



*Florida Department of
Environmental Protection*

EPA's Proposed Numeric Nutrient Criteria for Lakes and Flowing Waters: Florida's Experience

Proposed: January 26th, 2010

*Prepared by: Florida Department of Environmental Protection, Division of
Environmental Assessment and Restoration*



Background - EPA's Proposal

- Proposal Includes:
 - a) Lake, stream, and canal criteria for the protection of aquatic life in each waterbody; and
 - b) Additional stream criteria for the protection of aquatic life in **downstream waterbodies**.
 - *In any given waterbody, the more stringent criteria applies.*
- Contains Additional Provisions including the Establishment of Restoration Uses
- Proposed with an associated 60 day comment period.
- Scheduled for finalization October 15, 2010





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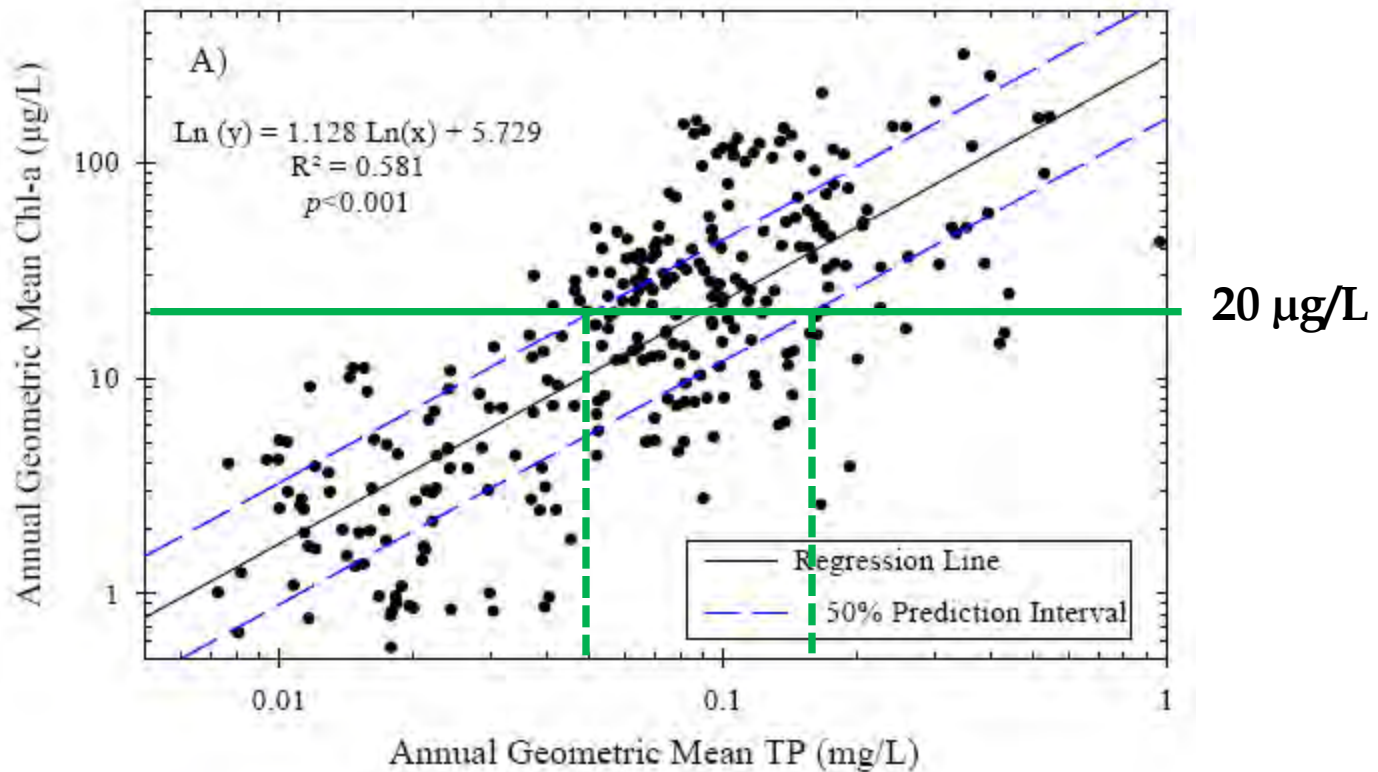
Criteria for Lakes

EPA Derivation and Application



Lakes: In-stream Protection Values

Derivation of criteria values that prevent excess phytoplankton.





Lakes: In-stream Protection Values

Establish Chlorophyll *a* threshold to prevent excess algae in the form of phytoplankton.

A	B	C		D	E		F
Long Term Average Lake Color and Alkalinity	Chlorophyll <i>a</i> ^f (µg/L) ^a	Baseline Criteria ^b		Modified Criteria (within these bounds) ^c			
		TP (mg/L) ^a	TN (mg/L) ^a	TP (mg/L) ^a	TN (mg/L) ^a	TP (mg/L) ^a	TN (mg/L) ^a
Colored Lakes > 40 PCU	20	0.050	1.23	0.050-0.157	1.23-2.25		
Clear Lakes, Alkaline ≤ 40 PCU ^d and > 50 mg/L CaCO ₃ ^e	20	0.030	1.00	0.030-0.087	1.00-1.81		
Clear Lakes, Acidic ≤ 40 PCU ^d and ≤ 50 mg/L CaCO ₃ ^e	6	0.010	0.500	0.010-0.030	0.500-0.900		

Criteria may be modified within these bounds if Chlorophyll *a* is attained.

May not be modified above applicable stream criteria in outflow from lake.

Values are annual geometric means not to be surpassed more than once in a 3-year period. Long-term average of annual geometric means shall also not surpass the listed values.

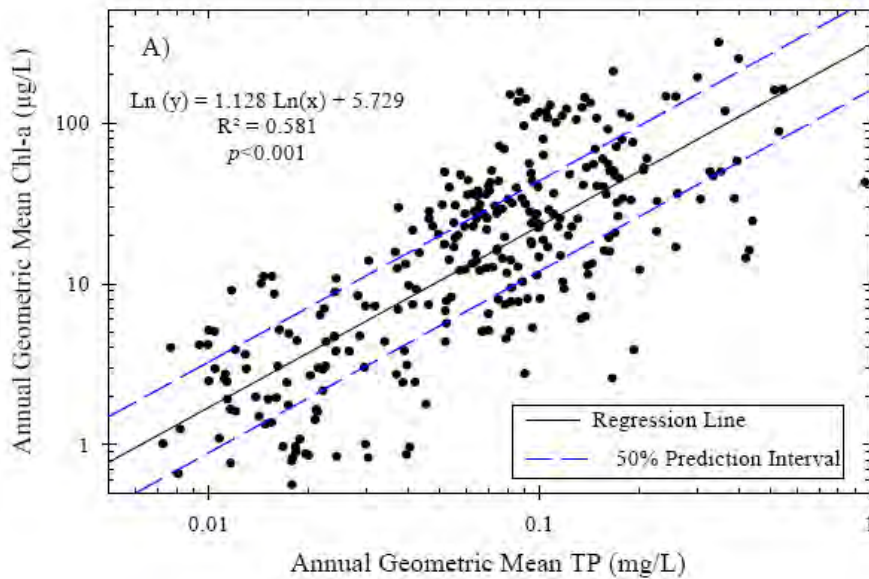




DEP Observations - Lake Criteria

- Overall methodology addresses observed variability
- EPA's Chlorophyll *a* Criteria (6 ug/l) for clear, acidic lakes is not linked to an adverse biological response
- Proposed alkalinity threshold of 50 mg/L CaCO₃ that defines clear, acidic lakes includes many lakes with naturally higher chlorophyll *a* values

Lake Criteria



Questions?

	B	C	D	E	F
	Chlorophyll a^f (µg/L) ^a	Baseline Criteria ^b		Modified Criteria (within these bounds) ^c	
		TP (mg/L) ^a	TN (mg/L) ^a	TP (mg/L) ^a	TN (mg/L) ^a
Colored Lakes > 40 PCU	20	0.050	1.23	0.050-0.157	1.23-2.25
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Criteria for Springs, Spring Runs, and Clear Streams

EPA Derivation and Application



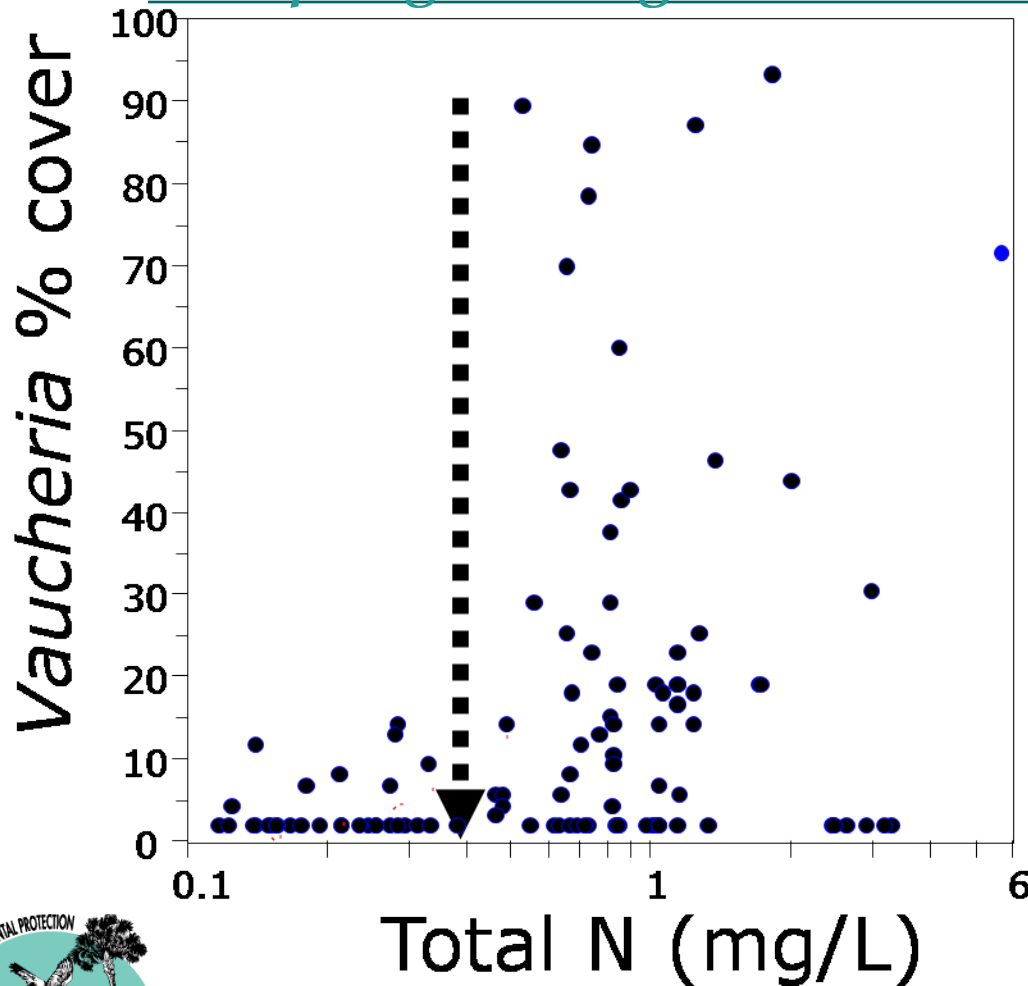
Clear Streams Criteria

- DEP has documented nuisance algal growth in clear streams due to nitrate enrichment





Field Studies Showed *Vaucheria* % Cover was Significantly Related to Springs Nitrogen Concentration



Excessive growth and cover of *Vaucheria* was found at sites with TN concentrations above 0.591 mg/L and **nitrate-nitrite concentrations at or above 0.454 mg/L.**





Spring/Clear Stream: In-Stream Protection Value

(3) *Criteria for springs, spring runs, and clear streams.* The applicable nitrate-nitrite criterion is 0.35 mg/L as an annual geometric mean not to be surpassed more than once in a three year period, nor surpassed as a long-term average of annual geometric mean values. In addition to this nitrate-nitrite criterion, criteria identified in paragraph (c)(2) of this section are applicable to clear streams.

95% confident that nuisance algal mats will be prevented at nitrate levels < 0.35 mg/L

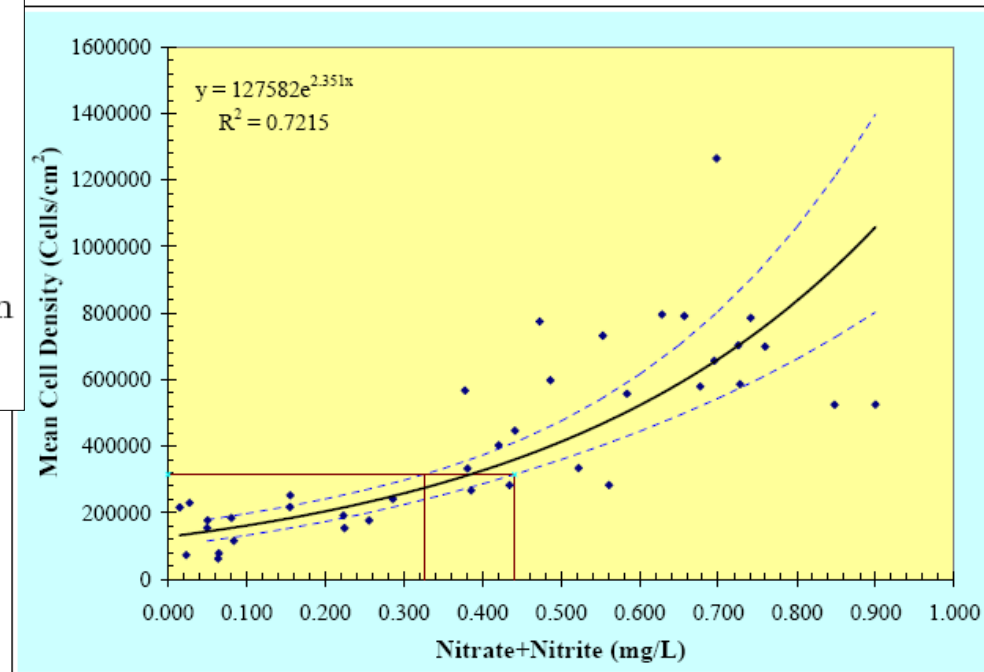


Figure 3-10. An example of the full-range confidence interval procedure to develop a nitrate plus nitrite criterion. The full confidence interval procedure resulted in a protective threshold of 0.33 mg/L. The upper half of confidence interval method yielded a protective threshold of 0.38 mg/L. The average of these complementary methods resulted in the final protective threshold of 0.35 mg/L.



DEP Observations - Spring Criteria

- Concentration endpoint (criterion) based on observed biological response
- Not consistent with the timeframes of observed biological effects contained in the studies used to derive criteria



Spring/Clear Stream Criteria

Questions?

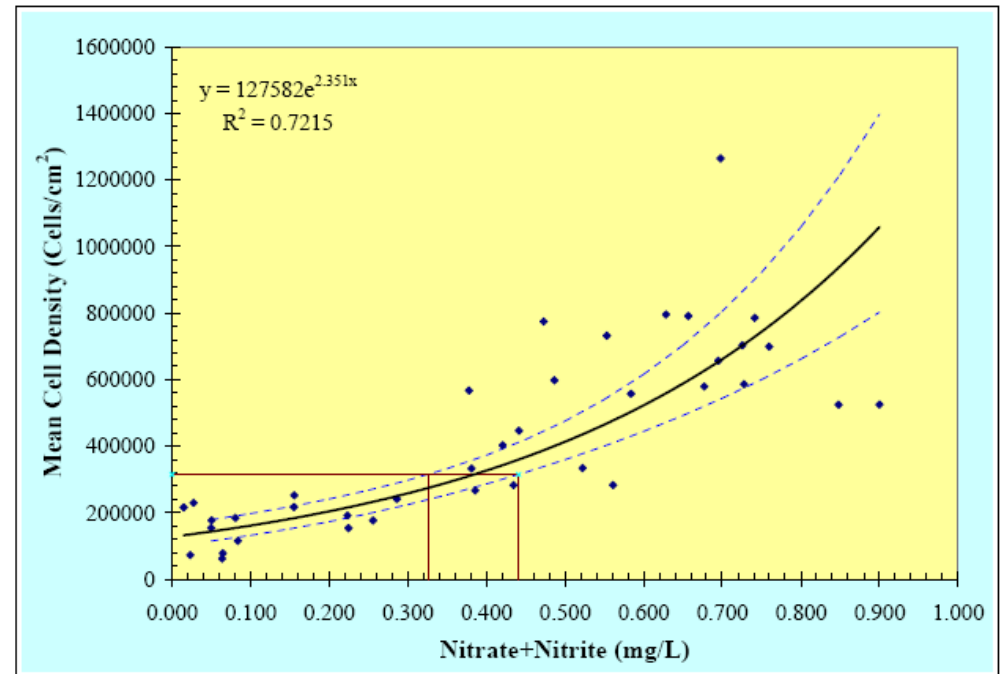


Figure 3-10. An example of the full-range confidence interval procedure to develop a nitrate plus nitrite criterion. The full confidence interval procedure resulted in a protective threshold of 0.33 mg/L. The upper half of confidence interval method yielded a protective threshold of 0.38 mg/L. The average of these complementary methods resulted in the final protective threshold of 0.35 mg/L.



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Criteria for Streams

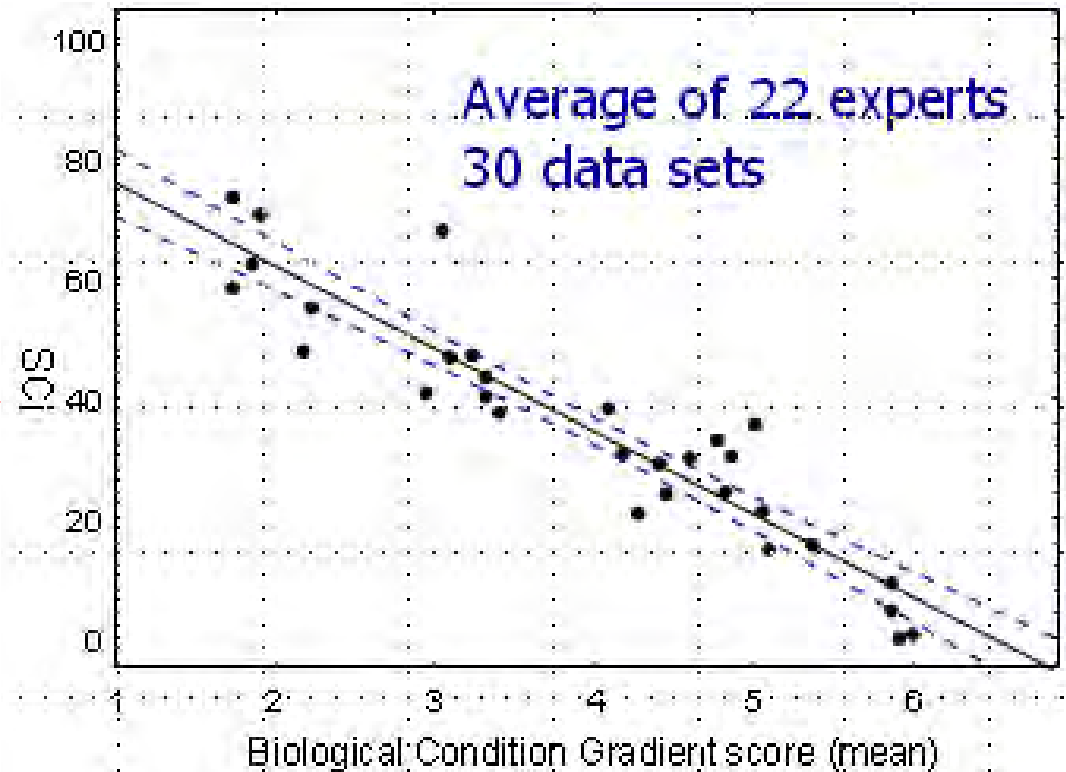
*- Total Nitrogen and Total Phosphorus
In-Stream Protection Values*

EPA Derivation and Application



Streams: In-stream Protection Values

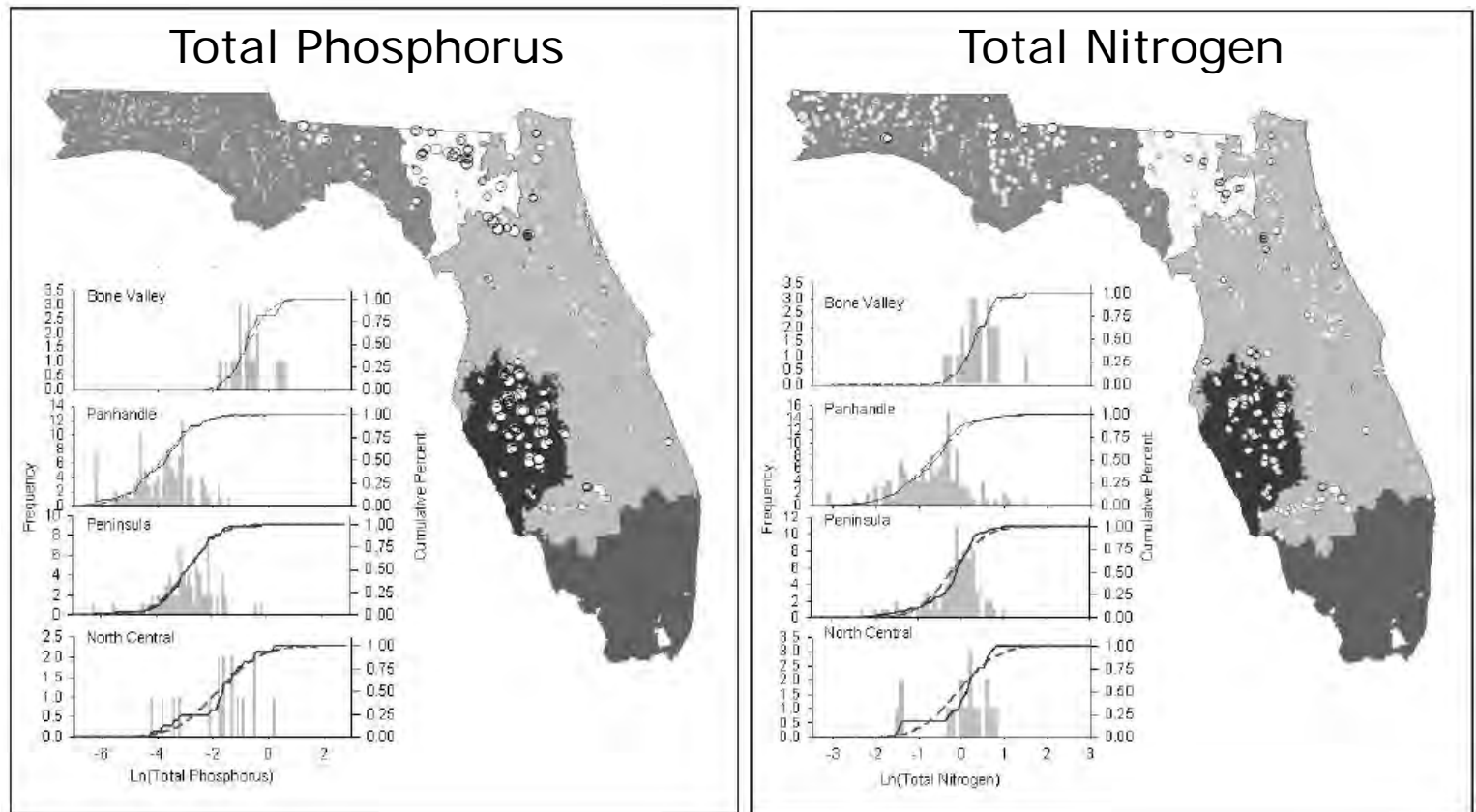
EPA identified all biologically healthy locations in rivers and streams.





Streams: In-stream Protection Values

EPA used the 75th Percentile Concentration of all Biologically Healthy Sites as Proposed Criteria Threshold



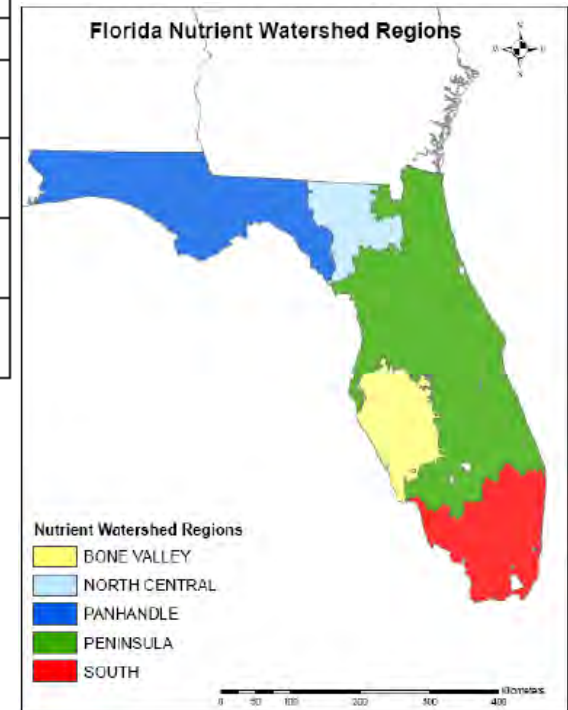
Dose-response relationships in streams were very weak.



Streams: *In-stream Protection Values*

Nutrient Watershed Region	Instream Protection Value Criteria	
	TN (mg/L) ^a	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

Expressed as annual geometric mean not to be surpassed more than once in a 3-year period. The long-term average of annual geometric means shall not surpass the criteria.





Canals: *In-stream Protection Values*

75th Percentile Concentration of all Sites not Listed as Impaired

- Set criteria for Total Phosphorus (0.042 mg/L), Total Nitrogen (1.6 mg/L), & Chlorophyll *a* (4 ug/L)
- Applies to all canals in South Florida Bioregion, except for within the Everglades Protection Area, where TP criterion of 0.010 mg/L applies
- Also expressed as annual geometric means not to be surpassed more than once in a 3-year period

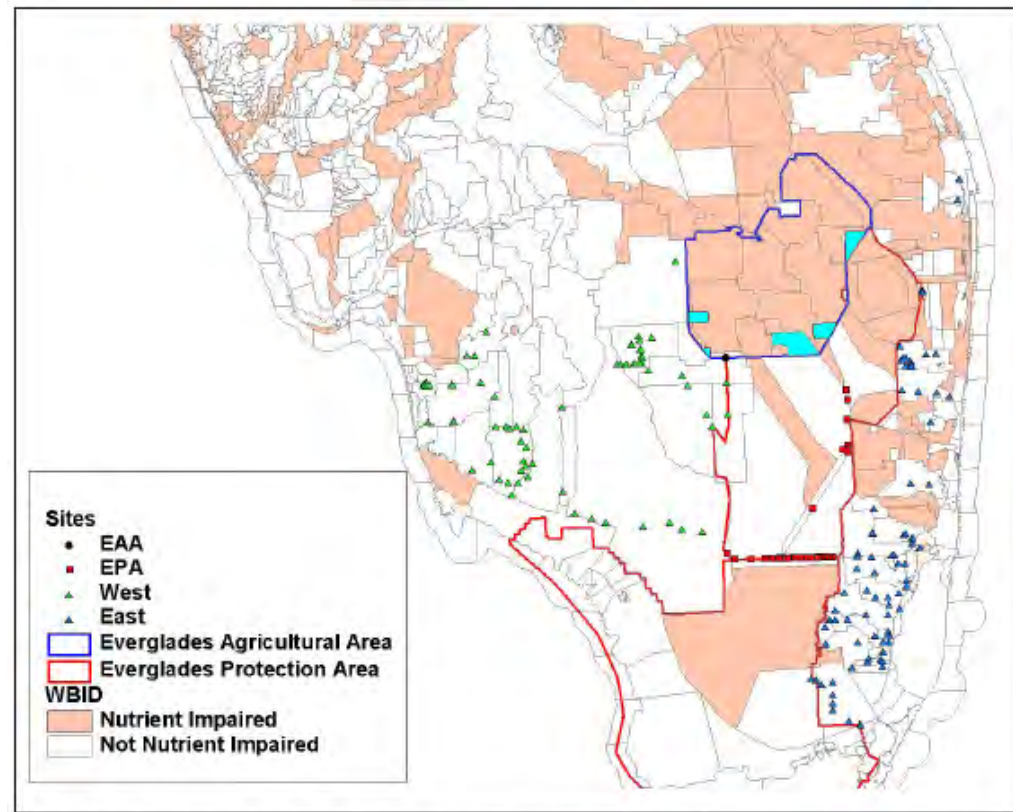


Figure 4-5. Sites located within WBIDs not listed as nutrient-impaired.

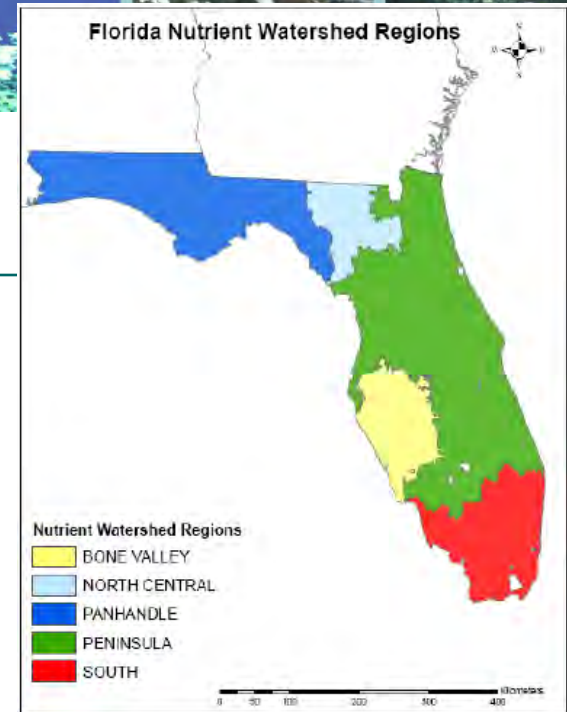


DEP Observations - Flowing Waters

- Provisions were not proposed that address the lack of a measurable dose/response relationship
 - Biological validation before listing as impaired
 - Well defined process for establishment of SSAC
- The Bone Valley delineation is large, and criteria may not adequately protect some waters in the Tampa Bay area

Criteria for Streams

Questions?



Nutrient Watershed Region	Instream Protection Value Criteria	
	TN (mg/L) ^a	TP (mg/L) ^a
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Stream Criteria for Downstream Protection

EPA Derivation and Application



Streams: Downstream Protection Values

Protection of Downstream Lakes

$$[TP]_S = \frac{1}{c_f} [TP]_L (1 + \sqrt{\tau_w})$$

where

$[TP]_S$ is the total phosphorus (TP) downstream lake protection value, mg/L

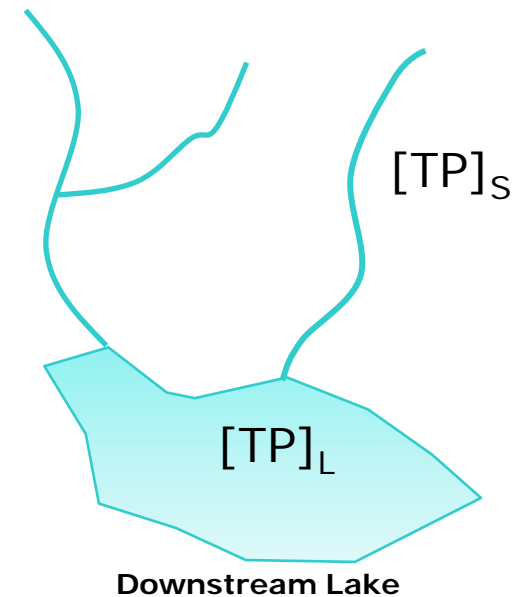
$[TP]_L$ is applicable TP lake criterion, mg/L

c_f is the fraction of inflow due to all streamflow, $0 \leq c_f \leq 1$

τ_w is lake's hydraulic retention time (water volume divided by annual flow rate)

The term $(1 + \sqrt{\tau_w})$ expresses the net phosphorus loss from the water column (e.g., via settling of sediment-sorbed phosphorus) as a function of the lake's retention time.

(B) The preset values for c_f and τ_w , respectively, are 0.5 and 0.2. The State may



Using Default Values

Colored Lakes: $[TP]_S = 0.12$ mg/L

Clear/Alkaline Lakes: $[TP]_S = 0.073$ mg/L





DEP's Assessment - Downstream Protection of Lakes

- Equation does not include settling terms for streams leading to the lake.
- Other sources of nutrients to lakes like groundwater and atmospheric deposition are not included.



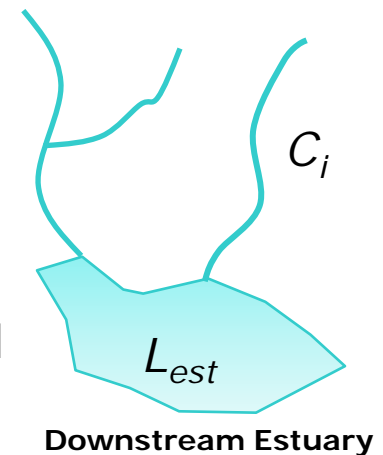
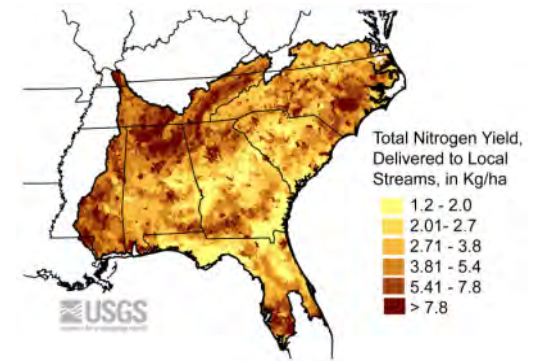
Streams: Downstream Protection Values

Protection of Downstream Estuaries

$$\bar{C}_i = kL_{est} \frac{1}{Q_W F_i},$$

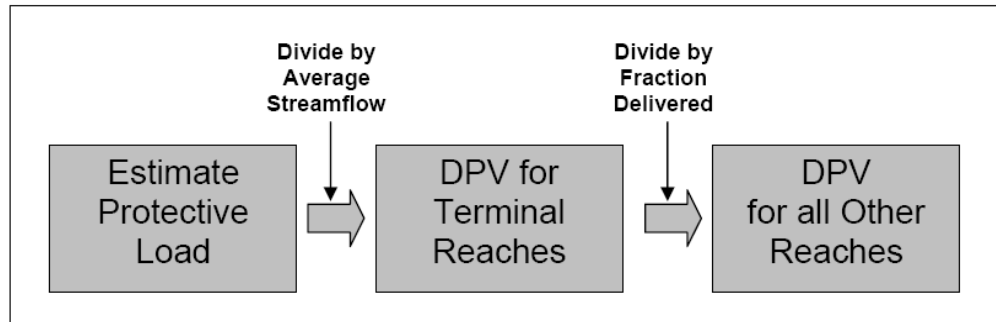
and where the terms are defined as follows for a specific or (i^{th}) stream reach:

- \bar{C}_i maximum flow-averaged nutrient concentration for a specific (the i^{th}) stream reach consistent with downstream use protection (i.e., the DPV)
- k fraction of all loading to the estuary that comes from the stream network resolved by SPARROW
- L_{est} protective loading rate for the estuary, from all sources
- \bar{Q}_W combined average freshwater discharged into the estuary from the portion of the watershed resolved by the SPARROW stream network
- F_i fraction of the flux at the downstream node of the specific (i^{th}) reach that is transported through the stream network and ultimately delivered to estuarine receiving waters (i.e. Fraction Delivered).



Target set at mid-point between estimated atmospheric nutrient load and estimated current load





Example Downstream Protection Values

Apalachicola Bay Watershed^{PH} (EDA Code¹: G100x)

Protective TN Load for the Estuary²: 10,971,582 kg y⁻¹

Protective TP Load for the Estuary³: TBD

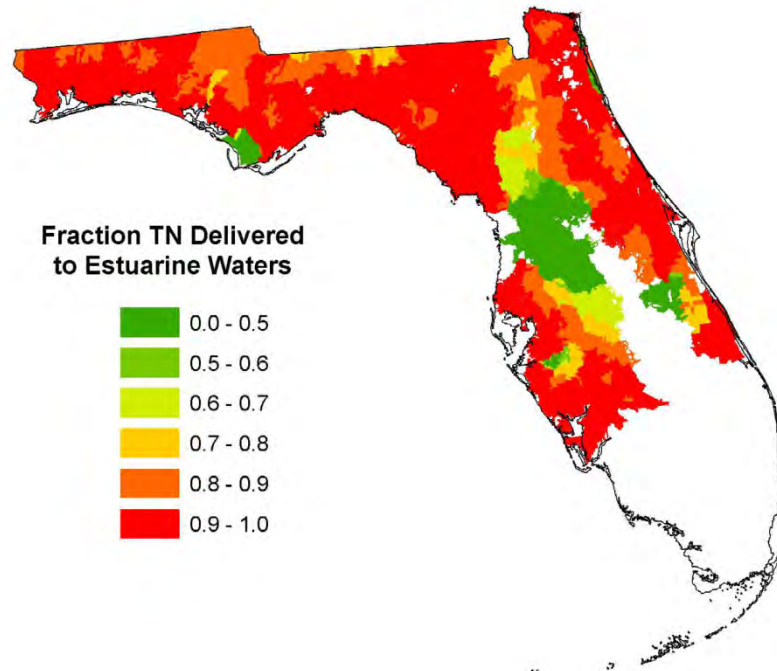
River/Stream Reach Category - Percent Delivered to Estuary ⁴	TN (mg L ⁻¹)		TP (mg L ⁻¹)	
	TN IPV ⁵	TN DPV ⁶	TP IPV ⁷	TP DPV ⁸
Less than 50%	0.824	0.91	0.043	<i>TBD</i>
50.1 – 60.0%	<i>NR</i>	<i>NR</i>	0.043	<i>TBD</i>
60.1 – 70.0%	0.824	0.65	0.043	<i>TBD</i>
70.1 – 80.0%	0.824	0.57	0.043	<i>TBD</i>
80.1 – 90.0%	0.824	0.51	0.043	<i>TBD</i>
90.1 – 100%	0.824	0.46	0.043	<i>TBD</i>





Streams: Downstream Protection Values

Protection of Downstream Estuaries



Estuary Drainage Area	TN Criteria at > 90% Delivered
Perdido Bay	0.30 mg/L
Pensacola Bay	0.43
Choctawhatchee Bay	0.43
St. Andrews Bay	0.24
Apalachicola Bay	0.46
Apalachee Bay	0.53
Suwannee River	0.55
Waccasassa Coastal	0.40
Tampa Bay	0.56
Sarasota Bay	0.54
Charlotte Harbor	0.95
Indian River	0.69
St. Johns River	0.70
Nassau Coastal	0.30
St. Mary's River	0.34





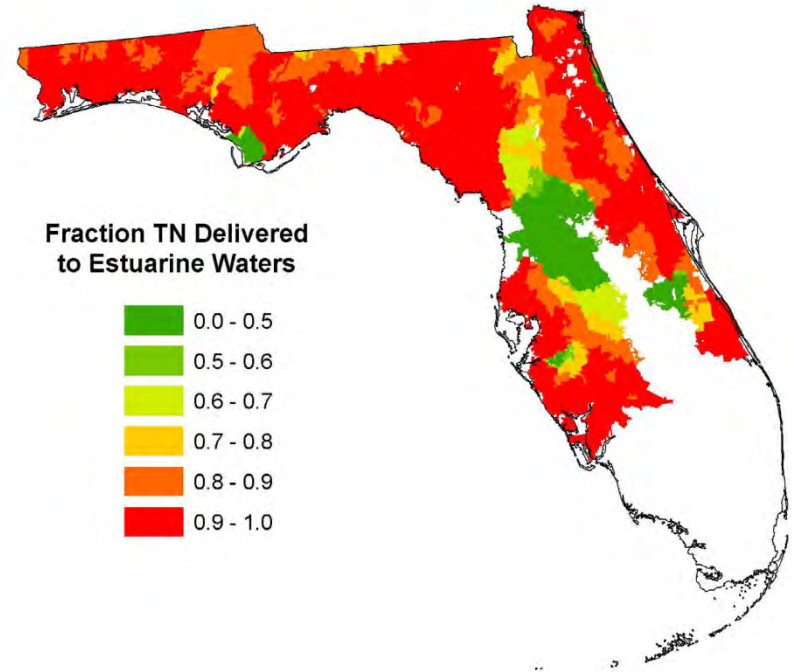
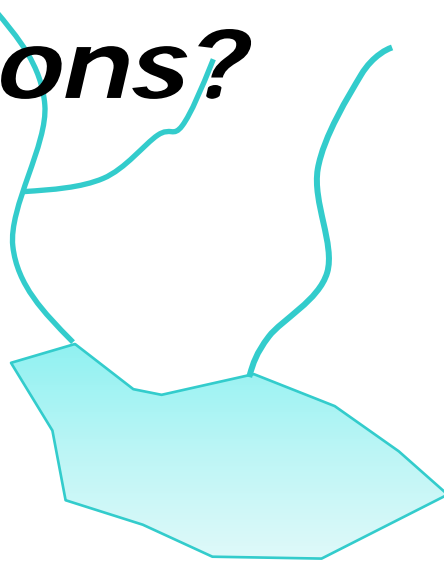
DEP Observations - Downstream Protection of Estuaries

- Model estimates of in-stream nitrogen losses are too low
- Method for establishing acceptable loads to estuaries not based on cause/effect relationship



Stream Criteria for Downstream Protection

Questions?



$$[TP]_S = \frac{1}{c_f} [TP]_L (1 + \sqrt{\tau_w})$$

$$\bar{C}_i = kL_{est} \frac{1}{Q_w F_i}$$





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Other Provisions

EPA Proposed



Other Proposed Provisions

Allowance for Site Specific Criteria Adoption

(1) Upon request from the State, the Regional Administrator may determine that site-specific alternative criteria shall apply to specific surface waters in lieu of the criteria established in paragraph (c). Any such determination shall be made consistent with §131.11.

Allowance for Mixing Zones

(i) For all waters with mixing zone regulations or implementation procedures, the criteria apply at the appropriate locations within or at the boundary of the mixing zones; otherwise the criteria apply throughout the water body including at the point of discharge into the water body.



Restoration Water Quality Standards

- Allows attainment over phased time periods where use is not currently attainable due to nutrients.
- Requires:
 - UAA for phased time periods,
 - Specify end of period protective uses and criteria,
 - Establish interim criteria, time periods, and spatial extent.
- Cannot exceed 20 Years
- Nonattainment Results in Loss of Restoration Use
- Restoration Use Waters Identified as Impaired under 303(d)






DEP Observations - Other Provisions

- Acknowledgement of the need for Site Specific Criteria is Critical
- Value of Restoration Standard Provisions is Unclear.



Other Provisions

Questions?


TUESDAY,
January 26, 2010

Part III

**Environmental
Protection Agency**

40 CFR Part 131
Water Quality Standards for the State of
Florida's Lakes and Flowing Waters;
Proposed Rule

