

Evaluation of Florida Benchmark Site Exceedance Frequency Relative to EPA’s Proposed In-stream Protection Values (IPVs) and Downstream Protection Values (DPVs)

**Prepared by the Bureau of Assessment and Restoration Support
Florida Department of Environmental Protection**

February 1, 2010

FDEP analyzed whether the healthiest, most preserved streams in the State would attain the numeric nutrient criteria proposed by EPA on January 14th, 2010. These streams, known as reference or benchmark sites, have healthy biological conditions and are characterized by minimal human activities that would contribute nutrients to the waterbody (see *Appendix B-17* of EPA’s Technical Support Document associated with the proposed rule). The healthy biological condition was measured by DEP scientists using ecologically sensitive metrics that analyze the algae and invertebrate community composition. An independent scientific review was conducted on DEP’s reference site selection process. Overall the reviewers concluded that DEP’s process for identifying healthy and minimally disturbed streams was valid and rigorous (see *Peer Review Comments Final: External Peer Review of EPA’s Proposed Methods and Approaches for Developing Numeric Nutrient Criteria for Florida’s Inland Waters* of EPA’s Technical Support Document associated with the proposed rule). DEP is confident that the designated use (a healthy, well balanced aquatic community) is supported at these reference sites. Determining if these reference streams would “pass” or “fail” EPA’s proposed criteria provides insight regarding a) their relationship to the health of the streams and b) their relationship to human induced nutrient enrichment in waterbodies.

A description of the methods used to evaluate whether these streams would attain EPA’s in-stream protection values (IPV) and downstream protection values (DPV), and the results of that evaluation, are contained below.

In-Stream Protection Values

- DEP’s reference sites were categorized using EPA’s Nutrient Watershed Regions.
- The applicable EPA in-stream protection value (IPV) criterion for total nitrogen (TN) and total phosphorus (TP) for streams within each respective nutrient watershed region is shown in the following table:

Nutrient Watershed	Instream Protection Value Criteria TN (mg/L) ^a	Instream Protection Value Criteria TP (mg/L) ^a
Panhandle ^b	0.824	0.043
Bone Valley ^c	1.798	0.739
Peninsula ^d	1.205	0.107
North Central ^e	1.479	0.359

- These values are based on an annual geometric mean not to be surpassed more than once in a three year period. In addition, the long-term average of annual geometric mean values shall not surpass the listed concentration values.
- The assessment methodology in EPA’s proposal appears to be tied to a site, although there is an allowance for the IWR methodology. DEP’s interpretation is that the assessment spatial scale will depend on application.
- EPA’s proposal did not specify a minimum annual sample size; therefore, no minimum annual sample size was applied to annual geometric mean calculations.
- The once in a three-year exceedance test was assessed for all reference sites with at least either a) three continuous years of data; or, b) two continuous years of data if there were either zero excursions or 2 excursions over the two-year period. This second approach works because:
 - A site (WBID) with zero excursions in a two-year period will always pass the three year test.
 - A site (WBID) with 2 excursions in a two-year period will always fail the three year test.
 - The status of a site (WBID) with only 1 excursion in a two-year period is uncertain; therefore, any site with 1 exceedance over a two-year period was excluded from the calculations.
 - Sites (WBIDs) with only one year of data were not included in the calculations.
 - Sites (WBIDs) with three continuous years of data could be fully assessed and were included in all analyses.
- Long-term average geometric mean concentrations were calculated for sites with at least three years of data.

The percentage of DEP reference sites that exceed EPA’s TP IPV criteria are summarized in the following table (to calculate the percent that attain the criteria, subtract the percentage provided from 100%):

Nutrient Region	Percent of DEP Reference Sites that Fail EPA Criteria Based on 1 in 3 Year Exceedance ^a		Percent of DEP Reference Sites that Fail EPA Criteria Based on Long-term Average Exceedance ^b	
	Sites	WBIDS	Sites	WBIDS
Bone Valley	0.0%	0.0%	0.0%	0.0%
North Central	4.2%	6.3%	4.2%	10.0%
Panhandle	46.2%	39.4%	48.3%	42.4%
Peninsula	20.0%	17.4%	11.1%	9.1%
Statewide Total	24.0%	22.0%	19.8%	19.8%

^a Only sites (WBIDs) with sufficient data for the assessment were included percentage calculations.

^b Only sites (WBIDs) with at least three years of data were included in the percentage calculations

The percentage of DEP reference sites that exceed EPA’s **TN** IPV criteria are summarized in the following table (to calculate the percent that attain the criteria, subtract the percentage provided from 100%):

Nutrient Region	Percent of DEP Reference Sites that Fail EPA Criteria Based on 1 in 3 Year Exceedance ^a		Percent of DEP Reference Sites that Fail EPA Criteria Based on Long-term Average Exceedance ^b	
	Sites	WBIDS	Sites	WBIDS
Bone Valley	0.0%	0.0%	0.0%	0.0%
North Central	47.6%	46.7%	16.7%	15.0%
Panhandle	26.7%	18.2%	15.6%	23.5%
Peninsula	40.4%	41.5%	37.2%	31.8%
Statewide Total	34.7%	31.9%	24.5%	24.5%

^a Only sites (WBIDS) with sufficient data for the assessment were included in the percentage calculations.

^b Only sites (WBIDS) with at least three years of data were included in the percentage calculations.

Downstream Protection Values (DPVs)

- EPA provided interim Downstream Protection Values (DPVs) for the protection of estuarine waters for total nitrogen only that were based on model estimates of the allowable loading to estuaries. EPA established the allowable loading as the mid-point between the estimated nutrient loadings without human sources of nutrients (other than atmospheric deposition) and the estimated current loadings.
- DEP’s benchmark sites were geo-referenced to EPA’s DPVs based on the information presented in Appendix B-18 of EPA’s technical support document.
- Because EPA did not specify the duration and frequency requirements for the DPV, we needed to decide on the most appropriate way to assess the DPV. We calculated both the long-term average of the geometric means of each site and the long-term arithmetic average of each site because the derivation of the DPVs results in a maximum flow-average (flow-weighted) TN concentration for a specific stream reach.
 - Flow-weighted means are not directly comparable to the geometric means used for the IPV. It is not possible to make a simple comparison between the DPV and IPV for a given segment. The stringency of the DPV relative to the IPV will vary depending on the flow during a given assessment period.
 - As a general rule, flow-weighted averages are more comparable to an arithmetic average than to geometric means.
 - Based on the derivation methodology, the DPVs are best characterized as long-term averages; therefore, long-term average TN concentrations were calculated for reference sites (WBIDS) with at least three years of data consistent with the IPV calculations.
- The long-term average geometric means and arithmetic average TN concentrations by site and WBID were compared to the geo-referenced DPVs.
- The DPVs represent a nutrient concentration delivered from a stream reach, thus the WBID level assessment may be the most consistent with the derivation.

The percentage of DEP reference sites exceeding EPA’s TN DPV criteria are summarized in the following table (to calculate the percent that attain the criteria, subtract the percentage provided from 100%):

Nutrient Region	Percent of DEP Reference Sites that Fail EPA Criteria Based on the Long-term Average Geometric Mean Exceeding the DPV		Percent of DEP Reference Sites that Fail EPA Criteria Based on the Long-term Arithmetic Average Exceeding the DPV	
	Percent Sites ^a	Percent WBIDs ^a	Sites ^a	WBIDs ^a
Bone Valley	33.3%	50.0%	33.3%	50.0%
North Central	100.0%	100.0%	100.0%	100.0%
Panhandle	75.9%	73.3%	79.3%	75.6%
Peninsula	81.1%	67.4%	83.8%	72.1%
Statewide Total	82.8%	75.0%	84.9%	77.7%

^a Only sites (WBIDs) with at least three years of data were included in the percentage calculations.

Waterbodies in Preserved Areas

Many DEP reference sites are located in fully protected and publically-owned lands. Department staff conducted an independent analysis of reference sites in these areas, and the following waterbodies did not attain the proposed criteria (see attached summary for full analysis).

Waterbodies Failing to Meet EPA’s Proposed Nutrient Criteria	WBID Number	WBID within Park/Preserve/Conservation Areas
Econfina River	3402	Econfina River State Park
Deer Prairie Creek	1978	Myakka River State Park
Little Withlacoochee	1381	Green Swamp Florida Forever Lands/Withlacoochee State Forests/Richloam Wildlife Management Area
Blackwater River	24	Blackwater River State Park; Blackwater Wildlife Management Area; portions of Florida Forever Lands and Outstanding Florida Waters
Big Coldwater Creek	18	OFW is located in WBID but is for Blackwater River; Some Florida Forever and a small portion of the WBID is State Forest.
New River	3506	Palatka to Lake Butler Trail
Black Water Creek	2929A	Seminole State Forest and Lower Wekiva River Preserve State Park

Conclusions

EPA's In-stream Protection Values

This analysis indicates that, in certain areas of the State, many of Florida's reference streams do not attain EPA's proposed in-stream protection values and would be deemed impaired. In particular, 40% of the DEP reference streams in the Panhandle will fail EPA's proposed TP criteria, and 47% of the reference streams in the North Central and Peninsula Nutrient Watershed Regions will fail EPA's proposed TN criteria. Conversely, the Bone Valley Region did not contain any failures. However, this is likely due to two factors. First, there are only three DEP reference streams in the region, meaning the small sample size may not be representative. Second, EPA's site selection methodology resulted in the use of data from Bone Valley streams with more anthropogenic nutrient enrichment than the reference streams. The fact that, in some areas of the State, EPA's proposed IPV's result in relatively high nonattainment percentages in Florida's reference streams indicates a need to reexamine the derivation methodology.

EPA's Downstream Protection Values

The vast majority (up to 85%) of Florida's reference streams do not attain EPA's proposed Downstream Protection Values and would be deemed impaired. This finding alone indicates a need to reexamine the derivation methodology for the DPVs because the reference streams have been documented to meet aquatic life uses. Further, streams that do not experience nutrient enrichment from human activities would not be expected to cause impacts or enrichment in the aquatic ecosystem of estuaries.

Attachment: Evaluation of water quality in waterbodies within Park/Preserve/Conservation areas.

Waterbody Name	WBID Number	WBID within Park/Preserve/ Conservation Areas	TN IPV Criterion (mg/L)	TN DPV Criterion (mg/L)	TN 10 yr Average based of annual Geometric Means (mg/L)	TN Annual Geo Mean Values (mg/L)	TN Exceeds Criteria (IPV, IPV-LT or DPV)?	TP IPV Criterion (mg/L)	TP 10 yr Average based of annual Geometric Means (mg/L)	TP Annual Geo Mean Values (mg/L)	TP Exceeds Criteria (IPV or IPV-LT)?
Econfina River	3402	Econfina River State Park	0.824	0.53	0.773	2000- 0.332 2001 - 0.500 2002 - 0.500 2003 - 1.511 2004 - 1.190 2005 - 1.023 2006 - 0.738 2007 - 0.503 2008 - 0.659	IPV & DPV	0.043	0.090	2000- 0.075 2001 - 0.101 2002 - 0.101 2003 - 0.093 2004 - 0.106 2005 - 0.081 2006 - 0.072 2007 - 0.062 2008 - 0.092 2009 - 0.119	IPV & IPV-LT
Deer Prairie Creek	1978	Myakka River State Park	1.798	0.95	1.022	2000-1.374 2001-0.971 2002-0.993 2003-0.956 2004-1.116 2005-1.061 2006-0.933 2007-0.847 2008-0.950	DPV & IPV-LT	0.739	0.286	2000-0.515 2001-0.368 2002-0.202 2003-0.196 2004-0.211 2005-0.096 2006-0.205 2007-0.376 2008-0.404	No

Waterbody Name	WBID Number	WBID within Park/Preserve/Conservation Areas	TN IPV Criterion (mg/L)	TN DPV Criterion (mg/L)	TN 10 yr Average based of annual Geometric Means (mg/L)	TN Annual Geo Mean Values (mg/L)	TN Exceeds Criteria (IPV, IPV-LT or DPV)?	TP IPV Criterion (mg/L)	TP 10 yr Average based of annual Geometric Means (mg/L)	TP Annual Geo Mean Values (mg/L)	TP Exceeds Criteria (IPV or IPV-LT)?
Little Withlacoochee	1381	Green Swamp Florida Forever Lands/Withlacoochee State Forests/Richloam Wildlife Management Area	1.205	1.41	1.186	2000 - 0.434 2001 - 1.703 2002 - 1.619 2003 - 1.303 2004 - 1.202 2005 - 1.123 2006 - 0.674 2007 - 0.974 2008 - 2.240 2009 - 0.592	IPV & DPV	0.107	0.051	2000 - 0.042 2001 - 0.071 2002 - 0.044 2003 - 0.043 2004 - 0.069 2005 - 0.038 2006 - 0.039 2007 - 0.087 2008 - 0.030 2009 - 0.049	No
Loxahatchee River (NW Fork)	3230A	Jonathan Dickinson State Park	1.205	*N/A	1.080	2000 - 1.315 2001 - 1.122 2002 - 0.584 2003 - 1.038 2004 - 1.036 2005 - 1.368 2007 - 1.105	No	0.107	0.048	2000 - 0.046 2001 - 0.050 2002 - 0.044 2003 - 0.044 2004 - 0.051 2005 - 0.036 2007 - 0.063	No
Blackwater River	24	Blackwater River State Park; Blackwater Wildlife Management Area; portions of Florida Forever Lands and OFWs	0.824	0.43	0.470	2000- 0.74 2001- 0.44 2003- 0.33 2007- 0.38	DPV	0.043	0.022	2000- 0.037 2001- 0.029 2003- 0.014 2007- 0.006	No

Waterbody Name	WBID Number	WBID within Park/Preserve/Conservation Areas	TN IPV Criterion (mg/L)	TN DPV Criterion (mg/L)	TN 10 yr Average based of annual Geometric Means (mg/L)	TN Annual Geo Mean Values (mg/L)	TN Exceeds Criteria (IPV, IPV-LT or DPV)?	TP IPV Criterion (mg/L)	TP 10 yr Average based of annual Geometric Means (mg/L)	TP Annual Geo Mean Values (mg/L)	TP Exceeds Criteria (IPV or IPV-LT)?
Big Coldwater Creek	18	OFW is located in WBID but is for Blackwater River; Some Florida Forever and a small portion of the WBID is State Forest.	0.824	0.43	1.002	2000 - 1.242 2001 - 1.065 2002 - 0.979 2003 - 0.857 2004 - 1.000 2005 - 0.810 2006 - 0.968 2007 - 1.108 2008 - 1.042 2009 - 0.947	IPV, IPV-LT & DPV	0.043	0.010	2000 - 0.006 2001 - 0.010 2002 - 0.012 2003 - 0.009 2004 - 0.008 2005 - 0.014 2006 - 0.009 2007 - 0.009 2008 - 0.010 2009 - 0.010	No
New River	3506	Palatka to Lake Butler Trail	1.479	0.61	1.350	2000-1.03 2001-1.49 2002-1.44 2003-1.74 2004-1.74 2005-1.65 2006-0.91 2007-0.80	IPV & DPV	0.359	0.180	2000-0.24 2001-0.21 2003-0.18 2004-0.16 2005-0.09 2006-0.15 2007-0.25	No
Black Water Creek	2929A	Seminole State Forest and Lower Wekiva River Preserve State Park	1.205	0.7	1.440	2000-1.24 2001-1.58 2002-1.74 2003-1.52 2004-1.76 2005-1.44 2006-1.27 2007-1.09 2008-1.34	IPV, IPV-LT & DPV	0.107	0.054	2000-0.05 2001-0.05 2002-0.05 2003-0.05 2004-0.08 2005-0.07 2006-0.06 2007-0.05 2008-0.03	No

*N/A – No DPV reported for WBID in Appendix B-19 (EPA’s Proposed Nutrient Criteria for FI Inland Surface Fresh Waters)
IPV – In-Stream Protection Value; IPV-LT – Long-term Average In-stream Protection Value
DPV – Downstream Protection Value

