

US EPA ARCHIVE DOCUMENT

**Proposed
Total Maximum Daily Loads
for the
Econlockhatchee
and
Little Econlockhatchee
WBID 2991A and 3001
Nutrients and Dissolved Oxygen**

September 30, 2009



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SUMMARY SHEET

Total Maximum Daily Load (TMDL)

1. 303(d) Listed Segment: 2991A and 3001: Econlockhatchee and Little Econlockhatchee Middle St. Johns River
2. TMDL Endpoints/Targets: Nutrients and Dissolved Oxygen
3. TMDL Technical Approach Calibration of a watershed and water quality model to current conditions, load reduction scenarios to meet water quality standards.
4. TMDL Waste Load and Load Allocation:

TMDL			WLA			LA & Wet Weather Discharge (MS4)		
Total Nitrogen (kg/yr)	Total Phosphorus (kg/yr)	BOD (kg/yr)	Total Nitrogen (kg/yr)	Total Phosphorus (kg/yr)	BOD (kg/yr)	Total Nitrogen (% Reduction)	Total Phosphorus (% Reduction)	BOD (% Reduction)
416,324	80,062	1,968,022	78,870	26,290	131,450	25%	25%	25%

5. Endangered Species Present: No
6. USEPA Lead TMDL or Other: USEPA
7. TMDL Considers Point Sources/Non Point Sources: MS4 and Non Point Source
8. Major NPDES Discharges to surface waters addressed in USEPA TMDL: Yes

1. Introduction

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not meeting water quality standards. 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 (USEPA, 1991).

The State of Florida Department of Environmental Protection (FDEP) developed a statewide, watershed-based approach to water resource management. Under the watershed management approach, water resources are managed on the basis of natural boundaries, such as river basins, rather than political boundaries. The watershed management approach is the framework FDEP uses for implementing TMDLs. The state's 52 basins are divided into five groups. Water quality is assessed in each group on a rotating five-year cycle. Middle Johns is a Group 2 basin; it was designated for TMDL development by a consent decree. FDEP established five water management districts (WMD) responsible for managing ground and surface water supplies in the counties encompassing the districts. Econlockhatchee and Little Econlockhatchee 2991A and 3001 reside in the St. Johns River Water Management District (SJRWMD).

For the purpose of planning and management, the WMDs divided the district into planning units defined as either an individual primary tributary basin or a group of adjacent primary tributary basins with similar characteristics. These planning units contain smaller, hydrological based units called drainage basins, which are further divided by FDEP into "water segments". A water segment usually contains only one unique waterbody type (stream, lake, canal, etc.) and is about 5 square miles. Unique numbers or waterbody identification (WBIDs) numbers are assigned to each water segment.

2. Problem Definition

The TMDLs addressed in this document are being established pursuant to commitments made by the United States Environmental Protection Agency (EPA) in the 1998 Consent Decree in the Florida TMDL lawsuit (Florida Wildlife Federation, et al. v. Carol Browner, et al., Civil Action No. 4: 98CV356-WS, 1998). That Consent Decree established a schedule for TMDL development for waters listed on Florida's EPA approved 1998 section 303(d) list. The 1998 section 303(d) list identified numerous Water Body Identifications (WBIDs) in the Upper St. Johns River Basin as not supporting water quality standards (WQS). After assessing all readily available water quality data, EPA is responsible for developing a TMDL in WBIDs 2991 & 3001

Econlockhatchee River and Little Econlockhatchee River (Figure 1). The parameters addressed in these TMDLs are Nutrients and Dissolved Oxygen.

Most waterbodies in the Middle St. Johns River Basin are designated as Class III waters having a designated use for recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The level of impairment is denoted as threatened, partially or not supporting designated uses. A waterbody that is classified as threatened currently meets WQS but trends indicate the designated use may not be met in the next listing cycle. A waterbody classified as partially supporting designated uses is defined as somewhat impacted by pollution and water quality criteria are exceeded on some frequency. For this category, water quality is considered moderately impacted. A waterbody that is categorized as not supporting is highly impacted by pollution and water quality criteria are exceeded on a regular or frequent basis. In such waterbodies, water quality is considered severely impacted.

To determine the status of surface water quality in the state, three categories of data – chemistry data, biological data, and fish consumption advisories – were evaluated to determine potential impairments. The level of impairment is defined in the Identification of Impaired Surface Waters Rule (IWR), Section 62-303 of the Florida Administrative Code (F.A.C.). The IWR is FDEP’s methodology for determining whether waters should be included on the state’s planning list and verified list. Potential impairments are determined by assessing whether a waterbody meets the criteria for inclusion on the planning list. Once a waterbody is on the planning list, additional data and information will be collected and examined to determine if the water should be included on the verified list.

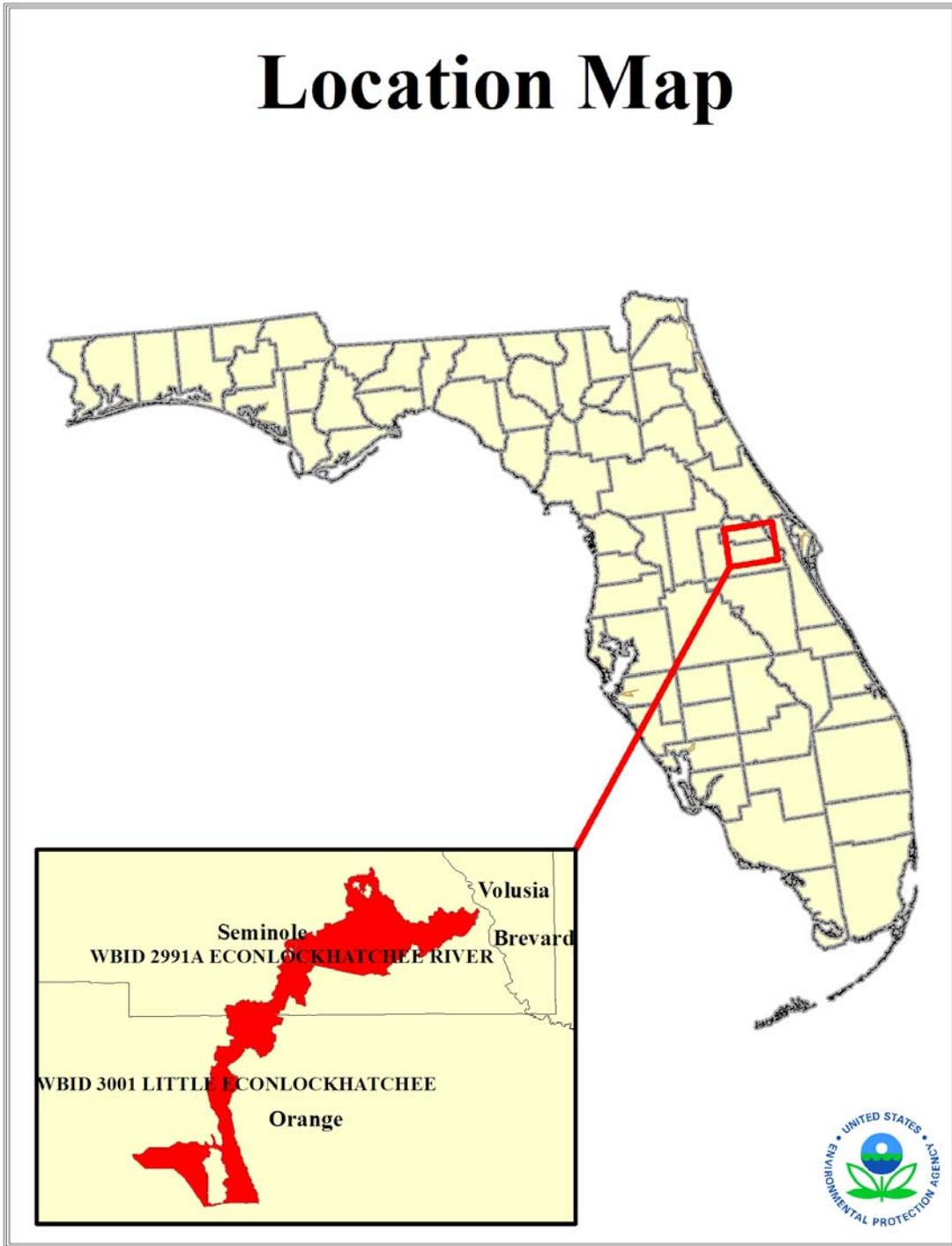


Figure 1 Location Map Econlockhatchee and Little Econlockhatchee

3. Watershed Description

The Econlockhatchee and Little Econlockhatchee Rivers are located in the north-central part of Orange County and in southern Seminole County. The Little Econlockhatchee River is a major tributary of the Econlockhatchee River. It originates in the relatively high lands of central Orange County, on the eastern edge of the Orlando metropolitan area. It flows primarily in a north direction in Orange County and in a northeasterly direction in Seminole County into the Econlockhatchee River. Unlike the largely unaltered Econlockhatchee River proper, the Little Econlockhatchee River is hydrologically altered extensively, with substantial portions of the river channel canalized and interrupted by control structures. A number of canals draining various parts of the Orlando area flow into the Little Econlockhatchee River. The watershed of the Little Econlockhatchee River is highly urbanized by residential land use.

4. Water Quality Standards/TMDL Targets

The waterbodies in both Econlockhatchee and Little Econlockhatchee WBIDs are Class III Freshwater with a designated use of Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife. Designated use classifications are described in Florida's water quality standards. See Section 62-302.400, F.A.C. Water quality criteria for protection of all classes of waters are established in Section 62-302.530, F.A.C. Individual criteria should be considered in conjunction with other provisions in water quality standards, including Section 62-302.500 F.A.C., which established minimum criteria that apply to all waters unless alternative criteria are specified Section 62-302.530, F.A.C. Several of the WBIDs addressed in this report were listed due to elevated concentrations of chlorophyll *a*. While there is no water quality standard specifically for chlorophyll *a*, elevated levels of chlorophyll *a* are frequently associated with a violation of the narrative nutrient standard, which is described below.

4.1. *Nutrients:*

The designated use of Class III waters is recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife. FDEP has not adopted a numeric nutrient criterion for Class III waters. Therefore, the Class III narrative criterion applies to Econlockhatchee and Little Econlockhatchee Rivers:

The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this chapter. Man induced nutrient enrichment (total nitrogen and total phosphorus) shall be considered degradation in relation to the provisions of Section 62-302.300, 62-302.700, and 62-4.242, FAC. 62-302.530(48)(b), F.A.C.

In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna. 62-302.530(48)(b), F.A.C.

Because the State of Florida does not have numeric criteria for nutrients, chlorophyll and DO levels are used to indicate whether nutrients are present in excessive amounts.

4.2. Dissolved Oxygen Criteria:

Numeric criteria for DO are expressed in terms of minimum and daily average concentrations. Rule 62-302(30), F.A.C., sets out the water quality criterion for the protection of Class III freshwater waters as:

Shall not be less than 5.0 mg/l. Normal daily and seasonal fluctuations above these levels shall be maintained.

4.3. Natural Conditions

In addition to the standards for nutrients, DO and BOD described above, Florida's standards include provisions that address waterbodies which do not meet the standards due to natural background conditions.

Florida's water quality standards provide a definition of natural background:

“Natural Background” shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody or on historical pre-alteration data. 62-302.200(15), FAC.

Florida's water quality standards also provide that:

Pollution which causes or contributes to new violations of water quality standards or to continuation of existing violations is harmful to the waters of this State and shall not be allowed. Waters having water quality below the criteria established for them shall be protected and enhanced. However, the Department shall not strive to abate natural conditions. 62-302.300(15) FAC

5. Water Quality Assessment

2991A and 3001 Econlockhatchee and Little Econlockhatchee were listed as not attaining its designated uses on Florida's 1998 303(d) list for nutrients and dissolved oxygen.

To determine impairment an assessment of available data was conducted. The source for current ambient monitoring data for WBID 2991A and 3001 Econlockhatchee and Little Econlockhatchee was the Impaired Waters Rule (IWR) data Run 35.

5.1. Water Quality Data

The tables and figures below present the station locations and time series data for dissolved oxygen, total nitrogen, total phosphorus, and chlorophyll a observations for Econlockhatchee and Little Econlockhatchee.

5.1.1. 2991A Econlockhatchee River

Table 1 provides a list of the water quality monitoring stations in the Econlockhatchee River WBID including the date range of the observations and the number of observations.

Table 1 Water Quality Monitoring Stations for WBID 2991A: Econlockhatchee

Station	Station Name	First Date	Last Date	No. Obs.
112WRD 02233500	ECONLOCKHATCHEE RIVER NR. CHULUOTA, FLA.	4/12/2000 13:00	4/12/2001 14:00	10
21FLA 20010300	BIG ECON SNOW HILL RD	2/26/1996 7:30	2/26/1996 7:30	4
21FLCEN 20010130	Econ River @ CR 419 bridge	1/25/1999 0:00	10/23/2007 10:54	28
21FLCEN 20010300	Big Econ at Snow Hill Road	1/25/1999 0:00	7/12/1999 0:00	6
21FLCEN 20010489	ECON R. UPSTREAM OF CONFLUENCE WITH ST JOHNS R.	5/7/2002 13:30	5/7/2002 13:30	2
21FLCEN 20010533	SJR upstream of Econ River	5/20/2002 10:24	5/20/2002 10:26	2
21FLCEN 20011004	Econ River @ 1000M downstream of CR 419 Bridge	3/20/2007 9:34	8/8/2007 9:28	29
21FLCEN 20011005	Econ River @ 750M downstream of CR 419 bridge	3/20/2007 9:43	8/8/2007 9:52	18
21FLCEN 20011006	Econ River @ 5000M downstream of CR 419 bridge	3/20/2007 9:54	10/23/2007 10:42	24
21FLCEN 20011007	Econ River @ 250M downstream of CR 419 bridge	3/20/2007 10:02	10/23/2007 10:47	22
21FLGFWFGCCR0173	ECONLOCKHATCHEE RIVER AT TREE LINE	2/18/1996 9:00	5/20/1996 9:06	6
21FLGW 19146	SJC-LR-1023 ECONLOCKHATCHEE RIVER	6/30/2003 12:25	6/30/2003 12:27	6
21FLGW 19150	SJC-LR-1028 UNNAMED LARGE RIVER	7/17/2003 12:45	7/17/2003 12:45	5
21FLGW 20122	SJC-SS-1036 UNNAMED SMALL STREAM	10/30/2003 11:45	10/30/2003 11:45	5
21FLGW 26963	SJ6-LR-2005 ECONLOCKHATCHEE RIVER	6/16/2005 11:20	6/16/2005 11:22	6
21FLGW 26977	SJ6-LR-2025 ECONLOCKHATCHEE RIVER	6/16/2005 10:25	6/16/2005 10:27	6
21FLGW 26987	SJ6-LR-2039 ECONLOCKHATCHEE RIVER	7/27/2005 11:05	7/27/2005 11:07	5
21FLGW 29239	SJ6-LR-2039B ECONLOCKHATCHEE RIVER	6/27/2005 12:10	6/27/2005 12:12	6
21FLORANBED	Big Econ D (Seminole Co., Hwy 419)	1/17/1996 10:06	4/15/2008 9:35	164
21FLORANBEE	Big Econ E (Seminole Co.(Snowhill))	1/17/1996 9:34	4/15/2008 10:30	175
21FLORANSJ26	St. Johns at Mouth of Big Econ (Seminole Co.)	1/17/1996 8:52	2/22/2001 11:50	107
21FLSEM BECO	Big Econlockhatchee River at CR 419	12/28/2000 0:00	5/28/2008 0:00	169
21FLSEM SNO	Econlockhatchee River at Snow Hill Rd	3/27/2001 0:00	6/10/2008 0:00	173
21FLSJWMECH	Econ River at Snowhill Road (SR 426)	1/2/1996 8:55	6/11/2008 11:40	523
21FLSJWMER-ULER	Econ River - Upstream of Little Econ	10/15/2002 14:15	6/11/2008 12:15	206

Figure 2 provides a location of the monitoring stations used in this assessment.

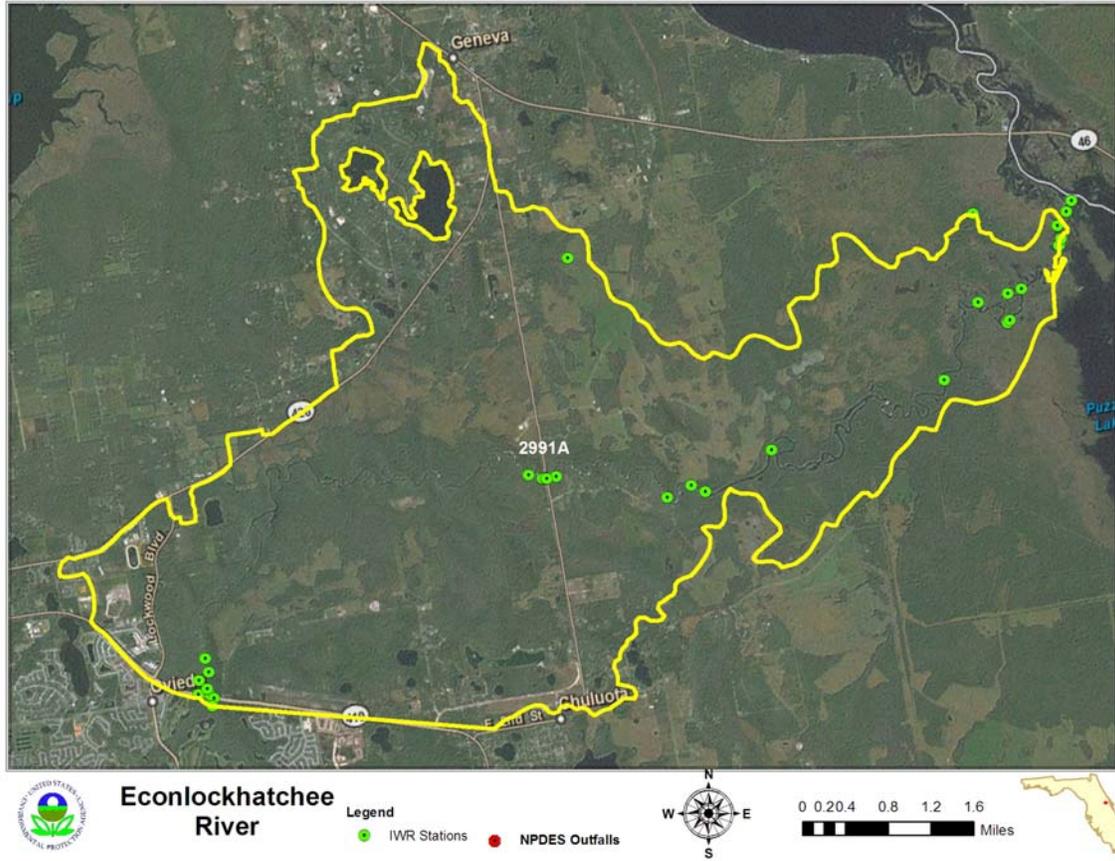


Figure 2 Station Locations for WBID: 2991A Econlockhatchee

Dissolved Oxygen

Figure 3 provides a time series plot for the measured dissolved oxygen concentrations in Econlockhatchee. There were 25 monitoring stations used in the assessment that included a total of 391 observations of which 67 (17%) fell below the water quality standard of 5 mg/l dissolved oxygen. The minimum value was 1.5 mg/l, the maximum was 11.7 mg/l and the average was 6.6 mg/l.

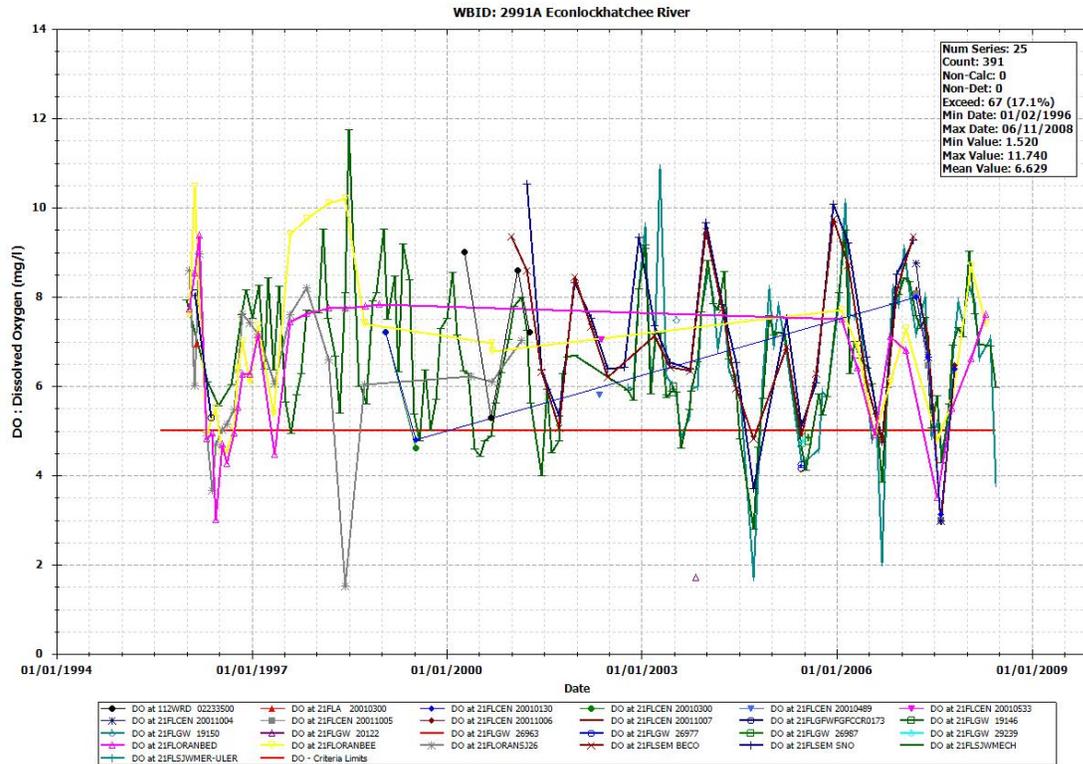


Figure 3 WBID: 2991A Econlockhatchee Measured Dissolved Oxygen

Biochemical Oxygen Demand

Figure 4 provides a time series plot for the measured BOD concentrations in Econlockhatchee. There were 9 monitoring stations used in the assessment that included a total of 102 observations. The minimum value was 0.0 mg/l, the maximum was 4.8 mg/l and the average was 1.7 mg/l.

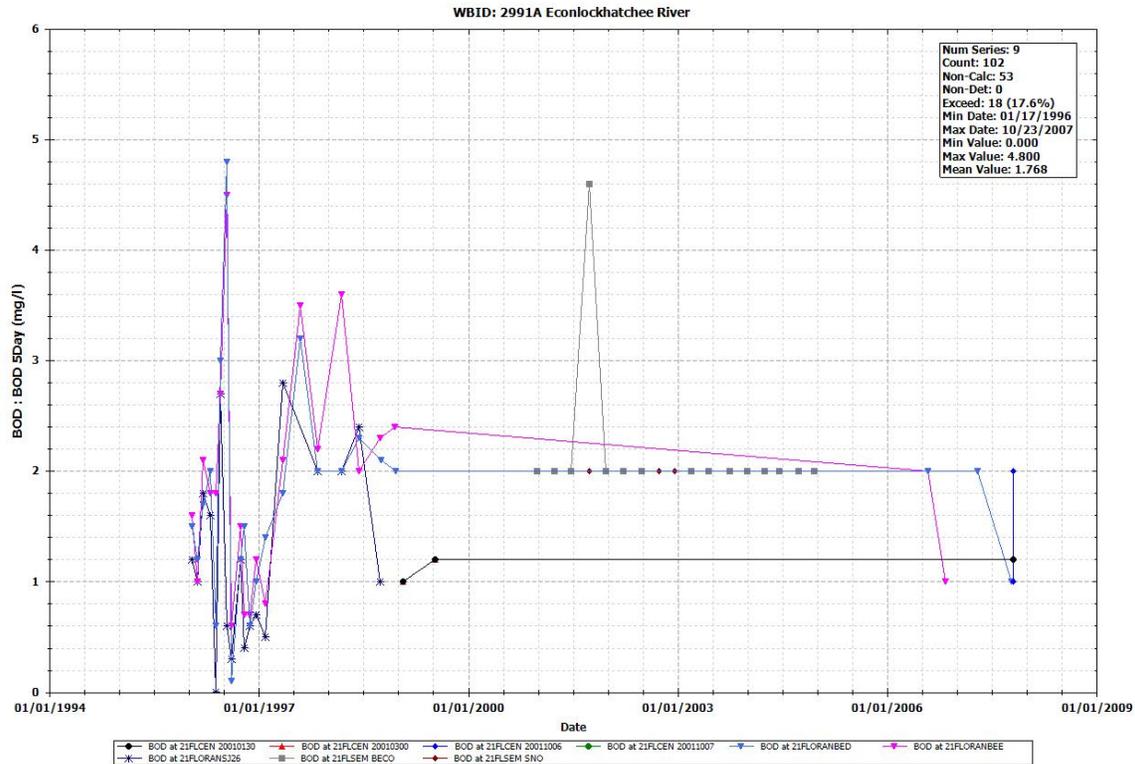


Figure 4 WBID: 2991A Econlockhatchee Measured BOD

Nutrients

For the nutrient assessment the monitoring data for total nitrogen, total phosphorus and chlorophyll a are presented. While Florida is currently working on the development and promulgation of numeric nutrient criteria, the current standards for nutrients are narrative criteria. The purpose of the nutrient assessment is to present the range, variability and average conditions for the WBID.

Total Nitrogen

Figure 5 provides a time series plot for the measured total nitrogen concentrations in Econlockhatchee. There were 23 monitoring stations used in the assessment that included a total of 405 observations. The minimum value was 0.28 mg/l, the maximum was 1.9 mg/l and the average was 0.97 mg/l.

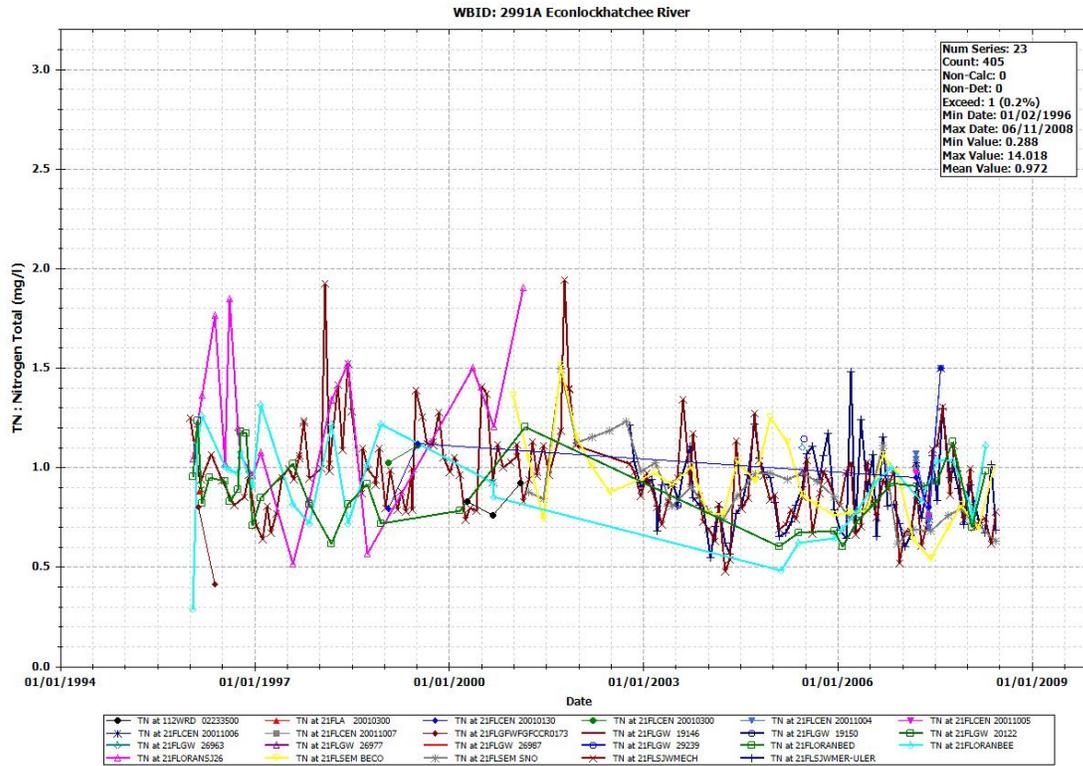


Figure 5 WBID: 2991A Econlockhatchee Measured Total Nitrogen

Total Phosphorus

Figure 6 provides a time series plot for the measured total phosphorus concentrations in Econlockhatchee. There were 22 monitoring stations used in the assessment that included a total of 405 observations. The minimum value was 0.008 mg/l, the maximum was 0.87 mg/l and the average was 0.096 mg/l.

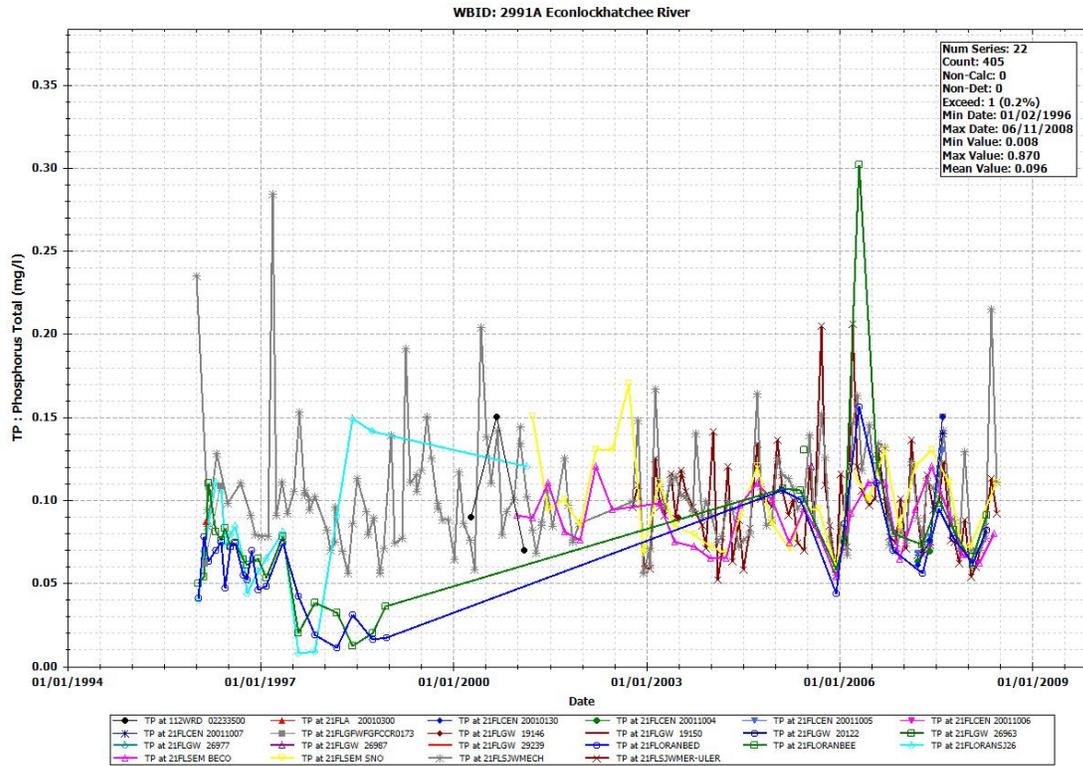


Figure 6 WBID: 2991A Econlockhatchee Measured Total Phosphorus

Chlorophyll a

Figure 7 provides a time series plot for corrected chlorophyll a concentrations in Econlockhatchee. There were 17 monitoring stations used in the assessment that included a total of 79 observations. The minimum value was 1.00 µg/l, the maximum was 26.0 µg/l and the average was 1.67 µg/l.

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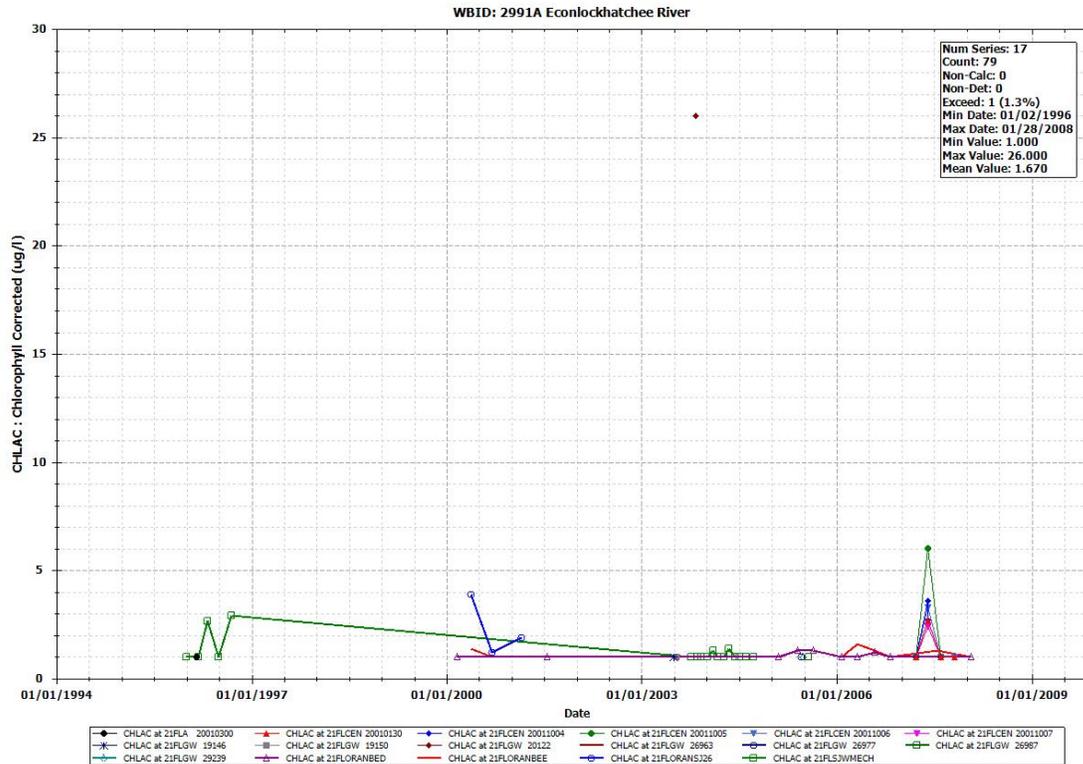


Figure 7 WBID: 2991A Econlockhatchee Measured Chlorophyll a Concentrations

5.1.2. 3001 Little Econlockhatchee

Table 2 Water Quality Monitoring Stations for WBID 3001: Little Econlockhatchee provides a list of the water quality monitoring stations in the Little Econlockhatchee WBID including the date range of the observations and the number of observations.

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Dissolved Oxygen

Figure 9 provides a time series plot for the measured dissolved oxygen concentrations in Little Econlockhatchee. There were 26 monitoring stations used in the assessment that included a total of 706 observations of which 187 (27%) fell below the water quality standard of 5 mg/l dissolved oxygen. The minimum value was 0.17 mg/l, the maximum was 13.9 mg/l and the average was 6.1 mg/l.

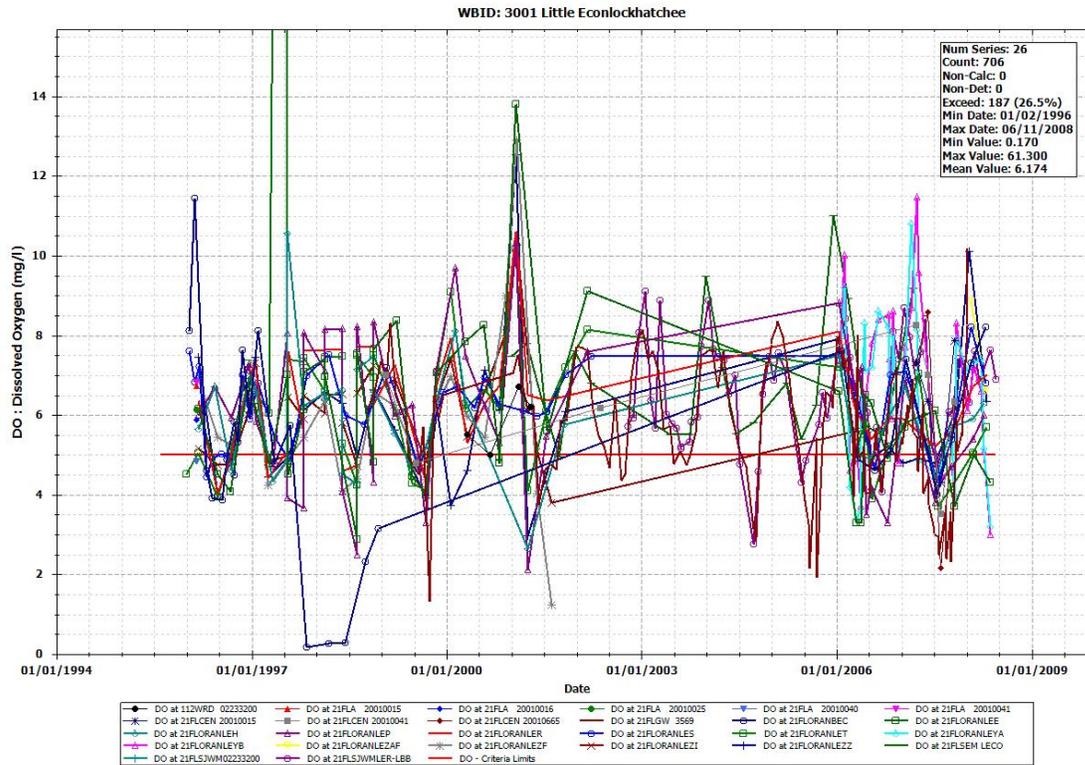


Figure 9 WBID: 3001 Little Econlockhatchee Measured Dissolved Oxygen

Biochemical Oxygen Demand

Figure 10 provides a time series plot for the measured BOD concentrations in Little Econlockhatchee. There were 16 monitoring stations used in the assessment that included a total of 300 observations. The minimum value was 0.1 mg/l, the maximum was 20.4 mg/l and the average was 1.95 mg/l.

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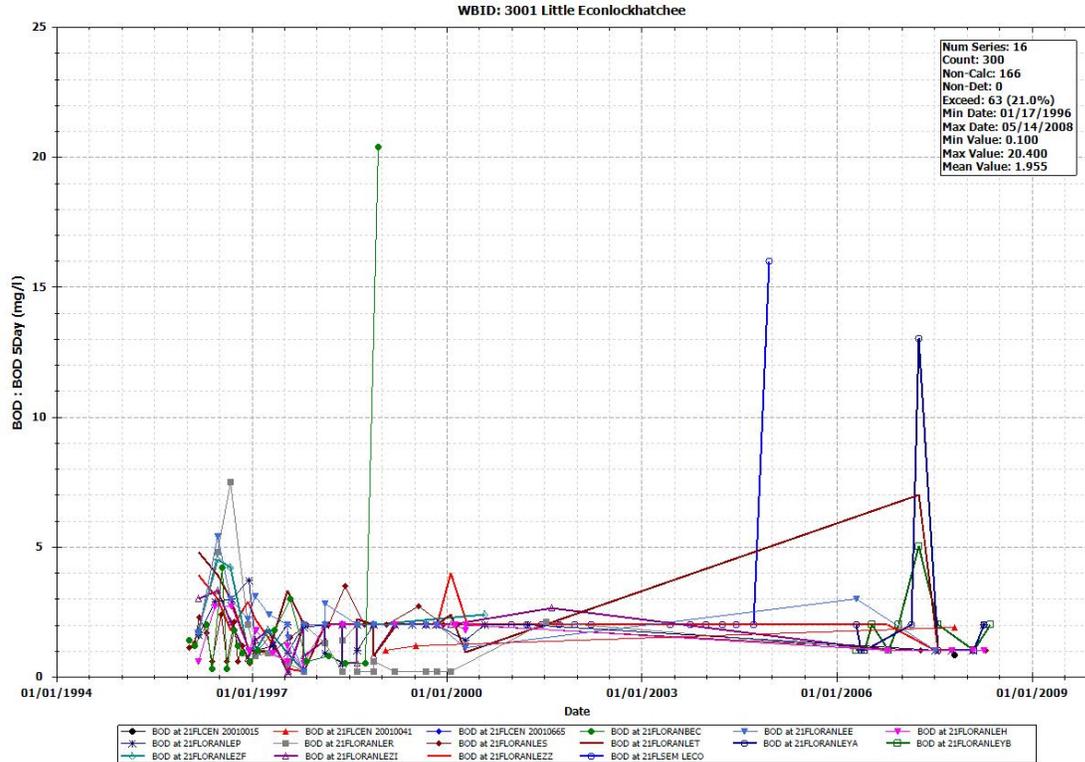


Figure 10 WBID: 3001 Little Econlockhatchee Measured BOD

Nutrients

For the nutrient assessment the monitoring data for total nitrogen, total phosphorus and chlorophyll a are presented. While Florida is currently working on the development and promulgation of numeric nutrient criteria, the current standards for nutrients are narrative criteria. The purpose of the nutrient assessment is to present the range, variability and average conditions for the WBID.

Total Nitrogen

Figure 11 provides a time series plot for the measured total nitrogen concentrations in Little Econlockhatchee. There were 26 monitoring stations used in the assessment that included a total of 675 observations. The minimum value was 0.0 mg/l, the maximum was 174.0 mg/l and the average was 1.22 mg/l.

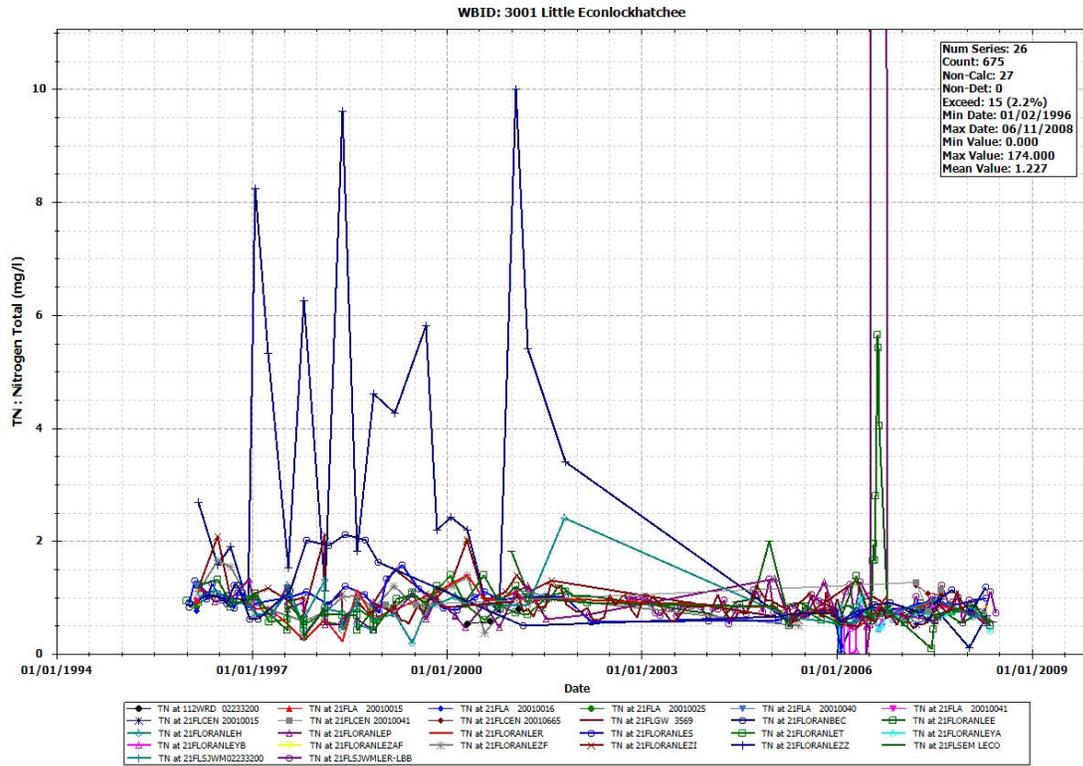


Figure 11 WBID: 3001 Little Econlockhatchee Measured Total Nitrogen

Total Phosphorus

Figure 12 provides a time series plot for the measured total phosphorus concentrations in Little Econlockhatchee. There were 26 monitoring stations used in the assessment that included a total of 673 observations. The minimum value was 0.002 mg/l, the maximum was 0.84 mg/l and the average was 0.108 mg/l.

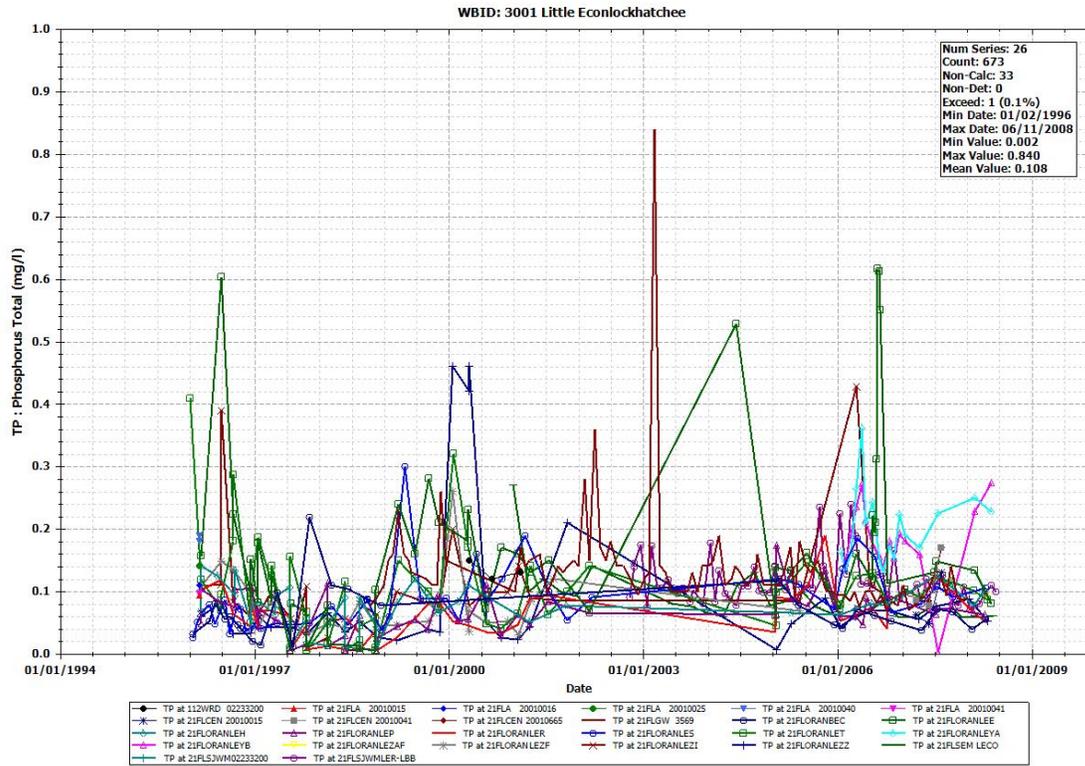


Figure 12 WBID: 3001 Little Econlockhatchee Measured Total Phosphorus

Chlorophyll a

Figure 13 provides a time series plot for corrected chlorophyll a concentrations in Little Econlockhatchee. There were 23 monitoring stations used in the assessment that included a total of 260 observations. The minimum value was 1.00 µg/l, the maximum was 31 µg/l and the average was 2.1 µg/l.

6.1. Point Sources

Point source facilities are permitted through the Clean Water Act National Pollutant Discharge Elimination System (NPDES) Program. There are one continuous discharge (Table 3) NPDES permitted point sources in the Econlockhatchee and Little Econlockhatchee River Watersheds.

Table 3 NPDES Continuous Dischargers in Econlockhatchee

NPDES	Facility Name
FL0037966	Iron Bridge Regional WRF

6.1.1. Municipal Separate Stormwater System Permits

Municipal Separate Stormwater Systems (MS4s) are point sources also regulated by the NPDES program. According to 40 CFR 122.26(b)(8), a municipal separate storm sewer (MS4) is “a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

- (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law)...including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges into waters of the United States.
- (ii) Designed or used for collecting or conveying storm water;
- (iii) Which is not a combined sewer; and
- (iv) Which is not part of a Publicly Owned Treatment Works.”

Municipal Separate Storm Sewer Systems (MS4s) may discharge nutrients and other pollutants to waterbodies in response to storm events. In 1990, USEPA developed rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) stormwater program, designed to prevent harmful pollutants from being washed by stormwater runoff into Municipal Separate Storm Sewer Systems (MS4s) (or from being dumped directly into the MS4) and then discharged from the MS4 into local waterbodies. Phase I of the program required operators of “medium” and “large” MS4s (those generally serving populations of 100,000 or greater) to implement a stormwater management program as a means to control polluted discharges from MS4s. Approved stormwater management programs for medium and large MS4s are required to address a variety of water quality related issues including roadway runoff management, municipal owned operations, hazardous waste treatment, etc.

Phase II of the rule extends coverage of the NPDES stormwater program to certain “small” MS4s. Small MS4s are defined as any MS4 that is not a medium or large MS4 covered by Phase I of the NPDES stormwater program. Only a select subset of small MS4s, referred to as “regulated small MS4s”, requires an NPDES stormwater permit. Regulated small MS4s are defined as all small MS4s located in "urbanized areas" as defined by the Bureau of the Census, and those small MS4s located outside of “urbanized areas” that are designated by NPDES permitting authorities.

There is six permitted MS4s in the Econlockhatchee and Little Econlockhatchee watershed (Table 4).

Table 4 MS4 Permits Potentially Impacted by TMDL

Permit Name	Permit Number	County
University of Central Florida	FLR04E076	Orange
City of Orlando	FLS000014	Orange
City of Oviedo	FLS000038	Seminole
City of Winter Park	FLS000011	Orange
Orange County	FLS000011	Orange
Seminole County	FLS000038	Seminole

6.2. Non Point Sources

Nonpoint source pollution generally involves a buildup of pollutants on the land surface that wash off during rain events and as such, represent contributions from diffuse sources, rather than from a defined outlet. Potential nonpoint sources are commonly identified, and their loads estimated, based on land cover data. Most methods calculate nonpoint source loadings as the product of the water quality concentration and runoff water volume associated with certain land use practices. The mean concentration of pollutants in the runoff from a storm event is known as the Event Mean Concentration, or EMC.

Table 5 provides the landuse distribution for the Econlockhatchee and Little Econlockhatchee watershed which contains WBIDs: 2991A and 3001. The latest landuse coverages were obtained from the Florida Department of the Environment (FDEP) FTP site. The landuses are described using the Florida Landuse Classification Code (FLUCC) Level 1. The predominant landuse draining directly to Econlockhatchee is wetlands (38%) and Little Econlockhatchee is Urban Build-up (69%).

Table 5 Landuse Distribution in Econlockhatchee and Little Econlockhatchee Watershed

WBID Number	Land Use Name	Area (ac)	Portion of Watershed (%)
2991A	AGRICULTURE	3685.7	21.9
2991A	BARREN LAND	11.6	0.07
2991A	RANGELAND	834.7	4.96
2991A	TRANSPORTATION, COMMUNICATION AND UTILITIES	113.2	0.67
2991A	UPLAND FORESTS	2966	17.62
2991A	URBAN AND BUILT-UP	2326.9	13.83
2991A	WATER	465.6	2.77
2991A	WETLANDS	6425.4	38.18
2991A	Totals	16829.1	100
3001	AGRICULTURE	1977.2	10.39
3001	BARREN LAND	43.8	0.23
3001	RANGELAND	911.1	4.79
3001	TRANSPORTATION, COMMUNICATION AND UTILITIES	1900.5	9.98
3001	UPLAND FORESTS	1898.9	9.98
3001	URBAN AND BUILT-UP	13218.8	69.44
3001	WATER	1277.9	6.71
3001	WETLANDS	4860.9	25.54
3001	Totals	19036	100

Figure 14 illustrates the landuses in the Econlockhatchee and Little Econlockhatchee watershed.

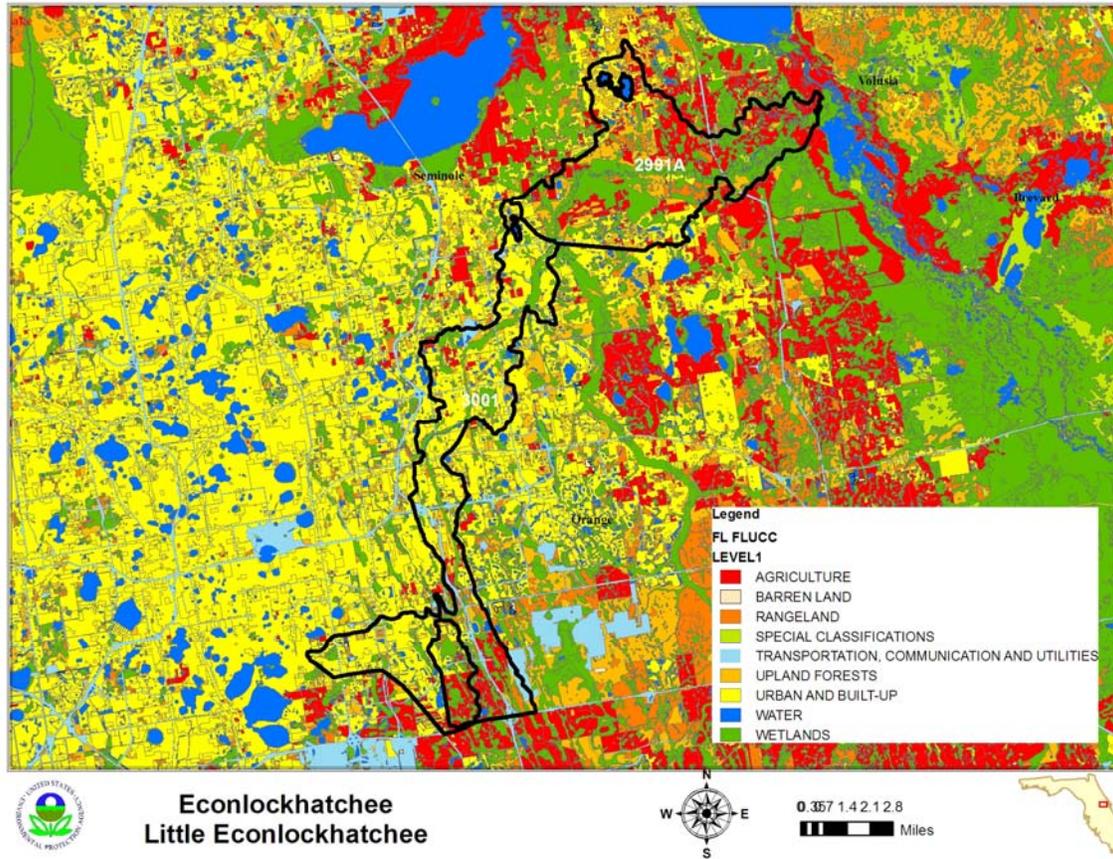


Figure 14 Econlockhatchee and Little Econlockhatchee Landuse Distribution

6.2.1. Urban Areas

Urban areas include land uses such as residential, industrial, extractive and commercial. Land uses in this category typically have somewhat high total nitrogen event mean concentrations and average total phosphorus event mean concentrations. Nutrient loading from MS4 and non-MS4 urban areas is attributable to multiple sources including stormwater runoff, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals.

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 outlined in Chapter 403 Florida Statutes (F.S.), was established as a technology-based program that relies upon the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C.

Florida's stormwater program is unique in having a performance standard for older stormwater systems that were built before the implementation of the Stormwater Rule in 1982. This rule states: "the pollutant loading from older stormwater management systems shall be reduced as needed to restore or maintain the beneficial uses of water" (Section 62-4-.432 (5)(c), F.A.C.).

Nonstructural and structural BMPs are an integral part of the State's stormwater programs. Nonstructural BMPs, often referred to as "source controls", are those that can be used to prevent the generation of nonpoint source pollutants or to limit their transport off-site. Typical nonstructural BMPs include public education, land use management, preservation of wetlands and floodplains, and minimization of impervious surfaces. Technology-based structural BMPs are used to mitigate the increased stormwater peak discharge rate, volume, and pollutant loadings that accompany urbanization.

6.2.2. Agriculture

Agricultural lands include improved and unimproved pasture, row and field crops, citrus, and specialty farms. The highest total nitrogen and total phosphorus event mean concentrations are associated with agricultural land uses.

6.2.3. Rangeland

Rangeland includes herbaceous, scrub, disturbed scrub and coastal scrub areas. Event mean concentrations for rangeland are about average for total nitrogen and low for total phosphorus.

6.2.4. Upland Forests

Upland forests include flatwoods, oak, various types of hardwoods, conifers and tree plantations. Event mean concentrations for upland forests are low for both total nitrogen and total phosphorus.

6.2.5. Water and Wetlands

These occur throughout the watershed and have very low event mean concentrations down to zero.

6.2.6. Barren Land

Barren land includes beaches, borrow pits, disturbed lands and fill areas. Barren lands comprise only a small portion of the watershed. Event mean concentrations for barren lands tend to be higher in total nitrogen.

6.2.7. Transportation, Communications and Utilities

Transportation uses include airports, roads and railroads. Event mean concentrations for these types of uses are in the mid-range for total nitrogen and total phosphorus.

7. Analytical Approach

In the development of a TMDL there needs to be a method for relating current loadings to the observed water quality problem. This relationship could be: statistical (regression for a cause and effect relationship), empirical (based on observations not necessarily from the waterbody in question) or mechanistic (physically and/or stochastically based) that inherently relate cause and effect using physical and biological relationships.

Two mechanistic models were used in the development of the TMDL for Econlockhatchee and Little Econlockhatchee River. The first model is a dynamic watershed model that predicts the quantity of water and pollutants that are associated with runoff from rain events. The second model is a dynamic water quality model that is capable of integrating the loadings from the watershed model to predict the water quality in the receiving waterbody.

The period of simulation that was considered in the development of this TMDL is January 1, 2001 to January 1, 2008. The models were used to predict time series for total nitrogen, total phosphorus, BOD, dissolved oxygen, and chlorophyll a. The models were calibrated to current conditions and were then used to predict improvements in water quality as function of reductions in loadings.

More details on the model application in the development of the Econlockhatchee and Little Econlockhatchee TMDL are presented in Appendix A.

7.1. Loading Simulation Program C++ (LSPC)

LSPC is the Loading Simulation Program in C++, a watershed modeling system that includes streamlined Hydrologic Simulation Program FORTRAN (HSPF) algorithms for simulating hydrology, sediment, and general water quality overland as well as a simplified stream fate and transport model. LSPC is derived from the Mining Data Analysis System (MDAS), which was originally developed by EPA Region 3 (under contract with Tetra Tech) and has been widely used for TMDLs. In 2003, the U.S. Environmental Protection Agency (EPA) Region 4 contracted with Tetra Tech to refine, streamline, and produce user documentation for the model for public distribution. LSPC was developed to serve as the primary watershed model for the EPA TMDL Modeling Toolbox.

LSPC will be used to simulate runoff (flow, total nitrogen, total phosphorus and BOD) from the land surface using a daily timestep for current and natural conditions of the Econlockhatchee and Little Econlockhatchee watershed. The predicted timeseries will be

used as boundary conditions for the receiving waterbody model to predict in-stream and in-lake water quality.

7.2. Water Quality Analysis Simulation Program (WASP)

The Water Quality Analysis Simulation Program— (WASP7), is a dynamic compartment-modeling program for aquatic systems, including both the water column and the underlying benthos. The time-varying processes of advection, dispersion, point and diffuse mass loading and boundary exchange are represented in the basic program. The conventional pollutant model within the WASP framework is capable of predicting time varying concentrations for chlorophyll a, dissolved oxygen, nutrients (nitrogen, phosphorus) as function of loadings, flows, and environmental conditions.

WASP was calibrated to the current conditions of the Econlockhatchee and Little Econlockhatchee watershed using known meteorology, predicted loadings from the LSPC model and constrained by observed data in Econlockhatchee and Little Econlockhatchee. Furthermore, WASP was used in determining the load reductions that would be needed to achieve the water quality standards and nutrient targets for Econlockhatchee and Little Econlockhatchee.

7.3. Scenarios

Several modeling scenarios were developed and evaluated in this TMDL determination. A full description of each of these scenarios is presented in Appendix A.

7.3.1. Current Condition

The first scenario is to model the current conditions of the watershed. This included the development of a watershed and water quality model. The watershed model is parameterized using the current landuses and measured meteorological conditions to predict the current loadings of nitrogen, phosphorus and BOD. These predicted loadings and flow time series are passed on to the water quality model where the predicted algal, nitrogen, phosphorus, BOD and dissolved oxygen concentrations are predicted over time. The models (watershed and water quality) are calibrated to an seven year period of time to take into account varying environmental, meteorological or hydrological conditions on water quality (Table 6).

Table 6 Existing Condition Annual Average Model Predictions

Econlockhatchee and Little Econlockhatchee Rivers	2002-2008 Model Prediction Annual Average
BOD (mg/l)	2.8
Total Nitrogen (mg/l)	0.8
Total Phosphorus (mg/l)	0.09
DO avg (mg/l)	6.7

DO min (mg/l)	4.0
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The current condition simulation will be used to determine the base loadings (Table 7) for the Econlockhatchee and Little Econlockhatchee. These base loadings compared with the TMDL scenario will be used to determine the percent reduction in nutrient loads that will be needed to achieve water quality standards.

Table 7 Econlockhatchee and Little Econlockhatchee Rivers Nutrient Loads (2002-2008)

Subbasin	Total Nitrogen Load (kg/yr)	Total Phosphorus Load (kg/yr)	BOD Load (kg/yr)
Wastewater Land Application (19 mgd)	78,870	26,290	131,450
Econlockhatchee and Little Econlockhatchee Rivers Watershed	337,454	53,772	1,836,572
Total for the Econlockhatchee and Little Econlockhatchee Rivers Watershed	416,324	80,062	1,968,022

7.3.2. Natural Condition

The natural condition scenario is developed to estimate what water quality conditions would exist if there were little to no impact from anthropogenic sources. There is one point source dischargers in the Econlockhatchee and Little Econlockhatchee watershed where the load will be removed in this analysis. Any landuse that is associated with man induced (urban, agriculture, transportation, barren lands and rangeland) activities gets converted to upland forests for purpose of this analysis and the associated event mean concentration for nitrogen, phosphorus and BOD are used. These natural condition loadings (Table 8) from the watershed model are passed onto the water quality model where natural water quality conditions are predicted.

Table 8 Natural Condition Annual Average Nutrient Loads

Subbasin	Total Nitrogen Load (kg/yr)	Total Phosphorus Load (kg/yr)	BOD Load (kg/yr)
Econlockhatchee and Little Econlockhatchee Rivers Watershed	212,935	18,617	571,895

The natural condition water quality predictions are presented in Table 9.

Table 9 Natural Condition Annual Average Model Predictions

Econlockhatchee and Little Econlockhatchee Rivers	2002-2008 Model Prediction Annual Average
BOD (mg/l)	1.1
Total Nitrogen (mg/l)	0.52
Total Phosphorus (mg/l)	0.033
DO avg (mg/l)	7.7
DO minimum (mg/l)	5.8

The purpose of the natural conditions scenario is to determine whether water quality standards can be achieved without abating the naturally occurring loads from the watershed. The natural condition scenario shows that the dissolved oxygen water quality standard of 5 mg/l can be met.

7.3.3. 25% Nutrient and BOD Load Reduction Scenario

A twenty five percent reduction of BOD, total nitrogen and total phosphorus and corresponding reduction in sediment oxygen demand (SOD) is shown in Table 10. Table 11 shows the resultant predictions for total nitrogen, total phosphorus and dissolved oxygen.

Table 10 25% Reduction Annual Average Nutrient Loads

Subbasin	total nitrogen Load (kg/yr)	TP Load (kg/yr)	BOD Load (kg/yr)
Wastewater Land Application (19 mgd)	78,870	26,290	131,450
Econlockhatchee and Little Econlockhatchee Rivers Watershed	233,373	33,756	1,344,567
Total for the Econlockhatchee and Little Econlockhatchee Rivers Watershed	312243	60046.37	1476016

Table 11 25% Predicted Water Quality Concentrations from 25% Reduction

Econlockhatchee and Little Econlockhatchee Rivers	2002-2008 Model Prediction Annual Average
BOD (mg/l)	2.3
Total Nitrogen (mg/l)	0.72
Total Phosphorus (mg/l)	0.076

DO avg (mg/l)	7.2
DO minimum (mg/l)	5.0

It should be noted that the 25% reduction in nutrient and BOD loadings will achieve the dissolved oxygen water quality standard of 5 mg/l.

7.3.4. TMDL

The TMDL scenario determines how much the current loadings would need to be reduced to achieve the applicable water quality standards (dissolved oxygen) and nutrient (nitrogen and phosphorus) interpretation of the narrative to protect against imbalance of flora and fauna. The predicted loading from the current conditions watershed model are incrementally reduced in the receiving waterbody model until the dissolved oxygen concentrations are above 5 mg/l or at natural background conditions.

Table 12 presents the current and TMDL loadings calculated by the model.

Table 12 TMDL Load Analysis and Allocation

Subbasin	Total Nitrogen Load (kg/yr)	Total Phosphorus Load (kg/yr)	BOD Load (kg/yr)
Existing WLA	78,870	26,290	131,450
Existing LA	337,454	53,772	1,836,572
Existing Load	416,324	80,062	1,968,022
TMDL WLA	78,870	26,290	131,450
TMDL LA	233,373	33,756	1,344,567
TMDL	312243	60046.37	1476016

8. TMDL Determination

A total maximum daily load (TMDL) for a given pollutant and waterbody is comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is represented by the equation:

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

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody and still achieve water quality standards and the waterbody's designated use. In TMDL development, allowable loadings from all pollutant sources that cumulatively amount to no more than the TMDL must be set and thereby provide the basis to establish

water quality-based controls. These TMDLs are expressed as annual mass loads, since the approach used to determine the TMDL targets relied on annual loadings. The TMDLs targets were determined to be the conditions needed to restore and maintain a balanced aquatic system. Furthermore, it is important to consider nutrient loading over time, since nutrients can accumulate in waterbodies.

The TMDL was determined for the loadings coming from the upstream watershed and watershed that directly drains to Econlockhatchee and Little Econlockhatchee. The allocations are given in Table 13. The MS4 service area is expected to reduce its loadings at the same percentage as the load allocation.

Table 13 TMDL Load Allocations for Econlockhatchee and Little Econlockhatchee (2991A and 3001)

TMDL			WLA			LA & Wet Weather Discharge (MS4)		
Total Nitrogen (kg/yr)	Total Phosphorus (kg/yr)	BOD (kg/yr)	Total Nitrogen (kg/yr)	Total Phosphorus (kg/yr)	BOD (kg/yr)	Total Nitrogen (% Reduction)	Total Phosphorus (% Reduction)	BOD (% Reduction)
416,324	80,062	1,968,022	78,870	26,290	131,450	25%	25%	25%

8.1. Critical Conditions and Seasonal Variation

EPA regulations at 40 CFR 130.7(c)(1) require TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. The critical condition is the combination of environmental factors creating the "worst case" scenario of water quality conditions in the waterbody. By achieving the water quality standards at critical conditions, it is expected that water quality standards should be achieved during all other times. Seasonal variation must also be considered to ensure that water quality standards will be met during all seasons of the year, and that the TMDLs account for any seasonal change in flow or pollutant discharges, and any applicable water quality criteria or designated uses (such as swimming) that are expressed on a seasonal basis.

The critical condition for nonpoint source loadings and wet weather point source loadings is typically an extended dry period followed by a rainfall runoff event. During the dry weather period, nutrients build up on the land surface, and are washed off by rainfall. The critical condition for continuous point source loading typically occurs during periods of low stream flow when dilution is minimized. Although loading of nonpoint source pollutants contributing to a nutrient impairment may occur during a runoff event, the expression of that nutrient impairment is more likely to occur during warmer months, and at times when the waterbody is poorly flushed. Because of the seven year simulation period used in the model development, the model encompasses both critical and seasonal variations to determine the annual average allowable load.

8.2. Margin of Safety

The Margin of Safety accounts for uncertainty in the relationship between a pollutant load and the resultant condition of the waterbody. There are two methods for incorporating a MOS into TMDLs (USEPA, 1991):

- Implicitly incorporate the MOS using conservative model assumptions to develop allocations
- Explicitly specify a portion of the total TMDL as the MOS and use the remainder for Allocations

This TMDL uses an implicit margin of safety as a TMDL targets for nutrients were determined using long term simulations that encompass a wide range of environmental conditions..

8.3. Waste Load Allocations

Only MS4s and NPDES facilities discharging directly into lake segments (or upstream tributaries of those segments) are assigned a WLA. The WLAs, are expressed separately for continuous discharge facilities (e.g., WWTPs) and MS4 areas, as the former discharges during all weather conditions whereas the later discharges in response to storm events.

8.3.1. NPDES Dischargers

Point source facilities are permitted through the Clean Water Act National Pollutant Discharge Elimination System (NPDES) Program. There is one continuous discharge (Table 3) NPDES permitted point sources in the Econlockhatchee and Little Econlockhatchee River Watershed.

8.3.2. Municipal Separate Storm System Permits

The WLA for MS4s are expressed in terms of percent reductions equivalent to the reductions required for nonpoint sources. Given the available data, it is not possible to estimate loadings coming exclusively from the MS4 areas. Although the aggregate wasteload allocations for stormwater discharges are expressed in numeric form, i.e. percent reduction, based on the information available today, it is infeasible to calculate numeric WLAs for individual stormwater outfalls because discharges from these sources can be highly intermittent, are usually characterized by very high flows occurring over relatively short time intervals, and carry a variety of pollutants whose nature and extent varies according to geography and local land use. For example, municipal sources such as those covered by these TMDLs often include numerous individual outfalls spread over large areas. Water quality impacts, in turn, also depend on a wide range of factors, including the magnitude and duration of rainfall events, the time period between events, soil conditions, fraction of land that is impervious to rainfall, other land use activities, and the ratio of stormwater discharge to receiving water flow.

These TMDLs assume for the reasons stated above that it is infeasible to calculate numeric water quality-based effluent limitations for stormwater discharges. Therefore, in the absence of information presented to the permitting authority showing otherwise, these TMDLs assume that water quality-based effluent limitations for stormwater sources of nutrients derived from this TMDL can be expressed in narrative form (e.g., as best management practices), provided that: (1) the permitting authority explains in the permit fact sheet the reasons it expects the chosen BMPs to achieve the aggregate wasteload allocation for these stormwater discharges; and (2) the state will perform ambient water quality monitoring for nutrients for the purpose of determining whether the BMPs in fact are achieving such aggregate wasteload allocation.

The percent reduction calculated for nonpoint sources is assigned to the MS4 as loads from both sources typically occur in response to storm events. Permitted MS4s will be responsible for reducing only the loads associated with stormwater outfalls which it owns, manages, or otherwise has responsible control. MS4s are not responsible for reducing other nonpoint source loads within its jurisdiction. All future MS4s permitted in the area are automatically prescribed a WLA equivalent to the percent reduction assigned to the LA. Best management practices for the MS4 service should be developed to meet the percent reduction for both nitrogen and phosphorus as prescribed in Table 13.

8.4. Load Allocations

The load allocation for nonpoint sources was assigned a percent reduction from the current loadings coming into Econlockhatchee and Little Econlockhatchee.

9. References

Florida Administrative Code. Chapter 62-302, Surface Water Quality Standards.

Florida Administrative Code. Chapter 62-303, Identification of Impaired Surface Waters.

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