

US EPA ARCHIVE DOCUMENT

**FINAL
TOTAL MAXIMUM DAILY LOAD (TMDL)**

For

Dissolved Oxygen & Nutrients

**In
Wall Spring
(WBID 1512Z)**

May 2013



US EPA ARCHIVE DOCUMENT

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SUMMARY SHEET for WBID 1512Z**Total Maximum Daily Load (TMDL)****2009 303(d) Listed Waterbody for TMDL addressed in this report:**

WBID	Segment Name	Class and Waterbody Type	Major River Basin	HUC	County	State
1512Z	Wall Spring (Health Spring)	Class III Marine	Springs Coast	03100207	Pinellas	Florida

TMDL Endpoints/Targets:

Dissolved Oxygen & Nutrients

TMDL Technical Approach:

The TMDL allocations were determined by analyzing the effects of TN and TP concentrations, and loadings, specifically NO₃NO₂, on DO concentrations in the waterbody. An analysis of average means was used to predict delivery of pollutants to the waterbody, and the proposed spring water quality standard was used to evaluate the in-stream impacts of the pollutants.

TMDL Waste Load and Load Allocation

Constituent	Current Condition		TMDL Condition		Percent Reduction		
	WLA (kg/yr)	LA (kg/yr)	WLA (kg/yr)	LA (kg/yr)	WLA	LA	MS4
Nitrate-Nitrite	--	28,551	--	2,031	--	93%	93%

Endangered Species Present (Yes or Blank): Yes**USEPA Lead TMDL (USEPA or Blank):** USEPA**TMDL Considers Point Source, Non-point Source, or Both:** Both**NPDES Discharges to surface waters addressed in USEPA TMDL:**

Permit ID	Permittee(s)	County	Permit Type
FLS000005	Pinellas County, FDOT (District VII)	Pinellas	Phase I MS4

1.0 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 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 and water quality is assessed in each group on a rotating five-year cycle. FDEP also established five water management districts (WMD) responsible for managing ground and surface water supplies in the counties encompassing the districts.

For the purpose of planning and management, the WMD divided the districts 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 five square miles. Unique numbers or waterbody identification (WBID) numbers are assigned to each water segment. This TMDL addresses WBID 1512Z, Wall Spring, which is impaired for dissolved oxygen (DO) and nutrients. WBID 1512Z is located in the Anclote River/Coastal Pinellas County Planning Unit and is managed by the Southwest Florida Water Management District (SWFWMD).

2.0 PROBLEM DEFINITION

To determine the status of surface water quality in Florida, 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 Waters Rule (IWR), Section 62-303 of the Florida Administrative Code (FAC). 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.

The TMDL addressed in this document is being established pursuant to commitments made by the United States Environmental Protection Agency (USEPA) 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 USEPA approved 1998 section 303(d) list. The 2009 section 303(d) list identified numerous WBIDs in the Anclote River/Coastal Pinellas County Basin as not meeting WQS. After assessing all readily available water quality data, USEPA is responsible for developing a TMDL to address nutrients and DO for WBID 1512Z, depicted in Figure 2.1.

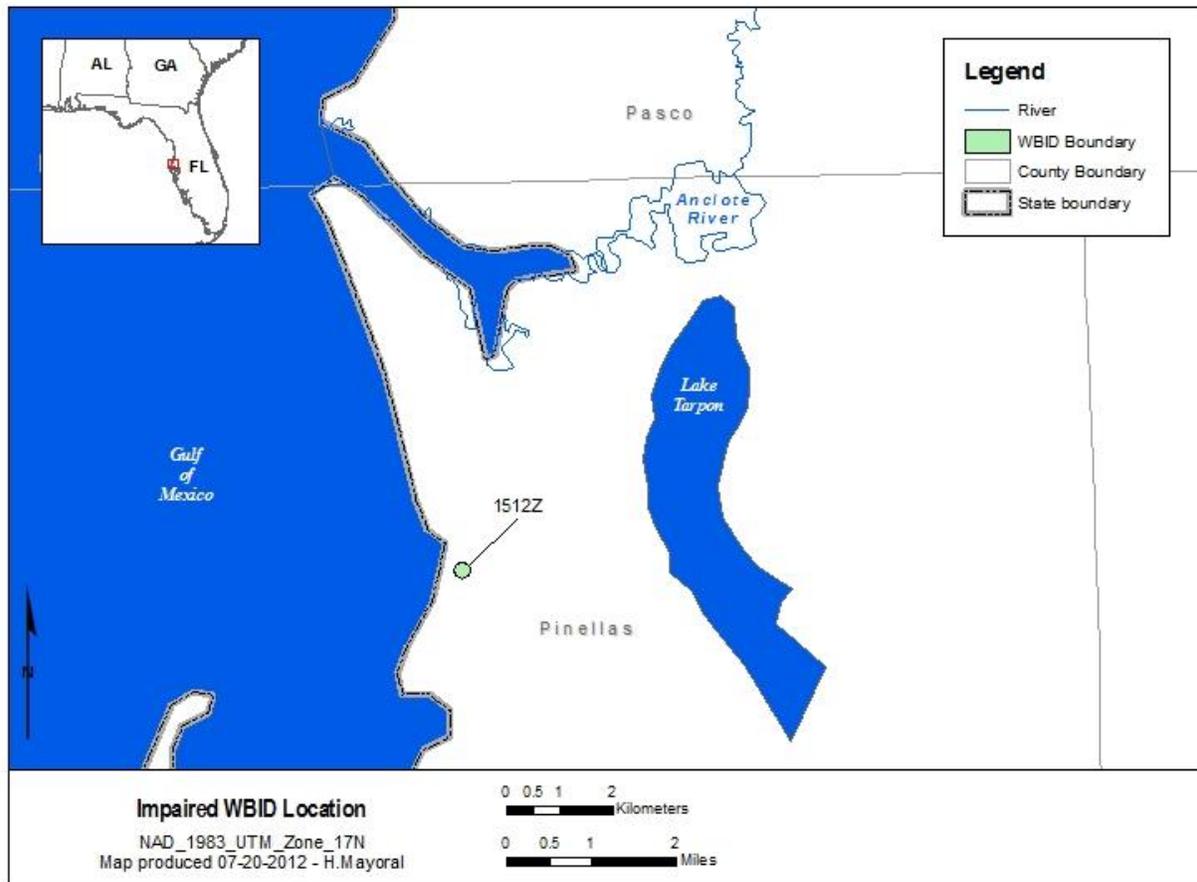


Figure 2.1 Location of the impaired WBID in the Anclote River basin

3.0 WATERSHED DESCRIPTION

3.1 Hydrologic characteristics

The Springs Coast Basin is located along the west coast of Florida, beginning just south of the Withlacoochee River in Citrus County and extending to Gulfport, Florida in Pinellas County, although it does not include Tampa Bay. Within the watershed are six major rivers: Crystal River, Homosassa River, Chassahowitza River, Weeki Wachee, the Anclote River, and the Pithlachascotee River; along with numerous springs and lakes. The Brooksville Ridge marks the

eastern boundary, created by sands historically deposited during higher sea-levels, and which define the karst geology that is characteristic of the area (FDEP 2008).

Wall Spring, also known as Health Springs, is located along the coast within Wall Springs Park in unincorporated Palm Harbor. Originally owned by the Wall family, the property was sold and used as a health spa and bathing area in the late 1940's, when it became known as Health Springs.

Pinellas County was able to acquire Wall Spring in 1988, and has since made several land acquisitions which allowed it to construct hiking trails, an observation tower, picnic shelters and restrooms for public recreation. The total area of the park is now approximately 210 acres, and is part of the Pinellas Greenway Trail, a linear trail extending from downtown St. Petersburg to Tarpon Springs. The spring is now encircled by a 2 ft high concrete wall that is approximately 30 ft in diameter, and surrounded by a chain link fence (Pinellas County Parks & Preserves).

The Wall Spring is a natural spring adjoined to a pond which connects to Saint Joseph Sound through Boggy Bayou. A system of underground caves feed the spring directly from the Upper Floridan Aquifer, with flow averaging approximately 4.2 million gallons per day (MGD). Measured flow has varied though, and ranged from no outflow during droughts to 10.7 MGD during high flows (Pinellas County Parks & Preserves).

3.2 Climate

The Springs Coast Basin is located on the west coast of Central Florida and experiences a subtropical climate with hot, humid summers and mild, short winters. Average high temperatures in the summer are in the low 90s (°F), and average low temperatures in the winter are in the upper 40s (°F). An average of 52 inches of rain every year is received in this part of Central Florida, of which a greater percentage falls during the wet season from June through September (SERCC 2012).

3.4 Land Use

There are only three land use classification types found within WBID 1512Z, Wall Spring, whose boundary includes the Wall Springs Park. Developed open space and open water account for a majority of the land use, each comprising 47 percent of the total land use (Figure 3.1 and Table 3.1). The remaining land use consists of forested wetlands, at six percent. There are no additional land uses within the WBID boundary.

While the Upper Florida Aquifer provides the source of groundwater to Wall Spring, the recharge area of the Upper Floridan Aquifer that provides groundwater is not currently known. It can be assumed that land use in the immediate area surrounding the Wall Spring directly influences the nutrient concentrations, but this has not been verified. The land area in the immediate vicinity of Wall Spring includes developed land, barren land, and golf courses.

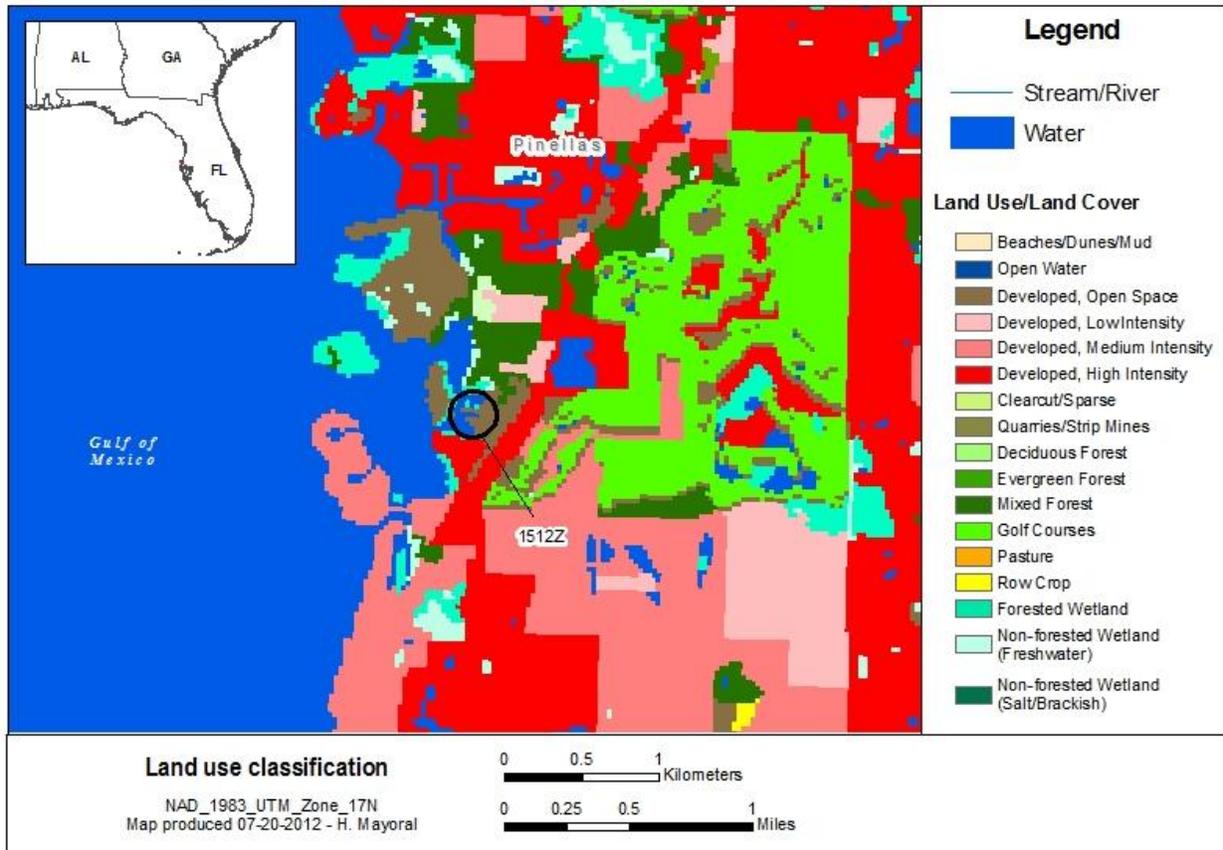


Figure 3.1 Land use for the impaired WBID in the Anclote River basin

Table 3.1 Land use distribution for WBID 1512Z in the Anclote River basin

Land Use Classification	WBID 1512Z	
	Acres	%
Evergreen Forest	0	0%
Deciduous Forest	0	0%
Mixed Forest	0	0%
Forested Wetland	1	6%
Non-Forested Wetland (Freshwater)	0	0%
Open Water	8	47%
Pasture	0	0%
Row Crop	0	0%

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Land Use Classification	WBID 1512Z	
	Acres	%
Clear cut Sparse	0	0%
Quarries Strip mines	0	0%
Utility Swaths	0	0%
Developed, Open Space	8	47%
Developed, Low intensity	0	0%
Developed, Medium intensity	0	0%
Developed, High intensity	0	0%
Beaches/Dunes/Mud	0	0%
Golf Courses	0	0%
Totals	17	100%

4.0 WATER QUALITY STANDARDS/TMDL TARGETS

The TMDL reduction scenarios were done to achieve Florida's dissolved oxygen concentration of 5 mg/L and ensure balanced flora and fauna within these WBIDs or establish the TMDL to be consistent with a natural condition if the dissolved oxygen standard cannot be achieved.

4.1 Designated Uses

Florida has classified its waters based on the designated uses those waters are expected to support. Waters classified as Class I waters are designated for Potable Water Supply; Class II waters are designated for Shellfish Propagation or Harvesting, and Class III waters are designated for 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 at section 62-302.400, F.A.C.

The waterbody addressed in this report is a Class III water. WBID 1512Z is Class III Marine.

4.2 Water quality criteria

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 FDEP does not have a streams water quality standard specifically for chlorophyll *a*, elevated levels of chlorophyll *a* are frequently associated with nonattainment of the narrative nutrient standard, which is described below.

4.3 Nutrient Criteria

In 1979, FDEP adopted a narrative criterion for nutrients. FDEP recently adopted numeric nutrient criteria for many Class III waters in the state, including streams, lakes, springs, and estuaries, which numerically interprets part of the state narrative criterion for nutrients. On November 30, 2012, EPA approved those criteria as consistent with the requirements of the CWA. Estuary specific criteria for a number of estuaries, as set out in 62-302.532(1), are effective for state law purposes. The remainder of the state criteria, however, are not yet effective for state law purposes.

In December 2010, EPA promulgated numeric nutrient criteria for Class I/III inland waters in Florida, including lakes and streams. On February 18, 2012, the federally promulgated criteria for lakes and springs were upheld by the U.S. District Court for the Northern District of Florida. Those criteria became effective on January 7, 2013. The Court invalidated the streams criteria and remanded those criteria back to EPA. EPA repropose the streams criteria on November 30, 2012.

Therefore, for lakes and springs in Florida, the applicable nutrient water quality criteria for CWA purposes are the federally promulgated criteria. For those estuaries identified in 62-302.532(1), the applicable nutrient water quality criteria for CWA purposes are FDEP's estuary criteria. For streams and the remaining estuaries in Florida, the applicable nutrient water quality standard for CWA purposes remains Florida's narrative nutrient criterion.

4.3.1 Narrative Nutrient Criteria

Florida's narrative nutrient criteria for Class I, II, and III waters provide:

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 Sections 62-302.300, 62-302.700, and 62-4.242. Section 62-302.530(47)(a), 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. Section 62-302.530(47)(b), F.A.C.

Chlorophyll and DO levels are often used to indicate whether nutrients are present in excessive amounts. The target for this TMDL is based on levels of nutrients necessary to prevent violations of Florida's DO criterion, set out below.

4.3.2 Inland Nutrient Criteria for streams

Florida's recently adopted numeric nutrient criteria interprets the narrative water quality criterion for nutrients in paragraph 62-302.530(48)(b), F.A.C. See section 62-302.531(2). While not yet effective as water quality criteria, the FDEP's numeric nutrient criteria represent the state's most recent interpretation of the second part of Florida's narrative criteria, set out at paragraph 62-302.530(47)(b), F.A.C. See section 62-302.531(2). Unless otherwise stated, where the EPA refers to the state nutrient rule in this TMDL, that rule is referenced as the state's interpretation of the narrative criterion. In addition, the first part of the narrative criteria, at paragraph 62-302.530(47)(a), F.A.C., also remains applicable to all Class I, II and III waters in Florida.

Florida's rule applies to streams. For streams that do not have a site specific criteria, Florida's rule provides for biological information to be considered together with nutrient thresholds to determine whether a waterbody is attaining 62-302.531(2)(c), F.A.C. The rule provides that the nutrient criteria are attained 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 and either 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 the nutrient thresholds set forth in Table 1 below are achieved. See section 62-302.531(2)(c).

Florida's rule provides that numeric nutrient criteria are expressed as a geometric mean, and concentrations are not to be exceeded more than once in any three calendar year period. Section 62-302.200 (25)(e), F.A.C.

Table 1 Inland numeric nutrient criteria

Nutrient Region	Watershed	Total Phosphorus Threshold	Nutrient	Total Nitrogen Threshold	Nutrient
	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.
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4.3.3 Inland Nutrient Criteria for estuaries with effective criteria

Numeric criteria for estuaries are expressed as either concentration-based estuary interpretations that are open water, area-wide averages or as load per million cubic meters of freshwater inflow that are the total load of that nutrient to the estuary divided by the total volume of freshwater inflow to that estuary. The criteria, set out at 62-302.532(1).

4.3.4 Inland Nutrient Criteria for lakes

Federal water quality criteria for lakes set out at 40 CFR 131.43(c)(1). The criteria are expressed as concentrations of chlorophyll a, total phosphorus, and total nitrogen as follows:

Lake Color and Alkalinity	Chl-a (mg/L)*	TN (mg/L)	TP (mg/L)
Colored Lakes (Long-term Color > 40 Platinum Cobalt Units (PCU))	0.020	1.27 [1.27-2.23]	0.05 [0.05-0.16]
Clear Lakes, High Alkalinity (Long-term Color ≤ 40 PCU and Alkalinity > 20 mg/L CaCO ₃)	0.020	1.05 [1.05-1.91]	0.03 [0.03-0.09]
Clear Lakes, Low Alkalinity (Long-term Color ≤ 40 PCU and Alkalinity ≤ 20 mg/L CaCO ₃)	0.006	0.51 [0.51-0.93]	0.01 [0.01-0.03]

* For a given waterbody, the annual geometric mean of chlorophyll a, TN or TP concentrations shall not exceed the applicable criterion concentration more than once in a three-year period.

4.3.5 Springs Nutrient Criteria

The numeric criteria for spring is 0.35 mg/L of nitrate-nitrite as an annual geometric mean, not to be exceeded more than once in any three year period.

4.4 Dissolved Oxygen Criteria

Numeric criteria for DO are expressed in terms of minimum and daily average concentrations. While FDEP has adopted revised DO criteria for freshwaters, these revisions have not yet been to EPA for review. Therefore, the applicable criterion for Clean Water Act purposes remains subsection 62-302.530(30), F.A.C.

For Class I and Class III freshwaters, subsection 62-302.530(30) provides as follows:

Shall not be less than 5.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained. [FAC 62-302.530 (30)]

For Class III marine waters, subsection 62-302.530(30) provides as follows:

Shall not average less than 5.0 mg/L in a 24-hour period and shall never be less than 4.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained. [FAC 62-302.530 (30)]

4.5 Biochemical Oxygen Demand Criteria

Biochemical Oxygen Demand (BOD) shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established for each class and, in no case, shall it be great enough to produce nuisance conditions. [FAC 62-302.530 (11)]

4.6 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. [FAC 62-302.200(19)]

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. [FAC 62-302.300(15)]

5.0 WATER QUALITY ASSESSMENT

The WBID addressed in this report was listed as not attaining their designated use on Florida's 2009 303(d) list for dissolved oxygen and nutrients. To determine impairment, an assessment of available data was conducted. The source for current ambient monitoring data was the Impaired Waters Rule (IWR) data Run 44, using data ranging January 1, 2002 to December 31, 2009. The IWR database contains data from various sources within the state of Florida, including the WMDs and counties.

5.1 Water Quality Data

A complete list of water quality monitoring stations in WBID 1512Z are located in Table 5.1, and an analysis of water quality data is documented in

Table 5.2. Figure 5.1 shows the locations of the water quality monitoring stations within the WBID. Water quality data for the WBID can be found below in Figure 5.2 through Figure 5.7, with the data from all water quality stations compiled in each figure.

5.1.1 Dissolved Oxygen

There are several factors that affect the concentration of dissolved oxygen (DO) in a waterbody. Natural DO levels are a function of water temperature, water depth and velocity, salinity and relative contributions from groundwater. Oxygen can be introduced by wind, diffusion, photosynthesis, and additions of higher DO water (e.g. from tributaries). DO concentrations can be lowered by processes that use up oxygen from the water, such as respiration and decomposition, and can be lowered through additions of water with lower DO (e.g. swamp or groundwater). Decomposition of organic matter, such as dead plants and animals, also consumes DO. The dissolved oxygen minimum concentration was 0.30 mg/L, and the maximum concentration was 8.04 mg/L. The mean concentration was 1.82 mg/L.

5.1.2 Biochemical Oxygen Demand

BOD is a measure of the amount of oxygen used by bacteria as they stabilize organic matter. The process can be accelerated when there is an overabundance of nutrients, increasing the aerobic bacterial activity in a waterbody. In turn, the levels of DO can become depleted, eliminating oxygen essential for biotic survival, and potentially causing extensive fish kills. Additionally, BOD is used as an indicator to determine the presence and magnitude of organic pollution from sources such as septic tank leakage, fertilizer runoff, and wastewater effluent. The mean BOD concentration for WBID 1512Z was 0.84 mg/L. The maximum BOD concentration was 2.00 mg/L and the minimum concentration was 0.20 mg/L.

5.1.3 Nutrients

Excessive nutrients in a waterbody can lead to overgrowth of algae and other aquatic plants such as phytoplankton, periphyton and macrophytes. This process can deplete oxygen in the water, adversely affecting aquatic life and potentially restricting recreational uses such as fishing and boating. For the nutrient assessment the monitoring data for total nitrogen, total phosphorus and

chlorophyll a are presented. The current standards for nutrients in estuarine bodies are narrative criteria, while numeric and narrative standards have been developed for freshwater bodies. 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.

5.1.3.1 Total Nitrogen

Total Nitrogen (TN) is comprised of nitrate (NO₃), nitrite (NO₂), organic nitrogen and ammonia nitrogen (NH₄). Though nitrogen is a necessary nutrient required for the growth of most plants and animals, not all forms are readily used or metabolized. Increased levels of organic nitrogen can occur from the decomposition of aquatic life or from sewage, while inorganic forms are generally from erosion and fertilizers. Nitrates are components of industrial fertilizers, yet can also be naturally present in soil, and are converted to nitrite by microorganisms in the environment. In springs, nitrate is the most common form of nitrogen and historically was less than 0.2 mg/L in spring water until the 1970s (Harrington et al 2010). The increase in nitrate, coupled with the increase in phosphorus, can cause changes in the biological systems and increase the presence of algae and aquatic plants. Surface runoff from agricultural lands can increase the natural presence of nitrates in the environment and can lead to 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 depletion in DO concentrations as a result of algal decomposition. The total nitrogen minimum concentration was 0.67 mg/L, and the maximum concentration was 6.61 mg/L. The mean total nitrogen concentration in WBID 1512Z was 5.01 mg/L.

5.1.3.2 Total Phosphorus

In natural waters, total phosphorus exists in either soluble or particulate forms. Dissolved phosphorus includes inorganic and organic forms, while particulate phosphorus is made up of living and dead plankton, and adsorbed, amorphous, and precipitated forms. Inorganic forms of phosphorus include orthophosphate and polyphosphates, though polyphosphates are unstable and convert to orthophosphate over time. Orthophosphate is both stable and reactive, making it the form most used by plants. Excessive phosphorus can lead to overgrowth of algae and aquatic plants, the decomposition of which depletes oxygen in the water. The total phosphorus minimum concentration was 0.08 mg/L, and the maximum concentration was 0.16 mg/L. The mean total phosphorus concentration in WBID 1512Z was 0.10 mg/L.

5.1.3.3 Chlorophyll-a

Chlorophyll is the green pigment in plants that allows them to create energy from light. In a water sample, chlorophyll is indicative of the presence of algae, and chlorophyll-*a* is a measure of the active portion of total chlorophyll. Corrected chlorophyll refers to chlorophyll-*a* measurements that are corrected for the presence of pheophytin, a natural degradation product of chlorophyll that can interfere with analysis because it has an absorption peak in the same spectral region. It is used as a proxy indicator of water quality because of its predictable response to nutrient availability. Increases in nutrients can potentially lead to blooms in phytoplankton biomass, affecting water quality and ecosystem health. The corrected chlorophyll a maximum concentration was 1.10 µg/L, and the mean concentration was 1.02 µg/L.

Table 5.1 Water quality stations located in WBID 1512Z

WBID	Station Number
1512Z	21FLSWFD22785
	21FLTPA 24040125

Table 5.2 Water quality data for WBID 1512Z

Parameter	Stats	WBID 1512Z
BOD, 5 Day, 20°C (mg/L)	# of obs	7
	min	0.20
	max	2.00
	mean	0.84
	Geomean	0.68
DO, Analysis by Probe (mg/L)	# of obs	48
	min	0.30
	max	8.04
	mean	1.82
	Geomean	1.37
Nitrogen, Total (mg/L as N)	# of obs	42
	min	0.67
	max	6.61
	mean	5.01
	Geomean	4.81

Parameter	Stats	WBID 1512Z
Phosphorus, Total (mg/L as P)	# of obs	43
	min	0.08
	max	0.16
	mean	0.10
	Geomean	0.10
Chlorophyll-A-corrected (µg/L)	# of obs	24
	min	1.00
	max	1.10
	mean	1.02
	Geomean	1.02

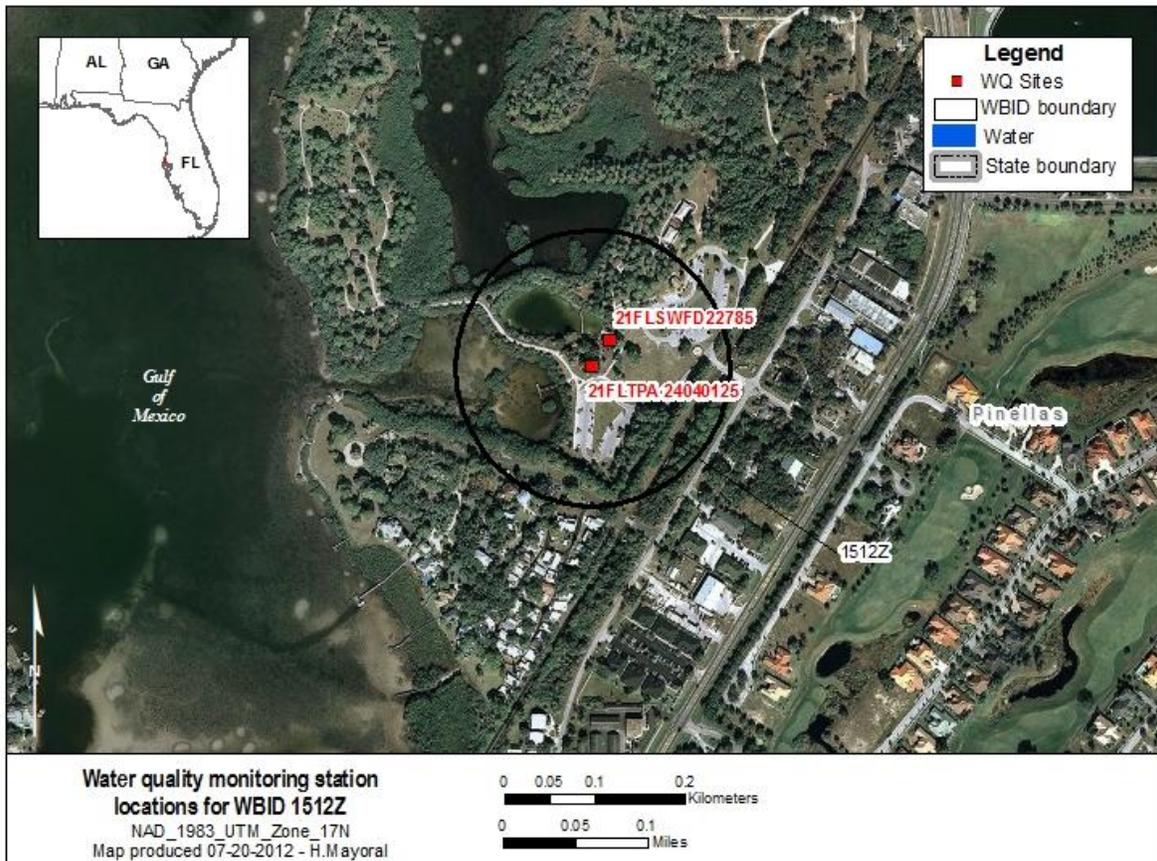


Figure 5.1 Water quality monitoring station locations for impaired WBID 1512Z in the Anclote River basin

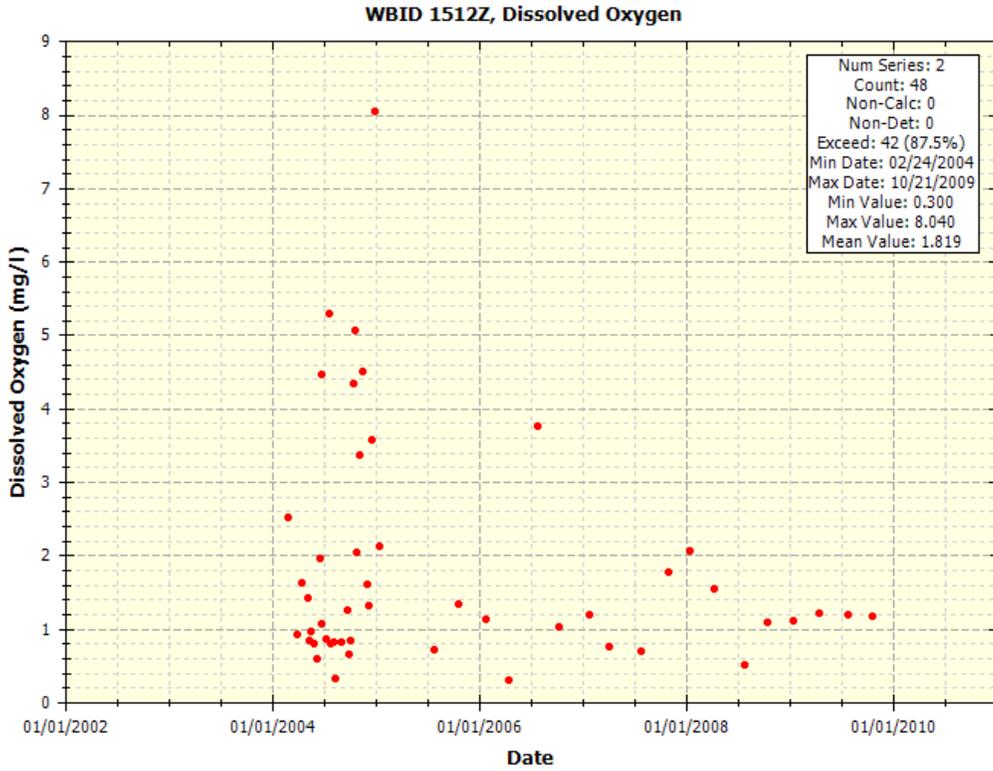


Figure 5.2 Dissolved oxygen concentrations for WBID 1512Z

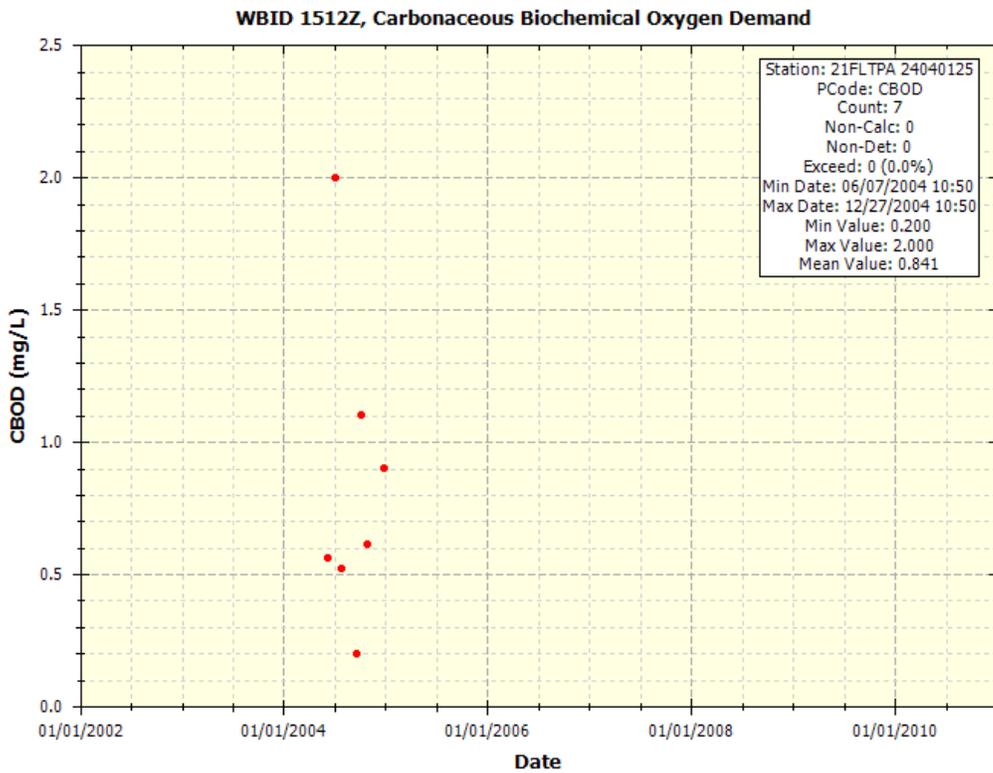


Figure 5.3 Carbonaceous biochemical oxygen demand concentrations for WBID 1512Z

US EPA ARCHIVE DOCUMENT

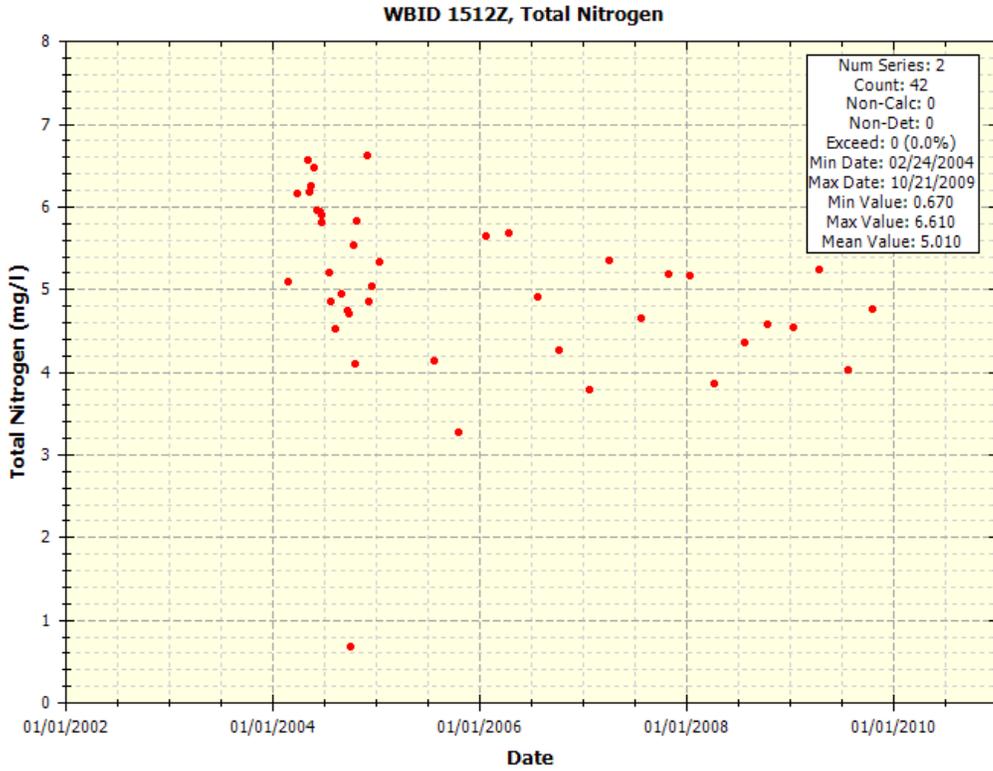


Figure 5.4 Total nitrogen concentrations for WBID 1512Z

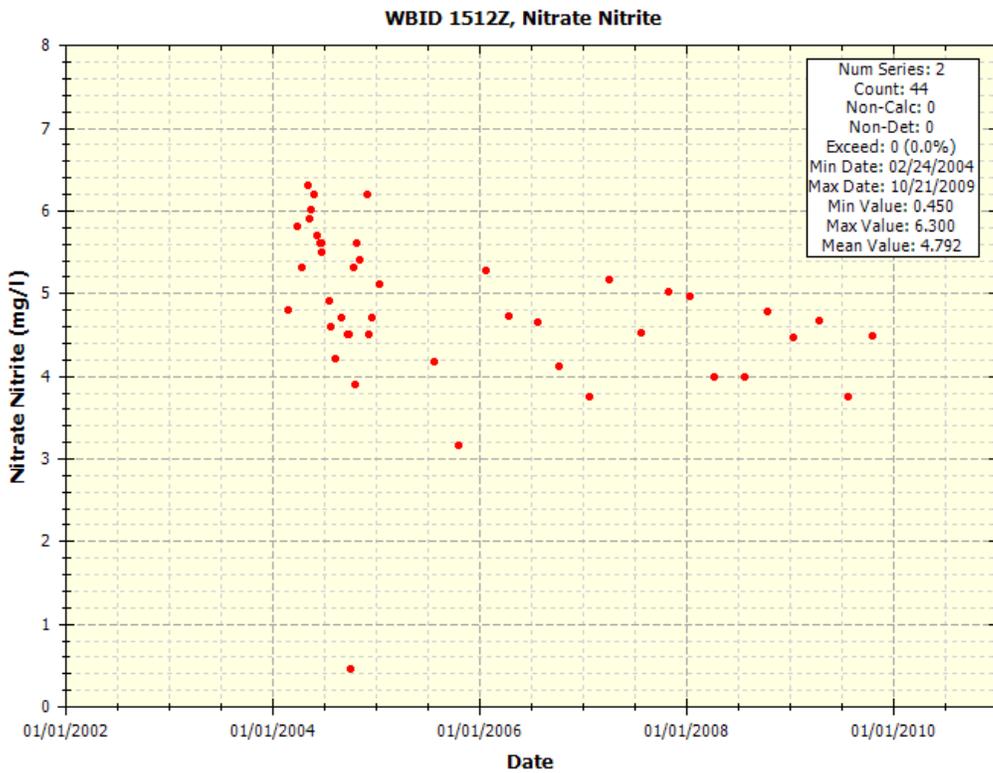


Figure 5.5 Nitrate nitrite concentrations for WBID 1512Z

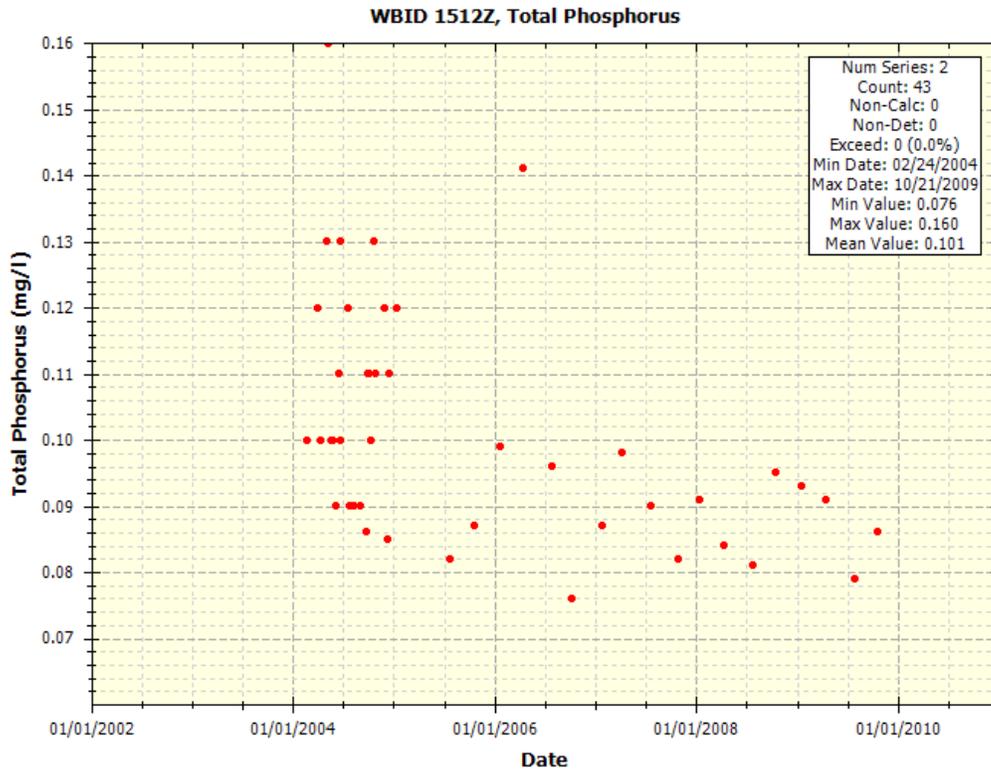


Figure 5.6 Total phosphorus concentrations for WBID 1512Z

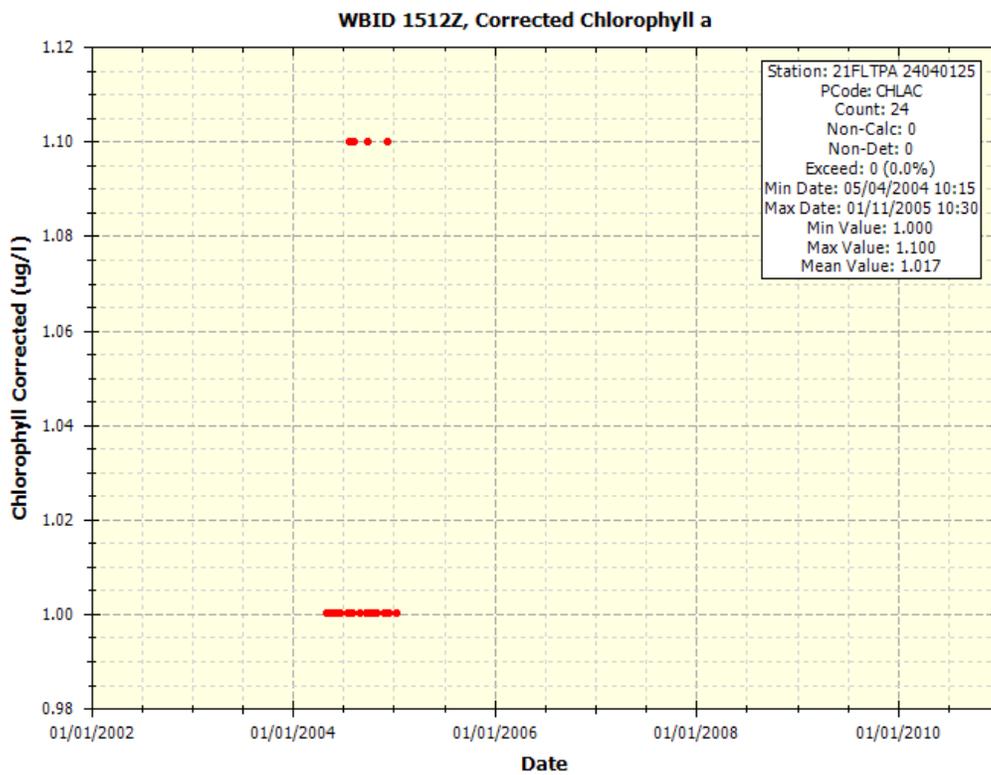


Figure 5.7 Corrected chlorophyll a concentrations for WBID 1512Z

6.0 SOURCE AND LOAD ASSESSMENT

An important part of the TMDL analysis is the identification of source categories, source subcategories, or individual sources of pollutants in the watershed and the amount of loading contributed by each of these sources. Sources are broadly classified as either point or nonpoint sources. Nutrients can enter surface waters from both point and nonpoint sources.

6.1 Point Sources

A point source is defined as a discernible, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source discharges of industrial wastewater and treated sanitary wastewater must be authorized by National Pollutant Discharge Elimination System (NPDES) permits. NPDES permitted discharges include continuous discharges such as wastewater treatment facilities as well as some stormwater driven sources such as municipal separate storm sewer systems (MS4s), certain industrial facilities, and construction sites over one acre.

6.1.1 Wastewater/Industrial Permitted Facilities

A TMDL wasteload allocation (WLA) is given to wastewater and industrial NPDES permitted facilities discharging to surface waters within an impaired watershed. There are no NPDES-permitted facilities in WBID 1512Z, therefore no WLA is necessary.

6.1.2 Stormwater Permitted Facilities/MS4s

MS4s are point sources also regulated by the NPDES program. According to 40 CFR 122.26(b)(8), an 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.”

MS4s may discharge nutrients and other pollutants to waterbodies in response to storm events. In 1990, USEPA developed rules establishing Phase I of the NPDES stormwater program, designed to prevent harmful pollutants from being washed by stormwater runoff into 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.

In October 2000, USEPA authorized FDEP to implement the NPDES stormwater program in all areas of Florida except Indian tribal lands. FDEP’s authority to administer the NPDES program is set forth in Section 403.0885, Florida Statutes (FS). The three major components of NPDES stormwater regulations are:

- MS4 permits that are issued to entities that own and operate master stormwater systems, primarily local governments. Permittees are required to implement comprehensive stormwater management programs designed to reduce the discharge of pollutants from the MS4 to the maximum extent practicable.
- Stormwater associated with industrial activities, which is regulated primarily by a multisector general permit that covers various types of industrial facilities. Regulated industrial facilities must obtain NPDES stormwater permit coverage and implement appropriate pollution prevention techniques to reduce contamination of stormwater.
- Construction activity general permits for projects that ultimately disturb one or more acres of land and which require the implementation of stormwater pollution prevention plans to provide for erosion and sediment control during construction.

Stormwater discharges conveyed through the storm sewer system covered by the permit are subject to the WLA of the TMDL. Any newly designated MS4s will also be required to achieve the percent reduction allocation presented in this TMDL. There is one MS4 permit associated with the impaired WBID, for Pinellas County as a Phase I C MS4 permit (FLS000005). The Phase I C MS4 permit for Pinellas County also falls under District VII Florida Department of Transportation.

6.2 Nonpoint Sources

Nonpoint sources of pollution are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. For nutrients, these sources include runoff of agricultural fields, golf courses, and lawns, septic tanks, and residential developments outside of MS4 areas. 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. Figure 3.1 provides a map of the land use, while Table 3.1 lists the land use distribution in the WBID.

The following sections are organized by land use. Each section provides a description of the land use, the typical sources of nutrient loading (if applicable), and typical total nitrogen and total phosphorus event mean concentrations. Because of limited data collected regarding Wall Spring and its recharge area, there are likely multiple non-point sources contributing to high nitrate which cannot be accurately identified, including excessive fertilization and failed septic systems.

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 FS, was established as a technology-based program that relies upon the implementation of Best Management Practices (BMPs) that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, FAC.

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." [FAC 62-40-.432(2)(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.

Urban, residential, and commercial developments are often a significant nonpoint source of nutrients and oxygen-demanding substances. In WBID 1512Z, 47 percent of the land use is comprised of developed, open space. The surrounding land in Pinellas County is dominated by urban land uses, which most likely contribute excessive nutrients to the groundwater which upwells to Wall Spring. Additionally, a golf course is located in close proximity and may also be contributing excessive nutrients to the Floridan Aquifer in that area.

Onsite Sewage Treatment and Disposal Systems (Septic Tanks)

As stated above, leaking septic tanks or onsite sewage treatment and disposal systems (OSTDs) can contribute to nutrient loading in urban areas. Water from OSTDs is typically released to the ground through on-site, subsurface drain fields or boreholes that allow the water from the tank to percolate (usually into the surficial aquifers) and either transpire to the atmosphere through surface vegetation or add to the flow of shallow ground water. When properly sited, designed, constructed, maintained, and operated, OSTDs are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTD receives natural biological treatment in the soil and is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, OSTDs can be a source of nutrients, pathogens, and other pollutants to both ground water and surface water.

The State of Florida Department of Health publishes data on new septic tank installations and the number of septic tank repair permits issued for each county in Florida. Table 6.1 summarizes the cumulative number of septic systems installed in Pinellas County since the 1970 census and the total number of repair permits issued for the ten years between 1999-2000 and 2009-2010 (FDOH 2009). The data do not reflect septic tanks removed from service. Leaking septic systems could be a relevant source of organic and nutrient loading in the watershed.

Table 6.1 County estimates of Septic Tanks and Repair Permits

County	Number of Septic Tanks (1970-2008)	Number of Repair Permits Issued (2000-2010)
Pinellas	23,869	3,015

Note: Source: <http://www.doh.state.fl.us/environment/ostds/statistics/ostdsstatistics.htm>

6.2.2 Pastures

Pastures include cropland and improved and unimproved pasturelands, such as non-tilled grasses woodland pastures, feeding operations, nurseries and vineyards; as well as specialty farms. Agricultural activities, including runoff of fertilizers or animal wastes from pasture and cropland and direct animal access to streams, can generate nutrient loading to streams. The highest total nitrogen and total phosphorus event mean concentrations are associated with agricultural land uses. There is no pasture land use within WBID 1512Z and therefore is not a source of nutrients loading.

6.2.3 Clear cut/Sparse

The clear cut/sparse land use classification includes recent clear cuts, areas of sparse vegetation or herbaceous dry prairie, shrub and brushland, other early successional areas, and mixed rangeland. Event mean concentrations for clear cut/sparse can be relatively low for total nitrogen and total phosphorus. There are no clear cut/sparse land uses within the WBID.

6.2.4 Forests

Upland forests include flatwoods, oak, various types of hardwoods, conifers and tree plantations. Wildlife located within forested areas deposit their feces onto land surfaces where it can be transported to nearby streams during storm events. Generally, the pollutant load from wildlife is assumed to represent background concentrations. Event mean concentrations for upland forests are low for both total nitrogen and total phosphorus. There are no combined forested land uses in WBID 1512Z.

6.2.5 Water and Wetlands

Water and Wetlands often have very low nutrient loadings, although decaying organic matter in wetlands can contribute to high organic nutrient concentrations. Open water accounts for 47 percent of the total land use in WBID 1512Z, and forested wetlands account for an additional 6 percent of the total land use.

6.2.6 Quarries/Strip mines

Land use classification includes quarries, strip mines, exposed rock and soil, fill areas, reclaimed lands, and holding ponds. Event mean concentrations for some barren lands tend to be higher in total nitrogen. There are no quarries/strip mines in WBID 1512Z.

7.0 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 relates cause and effect using physical and biological relationships.

To develop the TMDL for Wall Spring, measured water quality data was regressed against dissolved oxygen to determine whether there was a relationship. Several studies have indicated that reducing nitrate in streams in Florida reduces algal growth (Stevenson et al. 2007, Niu and Gao 2007). Excessive algal growth can reduce the amount of dissolved oxygen available in the water column, thereby increasing dissolved oxygen in the water column. No statistically significant relationship between DO and nitrate-nitrite (NO₃NO₂) and DO or TP was established, although NO₃NO₂ was found to have a statistically significant and proportional relationship with TP (Figure 7.1 through Figure 7.3).

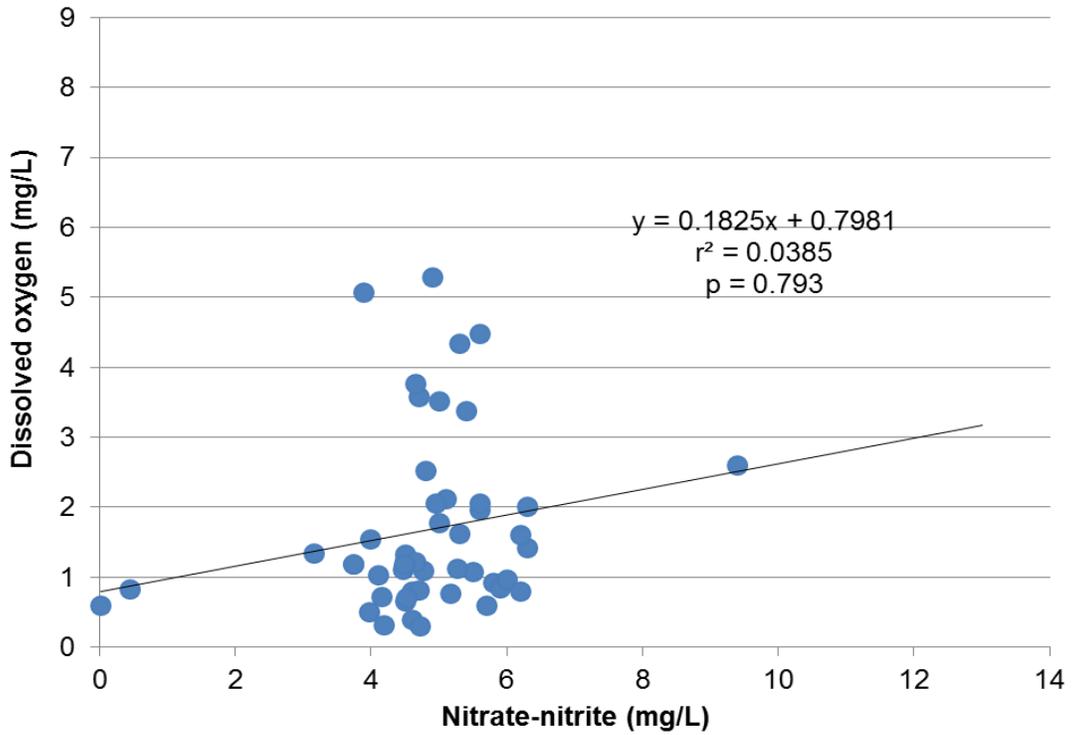


Figure 7.1 Nitrate-nitrite versus dissolved oxygen in WBID 1512Z

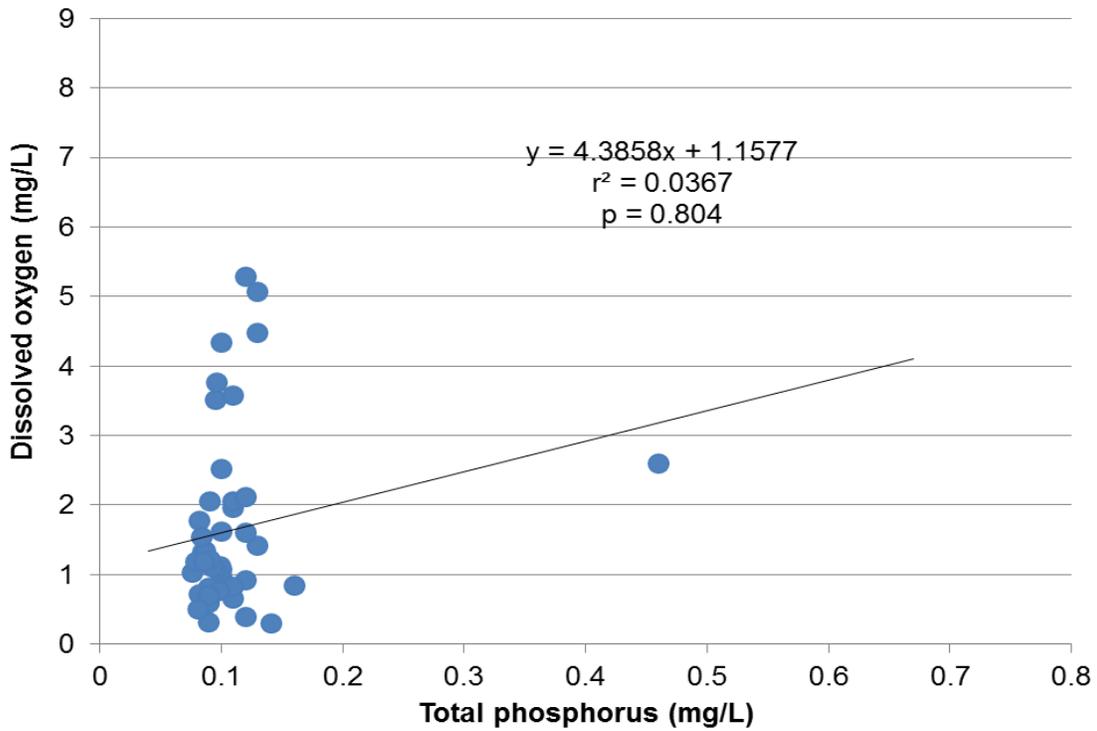


Figure 7.2 Total phosphorus versus dissolved oxygen in WBID 1512Z

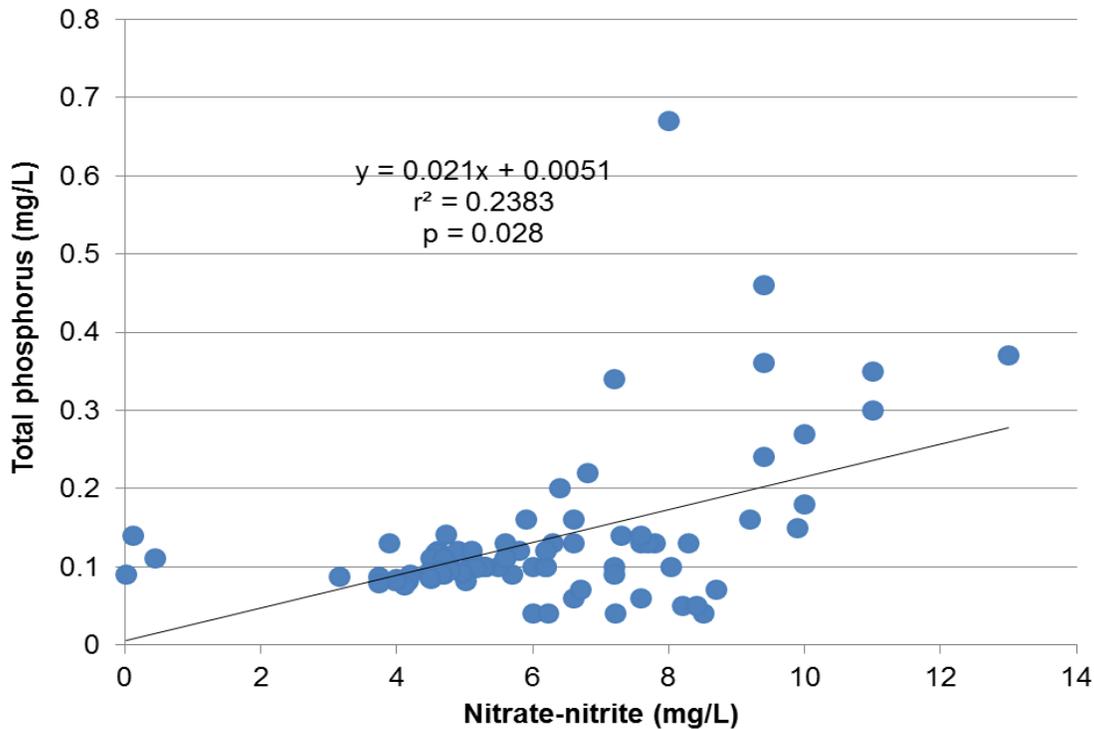


Figure 7.3 Nitrate-nitrite versus total phosphorus in WBID 1512Z

Dissolved oxygen data for Wall Spring was available after 1995. Nutrient concentration data was available beginning in 1978, and nitrate-nitrite concentrations were already greater than six mg/L at that time. Total phosphorus concentrations were approximately 0.05 mg/L in the late 1970s and early 1980s. Presumably, by 1995, there was already a shift in the aquatic biology in Wall Spring because of the 20 year history of elevated nutrients, which is why a trend between DO and NO_3NO_2 or TP could not be established. The FDEP evaluated nutrient trends throughout the state of Florida and found that the average nitrate concentration increased from 0.2 mg/L to 1.0 mg/L over the past 50 years (FDEP 2009), further indicating that the increase in nutrients in Wall Spring occurred prior to the 1978 sampling.

After an extensive literature review, FDEP determined that reducing nitrate-nitrite to 0.35 mg/L should return spring ecosystem back to their balanced states (FDEP 2009). Multiple studies have shown that reducing NO_2NO_3 concentration in springs can reduce algal growth (Stevenson *et al* 2007; Niu and Gao 2007; Pinowska *et al.* 2007). Field surveys indicated that NO_3NO_2 needed to be reduced to 0.454 mg/L to reduce excessive algal growth, while laboratory results have shown NO_3NO_2 should be reduced to 0.230 mg/L to prevent excessive algal growth. By reducing excessive NO_3NO_2 , there should be a reduction of aquatic vegetation and algae in Wall Spring, which will in turn increase DO. However, reducing NO_3NO_2 may not increase DO above the water quality standard of 5 mg/L because groundwater often has naturally low DO concentrations.

From 2000 through 2009, the average nitrate-nitrite concentration is 4.92 mg/L, and assuming an average flow of 4.2 MGD in the spring, the yearly NO_3NO_2 load is 28,551 kg/yr. The NO_3NO_2 concentration should be reduced to the FDEP suggested water quality standard of 0.35 mg/L, or

2,031 kg/yr in Wall Spring. Because of the relationship between NO₃NO₂ and TP, the reduction in NO₃NO₂ will also reduce TP loading in Wall Spring.

8.0 TMDL DETERMINATION

The 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 this TMDL development, allowable concentrations 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 average concentrations, since the approach used to determine the TMDL targets relied on annual average means. 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 concentrations and loadings at the outlet of WBID 1512Z, and included all loadings from upstream sources and streams.

Table 8.1 TMDL Load Allocations for Wall Spring, WBID 1512Z

Constituent	Current Condition		TMDL Condition		Percent Reduction		
	WLA (kg/yr)	LA (kg/yr)	WLA (kg/yr)	LA (kg/yr)	WLA	LA	MS4
Nitrate-Nitrite	--	28,551	--	2,031	--	93%	93%

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 concentration and wet weather point source concentrations 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 concentrations 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.

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 an 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 MOS since the TMDL targets for nutrients were set to the suggested FDEP water quality standard.

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, if applicable, 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 Wastewater/Industrial Permitted Facilities

A TMDL wasteload allocation (WLA) is given to wastewater and industrial NPDES-permitted facilities discharging to surface waters within an impaired watershed. There are no continuous discharge NPDES-permitted point sources in WBID 1512Z, therefore no WLA was calculated.

8.3.2 Municipal Separate Storm Sewer 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 concentrations coming exclusively from the MS4 areas. Although the aggregate concentration 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 this TMDL 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.

This TMDL assumes 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, this TMDL assumes 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.

All Phase 1 MS4 permits issued in Florida include a re-opener clause allowing permit revisions for implementing TMDLs once they are formally adopted by rule. Florida may designate an area as a regulated Phase II MS4 in accordance with Rule 62-620.800, FAC. Florida's Phase II MS4 Generic Permit has a "self-implementing" provision that requires MS4 permittees to update their stormwater management program as needed to meet their TMDL allocations once those TMDLs are adopted. 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. The MS4 service areas described in Section 6.1.2 of this report are required to meet the percent reduction prescribed in Table 8.1 through the implementation of BMPs.

8.4 Load Allocations

The load allocation for nonpoint sources was assigned a percent reduction in nutrient concentrations from the current concentrations coming into the WBID addressed in the TMDL report.

9.0 RECOMMENDATIONS/IMPLEMENTATION

The initial step in implementing a TMDL is to more specifically locate pollutant source(s) in the watershed. FDEP employs the Basin Management Action Plan (B-MAP) as the mechanism for developing strategies to accomplish the specified load reductions. Components of a B-MAP are:

- Allocations among stakeholders
- Listing of specific activities to achieve reductions
- Project initiation and completion timeliness
- Identification of funding opportunities

- Agreements
- Local ordinances
- Local water quality standards and permits
- Follow-up monitoring

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