



Florida Department of Environmental Protection

Numeric Nutrient Criteria: Current Status

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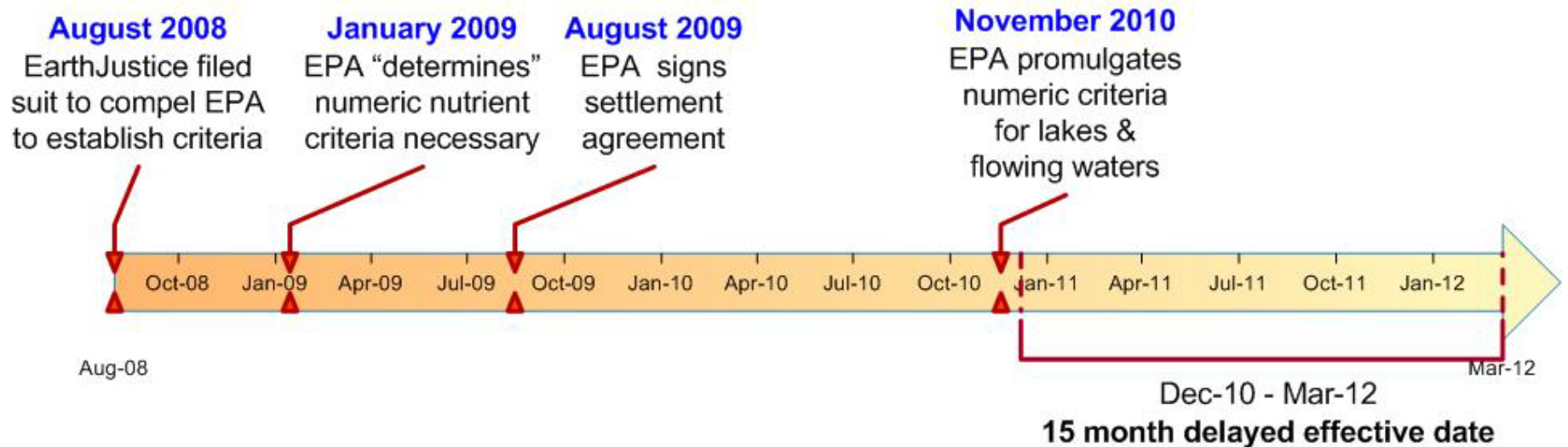
Nutrient Standards: History

- Long Standing Narrative: 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.
- 1998: EPA issued a strategy encouraging state adoption of numeric standards
- 2002: FDEP formed Technical Advisory Committee and started development





Timeline: Numeric Nutrient Criteria



Marine Criteria
Proposal – March, 2012
Final – November, 2012





FDEP Filed Petition with EPA (April 22, 2011)

- FDEP Petitioned EPA based on Florida's performance of the eight key elements identified in an EPA Memo.
- Petition included initiation of rule development for state standards, and requested that EPA:
 - o Rescind the Determination to Promulgate Numeric Nutrient Criteria in Florida
 - o Rescind Promulgated Criteria
- EPA's initial response (May 22, 2011) did not grant or deny.





FDEP Rule Concept

Hierarchy of Site Specific Numeric Interpretation of Narrative Nutrient Criterion

Nutrient Site Specific Analyses



Cause and Effect Relationships (Lakes & Springs)



**Reference-based Thresholds Combined with
Biological Data to Evaluate Attainment**



Narrative standard continues where numeric interpretation is unavailable.
(e.g., wetlands, intermittent streams)



Three Differences of FDEP's Draft Rule

**Give preference to nutrient
Site Specific Science.**

EPA's do not

**Only create nutrient reduction
expectations where necessary to
protect Florida waterbodies.**

**EPA's do
regardless of
waterbody
health**

**Eliminate unnecessary
procedures that do not add to
waterbody protection
and restoration.**

**EPA's use federal
procedures to
overcome
Illogical
outcomes**





Hierarchy 1: Site Specific Interpretations

- Captured by Proposed Regulations at 62-302.531(2)(a) F.A.C.
- Examples:
 - Total Maximum Daily Loads
 - Site Specific Alternative Criteria
 - Estuary-specific numeric interpretations
 - *Proposed Values Discussed Later*
 - Other properly noticed site specific interpretations





TMDLS as Hierarchy 1 NNC

- Approximately 135 waterbodies have TMDLs that were written to prevent imbalances of flora or fauna
- These will remain primary interpretations of the narrative criterion



Site Specific Estuary Values as Hierarchy 1 NNC

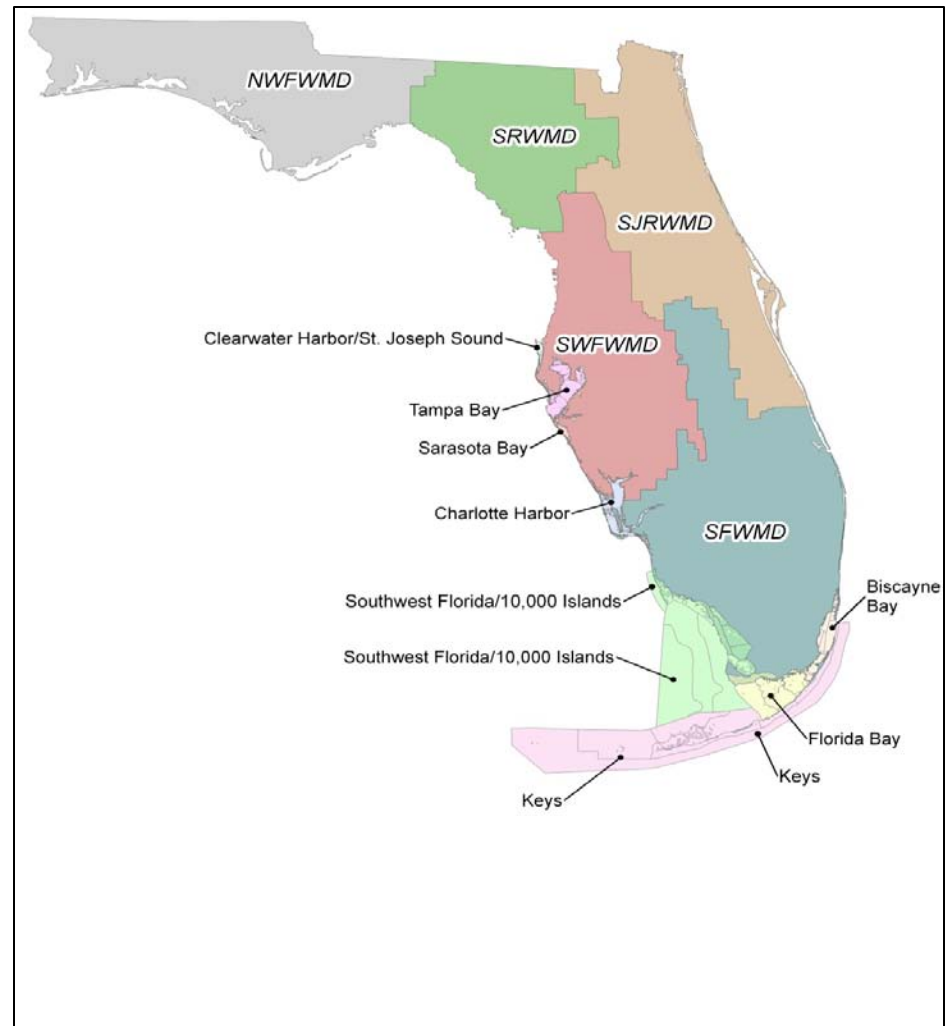
- Given the diversity of estuaries and site-specific nature of nutrient impacts in estuaries, DEP and local scientists developed estuary-specific nutrient standards
 - Rather than generally applicable standards
- Worked with local scientists, including Estuary Programs and EPA, to reach consensus on methods and standards
- Also worked with Marine Technical Advisory Committee (MTAC) on basic methodologies





Estuary and Coastal Segments Included in Proposed NNC

- **Proposing nutrient standards for estuaries from Clearwater/Tampa to Miami and the Keys**





Development of Estuarine Interpretations of Narrative

- Majority were developed by Estuary Programs (Tampa Bay, Sarasota Bay, and Charlotte Harbor) and the Department
- Pinellas County (and SWFWMD) developed values for Clearwater Harbor/Saint Joseph Sound
- Collier County developed values for Clam Bay
- DEP developed criteria for SW Coast, Florida Bay, Florida Keys, and Biscayne Bay





General Conceptual Model for NEP Criteria

TN Load → Chlorophyll → Light Attenuation



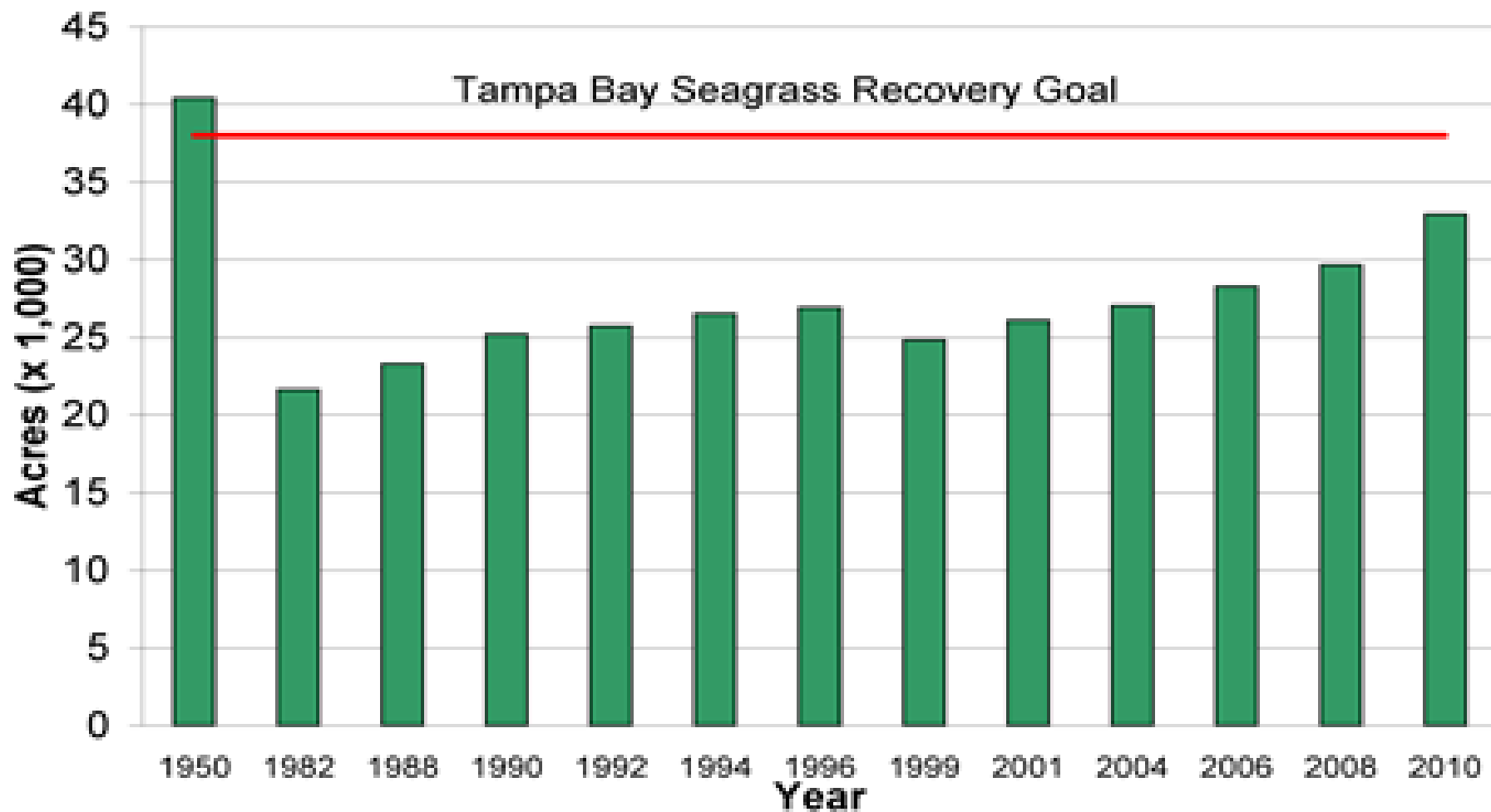
Seagrass Growth
& Reproduction

Seagrass Light
Requirement





Tampa Bay Seagrass Acreage Estimates





Nutrient Standards Developed by DEP

- DEP developed proposed nutrient standards for
 - Southwest Coast (Tidal Coghatchee River/Ten Thousand Islands), Florida Bay, Florida Keys, and Biscayne Bay
- Started work in these areas in 2010
 - Held 8 public meetings in spring/fall of 2010 to solicit information from stakeholders/scientists and then review findings
- Drafted reports for each estuarine system
 - Posted to website in late summer in 2010





Nutrient Standards Developed by DEP

- Reports included following information
 - Summarized available water quality data
 - Nutrients and Chlorophyll *a*
 - Summarized available biological data
 - Identified key biological resources
 - Determined current biological health
 - Selected approach for NNC development
 - Maintain existing conditions, 1 of 3 year exceedance of 90th percentile prediction interval





Schedule for Remaining Estuaries

- Subsection 62-302.532(3) includes a schedule for development of interpretations for remaining estuaries
 - Perdido Bay, Pensacola Bay (including Escambia Bay), St. Andrews Bay, Choctawhatchee Bay, and Apalachicola Bay by June 30, 2013
 - Remaining estuaries by June 30, 2015
- Schedule subject to the provisions of Chapter 120, F.S.





Hierarchy 2: Cause & Effect Interpretations

- Only applies to a waterbodies without site specific interpretations
- Captured by Proposed Regulations at 62-302.531(2)(b) F.A.C.
- Currently Derived for:
 - Florida Lakes
 - Florida Springs





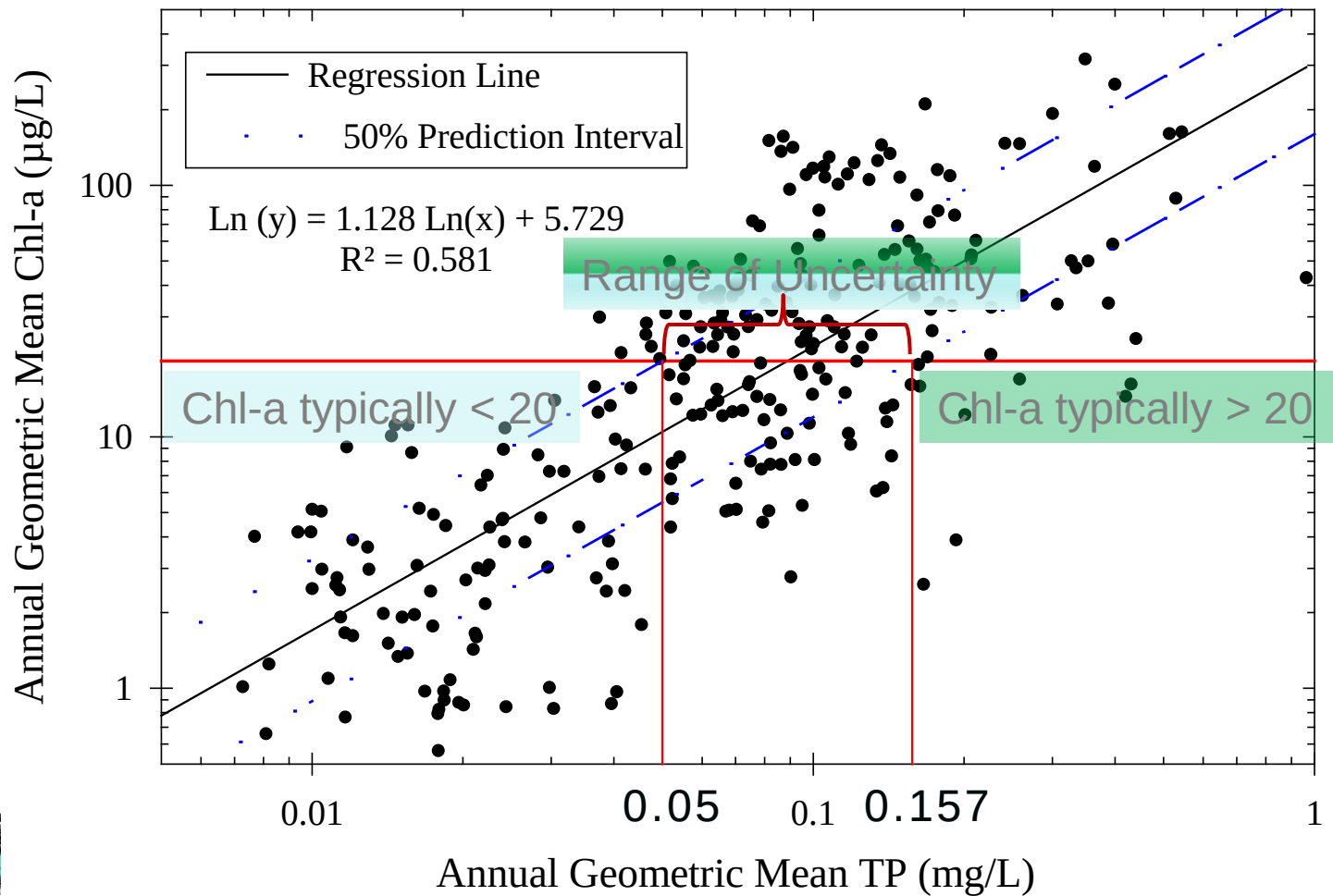
Numeric Interpretation for Lakes

- Cause and Effect based
- Annual geometric mean of chlorophyll *a* measurements is the primary indicator of balance of Flora and Fauna
 - Protect Oligotrophic Lakes (Chl *a* < 6 ug/L)
 - Protect Mesotrophic Lakes (Chl *a* < 20 ug/L)
- Color (PCU) & Alaklinity
 - Used to categorize background nutrient expectations
 - Increased color indicates increased TP & TN from wetlands and runoff
 - Increased Alkalinity indicates increased TP from soils





Colored Lake Chl-a Response to Total Phosphorus





Lake Nutrient Criteria

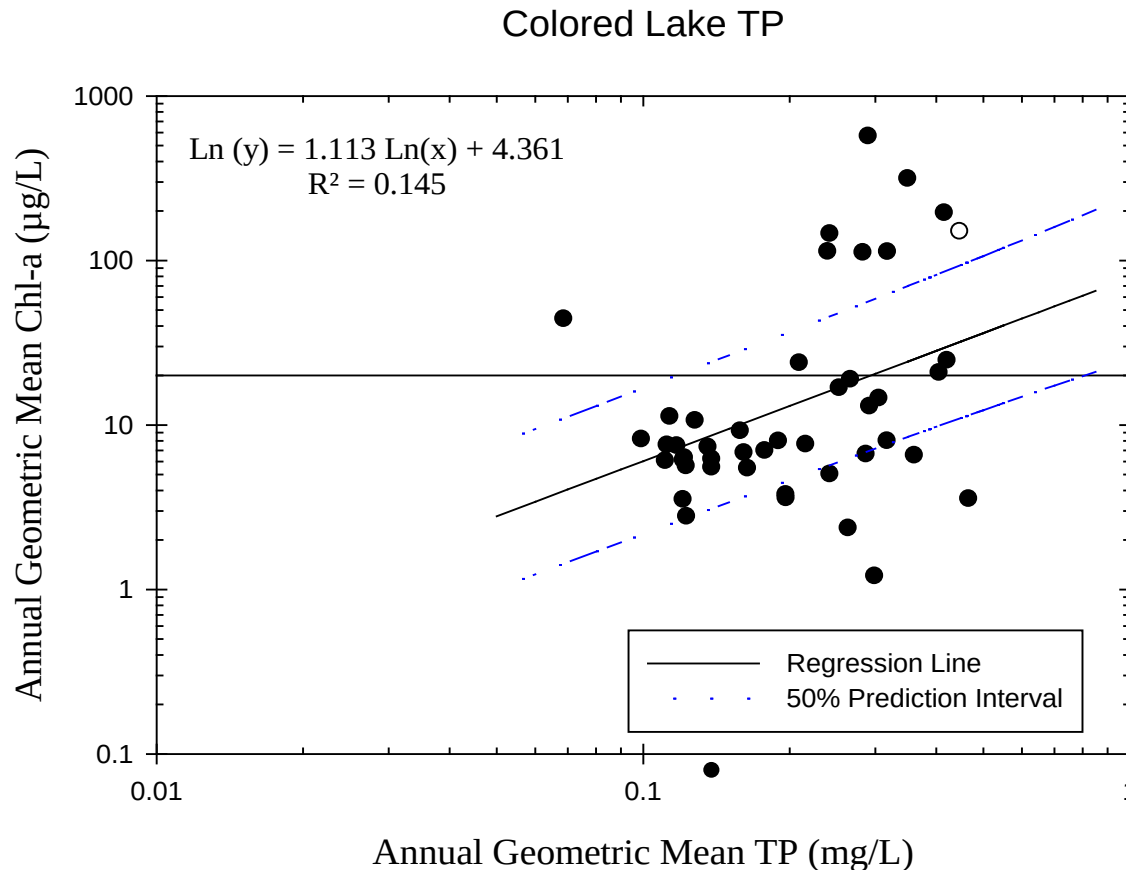
Annual Geometric Mean Thresholds, No more than 1 in 3 year exceedance

Long Term Geometric Mean Lake Color and Alkalinity	Annual Geometric Mean Chlorophyll <i>a</i>	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units	20 µg/L	0.05 mg/L	1.27 mg/L	0.16 mg/L ¹	2.23 mg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L CaCO ₃	20 µg/L	0.03 mg/L	1.05 mg/L	0.09 mg/L ¹	1.91 mg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L CaCO ₃	6 µg/L	0.01 mg/L	0.51 mg/L	0.03 mg/L ¹	0.93 mg/L





Relationship Between Annual Average (Ln transformed) Nutrients and Chl-a in Bone Valley Lakes consistent with other Regions except for TP in Colored Lakes



Added footnote allowing TP max limit to increase to 0.49 mg / L.



Manage Along a Continuum

- Added provisions in 62-303 designed to identify upward trends in nutrients and chlorophyll *a*
 - *Uses Statistical Tests*
 - *Accounts for confounding variables like climactic cycles and QA*
- Provides for action to set a site specific numeric interpretation to ensure imbalance does not occur.





Numeric Interpretation for Springs

- Cause and Effect based
- Lab and field studies used to inform threshold
- Criteria derived to prevent harmful effects



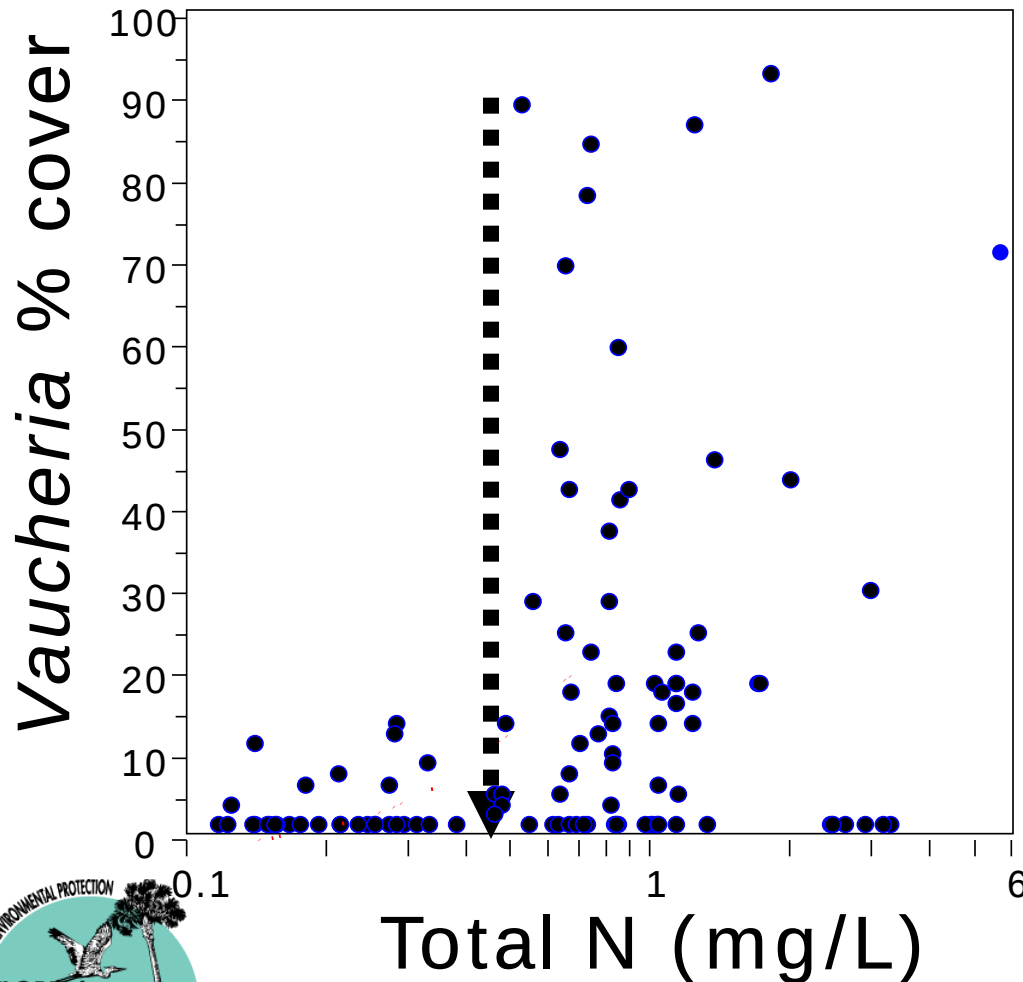
Cause and Effect Lines of Evidence

- Lab studies demonstrated nitrate-nitrite was primary factor causing elevated growth at levels above 0.230 to 0.263 mg/L
 - But don't know growth level resulting in impairment
- Independent field studies showed imbalances occur at 0.441 to 0.454 mg/L nitrate-nitrate
 - But need to set criterion below these levels to prevent imbalance from occurring





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



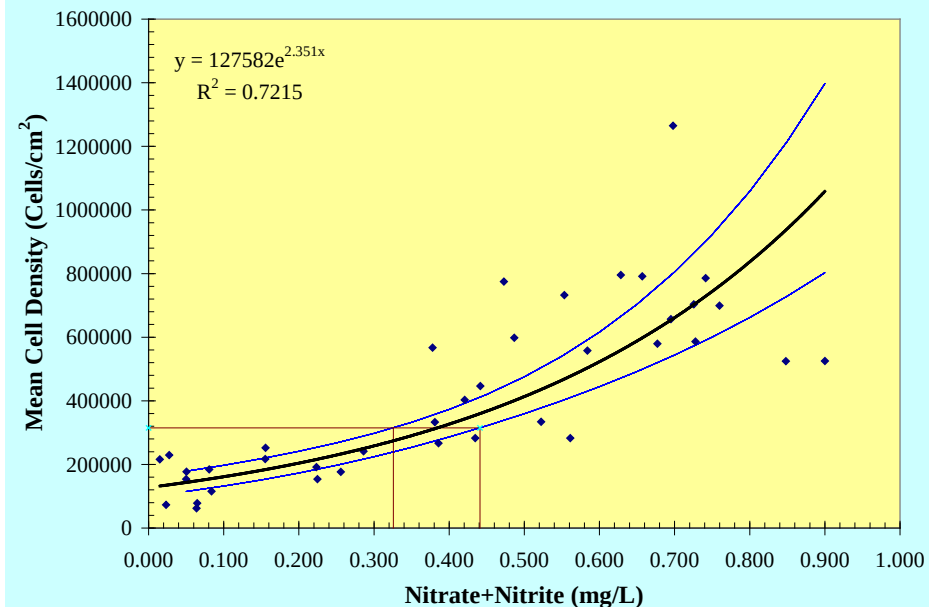
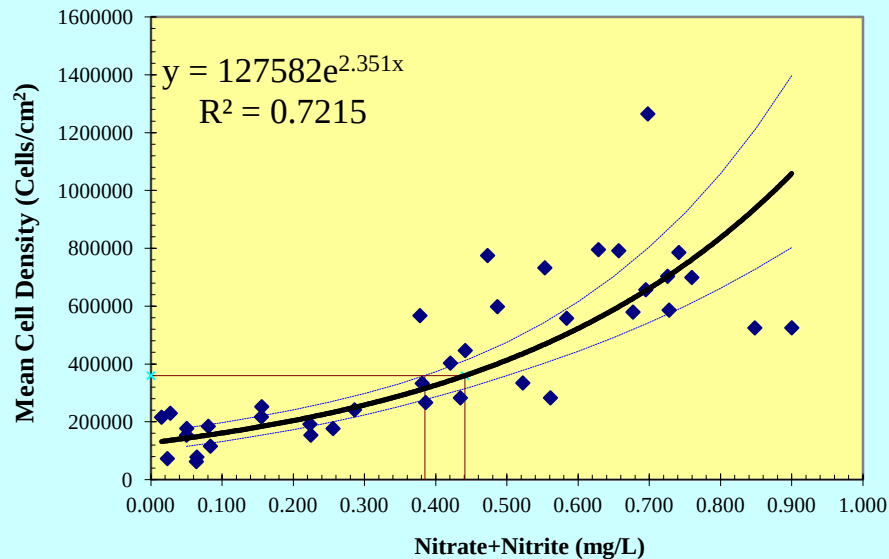
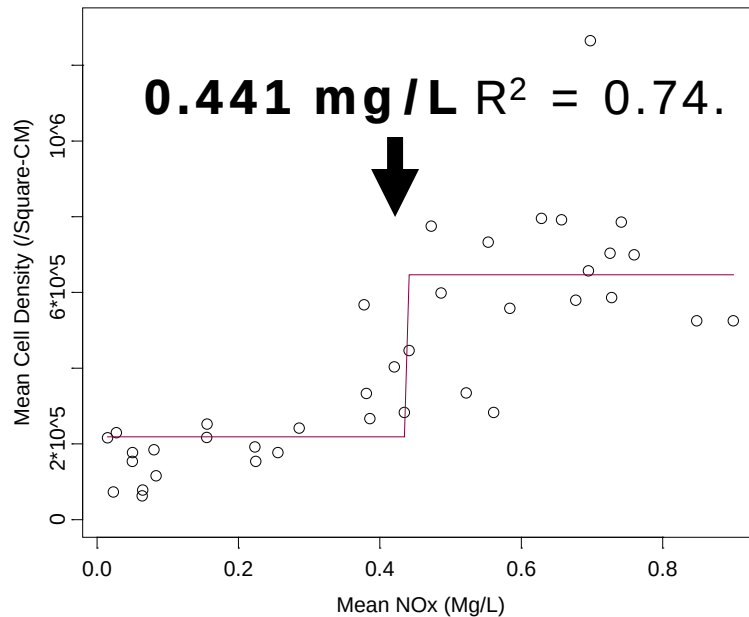
Excessive growth and cover of *Vaucheria* was found at sites with TN concentrations above 0.591 mg/L and **nitrate-nitrite concentrations at or above 0.454 mg/L.**





Nitrate-Nitrite

Annual Geomean of 0.35 mg/L





Spring Nitrate Conclusions

- Proposed criterion (0.35 mg/L) combines both lab and field lines of evidence and provides protection against levels demonstrating imbalance
 - Expressed as annual geometric mean, not to be exceeded more than once in any three calendar year period





Hierarchy 3: Reference Based Thresholds Combined with Biological Evaluations

- Only applies to waterbodies without site specific interpretations and cause & effect criteria
- Currently only proposed for streams and applies all components of narrative criteria

Nutrient Concentrations

Total Phosphorus
Total Nitrogen

Balanced Aquatic Flora or Fauna

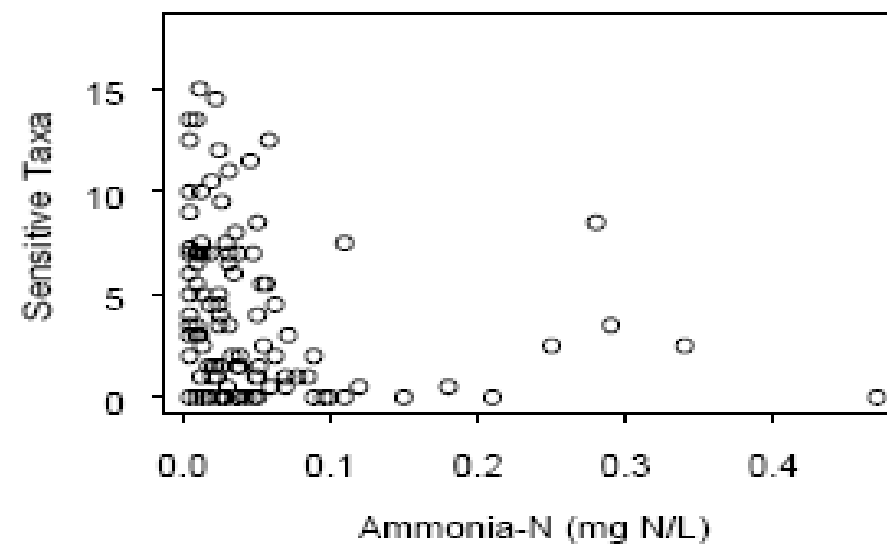
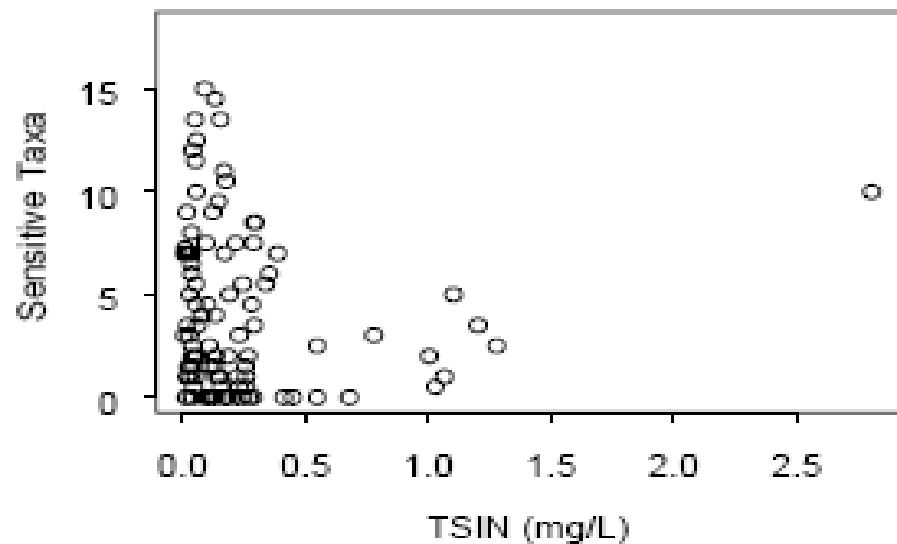
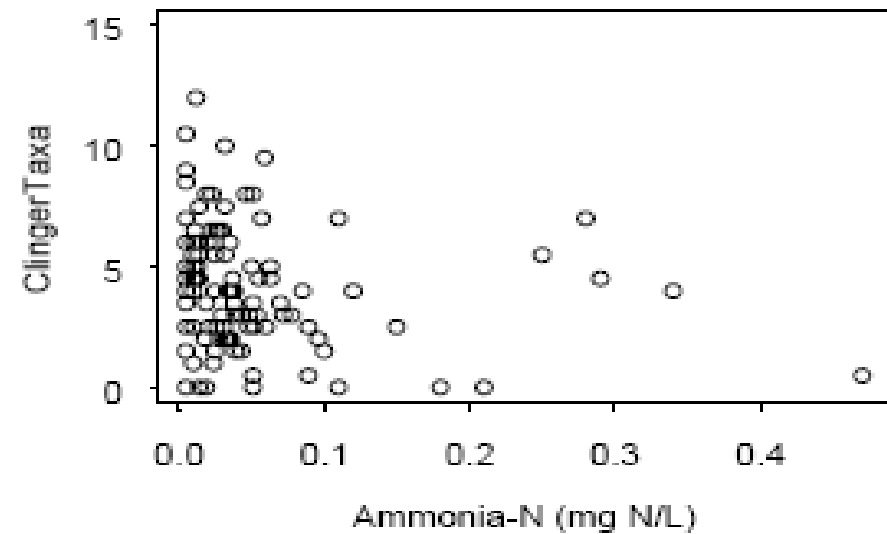
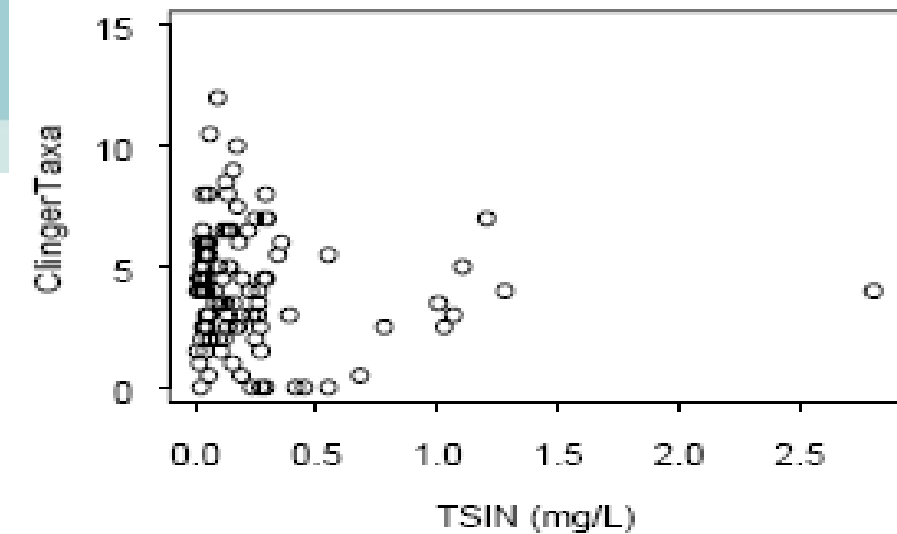
Flora: Chlorophyll a
Evaluation of Algal Mats
Fauna: Macroinvertebrates (Stream
Condition Index)





Attempted to Derive Stream Cause and Effect Values

- Evaluated responses of chlorophyll *a*, taxonomic composition of macroinvertebrate and algal communities, and frequency of occurrence and abundance of algae (Rapid Periphyton Survey)
- Used linear regression, multiple linear regression, non-linear regression, LOESS regression, change point analysis, CART, correlation analysis, and paired variable plots

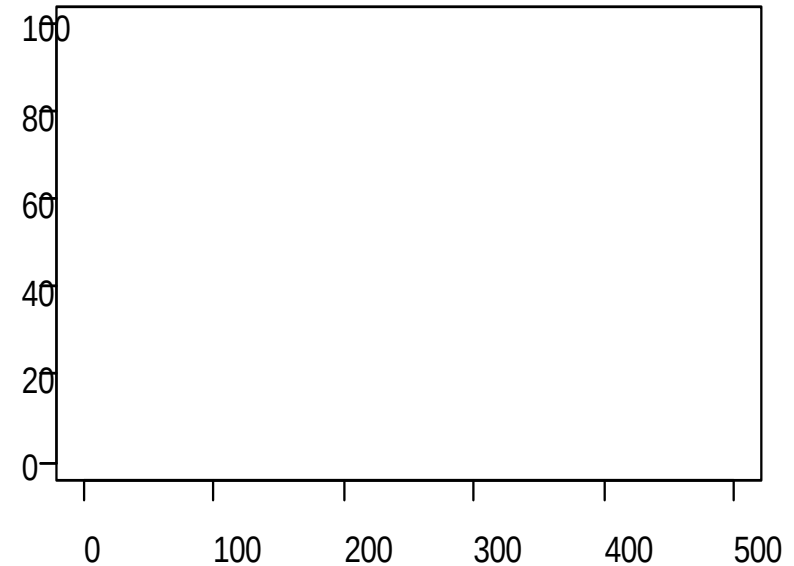
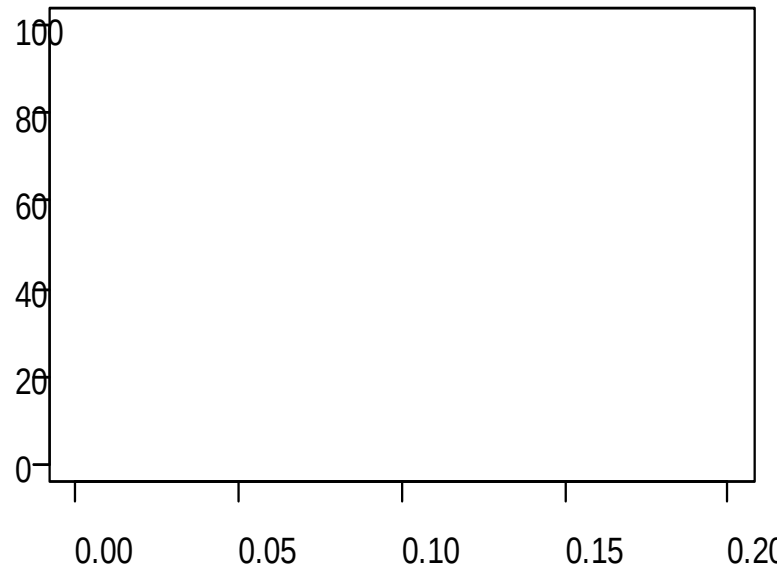


No stream macroinvertebrate responses to nutrient levels





Only Weak Relationships between Nutrients and Stream Algae (Conductivity was slightly stronger)





Stream Stressor-Response Conclusions

- Due to confounding factors (e.g., pH, color, conductivity), the relationships between the response variables and nutrient levels were insufficiently robust for establishing thresholds based on cause and effect
- Nitrate-nitrate was an exception (previously described)



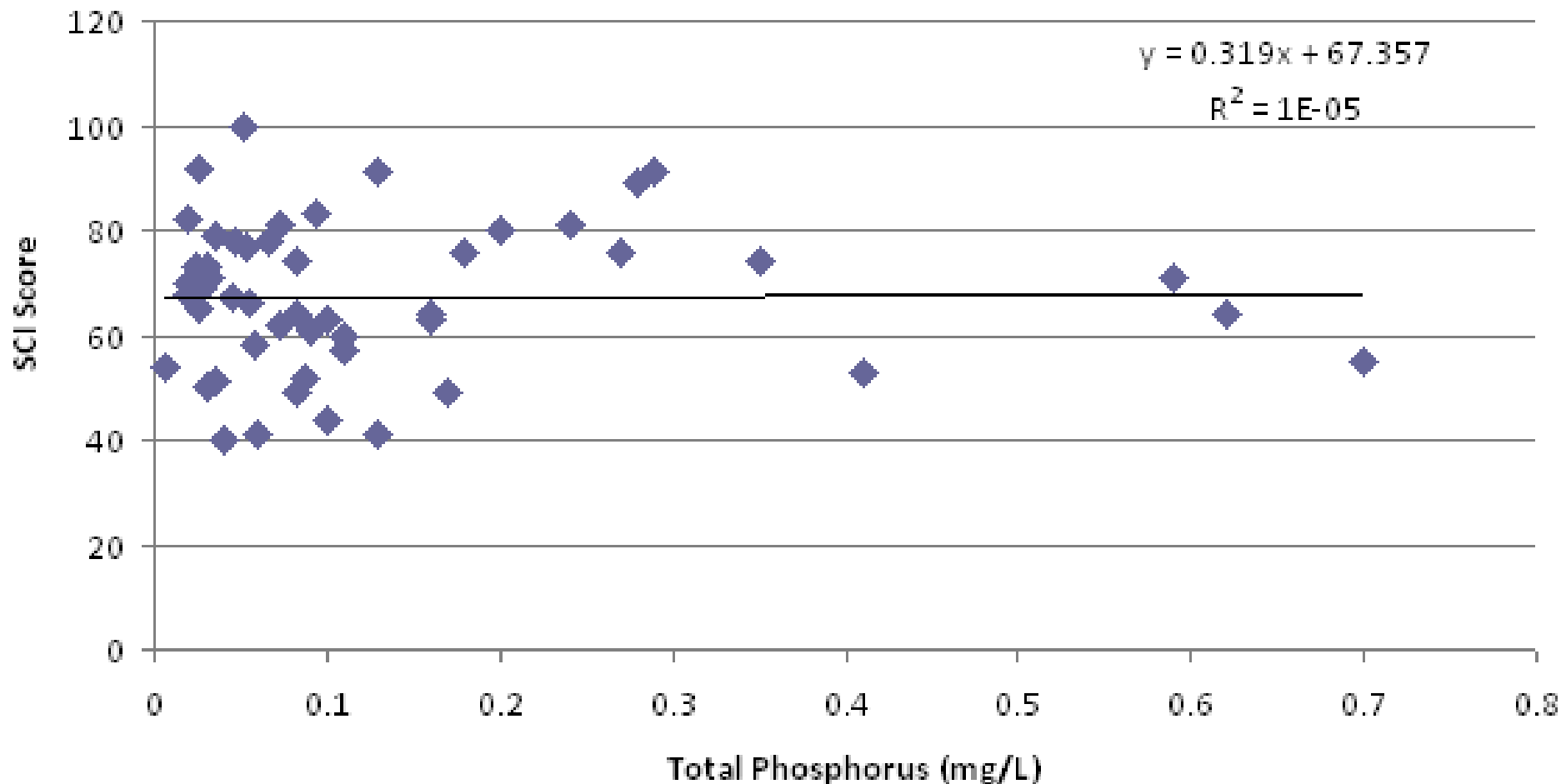
Plan B for Streams: Reference Site Approach

- Above issues associated with stressor-response analyses required use of Nutrient Benchmark site distributional approach
- Rationale: Nutrient regime associated with minimally disturbed sites (nutrient concentrations reflective of background), which are characterized by healthy biological communities, is inherently protective of the “healthy, well balanced” designated use



Biological Community Health in Benchmark (Reference Sites)

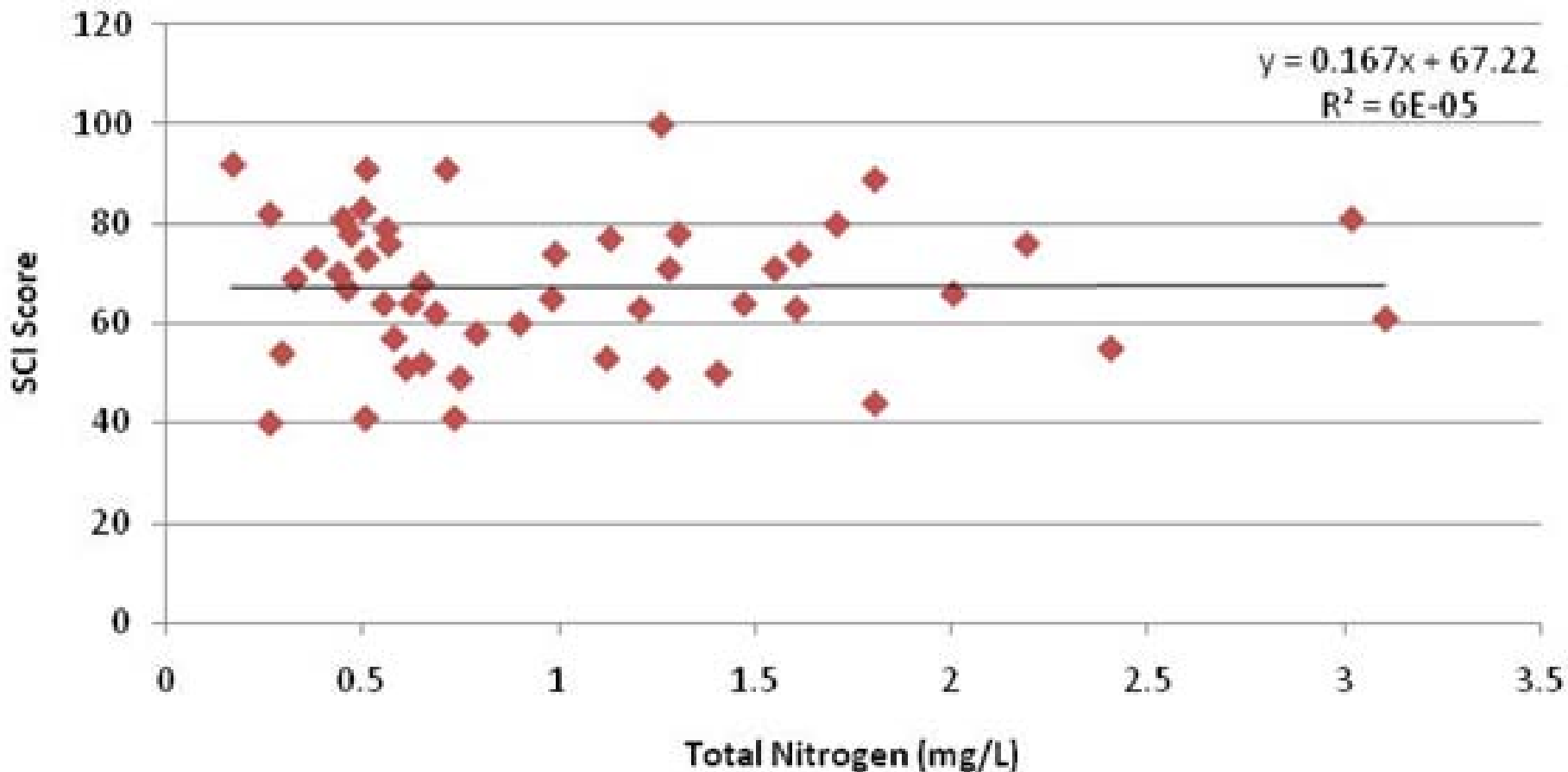
Benchmark Site Total Phosphorus vs. SCI Score





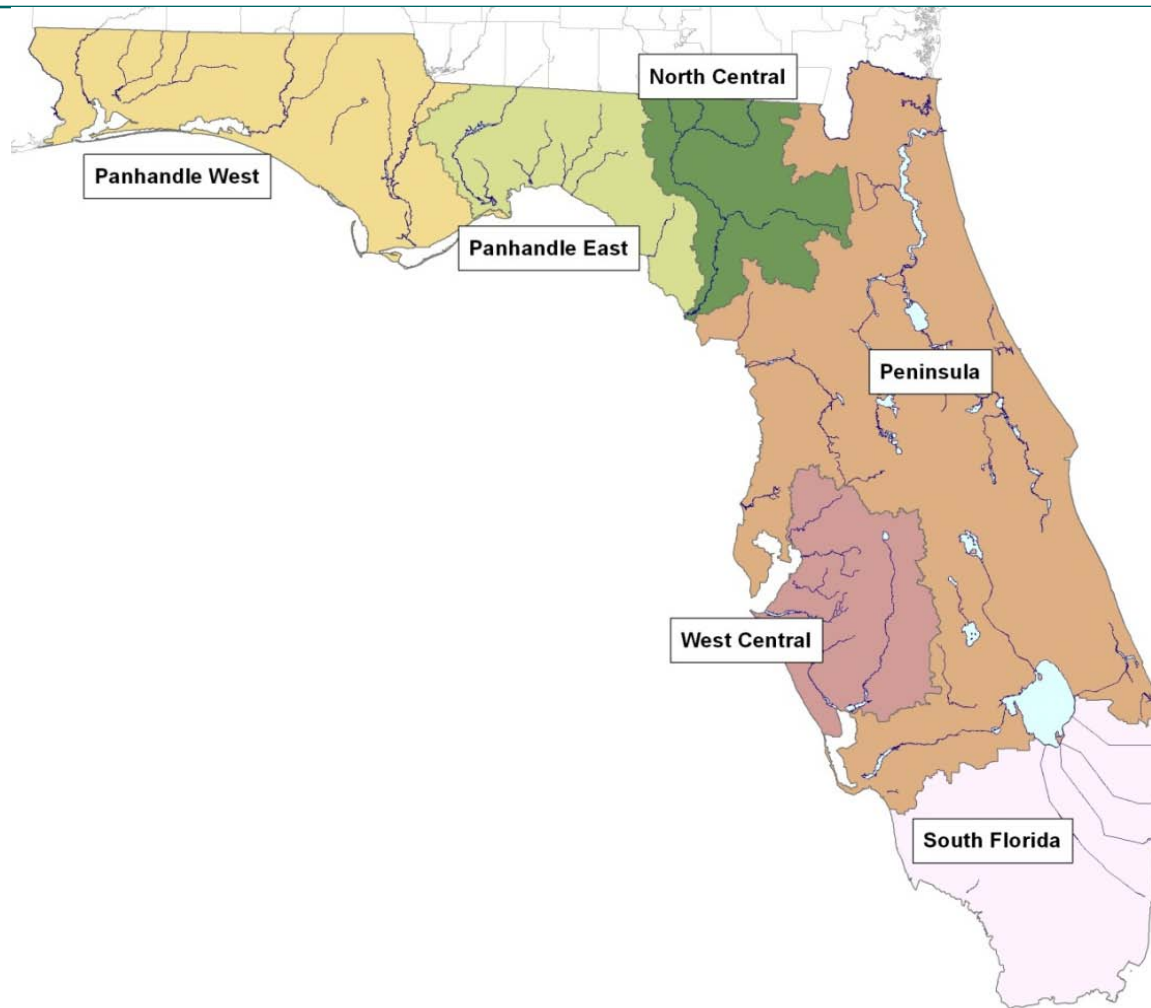
Biological Community Health in Benchmark (Reference Sites)

Benchmark Site Total Nitrogen vs. SCI score





Nutrient Regions for Streams





Criteria Based on Stream Reference Site Approach

Nutrient Region	Total Phosphorus Threshold	Total Nitrogen Threshold
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
Peninsula	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.	





Conclusion on SCI

- “An SCI score > 40 has been determined to be indicative of biologically healthy conditions based on an expert workshop and analyses performed by both FDEP and EPA. Please refer to the EPA’s January 2010 proposal and the final TSD accompanying this final rule for more information on the SCI and the selection of the SCI value of 40 as an appropriate threshold to identify biologically healthy sites” (Federal Register /Vol. 75, No. 233 /December 6, 2010 /Rules and Regulations , page 75775)





Methods for Evaluation: Flora

- Flora (metrics used in current rules)
 - Chlorophyll *a* is a common measure of phytoplankton (floating algae)
 - Evaluation of the presence of algal mats or blooms, nuisance macrophyte growth, and change of algal species:
 - A qualitative evaluation can be complete using the **Rapid Periphyton Survey** and **Linear Vegetation Survey** (can be conducted concurrent with a Stream Condition Index)
 - Other scientific methods can be used.





Methods for Evaluation: Flora

- Impaired waters rule:
 - Annual average chlorophyll *a* > 20 ug/L
 - Increase in chlorophyll *a* from historic values
 - presence of algal mats or blooms, nuisance macrophyte growth, and change of algal species



Hierarchy 3: Reference Based Thresholds Combined with Biological Evaluations

Contained at 62-302.531(2)(c)

- The narrative nutrient criterion in paragraph 62-302.530(47)(b), F.A.C., shall be interpreted as being achieved in a stream segment if:
- Information on chlorophyll *a* levels, algal mats or blooms, nuisance macrophyte growth, and changes in algal species composition do not indicate an imbalance in flora or fauna; AND EITHER



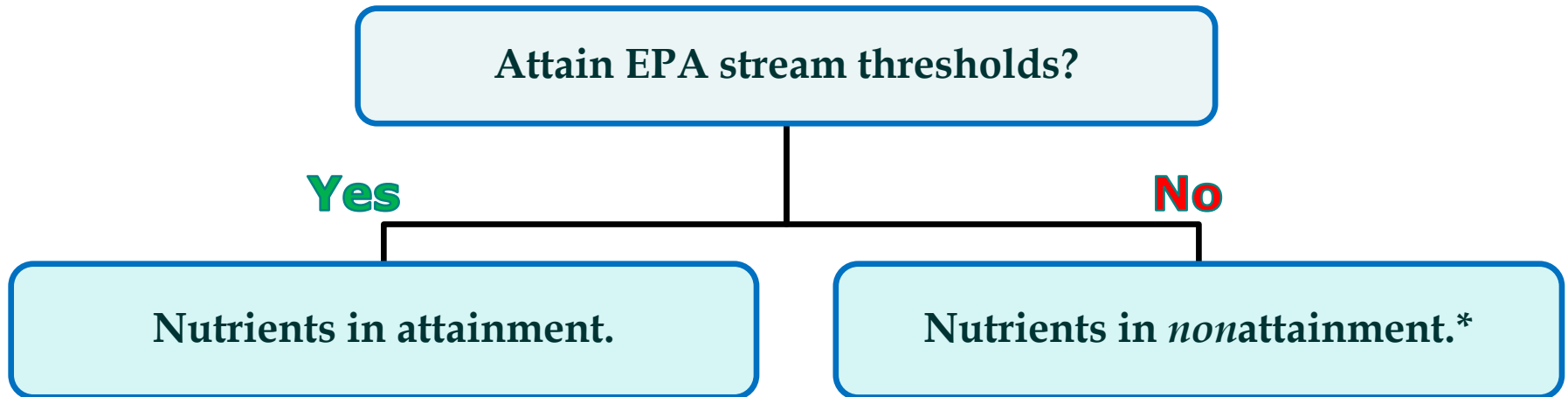


Application of Stream Reference Criteria (cont.)

- 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 (*i.e.*, no faunal imbalances), OR
- The Nutrient Thresholds (expressed as annual geometric means) are not exceeded more than once in a three year period.



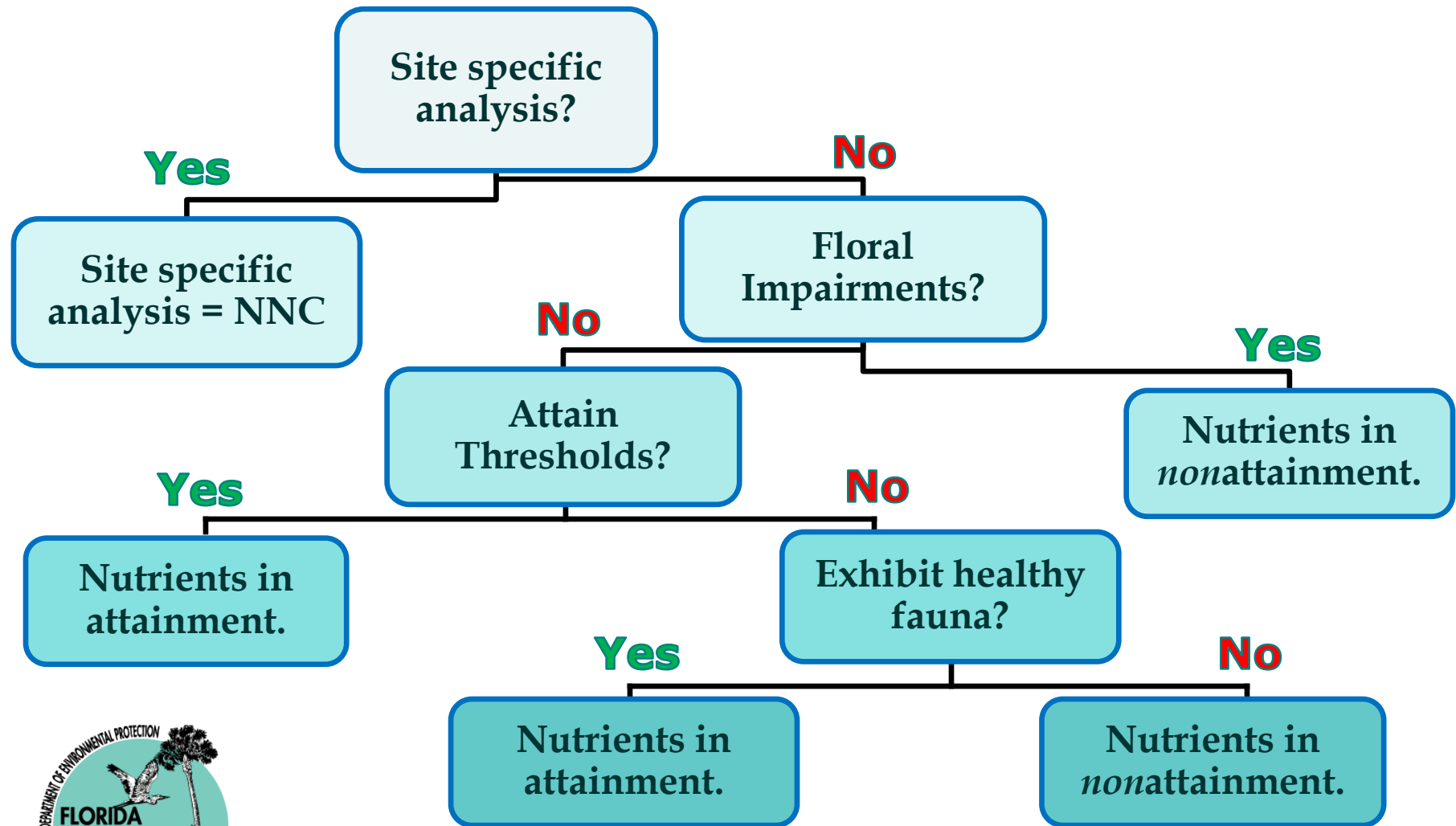
EPA's Process of Applying the Rule to a Stream



* If waterbody is healthy, entities can petition EPA to set a different criteria by submitting a thorough analysis. (Site Specific Alternative Criteria)



FDEP's Process of Applying the Rule to a Stream





Spatial Expression

- Attainment of the narrative criterion should be assessed as a spatial average for the waterbody
 - For SSACs and TMDLs, spatial component is as defined in the TMDL or SSAC document
 - If based on cause-effect relationship, stated in a manner consistent with the derivation of the criterion
 - Lake Criteria were based on lake averages





Spatial Expression (cont).

- For Hierarchy 3, rule states that nutrient concentrations are implemented as a spatial average which is consistent with how thresholds were derived. Spatial extent determined by site-specific considerations:
 - Relative system homogeneity, system classification, biological expectations, or empirically measured responses
 - WBIDs or aggregations of segments may be appropriate





Downstream Protection

- Protection of downstream waters can be provided using a narrative:
 - In no case shall the loading of nitrogen or phosphorus from a Class I or III fresh water stream or lake cause or contribute to an exceedance of water quality standards in a downstream waterbody
 - Upstream actions taken by the Department would consider downstream standards pursuant to this narrative

Comment: Lack of Numeric Downstream Protection Values.

Response: Neither EPA nor FDEP has enough science to establish numeric values





New Rules for Type III SSACs

- Healthy Stream Documented by :
 - Information on chlorophyll *a*, algal mats & species composition, nuisance plant growth indicate no imbalance and
 - Two Stream Condition Index Scores average above 40 (with neither score less than 35)
 - Total Nitrogen and Total Phosphorus Data Collected to estimate current conditions.





New Rules for Type III SSACs (cont.)

- Healthy Lake Documented by :
 - Information on chlorophyll *a*, algal matts & blooms indicate no imbalance and
 - At least two Lake Vegetation Index Scores average above 43
 - Total Nitrogen and Total Phosphorus Data Collected to estimate current conditions.



Implementation

- DEP's rule strives to remove implementation uncertainty
 - Spatial extent of criteria
 - Predictable SSAC
 - Assessment of Attainment Contained in 62-303 F.A.C.
 - Permitting can be Accomplished through
 - Hierarchy 1 methods (TMDL or WQBEL) or
 - Demonstration of Healthy Receiving Stream





Consequences of Not Setting State Rules, or EPA Disapproving the Rules

- EPA's rules will go into effect.
- FDEP cannot implement those rules.
- Permits would be issued by EPA.
- TMDLs would be issued by EPA.
- Costs would be passed down to households, businesses, and visitors.

