TOTAL MAXIMUM DAILY LOAD (TMDL) FOR DISSLOVED OXYGEN (DO) IN CYPRESS CREEK (WIBID #1402)

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September 30, 2004

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PREAMBLE

This Total Maximum Daily Load (TMDL) for Cypress Creek (WBID 1402) is being established as required by the Consent Decree Florida Wildlife Federation, et al. v. Carol Browner, et al. The U.S. Environmental Protection Agency (EPA) has analyzed the available data and information for this waterbody, and has determined that this waterbody is *likely* not meeting the State of Florida's applicable water quality standard for dissolved oxygen (DO) due to naturally-occurring conditions. If the waterbody is not meeting its applicable water quality standards due to natural conditions (i.e., a pollutant is not causing the impairment), a TMDL would not be necessary nor would it be required by the consent decree. However, the existing data and information does not provide certainty that a pollutant is *not* causing the violation of the DO water quality standard; therefore, as a legal precaution, EPA is fulfilling its court-ordered commitment by proposing a TMDL for this waterbody. The TMDL, as proposed, indicates that the existing water quality standard for DO is not attainable in this waterbody, and therefore, recommends that the State of Florida establish a site-specific criterion for DO for this waterbody.

In this proposed TMDL, EPA is seeking comments on the technical analysis presented in the TMDL. EPA is also requesting stakeholders to submit any additional data and information related to the causes of non-attainment of the DO water quality standard in this waterbody. If EPA is able to establish that the low DO conditions of the waterbody are due to natural conditions, the TMDL will not be finalized. If, on the other hand, EPA obtains data and information indicating a pollutant to be the cause, EPA will revise the TMDL to reflect this finding.

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 water body 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 non-point 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 this approach, water resources are managed on the basis of natural boundaries, such as river basins, rather than political boundaries. This approach is also the framework FDEP uses for implementing TMDLs. The state's 52 basins are divided in 5 groups. Water quality is assessed in each group on a rotating five-year cycle. For assessment purposes, FDEP has divided the basins into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) for each watershed or stream reach.

PROBLEM DEFINITION AND WATERSHED DESCRIPTION

Cypress Creek is a Florida Class II freshwater. It is located almost entirely in northern Hillsborough County and is part of the Hillsborough River Planning Unit. It is characterized as rural. The major land uses are wetlands (39 percent), residential (17%), agriculture (13%), and forest (10%). The watershed is bordered by I-75 on the East, U.S. 41 on the West, and Bruce B. Downs Boulevard (S.R. 551) on the South. Figure 1 shows it locations. Cypress Creek was listed on the 1998 303(d) for low DO and EPA is responsible for developing the TMDL pursuant to the Consent Decree.

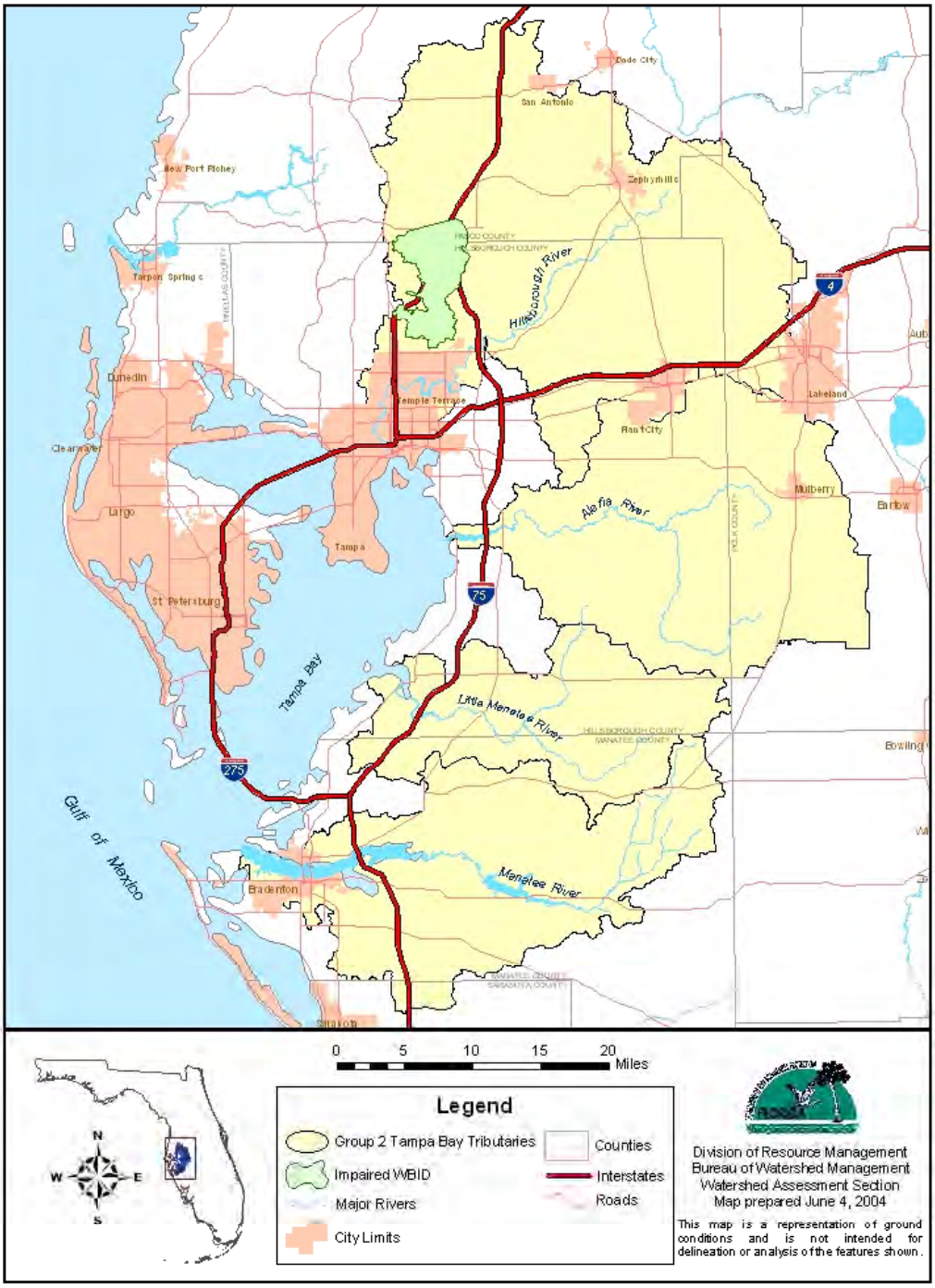

Figure 1. Location of Cypress Creek and Major Geopolitical Features in the Tampa Bay Tributaries Basin (Courtesy of Florida DEP).

WATER QUALITY STANDARD AND TARGET IDENTIFICATION

Dissolved Oxygen (DO) shall not be less than 5.0 milligrams/L in a 24-hour period and shall never be less than 4.0 milligrams/L. Normal daily and seasonal fluctuations above these levels shall be maintained (FAC 62-3-2.530 (12)).

WATER QUALITY AND ENVIRONMENTAL DATA

Dissolved oxygen data used in the assessment of this impaired waterbody was obtained from water quality stations listed in Table 1. A summary analysis of this data is presented in Table 2. Figure 2 illustrates DO data from all stations in relation to the Florida criteria. There were 428 violations of the DO criteria out of 472 measurements, or 91 percent. This indicates that EPA has to develop a TMDL for Cypress Creek.

Table 1. Water quality monitoring stations in WBID 1402

Station number	Station Name	First Date	Last Date
21FLTPA 281114168224966	cc-2 cypress creek	3/26/2002	8/7/2002
21FLTPA 28051888224293	cc-1 cypress creek	3/26/2002	8/7/2002
21FLKWATHIL-CYREEK122-	hillsborough-cypress creek-122-3	12/14/1999	12/4/2002
21FLKWATHIL-CYREEK122-	hillsborough-cypress creek-122-2	12/14/1999	12/4/2002
21FLKWATHIL-CYREEK122-	hillsborough-cypress creek-122-1	12/14/1999	12/4/2002
21FLKWATHIL-CYREEK107-	hillsborough-cypress creek-107-3	8/30/1999	12/7/2001
21FLKWATHIL-CYREEK107-	hillsborough-cypress creek-107-2	8/30/1999	12/7/2001
21FLKWATHIL-CYREEK107-	hillsborough-cypress creek-107-1	8/30/1999	12/7/2001
21FLHILL24030047	cypress creek at sr581	01/23/1996	12/8/1998
21FLHILL120	cypress creek at sr 581	1/19/1999	11/19/2002
21FLGW 7639	swb-sl-1035	7/19/2000	7/19/2000
112WRD 02303800	cypress creek nr sulphur springs, fla.	3/7/1991	9/20/2001
112WRD 02303420	cypress creek at worthington gardens, fla.	3/6/1991	9/10/2001

Table 2. Summary of data for Cypress Creek WBID 1402

Parameter	Obs	Max	Min	Mean	StDev	Violations	Florida Criteria
Dissolved Oxygen (mg/l)	472	12.59	0.10	2.68	1.69	428	5

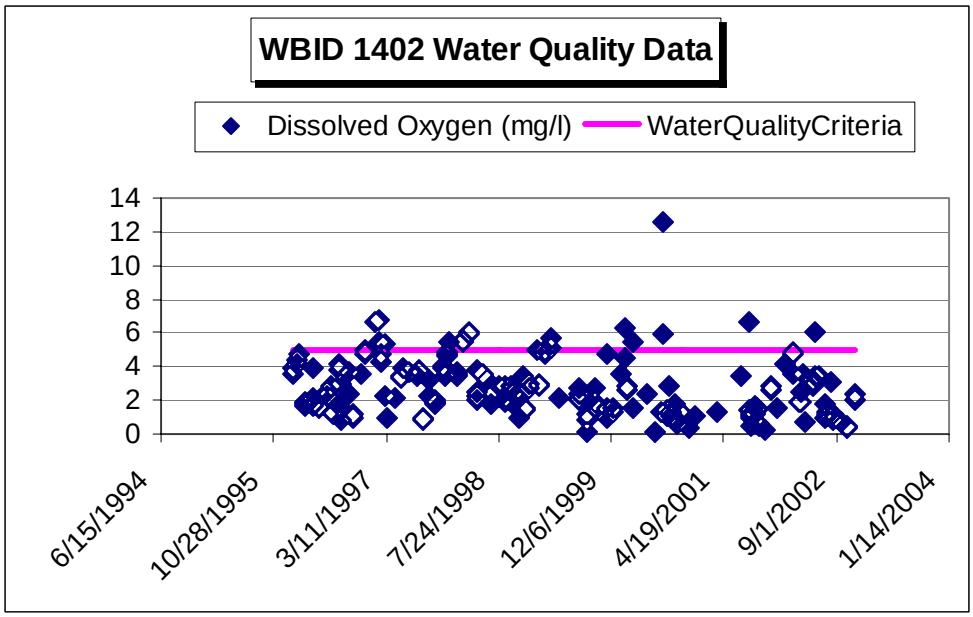

Figure 2. Dissolved Oxygen concentrations measured in Cypress Creek

SOURCE ASSESSMENT

Low DO in water bodies may be associated with high BOD loads and excessive nutrient enrichment from urban areas. Excessive nutrient enrichment contributes to DO depletion via algae, and plant growth and decay. However, there are no point sources of nutrients or BOD in the Cypress Creek contributing areas. Another potential source of nutrients in Cypress Creek is groundwater and overland flow from development and agriculture (non point sources). The WBID is covered by four MS4 permit areas including Wesley Chapel, Land O'Lakes, Tampa, and Lutz but the Creek was not listed for nutrients or BOD impairment. Also, an assessment of BOD values collected from 1991 to 2002 yielded a median value of 1.4 mg/L, which is below the 70th percentile (2.0 mg/L) of state stream data. A value lower than 2 mg/L indicates that the stream meets its designated uses. In conclusion, BOD and nutrients are not the causes of DO depletion in Cypress Creek.

Data on additional parameters are shown in Figure 2 through Figure 7. Nutrient values are not elevated and have average nitrate/nitrite of 0.06mg/l, ammonia of 0.11 mg/l, and total phosphorus of 0.070 mg/l. These values, coupled with a low average chlorophyll-a concentration (5.3 µg/l), are evidence that nutrient enrichment is not a problem in Cypress Creek. In comparison, statewide averages for nitrate/nitrite, ammonia, and total phosphorus are 0.100 mg/l, 0.04 mg/l and 0.09 mg/l, respectively (Ocklawaha Basin Status Report, DEP, Nov. 2001). Also, the difference between average total nitrogen and the sum of nitrate/nitrite and ammonia appears to be relatively high, an indication of a large organic nitrogen component characteristic of black water streams.

Low DO occurrences in Cypress Creek are most likely due to high content of naturally occurring oxygen demand organic substances in riparian wetlands. Warm temperatures promote algae and plant growth and decay in these wetlands, which ultimately results in pools of waters of low DO draining into the stream. Also, low stream gradient, riparian swamps, and darkly stained water from tannins that color water in Cypress Creek are all characteristics of low-DO black water streams. Published studies have reported that this condition occurs in southern blackwater streams (Benke et al. 1984, Edwards and Meyer 1987, Hughes et al. 2000, USEPA 1986**).**

Non-point sources are conveyed by overland flow and are evaluated by examining the landuse in the watershed contributing to the impaired stream. As shown above, Cypress Creek has a substantial amount of residential (17%) and agricultural land (13%). Excessive nutrients can contribute to DO depletion through algae, and plant growth and decay. However, stream nutrient enrichment from these sources can be considered relatively low because, 1) the stream is protected from direct runoff by the surrounding swamps/wetlands (see land use distributions, Figure 8) Cypress Creek flow regime and characteristics mentioned above point to natural conditions of low DO values observed in its waters.

TMDL DEVELOPMENT

Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating loads among all of the known pollutant sources. A TMDL is expressed as the sum of all point source loads (Waste Load Allocations, or WLAs), nonpoint source loads (Load Allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality. The equation is:

$$\mathbf{TMDL = \sum WLA + \sum LA + MOS}$$

in which,
TMDL = Total maximum daily load
WLA = Waste load allocation
LA = Load allocation
MOS = margin of safety

TMDL Computations

Dissolved oxygen TMDL for Cypress Creek is computed as the amount of DO needed to bring the current DO levels to the standard of 5 mg/L. The average DO value for Cypress Creek is 2.68 mg/L. Its average flow obtained from data measured during the 1994-1999 period is 57.90 cubic feet per second (cfs). TMDL computations are as follows:

Average DO concentration needed to bring the system to 5 mg/L=

5 mg/L – 2.68 mg/l = 2.32 mg/L

Average amount of DO needed to bring Cypress Creek up to 5 mg/L=
DO concentration x Flow
2.32 mg/L x 57.90 ft^3/second x 28.32 = 3803.74 mg/s

28.32 is the conversion factor from ft^3 to liters.

Since 1 mg/s is equal to 0.19 lbs/day,

DO needed to bring the system to the standard is therefore:
3803.74 x 0.19 = 724. 53 lbs/day

The TMDL components are presented in Table below.

Table 3. TMDLs for Cypress Creek (WBID #1402)

WBID	Parameter	TMDL DO Added (lb/day)	LA (lb/day)	WLA[1]		MOS[2] (lb/day)
				Continuous (lb/day)	MS4	
1402	Dissolved Oxygen	796.98	724.53	0	0	72.5

[1]WLAs is broken out into two separate categories for wastewater discharges and stormwater discharges regulated under the NPDES program. There were no point sources discharging to Cypress Creek. Waste load allocation from stormwater discharges are considered zero since BOD and nutrients appear not to be sources of DO impairment in the Creek.

[2]Margin of safety (MOS). MOS is explicitly assigned 10% reduction in DO loading numerical target.

CRITICAL CONDITIONS

Cypress Creek TMDL for DO is based on averages rather than variations over a given time period. This is because the approach used to compute TMDL is based on long-term rather than short-term assessments, and that the methodology to determine the impairment in the Creek was based on annual basis and therefore required data collected over a long time period.

RECOMMENDATIONS

It is recommended that the State not allow any point sources of BOD and nutrients to discharge to the Creek. The state should consider developing site-specific dissolved oxygen criteria.

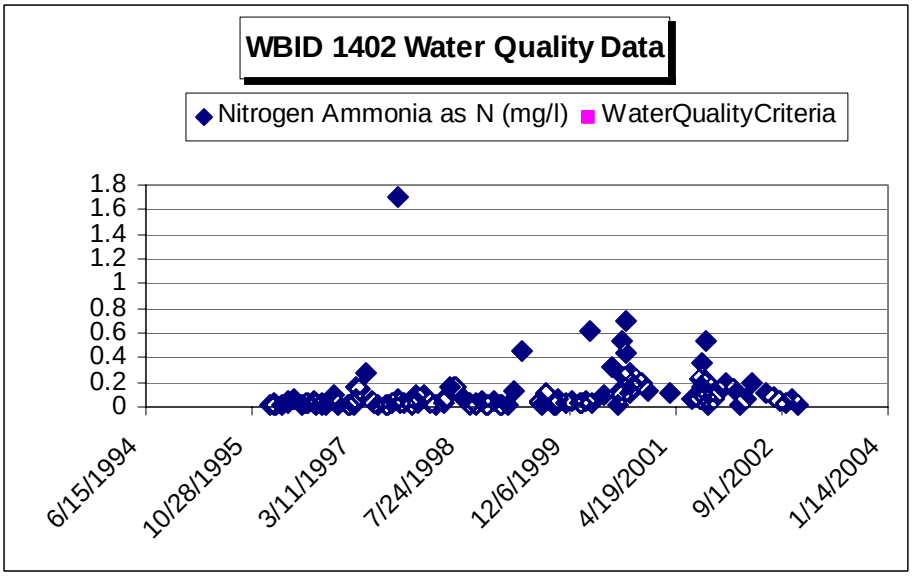

Figure 3. Ammonia concentrations measured in Cypress Creek

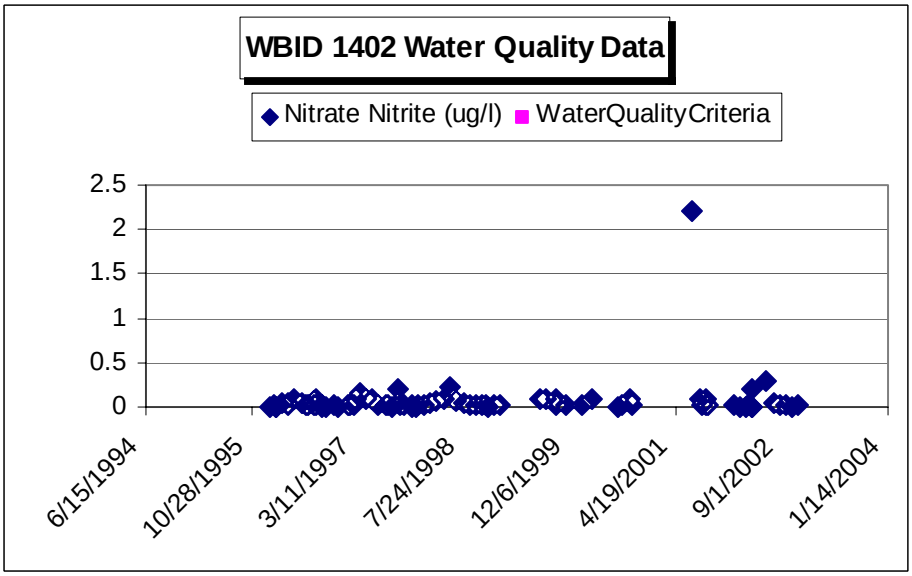

Figure 4. Nitrate/nitrite concentrations measured in Cypress Creek

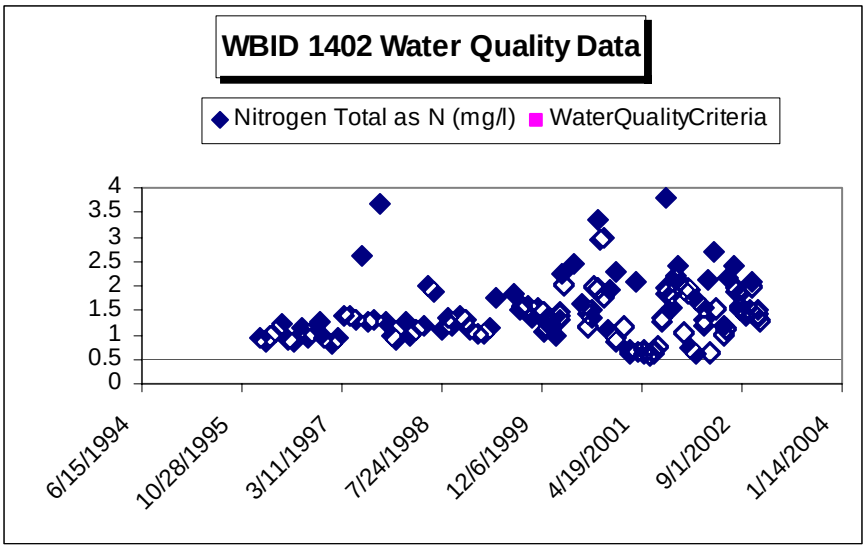

Figure 5. Total nitrogen concentrations measured in Cypress Creek

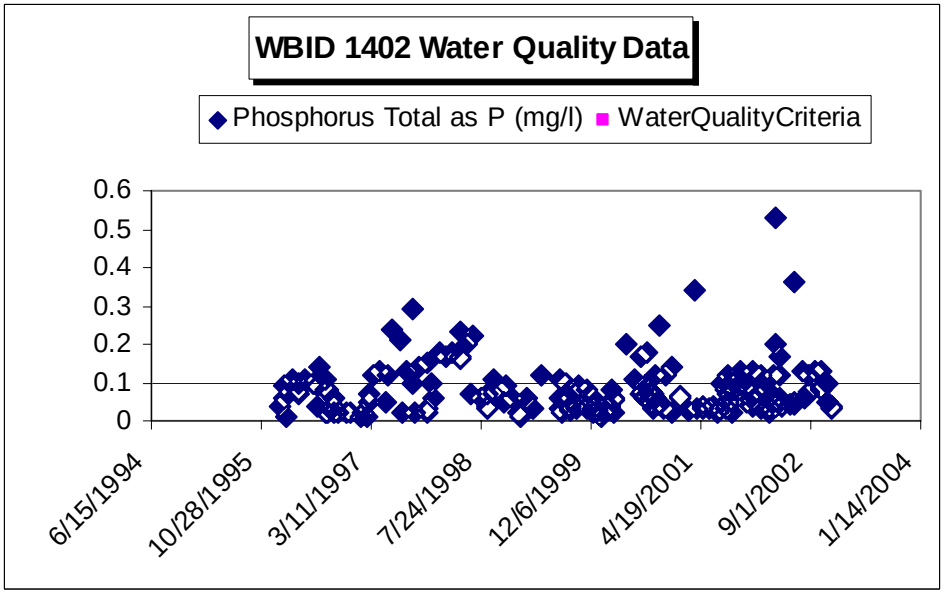

Figure 6. Total phosphorus concentrations measured in Cypress Creek

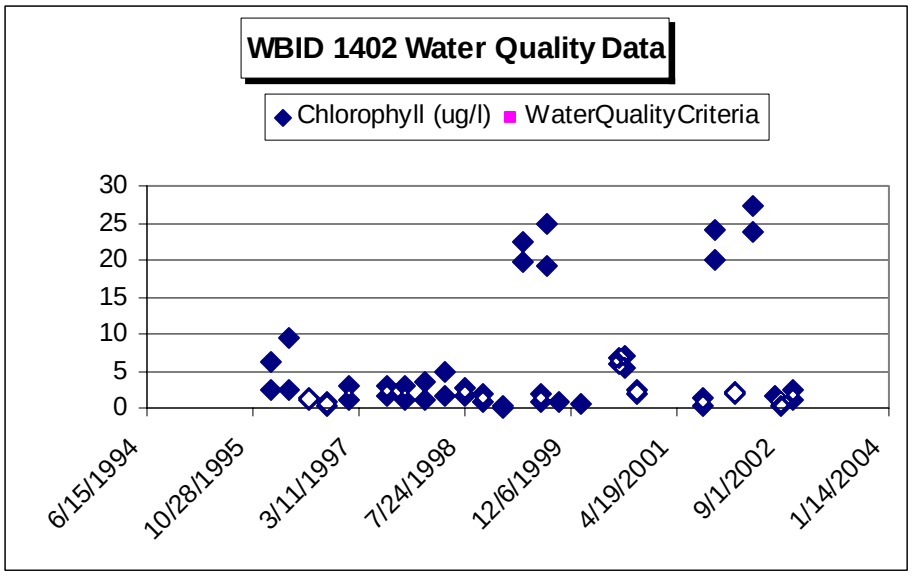

Figure 7. Chlorophyll-a measurements in Cypress Creek

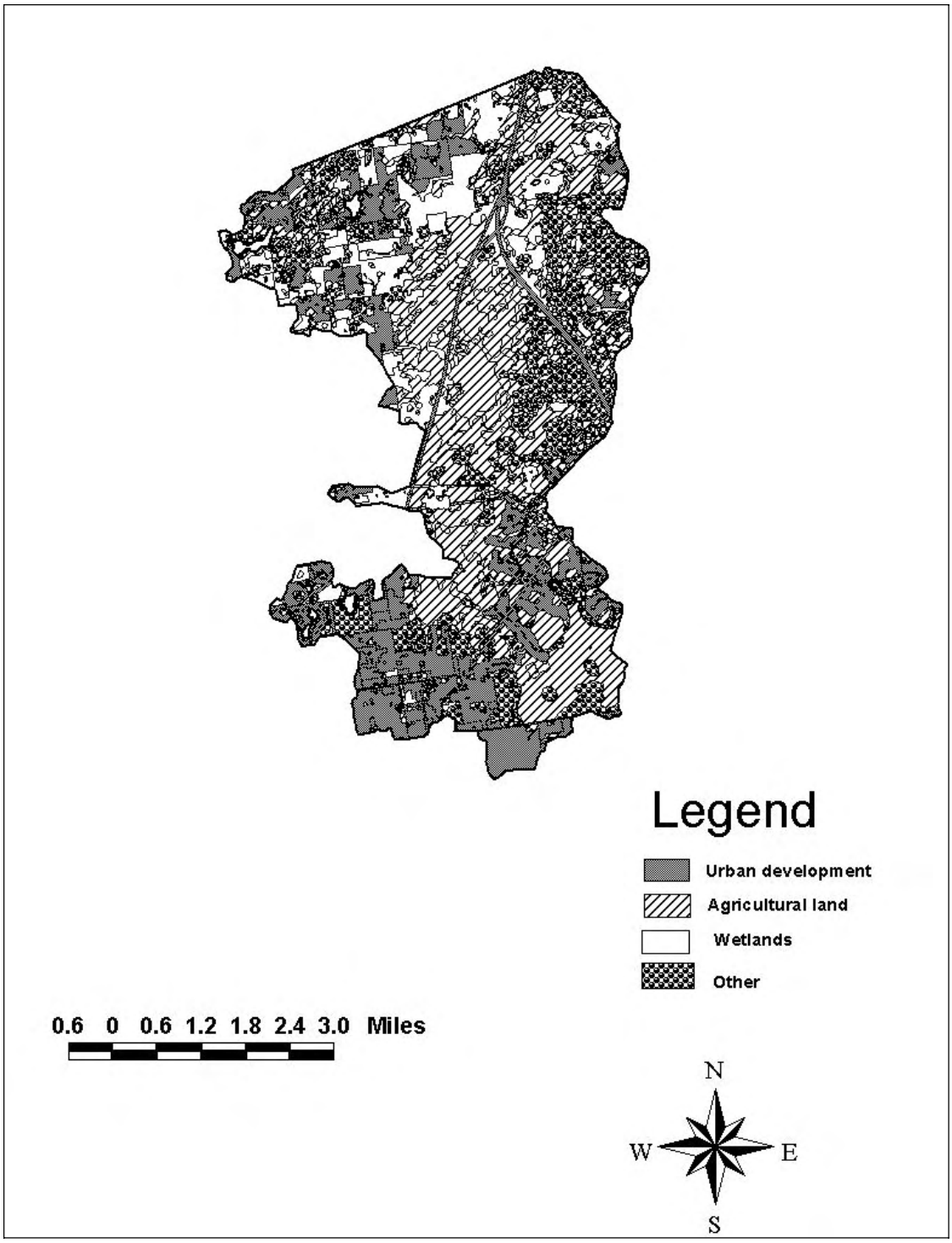

Figure 8. Land use distribution in Cypress Creek

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