
Wetland Nonreach	2,080.0	1,333.3	524.7	426.0	1,873.7	1,164.0	336.7	1.4	950.8
SUM	**4,034.4**	**3,202.3**	**1,209.3**	**696.4**	**3,842.6**	**2,613.1**	**972.7**	**6.8**	**1,807.4**

Subwatershed 24: Lake Jeffords

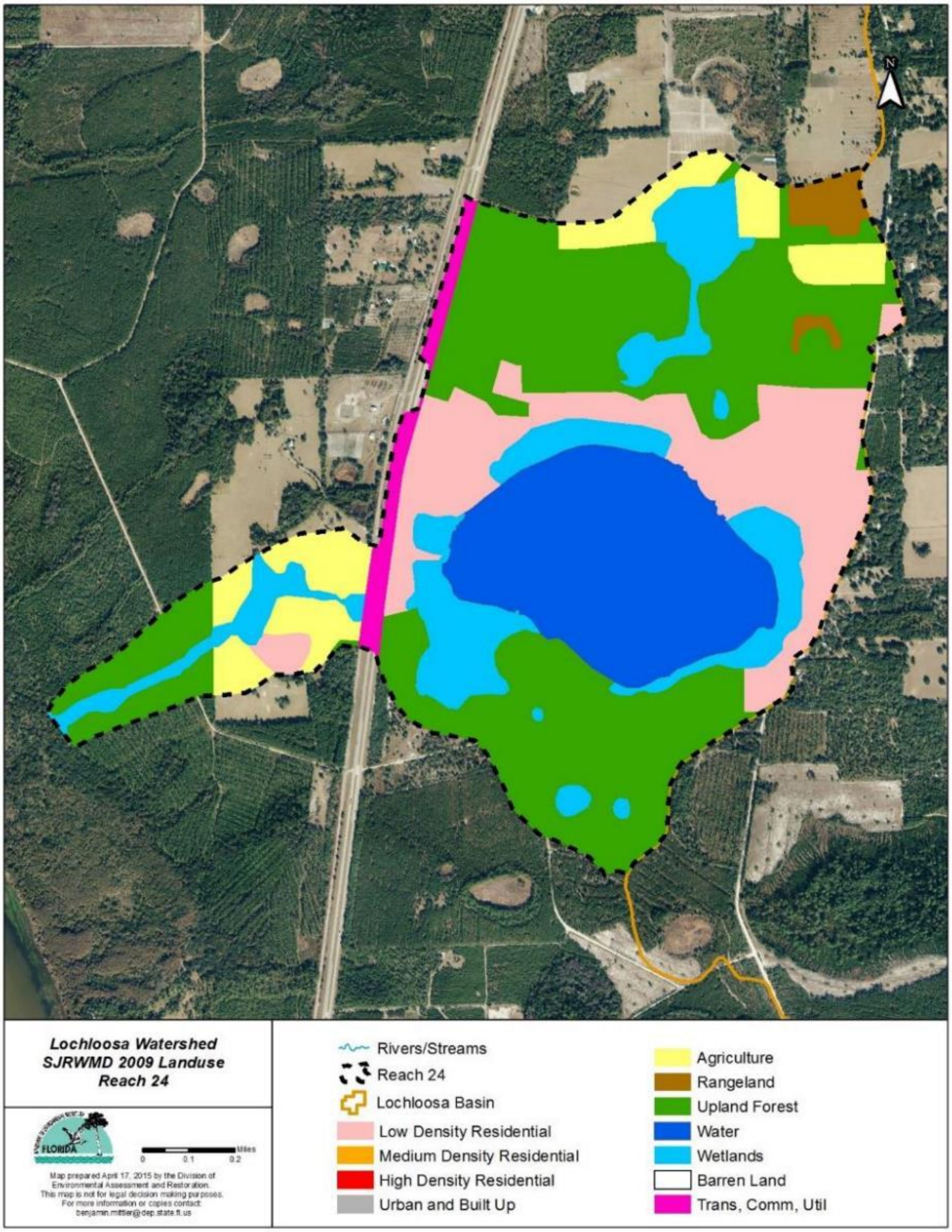

Figure I.9. Subwatershed 24 2009 land use

Table I.25. Subwatershed 24 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	145.39
1180	Rural residential	Low Density Residential	15.20
2110	Improved pastures (monocult, planted forage crops)	Pasture	50.39
2120	Unimproved pastures	Pasture	11.61
2150	Field crops	Agriculture General	24.26
3100	Herbaceous upland nonforested	Rangeland	2.78
4340	Upland mixed coniferous/hardwood	Forest	47.42
4410	Coniferous pine	Forest	271.65
4430	Forest regeneration areas	Forest Regeneration	12.80
5200	Lakes	Water	159.64
6110	Bay swamps	Wetlands	32.64
6170	Mixed wetland hardwoods	Wetlands	20.35
6300	Wetland forested mixed	Wetlands	61.46
6410	Freshwater marshes	Wetlands	7.46
6460	Treeless hydric savanna/Mixed scrub-shrub wetland	Wetlands	5.21
8140	Roads and highways (divided 4-lanes with medians)	Industrial and Commercial	19.91
		SUM	**888.18**

Table I.26a. Annual TN load (lbs/yr) from land uses in Subwatershed 24 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	1,560.4	2,023.0	583.4	1,012.6	1,465.3	1,487.2	890.4	20.3	1,467.4
High Density Residential	374.5	441.2	147.9	253.0	323.7	349.8	213.6	6.7	330.0
Pasture	629.9	893.1	255.8	438.5	654.1	616.6	363.6	5.7	637.2
Agriculture Crops	29.3	48.0	13.1	15.7	30.0	27.7	15.4	0.2	25.4
Rangeland	13.4	21.3	5.4	6.8	13.7	12.4	7.1	0.1	12.2
Forest	622.7	1,173.1	344.7	375.6	689.4	593.8	273.0	3.3	685.3
Water	141.3	361.7	167.9	35.3	123.6	85.1	66.9	4.1	156.5
Wetlands	345.2	959.2	234.1	176.2	539.4	651.9	447.6	2.0	247.4
Forest Regeneration	28.0	51.8	14.7	16.7	31.6	27.8	12.8	0.2	30.0
Wetlands Nonreach	56.0	135.5	32.6	41.9	82.9	99.0	63.2	0.4	68.3
SUM	**3,800.7**	**6,107.9**	**1,799.5**	**2,372.3**	**3,953.9**	**3,951.3**	**2,353.7**	**43.0**	**3,659.5**

Table I.26b. Annual TP load (lbs/yr) from land uses in Subwatershed 24 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	203.0	270.8	75.0	117.7	201.2	190.8	109.3	12.4	187.9
Industrial/Commercial	42.2	48.3	22.8	31.5	37.2	39.9	28.0	12.6	37.7
Pasture	79.9	117.7	29.5	47.1	86.6	77.0	40.8	0.6	80.1
Agriculture Crops	4.1	6.7	1.7	1.7	4.0	3.7	1.9	0.0	3.4
Rangeland	0.9	1.4	0.4	0.5	1.0	0.9	0.5	0.0	0.9
Forest	46.7	86.5	24.4	26.3	50.0	42.1	18.5	0.2	51.6
Water	8.8	23.7	9.7	1.7	6.5	4.0	3.2	0.2	9.9
Wetlands	24.4	70.8	16.4	11.8	39.9	46.0	34.5	0.1	15.7
Forest Regeneration	2.1	3.9	1.0	1.2	2.3	2.0	0.9	0.0	2.3
Wetlands Nonreach	4.0	10.1	2.3	2.8	6.3	7.2	5.0	0.0	4.7
SUM	**415.9**	**639.8**	**183.2**	**242.2**	**435.0**	**413.5**	**242.4**	**26.1**	**394.2**

Table I.26c. Annual discharge (acre-ft/yr) from land uses in Subwatershed 24 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	191.3	138.2	53.9	92.0	147.3	96.2	42.5	14.2	172.9
Industrial/Commercial	48.1	38.8	24.7	33.0	38.0	37.3	20.5	16.0	45.0
Pasture	43.7	30.9	9.6	18.2	33.4	17.5	7.1	0.0	39.0
Agriculture Crops	4.1	5.8	1.5	1.2	3.3	2.6	1.6	0.0	2.8
Rangeland	4.0	4.1	1.1	1.5	3.2	2.0	1.1	0.0	3.2
Forest	162.3	144.2	47.3	37.5	112.2	57.6	30.6	0.1	115.6
Water	79.5	112.2	39.6	13.8	33.6	33.1	25.9	1.6	68.3
Wetlands	276.1	394.0	121.2	27.9	376.4	232.1	151.6	0.8	108.0
Forest Regeneration	7.5	6.1	2.0	2.1	5.3	2.6	1.3	0.0	5.9
Wetlands Nonreach	151.2	114.9	39.1	46.6	129.1	64.9	29.4	0.1	106.1
SUM	**967.6**	**989.3**	**340.1**	**273.7**	**881.8**	**545.9**	**311.5**	**32.9**	**666.7**

Table I.27a. Annual TN load (lbs/yr) from land uses in Subwatershed 24 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	1,044.4	1,967.3	579.2	635.8	1,160.5	998.0	456.6	5.7	1,156.8
Wetlands	425.6	1,182.8	288.7	217.3	665.2	803.8	551.9	2.5	305.0
Wetland Nonreach	72.2	189.2	45.8	58.3	109.4	132.5	87.8	0.4	91.8
SUM	**1,542.3**	**3,339.3**	**913.8**	**911.3**	**1,935.1**	**1,934.3**	**1,096.3**	**8.5**	**1,553.7**

Table I.27b. Annual TP load (lbs/yr) from land uses in Subwatershed 24 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	78.7	145.7	41.2	44.6	84.5	71.1	31.1	0.4	87.4
Wetlands	30.1	87.3	20.2	14.5	49.2	56.7	42.6	0.1	19.3
Wetland Nonreach	5.1	14.1	3.2	3.9	8.2	9.5	6.8	0.0	6.2
SUM	**113.9**	**247.1**	**64.6**	**63.1**	**141.8**	**137.2**	**80.5**	**0.5**	**112.9**

Table I.27c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 24 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	270.4	234.8	77.8	62.5	186.3	93.5	49.1	0.2	193.4
Wetlands	340.4	485.9	149.5	34.4	464.2	286.1	186.9	1.0	133.2
Wetland Nonreach	167.8	132.2	48.1	33.1	145.9	65.9	35.1	0.2	107.1
SUM	**778.6**	**852.8**	**275.3**	**130.1**	**796.3**	**445.6**	**271.1**	**1.4**	**433.7**

Subwatershed 25: Unnamed Drain

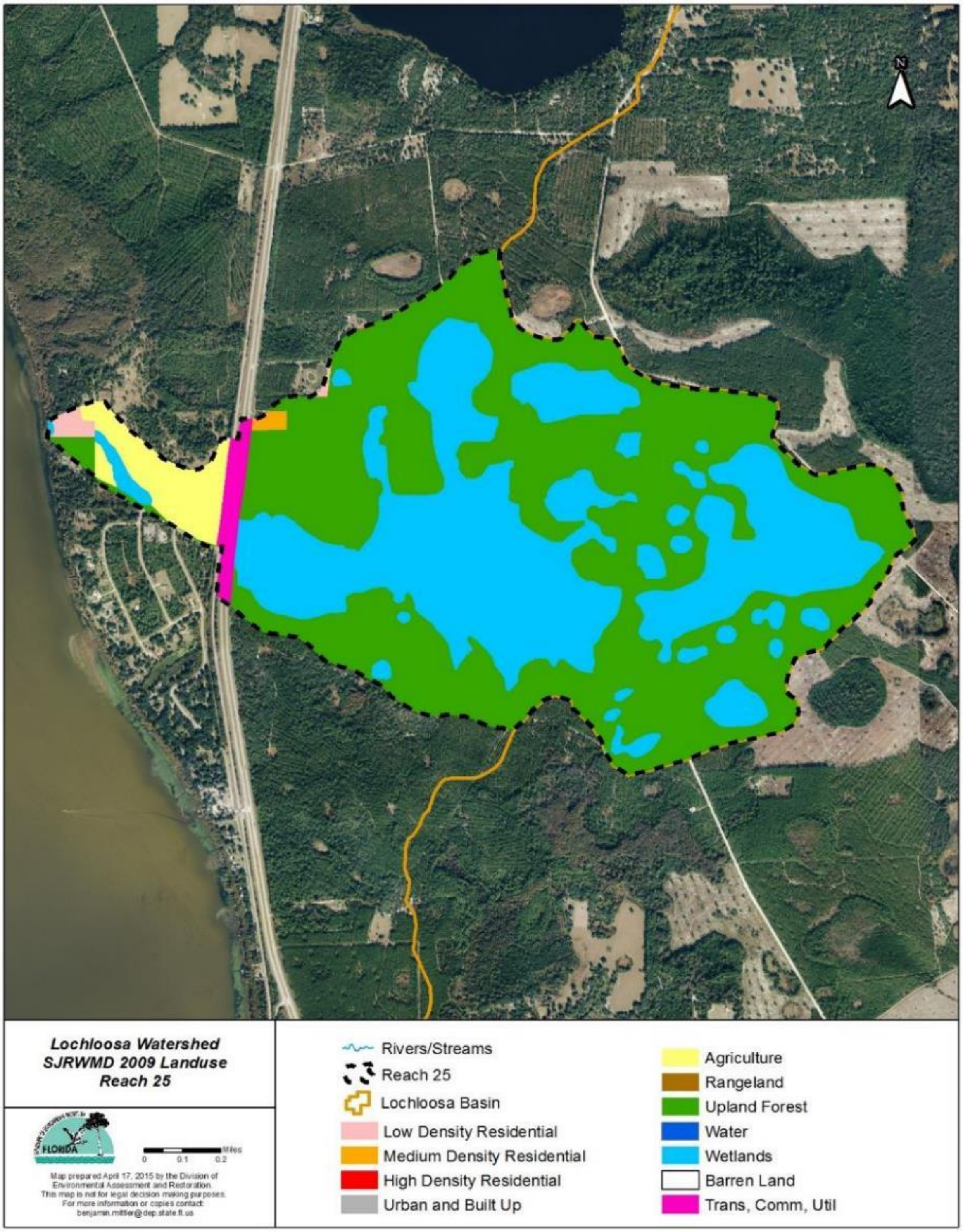

Figure I.10. Subwatershed 25 2009 land use

Table I.28. Subwatershed 25 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	5.15
1180	Rural residential	Low Density Residential	6.87
1920	Inactive land with street pattern but no structures	Open Land and Barren Land	2.13
2110	Improved pastures (monocult, planted forage crops)	Sum	35.92
4110	Pine flatwoods	Forest	11.60
4340	Upland mixed coniferous/hardwood	Forest	26.81
4410	Coniferous pine	Forest	348.62
4430	Forest regeneration areas	Forest Regeneration	162.67
6110	Bay swamps	Wetlands	23.54
6210	Cypress	Wetlands	16.82
6250	Hydric pine flatwoods	Wetlands	46.90
6300	Wetland forested mixed	Wetlands	157.65
6410	Freshwater marshes	Wetlands	29.86
6430	Wet prairies	Wetlands	1.81
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	130.49
8140	Roads and highways (divided 4-lanes with medians)	Industrial and Commercial	14.03
		SUM	**1,020.87**

Table I.29a. Annual TN load (lbs/yr) from land uses in Subwatershed 25 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	80.0	103.4	30.8	54.6	73.9	55.3	45.7	1.8	77.2
Industrial/Commercial	302.6	360.6	130.0	212.9	261.3	204.3	180.4	13.5	271.9
Pasture	504.2	701.8	204.5	380.9	512.5	360.1	285.5	8.3	531.0
Rangeland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forest	582.6	939.2	291.2	378.5	580.9	267.1	171.5	3.7	666.6
Wetlands	250.5	795.1	194.0	164.9	398.7	267.3	395.0	3.2	215.2
Forest Regeneration	268.4	432.4	127.6	187.8	271.7	144.2	89.4	2.1	301.1
Wetlands Nonreach	237.1	738.8	180.7	188.3	370.3	260.6	365.4	2.9	384.0
SUM	**2,225.3**	**4,071.4**	**1,159.0**	**1,567.9**	**2,469.2**	**1,559.0**	**1,533.0**	**35.6**	**2,447.2**

Table I.29b. Annual TP load (lbs/yr) from land uses in Subwatershed 25 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	10.5	13.5	3.9	6.5	9.9	7.1	5.6	0.8	10.1
Industrial/Commercial	34.8	39.5	19.9	26.7	30.3	26.8	23.8	11.2	31.2
Pasture	63.8	90.2	23.1	42.4	65.2	43.4	31.7	0.8	68.0
Rangeland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forest	43.2	66.6	20.1	26.6	41.3	18.1	11.4	0.3	50.0
Wetlands	18.1	58.4	13.5	11.3	29.0	18.6	30.0	0.1	13.6
Forest Regeneration	19.9	31.0	8.8	13.3	19.5	10.0	6.0	0.1	22.6
Wetlands Nonreach	17.2	54.5	12.6	13.3	27.0	18.1	27.8	0.1	26.3
SUM	**207.5**	**353.6**	**101.9**	**140.1**	**222.3**	**142.1**	**136.3**	**13.5**	**221.8**

Table I.29c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 25 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	10.4	6.5	3.1	5.3	7.0	3.6	2.1	0.9	9.4
Industrial/Commercial	40.8	30.7	21.6	29.5	29.8	26.9	17.9	14.9	37.4
Pasture	36.7	20.7	8.6	15.9	23.9	8.4	4.5	0.1	32.8
Rangeland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forest	163.2	129.8	52.4	40.0	99.8	29.1	20.8	0.2	112.4
Wetlands	230.5	295.5	105.5	77.4	277.3	91.6	137.3	1.3	99.6
Forest Regeneration	77.7	56.8	23.0	21.9	48.3	13.6	9.3	0.1	58.6
Wetlands Nonreach	362.5	324.2	134.0	108.0	340.2	93.4	132.3	1.2	207.8
SUM	**921.8**	**864.1**	**348.2**	**298.0**	**826.4**	**266.6**	**324.3**	**18.5**	**558.0**

Table I.30a. Annual TN load (lbs/yr) from land uses in Subwatershed 25 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	889.5	1,432.2	445.1	582.1	889.6	408.2	261.5	5.7	1,024.6
Wetlands	295.3	937.2	228.7	194.4	470.0	315.1	465.6	3.8	253.7
Wetland Nonreach	238.3	743.6	182.2	176.2	371.7	260.7	367.9	3.0	386.1
SUM	**1,423.0**	**3,113.0**	**856.0**	**952.7**	**1,731.3**	**984.0**	**1,095.1**	**12.4**	**1,664.3**

Table I.30b. Annual TP load (lbs/yr) from land uses in Subwatershed 25 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	66.3	101.9	30.8	41.0	63.5	27.8	17.4	0.4	77.0
Wetlands	21.3	68.8	15.9	13.3	34.1	21.9	35.4	0.2	16.1
Wetland Nonreach	17.3	54.8	12.7	12.3	27.1	18.1	28.0	0.1	26.4
SUM	**104.9**	**225.5**	**59.4**	**66.6**	**124.8**	**67.8**	**80.7**	**0.7**	**119.5**

Table I.30c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 25 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	248.0	192.7	78.9	60.5	151.0	43.0	30.7	0.2	171.2
Wetlands	271.7	348.3	124.3	91.2	326.9	108.0	161.8	1.5	117.4
Wetland Nonreach	360.0	323.3	134.9	103.8	336.1	94.0	133.3	1.2	201.1
SUM	**879.7**	**864.3**	**338.2**	**255.5**	**814.0**	**245.1**	**325.8**	**2.9**	**489.7**

Subwatershed 26: Watson Prairie

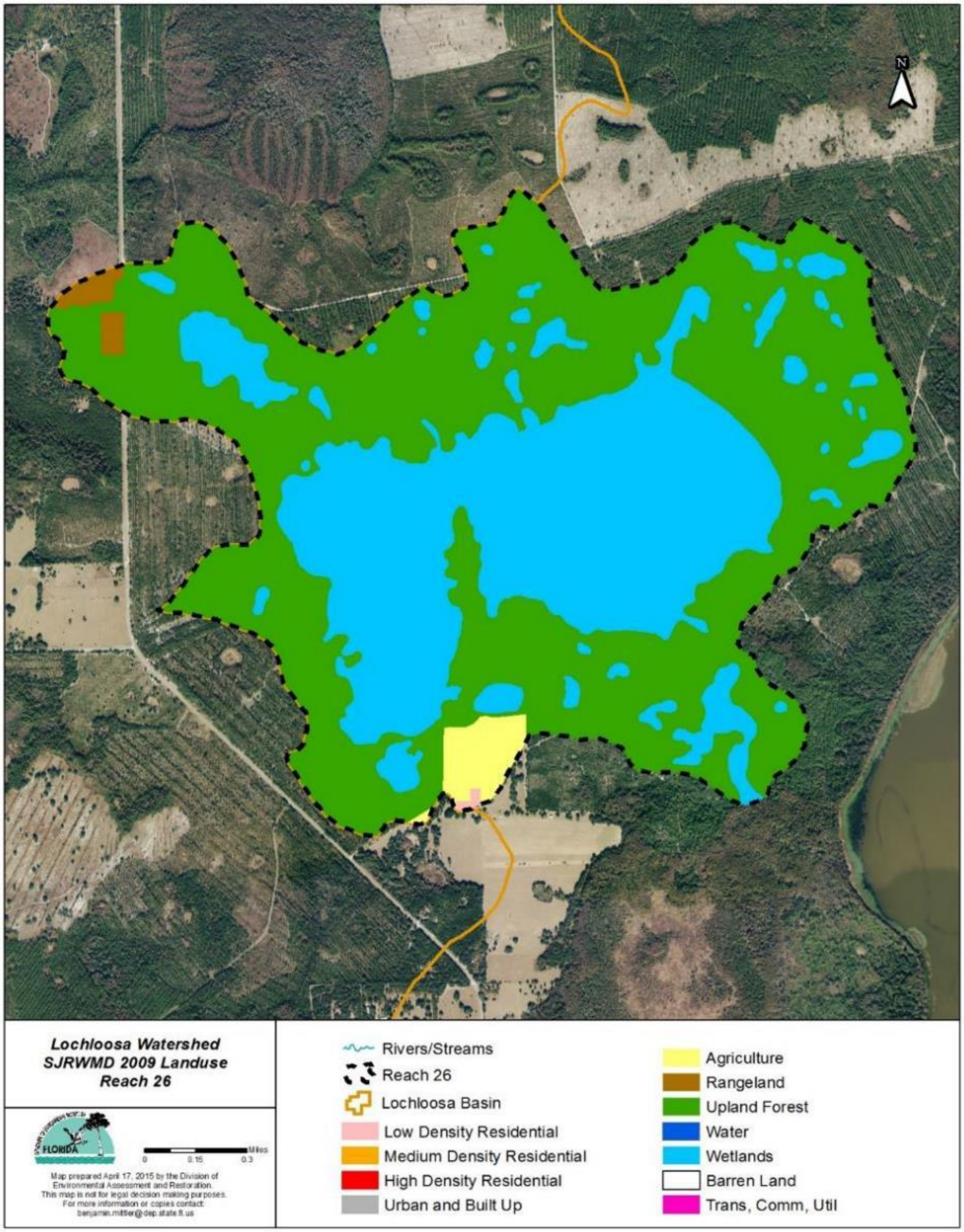

Figure I.11. Subwatershed 26 2009 land use

Table I.31. Subwatershed 26 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	1.73
1180	Rural residential	Low Density Residential	11.87
2110	Improved pastures (monocult, planted forage crops)	Pasture	5.72
2130	Woodland pastures	Pasture	26.15
3100	Herbaceous upland nonforested	Rangeland	14.53
4110	Pine flatwoods	Forest	5.43
4340	Upland mixed coniferous/hardwood	Forest	56.48
4410	Coniferous pine	Forest	794.64
4430	Forest regeneration areas	Forest Regeneration	233.14
6170	Mixed wetland hardwoods	Wetland	162.57
6210	Cypress	Wetland	42.79
6250	Hydric pine flatwoods	Wetland	138.24
6300	Wetland forested mixed	Wetland	25.22
6410	Freshwater marshes	Wetland	255.72
6430	Wet prairies	Wetland	6.68
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetland	69.91
		SUM	**1,850.82**

Table I.32a. Annual TN load (lbs/yr) from land uses in Subwatershed 26 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	6.2	8.0	3.9	4.5	4.9	5.8	2.9	0.1	4.8
Pasture	416.1	570.0	243.3	334.9	358.1	396.1	197.5	4.6	351.5
Rangeland	61.2	87.5	32.3	43.2	50.0	53.3	28.9	0.5	47.4
Forest	1,793.2	3,428.4	1,022.8	1,174.1	1,646.4	1,313.3	778.4	11.9	1,620.1
Wetlands	969.1	2,534.6	585.1	750.9	1,148.1	1,759.1	1,124.0	8.2	183.6
Forest Regeneration	497.2	926.0	275.1	337.4	458.9	387.4	226.4	3.8	444.5
Wetlands Nonreach	117.0	303.9	68.9	89.3	135.1	208.7	132.2	0.9	135.1
SUM	**3,860.0**	**7,858.5**	**2,231.4**	**2,734.4**	**3,801.5**	**4,123.6**	**2,490.2**	**30.0**	**2,787.0**

Table I.32b. Annual TP load (lbs/yr) from land uses in Subwatershed 26 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	0.8	1.0	0.4	0.5	0.6	0.7	0.4	0.0	0.6
Pasture	55.1	74.3	27.7	37.9	44.1	46.5	24.2	0.5	42.3
Rangeland	4.6	6.5	2.3	3.1	3.7	3.8	2.1	0.0	3.5
Forest	138.3	252.7	73.2	82.5	120.1	91.8	53.7	0.8	120.5
Wetlands	68.4	185.1	40.9	49.7	83.1	125.0	87.4	0.4	8.7
Forest Regeneration	38.2	68.2	19.6	23.9	33.6	27.1	15.7	0.3	33.1
Wetlands Nonreach	8.3	22.4	4.9	6.0	9.9	15.0	10.4	0.0	9.1
SUM	**313.8**	**610.2**	**169.0**	**203.4**	**295.0**	**309.8**	**193.7**	**2.0**	**217.7**

Table I.32c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 26 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	0.8	0.7	0.2	0.4	0.4	0.3	0.2	0.0	0.5
Pasture	31.4	23.4	7.1	14.5	16.9	9.4	4.7	0.0	19.6
Rangeland	17.5	12.7	3.9	8.0	9.3	5.2	2.5	0.0	10.8
Forest	513.5	474.6	147.4	164.3	254.8	121.4	85.4	0.5	192.4
Wetlands	892.4	1135.3	287.0	308.0	716.5	569.9	391.8	3.2	71.4
Forest Regeneration	149.8	132.2	40.1	51.8	76.0	36.3	24.1	0.2	67.0
Wetlands Nonreach	338.3	274.6	78.2	114.3	193.2	106.5	58.9	0.4	102.9
SUM	**1,943.6**	**2,053.4**	**563.9**	**661.2**	**1,267.1**	**848.9**	**567.5**	**4.1**	**464.6**

Table I.33a. Annual TN load (lbs/yr) from land uses in Subwatershed 26 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	2,392.2	4,573.8	1,364.6	1,567.8	2,197.9	1,753.4	1,038.2	15.9	2,164.2
Wetlands	970.4	2,538.2	586.0	752.0	1,149.8	1,761.6	1,125.6	8.2	183.9
Wetland Nonreach	116.9	304.2	69.1	89.0	135.2	208.7	132.4	0.9	133.4
SUM	**3,479.5**	**7,416.2**	**2,019.6**	**2,408.7**	**3,482.9**	**3,723.7**	**2,296.2**	**25.1**	**2,481.5**

Table I.33b. Annual TP load (lbs/yr) from land uses in Subwatershed 26 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	184.6	337.3	97.8	110.2	160.4	122.6	71.7	1.1	161.1
Wetlands	68.5	185.3	40.9	49.8	83.2	125.2	87.5	0.4	8.7
Wetland Nonreach	8.3	22.4	4.9	6.0	9.9	15.0	10.4	0.0	8.9
SUM	**261.4**	**545.1**	**143.6**	**165.9**	**253.4**	**262.7**	**169.5**	**1.5**	**178.6**

Table I.33c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 26 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	684.5	630.9	196.0	218.9	339.4	161.4	113.3	0.6	256.6
Wetlands	893.7	1,136.9	287.4	308.4	717.5	570.7	392.4	3.2	71.5
Wetland Nonreach	330.7	269.9	77.8	108.0	187.7	102.6	57.2	0.4	92.9
SUM	**1,908.9**	**2,037.7**	**561.2**	**635.3**	**1,244.7**	**834.7**	**562.9**	**4.1**	**421.1**

Subwatershed 27: Lochloosa Lake

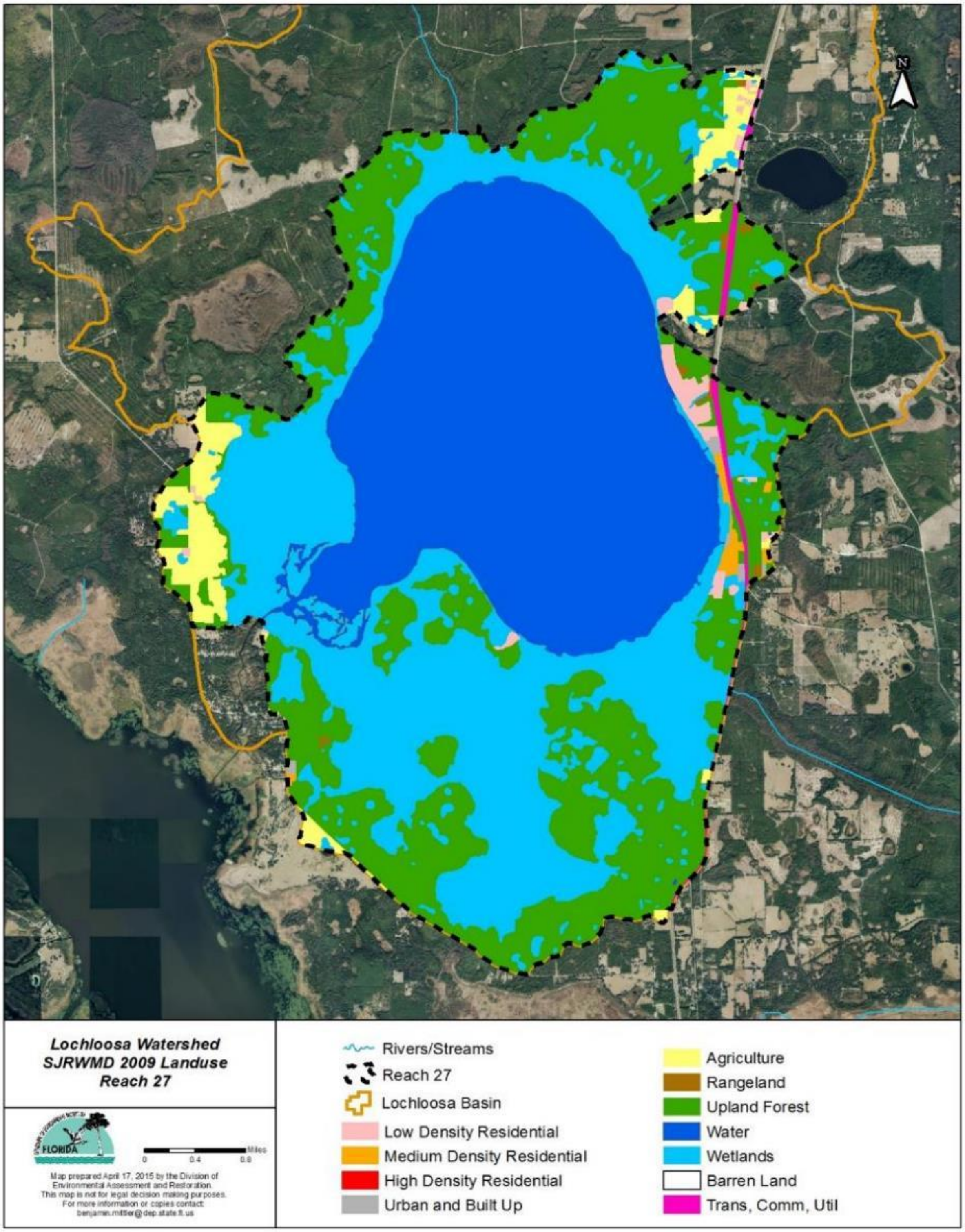

Figure I.12. Subwatershed 27 2009 land use

Table I.34. Subwatershed 27 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	145.35
1180	Rural residential	Low Density Residential	110.54
1200	Residential, medium density – 2–5 dwelling units/acre	Medium Density Residential	46.62
1400	Commercial and services	Industrial and Commercial	13.51
1700	Institutional	Industrial and Commercial	6.71
1840	Marinas and fish camps	Industrial and Commercial	0.92
1850	Parks and zoos	Open Land and Barren Land	2.34
1920	Inactive land with street pattern but no structures	Open Land and Barren Land	37.58
2110	Improved pastures (monocult, planted forage crops)	Pasture	412.34
2130	Woodland pastures	Pasture	66.80
2140	Row crops	Agriculture General	16.97
2150	Field crops	Agriculture General	4.68
2200	Tree crops	Agriculture Tree Crops	6.89
3100	Herbaceous upland nonforested	Rangeland	24.63
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub	Rangeland	2.23
4110	Pine flatwoods	Forest	93.65
4340	Upland mixed coniferous/hardwood	Forest	495.43
4410	Coniferous pine	Forest	3,133.49
4430	Forest regeneration areas	Forest Regeneration	248.61
5100	Streams and waterways	Water	1.08
5200	Lakes	Water	5,429.79
5300	Reservoirs – pits, retention ponds, dams	Water	0.33
6110	Bay swamps	Wetlands	13.63
6170	Mixed wetland hardwoods	Wetlands	1,176.83
6210	Cypress	Wetlands	517.06
6250	Hydric pine flatwoods	Wetlands	229.74
6300	Wetland forested mixed	Wetlands	437.99
6410	Freshwater marshes	Wetlands	1,973.79
6430	Wet prairies	Wetlands	10.57
6440	Emergent aquatic vegetation	Wetlands	287.16
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	271.86
8140	Roads and highways (divided 4-lanes with medians)	Industrial and Commercial	94.63
		SUM	**15,313.74**

Table I.35a. Annual TN load (lbs/yr) from land uses in Subwatershed 27 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	1,077.1	1,457.5	389.5	869.1	1,064.3	825.7	600.0	35.9	1,027.1
Medium Density Residential	572.1	731.9	206.3	464.8	552.7	438.1	313.2	28.3	524.0
Industrial/Commercial	1,875.0	2,326.1	693.8	1,505.1	1,777.9	1,443.5	1,027.1	131.4	1,671.7
Open Land	8.8	12.4	3.5	7.0	9.0	6.5	4.7	0.4	8.4
Pasture	3,853.2	5,422.8	1,506.3	3,323.3	3,979.3	2,840.5	2,128.6	101.9	3,948.9
Agriculture Crops	83.7	124.4	37.8	71.5	88.0	52.8	43.7	1.2	91.1
Agriculture Trees	1.8	3.0	0.7	0.6	1.3	0.6	0.7	0.0	0.8
Rangeland	69.2	103.3	26.3	50.7	69.3	46.6	36.4	1.1	67.6
Forest	6,664.0	10,912.5	3,340.3	3,944.4	6,968.3	2,131.2	2,059.9	59.4	8,010.6
Variable Water/Wetlands	1,065.6	1,287.2	397.4	42.0	2,980.5	4,449.0	3,498.0	53.8	2,076.6
Forest Regeneration	352.8	582.4	169.9	237.1	368.4	140.6	133.4	3.3	405.8
Wetlands Nonreach	430.9	1,280.6	339.1	288.2	655.9	848.5	668.1	6.2	695.1
SUM	**16,054.1**	**24,244.2**	**7,110.9**	**10,803.8**	**18,514.8**	**13,223.6**	**10,513.9**	**422.9**	**18,527.5**

Table I.35b. Annual TP load (lbs/yr) from land uses in Subwatershed 27 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	143.0	189.1	51.2	102.8	135.7	104.5	78.0	12.7	128.6
Medium Density Residential	79.9	98.4	31.8	59.4	75.0	60.6	46.1	13.3	69.9
Industrial/Commercial	227.8	263.3	123.7	188.4	210.2	191.7	153.4	84.6	202.2
Open Land	0.7	0.9	0.2	0.5	0.7	0.5	0.3	0.0	0.6
Pasture	490.1	688.5	168.9	368.6	483.3	331.4	244.8	9.8	474.2
Agriculture Crops	11.2	16.2	4.2	7.8	10.6	5.8	4.8	0.1	11.0
Agriculture Trees	0.3	0.5	0.1	0.1	0.2	0.1	0.1	0.0	0.1
Rangeland	5.1	7.5	1.8	3.6	5.0	3.3	2.6	0.1	4.9
Forest	506.6	792.9	233.0	275.1	503.1	145.5	139.1	4.2	595.6
Variable Water/Wetlands	58.1	78.2	23.6	1.6	180.7	257.2	244.7	2.0	102.1
Forest Regeneration	26.2	41.7	11.6	16.5	26.3	9.6	9.0	0.2	29.9
Wetlands Nonreach	31.7	93.1	23.7	19.7	47.2	58.1	52.4	0.3	46.6
SUM	**1,580.8**	**2,270.3**	**673.9**	**1,043.9**	**1,678.1**	**1,168.3**	**975.4**	**127.2**	**1,665.8**

Table I.35c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 27 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	153.1	104.2	43.1	83.4	104.3	47.9	33.9	13.9	128.7
Medium Density Residential	76.7	54.1	27.8	48.1	54.4	35.2	23.5	15.8	66.8
Industrial/Commercial	277.8	220.0	141.6	206.2	207.2	187.5	123.8	109.9	249.1
Open Land	2.4	1.4	0.5	1.3	1.6	0.5	0.3	0.0	2.0
Pasture	307.1	204.5	67.3	145.9	202.3	58.1	46.3	0.7	245.9
Agriculture Crops	7.3	6.2	1.9	2.8	4.8	1.2	1.3	0.0	5.2
Agriculture Trees	0.7	1.2	0.3	0.2	0.5	0.3	0.3	0.0	0.3
Rangeland	21.3	13.7	4.6	9.9	13.9	3.8	3.1	0.0	17.2
Forest	1,823.4	1,396.2	497.4	415.3	1,072.6	182.9	2,15.9	2.0	1,059.7
Variable Water/Wetlands	668.2	559.5	194.1	18.1	2,052.6	890.7	1,359.4	23.2	584.1
Forest Regeneration	104.4	84.2	27.9	29.8	65.1	12.8	14.4	0.1	68.9
Wetlands Nonreach	1,178.4	889.8	334.5	258.2	923.5	233.8	285.7	2.4	652.2
SUM	**4,620.8**	**3,535.2**	**1,341.1**	**1,219.4**	**4,702.8**	**1,654.7**	**2,108.0**	**168.0**	**3,080.0**

Table I.36a. Annual TN load (lbs/yr) from land uses in Subwatershed 27 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	7,754.5	12,705.4	3,885.6	4,580.7	8,098.5	2,479.4	2,399.0	68.9	9,301.6
Variable Water/Wetlands	1,462.4	2,095.4	622.1	48.6	3,474.9	5,172.5	3,969.1	57.7	2,675.9
Wetland Nonreach	554.4	1,574.0	440.5	369.6	852.9	982.4	864.8	7.2	881.7
SUM	**9,771.3**	**16,374.9**	**4,948.2**	**4,998.9**	**12,426.3**	**8,634.3**	**7,232.9**	**133.8**	**12,859.2**

Table I.36b. Annual TP load (lbs/yr) from land uses in Subwatershed 27 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	588.8	922.0	270.7	319.3	584.3	169.2	161.8	4.9	691.3
Variable Water/Wetlands	83.0	129.4	37.3	1.8	211.1	299.2	277.7	2.1	133.1
Wetland Nonreach	40.7	113.5	30.8	25.1	61.2	66.0	67.4	0.3	58.3
SUM	**712.5**	**1,165.0**	**338.8**	**346.2**	**856.6**	**534.3**	**506.9**	**7.3**	**882.7**

Table I.36c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 27 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	2,124.7	1,638.9	581.6	484.3	1,250.9	215.2	254.4	2.3	1,233.8
Variable Water/Wetlands	1,013.6	942.8	319.8	21.0	2,447.8	1,044.0	1,545.1	24.9	732.5
Wetland Nonreach	1,306.7	987.7	389.8	130.7	1,015.7	202.4	334.0	2.8	604.8
SUM	**4,445.1**	**3,569.4**	**1,291.2**	**636.0**	**4,714.4**	**1,461.6**	**2,133.5**	**30.0**	**2,571.1**

Subwatershed 28: Cross Creek

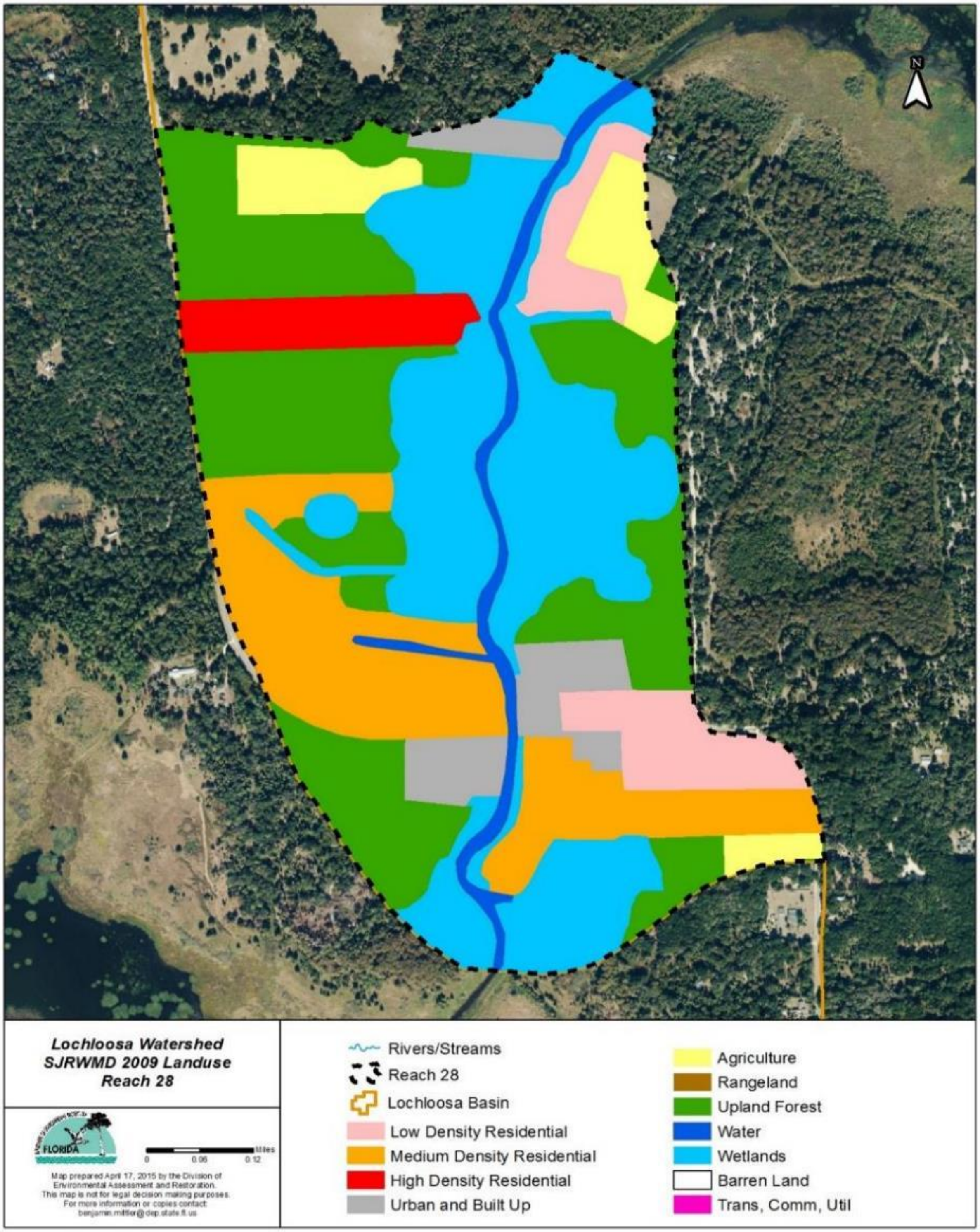

Figure I.13. Subwatershed 28 2009 land use

Table I.37. Subwatershed 28 land use summary

Land Use Code	Land Use Classification	HSPF Group	Acres
1100	Residential, low density – less than 2 dwelling units/acre	Low Density Residential	20.93
1180	Rural residential	Low Density Residential	41.02
1200	Residential, medium density – 2–5 dwelling units/acre	Medium Density Residential	51.91
1300	Residential, high density – 6 or more dwelling units/acre	High Density Residential	12.61
1400	Commercial and services	Industrial and Commercial	13.07
1840	Marinas and fish camps	Industrial and Commercial	3.78
2110	Improved pastures (monocult, planted forage crops)	Pasture	16.71
2200	Fruit Orchards (Peaches are an example of a crop type that is typical for this category)	Agriculture Tree Crops	2.52
4340	Upland mixed coniferous/hardwood	Forest	52.43
5100	Streams and waterways	Water	10.67
6170	Mixed wetland hardwoods	Wetlands	26.35
6210	Cypress	Wetlands	30.76
6250	Hydric pine flatwoods	Wetlands	3.75
6300	Wetland forested mixed	Wetlands	1.69
6410	Freshwater marshes	Wetlands	27.16
6460	Treeless hydric savanna/ Mixed scrub-shrub wetland	Wetlands	6.12
		SUM	**321.49**

Table I.38a. Annual TN load (lbs/yr) from land uses in Subwatershed 28 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	225.7	276.7	93.6	153.0	194.0	137.8	104.2	66.4	167.4
Medium Density Residential	753.7	884.6	353.7	506.4	638.6	460.3	351.0	242.5	541.4
High Density Residential	329.8	385.6	161.7	221.6	281.2	202.2	153.9	108.1	236.0
Industrial/Commercial	376.8	434.9	190.5	249.7	317.8	234.1	177.9	124.4	266.5
Pasture	258.4	334.6	101.5	190.9	232.6	156.0	117.7	71.0	207.8
Agriculture Trees	31.9	46.2	11.7	23.1	29.8	18.5	14.1	2.7	28.8
Forest	238.0	407.6	107.6	153.0	223.9	97.4	59.7	2.8	236.5
Water	9.2	15.2	7.8	2.3	3.9	4.5	2.7	0.5	3.1
Wetlands	150.1	312.6	92.7	1.2	180.8	161.5	189.3	2.8	30.5
Wetlands Nonreach	2.6	5.5	1.4	1.7	2.9	3.2	2.9	0.0	2.1
SUM	**2,376.3**	**3,103.4**	**1,122.3**	**1,502.8**	**2,105.5**	**1,475.6**	**1,173.7**	**621.3**	**1,720.1**

Table I.38b. Annual TP load (lbs/yr) from land uses in Subwatershed 28 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	29.7	35.9	11.3	18.1	24.3	17.7	13.3	8.0	21.2
Medium Density Residential	63.6	72.7	34.8	45.3	53.8	43.3	35.5	27.5	47.9
High Density Residential	40.1	45.5	20.5	26.9	33.6	26.5	21.4	15.9	29.4
Industrial/Commercial	43.0	47.6	26.2	31.5	36.5	31.6	26.6	21.9	33.4
Pasture	33.1	42.8	11.3	21.3	28.1	18.7	13.4	7.1	25.1
Agriculture Trees	4.2	6.0	1.3	2.5	3.5	2.1	1.5	0.3	3.5
Forest	18.2	30.5	7.6	10.8	16.4	7.0	4.1	0.2	17.4
Water	0.6	0.9	0.4	0.1	0.2	0.2	0.1	0.0	0.1
Wetlands	10.6	22.8	6.5	0.1	12.9	10.9	14.7	0.1	1.4
Wetlands Nonreach	0.2	0.4	0.1	0.1	0.2	0.2	0.2	0.0	0.1
SUM	**243.3**	**305.2**	**119.9**	**156.5**	**209.5**	**158.1**	**130.9**	**81.1**	**179.6**

Table I.38c. Annual discharge (ac-ft/yr) from land uses in Subwatershed 28 under current conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Low Density Residential	27.3	19.7	7.6	13.6	16.9	8.9	5.4	3.6	18.6
Medium Density Residential	88.6	67.7	32.9	51.3	58.1	41.2	25.9	23.7	65.3
High Density Residential	30.2	24.9	14.5	20.0	20.8	18.3	11.9	12.4	23.8
Industrial/Commercial	49.2	41.9	25.9	34.2	34.7	32.7	21.6	23.1	39.7
Pasture	17.1	11.4	3.6	7.5	10.1	3.6	2.1	0.6	10.9
Agriculture Trees	2.2	1.5	0.5	0.8	1.2	0.3	0.2	0.0	1.2
Forest	48.3	23.8	9.7	10.9	23.4	3.1	1.4	0.1	16.5
Water	4.9	7.3	2.0	0.9	1.5	1.8	1.1	0.2	1.2
Wetlands	111.6	158.5	45.0	0.5	109.8	37.0	68.7	1.1	11.9
Wetlands Nonreach	3.0	3.4	0.9	0.9	2.6	1.2	1.2	0.0	0.9
SUM	**382.5**	**360.0**	**142.6**	**140.5**	**279.1**	**148.0**	**139.4**	**64.8**	**189.9**

Table I.39a. Annual TN load (lbs/yr) from land uses in Subwatershed 28 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	449.7	770.0	203.3	289.0	423.0	184.0	112.9	5.3	446.8
Wetlands	204.5	425.8	126.3	1.6	246.3	220.0	257.9	3.8	41.6
Wetland Nonreach	2.8	5.7	1.7	0.3	3.4	3.0	3.4	0.1	0.6
SUM	**657.0**	**1,201.5**	**331.3**	**290.9**	**672.7**	**406.9**	**374.2**	**9.1**	**488.9**

Table I.39b. Annual TP load (lbs/yr) from land uses in Subwatershed 28 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	34.4	57.7	14.3	20.4	30.9	13.1	7.7	0.4	32.9
Wetlands	14.5	31.0	8.8	0.1	17.6	14.8	20.0	0.2	2.0
Wetland Nonreach	0.2	0.4	0.1	0.0	0.2	0.2	0.3	0.0	0.0
SUM	**49.1**	**89.1**	**23.2**	**20.5**	**48.7**	**28.2**	**28.0**	**0.5**	**34.9**

Table I.39c. Annual discharge (ac-ft/yr) from land uses in Sub-Basin 28 under natural background conditions

HSPF Land Use Categories	2004	2005	2006	2007	2008	2009	2010	2011	2012
Forest	114.3	85.9	29.2	26.1	56.4	11.9	10.0	0.2	41.3
Wetlands	152.1	216.0	61.3	0.6	149.6	50.4	93.5	1.5	16.1
Wetland Nonreach	2.5	3.1	0.9	0.0	2.3	0.7	1.3	0.0	0.2
SUM	**268.9**	**305.0**	**91.4**	**26.7**	**208.3**	**62.9**	**104.8**	**1.7**	**57.6**

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

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

— Documents location and descriptive information.

Waterbody Location Information	Description of Waterbody Location Information
Waterbody name	Lochloosa Lake and Cross Creek
Waterbody type(s)	Lochloosa Lake: freshwater lake Cross Creek: freshwater stream
Waterbody ID (WBID)	WBID 2738A and 2754 (see **Figure 1.1** of this TMDL report)
Description	Lochloosa Lake is located southeast of the city of Gainesville, in Alachua County, Florida. The surface area of the lake is 5,653 acres, and the watershed encompasses 56,186 acres. The average lake volume is $1.69 * 10^{10}$ gallons. The average depth of the lake is 6.1 feet, with a maximum depth of 18.52 feet. Cross Creek is the primary lake outlet from the lake, which makes up 95% of the flow in the creek. Cross Creek flows 1.5 miles to the southwest to Orange Lake. Orange Lake discharges to Orange Creek, which then flows into the Ocklawaha River. **Section 1.2** of the report contains a more detailed description of the waterbodies.
Specific location (latitude/longitude or river miles)	The center of Lochloosa Lake is located at N: 29^{0} 31'27.56"/ W: -82^{0} 7'52.44". Cross Creek extends from the southwest corner of Lochloosa Lake for a distance of 1.5 miles to Orange Lake.
Map	**Figure 1.1** shows the general location of Lochloosa Lake and its watershed, and **Figure 4.2** shows land uses in the watershed. Land use is predominately upland forest (49.8 %) and wetlands (23.1 %). Agriculture and pasture represent 11 % of the watershed area, with 5 % of the land area considered urban and built-up. Surface waters cover 10% of the watershed.
Classification(s)	Lochloosa Lake: Class III Freshwater, colored, high-alkalinity lake Cross Creek: Class III freshwater stream
Basin name (Hydrologic Unit Code [HUC] 8)	Ocklawaha River Basin (03080102)

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

Numeric Interpretation of Narrative Nutrient Criterion	Parameter Information Related to Numeric Interpretation of the Narrative Nutrient Criterion
NNC summary: Default nutrient watershed region or lake classification (if applicable) and corresponding NNC	Because the long-term geometric mean color of Lochloosa Lake exceeds 40 PCU, the lake is classified as a colored lake, and the generally applicable NNC, which are expressed as AGM concentrations not to be exceeded more than once in any consecutive 3-year period, are chlorophyll *a* of 20 µg/L, TN of 1.27 to 2.23 mg/L, and TP of 0.05 to 0.16 mg/L. Cross Creek is located in the peninsular part of the state. The stream NNC require no observable imbalance with chlorophyll *a*, algal mats or blooms, nuisance macrophyte growth, and algal species composition, and either benthic invertebrate communities are healthy or AGM TN and TP concentrations measured in the stream do not exceed nutrient thresholds in more than 1 of any 3 continuous calendar years. Nutrient thresholds for this part of the state are 0.12 mg/L of TP and 1.54 mg/L of TN.
Proposed TN, TP, chlorophyll *a*, and/or nitrate+nitrite (magnitude, duration, and frequency)	Numeric interpretations of the narrative nutrient criterion for Lochloosa Lake: This TMDL is modifying the default NNC for TN, TP and chlorophyll *a*. The revised TN and TP NNC are expressed as long-term loads, and the revised chlorophyll *a* is expressed as a long-term concentration. Specifically, the TN loads of 78,163 kg/yr and TP loads of 4,505 kg/yr are expressed as the long-term (7-year) average of annual loads not to be exceeded. (For assessment purposes, the long-term average annual loads will be calculated using the annual loads of the most recent 7 years in the verified period.) These loadings were derived from watershed and receiving water modeling that resulted in the revised H1 chlorophyll *a* concentration of 38 µg/L, expressed as a long-term (7 year) average of the AGMs not to be exceeded. (Assessment methods are described in Rule 62-303.350, FAC.) Numeric interpretations of the narrative nutrient criterion for Cross Creek: This TMDL is modifying the default NNC for TN, TP and chlorophyll *a*. The revised chlorophyll *a* will also replace all other default stream floral metrics for Cross Creek (see **Section 3.2)**. The revised TN and TP NNC are expressed as long-term loads, and the revised chlorophyll *a* is expressed as a long-term concentration. Specifically, the TN loads of 32,514 kg/yr and TP loads of 1,601 kg/yr, are expressed as long-term (7 year) averages of annual loads, not to be exceeded. (The natural background conditions in Lochloosa Lake reflect the best water quality expected for Cross Creek, given that discharge from Lochloosa Lake will contribute on average 95 % of the TP load and 97 % of the TN load in Cross Creek. Loads from the watershed immediately adjacent to Cross Creek and outflow loads from TMDL model simulations for Lochloosa derived from HPSF over the 2004–10 period (7 years) were used to determine the Cross Creek nutrient TMDL.) Since Cross Creek is dominated by the discharge from Lochloosa Lake, the chlorophyll *a* concentration will be 38 µg/L, expressed as a long-term (7-year) average of the AGMs not to be exceeded. Nutrient concentrations are provided for comparative purposes only (1.15 mg/L TN and 0.055 mg/L TP). This approach establishes specific targets that are more representative of natural conditions in Lochloosa Lake and Cross Creek than the generally applicable TN, TP, chlorophyll *a* and stream floral metrics NNC. The TMDL loads and the chlorophyll *a* concentrations will be considered the site-specific interpretation of the narrative criterion. Section 5.6 of this report provides detail concerning the derivation of the proposed criteria.
Period of record used to develop the numeric	The proposed TN and TP TMDLs were based on the hydrology records from 2004 through 2010 and the SJRWMD's 2009 land use GIS information.

Numeric Interpretation of Narrative Nutrient Criterion	Parameter Information Related to Numeric Interpretation of the Narrative Nutrient Criterion
interpretations of the narrative nutrient criterion for TN and TP criteria	
Indicate how criteria developed are spatially and temporally representative of the waterbody or critical condition.	Simulations with the BATHTUB model spanned the 2004–10 period, which included both wet and dry years. The long-term annual rainfall for Gainesville is 49.7 inches. The annual average rainfall for 2004 to 2010 on Lochloosa Lake was 51.2 inches. The years 2006, 2007, and 2010 were dry years, 2008 to 2009 were average years, and 2004 and 2005 were wet years. **Figure 2.1** in this report shows the locations of the sampling stations in Lochloosa Lake and Cross Creek. These stations are distributed across the lake. The SJRWMD collected the majority of the chlorophyll *a* measurements at 2 locations. TN and TP measurements were primarily from the 2 SJRWMD sites and the 4 Florida LakeWatch sites. Water quality data for variables relevant to TMDL development are presented in graphs in **Chapter 5** of the Lochloosa Lake and Cross Creek TMDL report.

Table J-3. Designated use, verified impairment, and approach to establish protective restoration targets

Designated Use Requirements	Information Related to Designated Use Requirements
History of assessment of designated use support.	Lochloosa Lake (WBID 2738A) was initially verified as impaired during the Cycle 1 assessment (verified period January 1, 1995–June 30, 2002) due to excessive nutrients because the TSI threshold of 60 was exceeded using the methodology in the IWR (Chapter 62-303, F.A.C.). As a result, the lake was included on the Cycle 1 Verified List of impaired waters for the Ocklawaha Basin that was adopted by Secretarial Order on August 22, 2002 (amended March 11, 2003). During the Cycle 2 assessment (verified period January 1, 2000–June 30, 2007), the impairment for nutrients was documented as continuing, as the TSI threshold of 60 was exceeded. The Cycle 3 assessment (verified period January 1, 2005–June 30, 2012) reaffirmed the impairment based on an exceedance of the TSI threshold of 60. Cross Creek (WBID 2754) was verified as impaired during the Cycle 1 assessment for nutrients based on exceedance of the stream chlorophyll threshold of 20 µg/L. The impairment for nutrients was reaffirmed in the Cycle 2 assessment. There were insufficient chlorophyll *a* data to assess in Cycle 3. Cross Creek was also verified as impaired for DO in the Cycle 1 assessment. The DO impairment was reaffirmed in the Cycle 2 and Cycle 3 assessments. Based on an analysis of the data from 2000 to 2013 in IWR Database Run 49, the results indicate that Lochloosa Lake would not attain the generally applicable lake NNC for chlorophyll *a*, TN, and TP, and thus remains impaired for nutrients. There are insufficient chlorophyll *a*, TN, or TP data for Cross Creek since 2010 to assess Cross Creek under the stream nutrient standard. **Section 2.2** of this report contains a more detailed discussion of the impairment assessment history of Lochloosa Lake and Cross Creek.
Basis for use support	DEP evaluated a site-specific interpretation of the narrative nutrient criterion for Lochloosa Lake and Cross Creek, taking into account the natural conditions of these waterbodies. Based on model simulation using the site specific data, DEP determined site specific AGM nutrient and chlorophyll target concentrations representative of natural background conditions. The TMDL targets, which are inherently protective of the designated uses of the lake and creek, are provided for comparative purposes only (1.15 mg/L TN, 0.055 mg/L TP and 38 µg/L of chlorophyll *a*). Lochloosa Lake nutrient targets represent the natural background condition. When these concentration targets are achieved, the nutrient loads going through Cross Creek will be the background condition loads. Therefore, both flora and fauna in Cross Creek will inherently be protected.
Summarize approach used to develop criteria and how it protects uses	The numeric interpretations of the narrative nutrient criterion for TN and TP were based on model simulations of lake conditions using natural background watershed conditions. Background TN and TP in-lake concentrations were derived from the natural background watershed simulations. TN and TP loads and the associated in-lake TN and TP target concentrations attained by the TMDLs will become the numeric interpretation. Attaining the background TN and TP AGM targets for Lochloosa Lake resulted in a long-term mean chlorophyll *a* (based on AGMs) concentration in the lake of 38 µg/L. Because the flow in Cross Creek is dominated by the outflow from Lochloosa Lake, the same natural background target concentrations determined for the lake were used for the creek. Loads necessary to achieve the target concentrations were then determined from the model simulations.

Designated Use Requirements	Information Related to Designated Use Requirements
	Because these nutrient targets represent the natural background condition for Lochloosa Lake and Cross Creek, they are inherently protective of the designated uses of the waterbodies.
Discuss how the TMDL will ensure that nutrient-related parameters are attained to demonstrate that the TMDL will not negatively impact other water quality criteria.	Since the nutrient concentration targets are representative of natural background conditions, other water quality criteria will not be adversely impacted and designated uses will be maintained. DEP notes that there were no impairments for DO or un-ionized ammonia in the lake. The proposed reductions in nutrient inputs will result in further improvements in water quality. Based on attaining the natural background based in-lake TN and TP targets each year, the predicted long-term average annual chlorophyll *a* AGM was 38 µg/L. Model simulations reflect water quality results from both high- and low-rainfall years during a period when lake chlorophyll *a* concentrations tended to be inversely related to rainfall. Lochloosa Lake nutrient targets represent the natural background condition. When these concentration targets are achieved, the nutrient loads going through Cross Creek will be the background condition levels. The implementation of the nutrient TMDL reductions for Lochloosa Lake to achieve those criteria are expected to address the nutrient and DO impairments in Cross Creek, since this will represent natural background conditions and achieve the TMDL for the creek.

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

Downstream Waters Protection and Monitoring Requirements	Information Related to Downstream Waters Protection and Monitoring Requirements
Identification of downstream waters: List receiving waters and identify technical justification for concluding downstream waters are protected.	The primary outlet from Lochloosa Lake is Cross Creek, which connects Lochloosa Lake to Orange Lake. Cross Creek is on the Verified List for nutrient (chlorophyll *a*) and DO impairments. The immediate watershed of Cross Creek is small, and water quality in Cross Creek is dominated by discharge from Lochloosa Lake. Achieving the TMDL nutrient reductions in Lochloosa Lake will result in a 31 % reduction in the current load of TP and a 43 % reduction in the current load of TN transported through Cross Creek to Orange Lake. For comparative purposes, the Lochloosa Lake nutrient concentration targets of 1.15 mg/L for TN and 0.055 mg/L for TP are less than the Peninsular Nutrient Watershed Region stream nutrient thresholds of 1.54 mg/L for TN and 0.12 mg/L for TP. Both the Peninsular Nutrient Watershed Region stream thresholds and the Lochloosa Lake nutrient targets are expressed as AGMs, not to be exceeded more than once in a 3-year period. Since the TMDL nutrient targets are lower than the stream nutrient thresholds for the area and are expressed with a similar frequency, the TMDL targets are protective of the applicable stream thresholds. In addition, the concentration targets established for Lochloosa Lake represent the natural background condition. When these concentration targets are achieved, the nutrient loads going through Cross Creek will be the background condition loads. Therefore, both flora and fauna in Cross Creek are expected to be protected. Orange Lake was verified impaired for nutrients (TSI > 60) in the Cycle 1 assessment, and a TMDL was adopted in 2003. The Orange Lake TMDL determined that a 45 % reduction in TP loading to Orange Lake was necessary to meet a target TSI of 60. According to the TMDL, the mean of annual average TP concentration from 1995 to 1998 was 0.062 mg/L. Annual TP loads from Cross Creek in 1995, 1996, and 1997 averaged 2,570 lbs/yr, which represented 7 % of the total load to Orange Lake. In 1998, the TP load from Cross Creek was 13,472 lbs, which represented 25 % of the total TP to Orange Lake. The reductions in nutrient loads prescribed in the Lochloosa Lake and Cross Creek TMDLs are not expected to cause nutrient impairments downstream and will actually result in water quality improvements to downstream waters. While the Orange Lake TMDL requires a 46 % reduction in TP, and the proposed Lochloosa Lake and Cross Creek TMDLs required the TP load through Cross Creek be reduced by 31 %, the required TP reductions for the Lochloosa Lake and Cross Creek watersheds are related to the natural background condition. Further reduction of TP loads from the Lochloosa Lake and Cross Creek watersheds will abate the natural background condition. In addition to identifying Cross Creek as a source of TP loading to Orange Lake, the Orange Lake TMDL identified Camps Canal and the Camps Canal/River Styx and Orange Lake sub-basins. Annual TP loads from Camps Canal in 1995, 1996, and 1997 averaged 8,622 lbs/yr, which represented 24.6 % of the total load to Orange Lake. In 1998, the TP load from Camps Canal was 22,786 lbs/yr, or 42 % of the total TP to Orange Lake. Nutrient reductions based on the adopted Newnans Lake nutrient TMDL will reduce

Downstream Waters Protection and Monitoring Requirements	Information Related to Downstream Waters Protection and Monitoring Requirements
	loads entering Orange Lake via Camps Canal. Contributions of TP from the Camps Canal/River Styx and Orange Lake sub-basins represented between 20 % and 52 % of the TP load to Orange Lake over the 1995–98 period. In addition to the 31 % reduction in the TP load from Cross Creek to Orange Lake, reductions from the other sources (Camps Canal, Camps Canal/River Styx sub-basin, and Orange Lake sub-basin) will be necessary to meet the Orange Lake TMDL.
Provide summary of existing monitoring and assessment related to implementation of Subsection 62-302.531(4), F.A.C., and trends tests in Chapter 62-303, F.A.C.	The SJRWMD conducts routine bimonthly monitoring of Lochloosa Lake at one station. It also conducts routine bimonthly monitoring at one station in Orange Lake. This frequency of sampling of these waterbodies meets minimum sampling requirements for future assessments, including trend tests.

Table J-5. Documentation to demonstrate administrative requirements are met

Administrative Requirements	Information for Administrative Requirements
Notice and comment notifications	DEP conducted a public workshop on March 31, 2015, in Gainesville to obtain comments on the draft nutrient TMDLs for Lochloosa Lake and Cross Creek. The workshop notice indicated that these nutrient TMDLs, if adopted, constitute site-specific numeric interpretations of the narrative nutrient criterion set forth in Paragraph 62-302.530(47)(b), F.A.C., that would replace the otherwise applicable NNC in Subsection 62-302.531(2), F.A.C., for these particular waters. A 30-day public comment period was provided (ended April 16) to allow the general public the opportunity to submit written comments to DEP. Formal comments were received from FDOT related to the establishment of the TMDLs as the site-specific interpretation of the narrative nutrient criterion or on the TMDLs themselves. The document was updated to address comments. DEP conducted a second public workshop on August 4, 2016, in Gainesville to obtain comments on the revised draft nutrient TMDLs for Lochloosa Lake and Crook. The workshop notice indicated that these nutrient TMDLs, if adopted, constitute site-specific numeric interpretations of the narrative nutrient criterion set forth in Paragraph 62-302.530(47)(b), F.A.C., that would replace the otherwise applicable NNC in Subsection 62-302.531(2), F.A.C., for these particular waters. The public comment period on the revised draft document ended on August 12, 2016. Formal comments were received from FDOT. A number of the comments were the same as those submitted in 2015 and had been previously addressed.
Hearing requirements and adoption format used; responsiveness summary	Since the public comments received by DEP had been addressed in the revised draft document presented at the second workshop or did not result in a significant revision of the TMDL, DEP will publish a Notice of Proposed Rule (NPR) to initiate the TMDL rule adoption process. Following the publication of the NPR, DEP will provide a 21-day challenge period.
Official submittal to the EPA for review and General Counsel (GC) certification	If DEP does not receive a challenge, the certification package for the rule will be prepared by DEP 's program attorney. At the same time, DEP will prepare the TMDL and Site-Specific Interpretation package for the TMDL and submit these documents to the EPA.

Appendix K. Important Links

Email addresses:

Wayne Magley: wayne.magley@dep.state.fl.us
Mary Paulic: mary.paulic@dep.state.fl.us

Websites

Florida Department of Environmental Protection:

TMDL Program: http://www.dep.state.fl.us/water/tmdl/index.htm
Identification of Impaired Surface Waters Rule:
http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf
Florida STORET Program: http://www.dep.state.fl.us/water/storet/index.htm
2016 Integrated Report: http://www.dep.state.fl.us/water/docs/2016-Integrated-Report.pdf
Criteria for Surface Water Quality Classifications:
http://www.dep.state.fl.us/legal/Rules/shared/62-302/62-302.pdf
Basin Management Action Plans:
http://www.dep.state.fl.us/water/watersheds/bmap.htm

University of Florida Institute of Food and Agricultural Sciences:

Lusk et al. (2011): http://edis.ifas.ufl.edu/ss551
Toor et al. (2011): https://edis.ifas.ufl.edu/ss550

U.S. Census Bureau:

QuickFacts: Polk County, Florida:
http://www.census.gov/quickfacts/table/BZA010214/12105

U.S. Environmental Protection Agency:

Region 4: TMDLs in Florida:
https://archive.epa.gov/pesticides/region4/water/tmdl/web/html/index-2.html
National STORET Program:
https://www.epa.gov/waterdata/storage-and-retrieval-and-water-quality-exchange