

Proposed Nutrient Criteria for Vermont's Inland Lakes and Wadeable Streams



Vermont Department of Environmental Conservation
Watershed Management Division

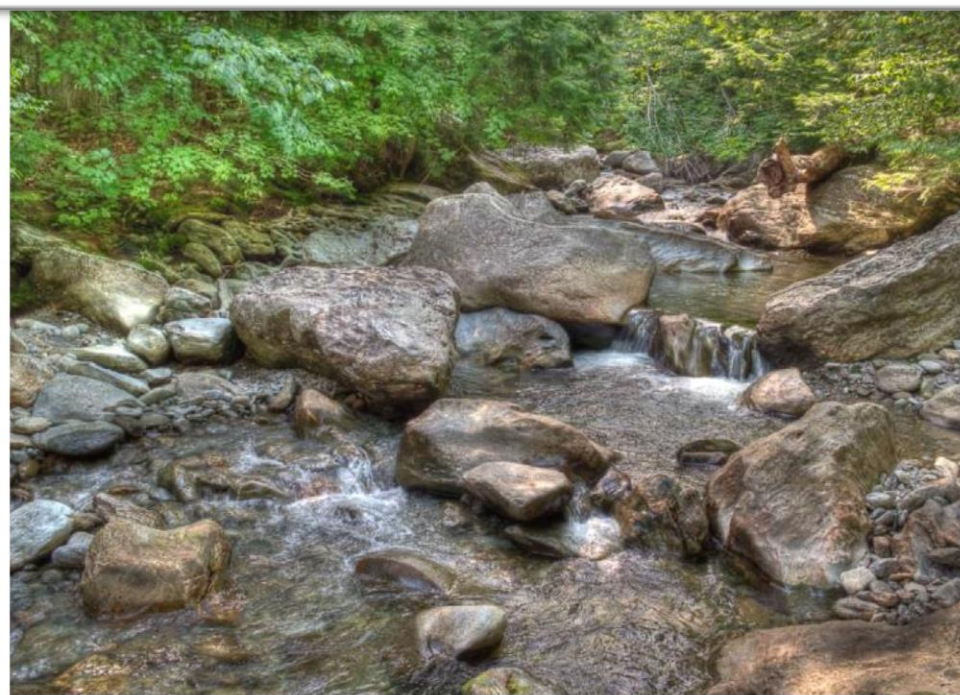
April 16, 2014

Proposed Nutrient Criteria for Vermont's Inland Lakes and Wadeable Streams

- VT has numeric WQ criteria for phosphorus in Lake Champlain, Memphremagog, and Class A(1) streams.
- VT has a narrative:
 - In all waters, total phosphorous loadings shall be limited so that they will not contribute to the acceleration of eutrophication or the stimulation of the growth of aquatic biota in a manner that prevents the full support of uses.

Proposed Nutrient Criteria for Vermont's Inland Lakes and Wadeable Streams

- EPA national initiative is pushing states to develop numeric criteria for nutrients
- VT sees this as a useful tool for predictability and interpretation of narrative standard.
- At issue: Creating criteria for something like phosphorus defies a one-size fits all. Every waterbody responds to increasing nutrients differently



Scope and Limitations of the Analysis

		Waterbody Type		
		Inland Lakes and Reservoirs	Wadeable Streams	Non-Wadeable Streams
Designated Use	Aquatic biota, wildlife, and aquatic habitat	Not analyzed	Evaluated as change in biota from reference condition	Not analyzed
	Aesthetics	Evaluated from lake user survey	Not analyzed	Not analyzed
	Swimming and other primary contact recreation	May be supported if aesthetic uses are supported	Not analyzed	Not analyzed
	Boating, fishing, and other recreational uses	May be supported if aesthetic uses are supported	May be supported if biological uses are supported	Not analyzed
	Public water supplies	Not analyzed	Not analyzed	Not analyzed
	Irrigation of crops and other agricultural uses	May be supported if aesthetic uses are supported	May be supported if biological uses are supported	Not analyzed

These analyses conducted for:

- Lakes:
 - A(1), A(2), B
- Streams
 - A(1)
 - A(2)/B
 - Small high gradient
 - Medium high gradient
 - Warmwater medium gradient

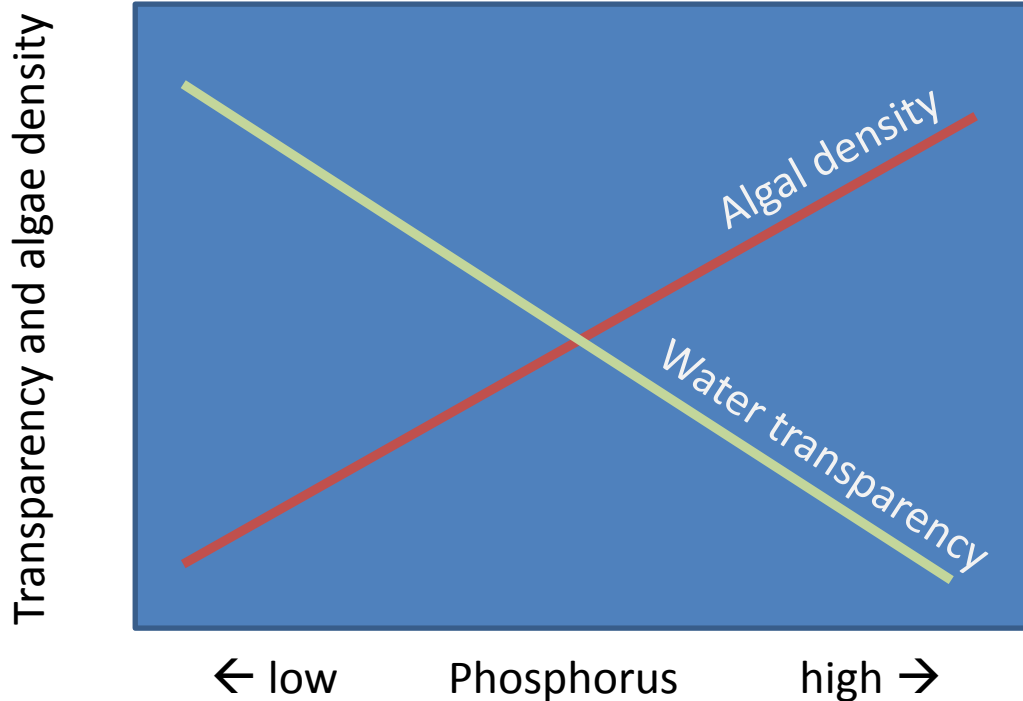
The Vermont DEC Wadeable Stream Macroinvertebrate Community Assessment Procedure



Example bioassessment

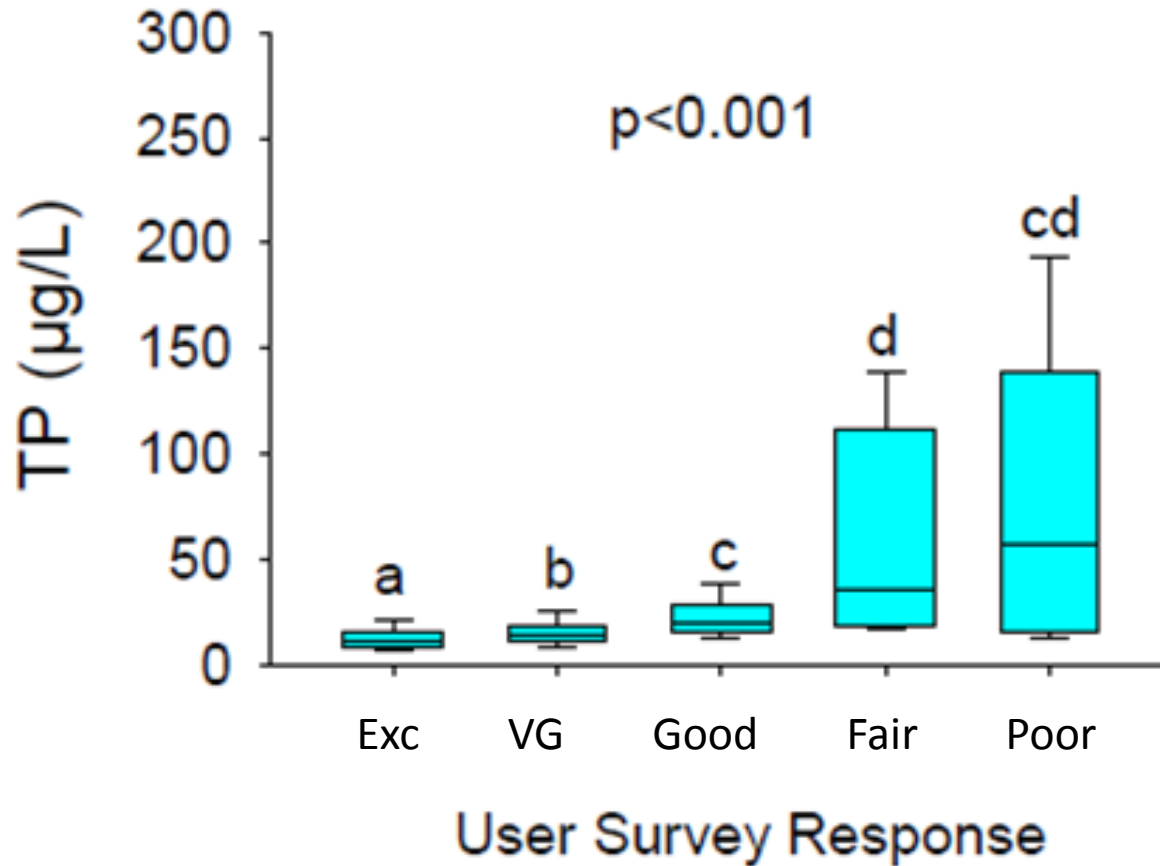
Macroinvertebrate Site Summary										
Location: Saxtons River						Location ID: 501283				
Town: Rockingham						Bio Site ID: 060000000045				
Description: Located below town, and WWTF 1/4mi below bridge. Aprox. 0.4 miles below Saxton River WWTF.						WBID: VT11-05				
Date	Sample Method	Density	Richness	EPT Richness	PMA O	BI	Oligo.	EPT / EPT + C	PPCS F	Community Assessment
10/4/1993	KN	2100	44.0	22.0	78.4	4.42	0.00	0.710	55.7	Good
9/25/2008	KN	3640	51.0	29.0	78.0	4.47	1.10	0.973	45.9	Good
9/21/2012	KN	1006	41.0	18.0	66.7	4.78	0.00	0.930	49.3	Good
Full Support		> 350	> 28	> 17	> 50%	< 4.35	< 9.5%	> 0.47	> 45%	
Meets Threshold		≥ 300	≥ 27	≥ 16	≥ 45%	≤ 4.5	≤ 12	≥ 0.45	≥ 40 %	
Near Threshold		≥ 250	≥ 26	≥ 15	≥ 40%	≤ 4.65	≤ 14.5%	≥ 0.43	≥ 35%	
Non-Support		< 250	< 26	< 15	< 40%	> 4.65	>14.5%	< 0.43	< 35%	

Traditional approach – set low WQS to minimize effect of phosphorus on water quality



- In an ideal world we would:
- Identify undesirable algae or transparency, and
- Select associated Phos value
- Lower Phos should protect to clearer water, right?

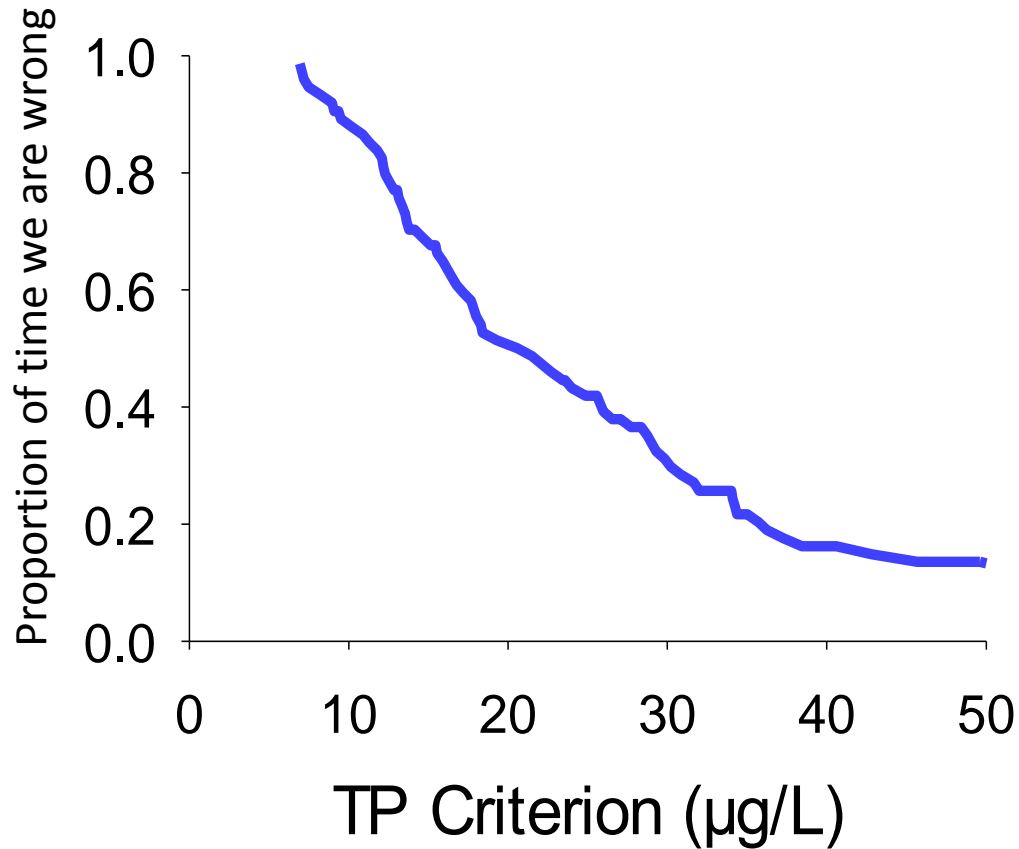
But when we examine responses against TP levels we see significant overlap



Nutrient Criteria Approach

- Pair phos with response variable
- Examine likelihood of impairment with increasing P levels.
- Calculate the risk of false positive or false negative decision-calls along the gradient of phosphorus.

We calculate the proportion of time impairment is indicated given a phos. criterion



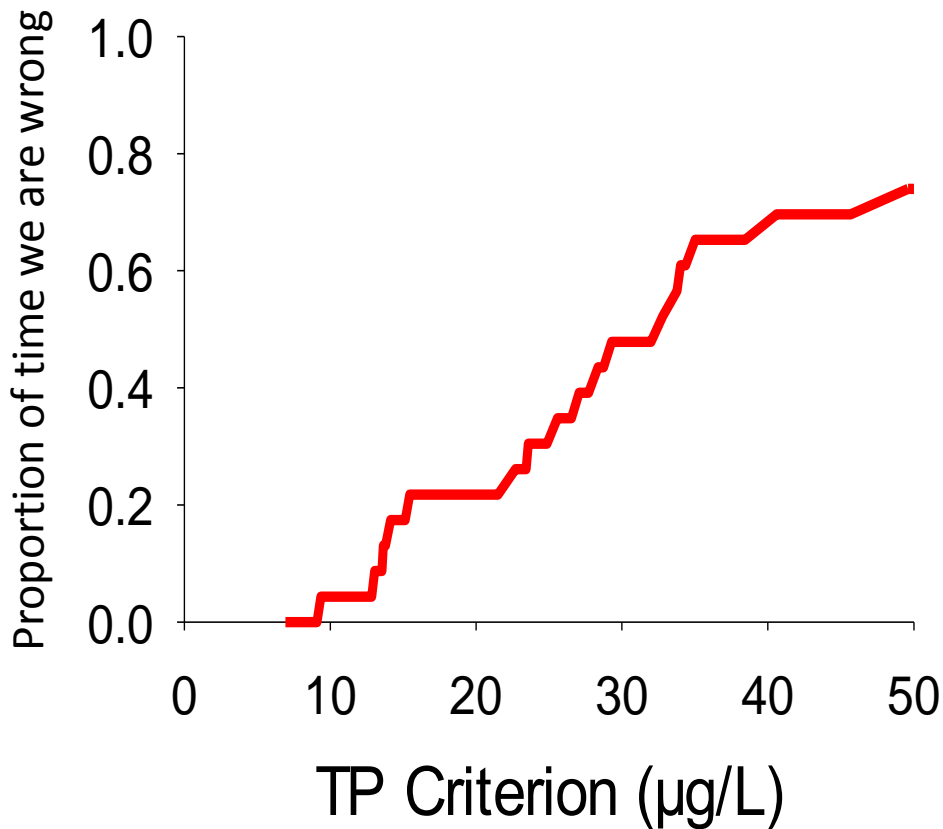
False positive:

- We call it bad when it is not
- “Error” means as making the wrong call
- Notice the steady decline in error.
- Where do you draw the line?

Consequences:

- Require nutrient control technology where it is not needed.
- Manage the wrong subwatersheds of NPS nutrients.
- Cost people lots of \$\$ for no reason.

We calculate the proportion of instances impairment is indicated given a phos. criterion



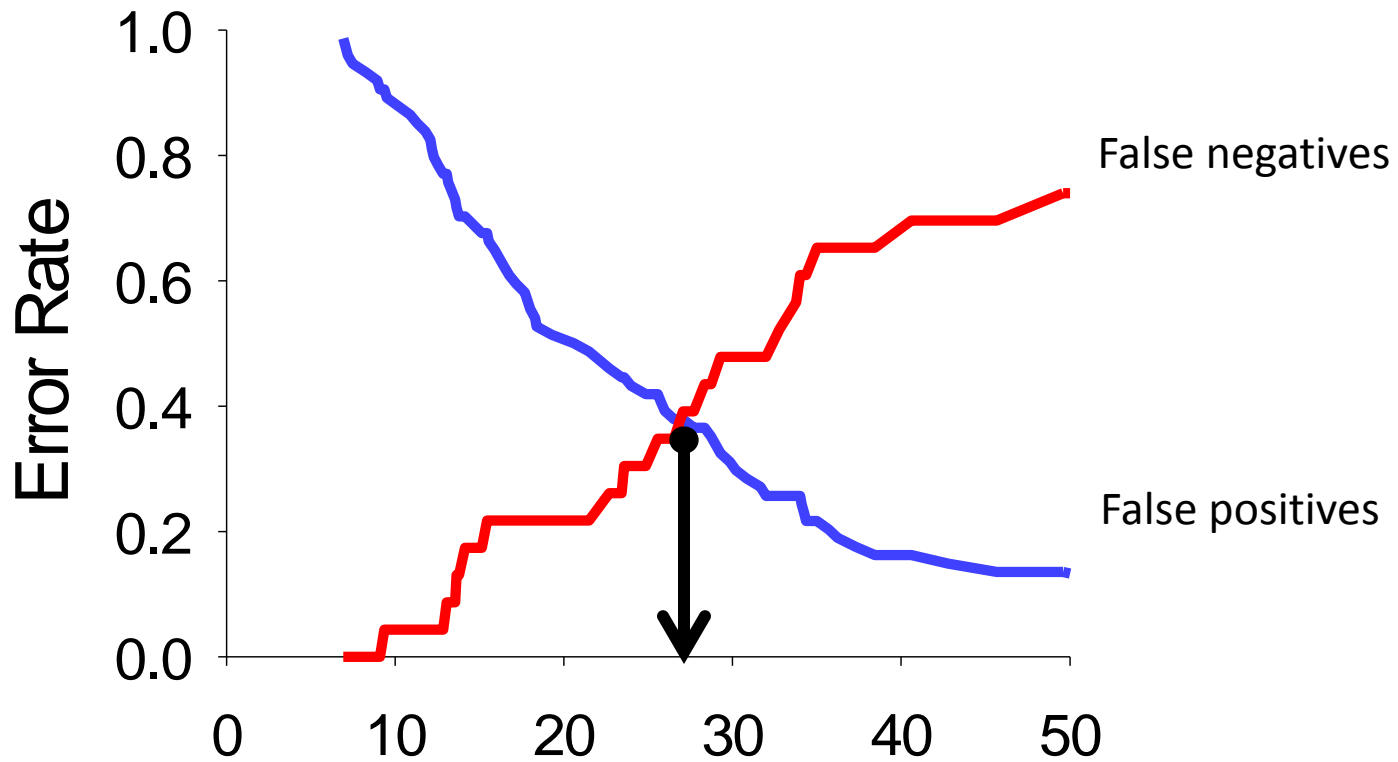
False negatives:

- We call it good when it is not
- "Error" means as making the wrong call
- Notice the steady rise in error.
- Where do you draw the line?

Consequence:

- Miss important pollution issues
- Allow impairments to perpetuate
- Fail to take management action where it is needed

Minimizing false positive and false negative impairment determinations



Error rate of 40% is too high

- Fundamental problem with nutrient criteria:
 - Either way you balance error, there still is a lot of error.
 - Should the state require multimillion dollar expenditures to fix a nutrient impairment when we are 40% likely to be wrong?
 - Can the state ignore a problem if we are 60% sure impairment exists?
 - There needs to be verification!

Rule Structure Example

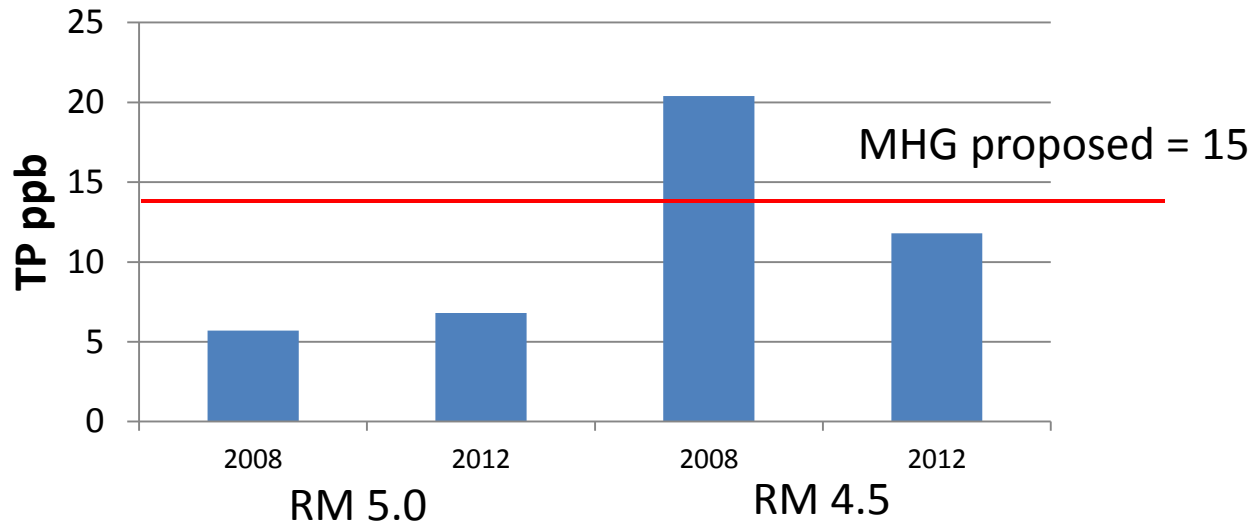
In all Class B waters except for segments within Lake Champlain and Lake Memphremagog, compliance with nutrient criteria shall be achieved either by compliance with the nutrient concentration values in Table 5 **or** by compliance with all nutrient response conditions in Table 5.

	Small, High- Gradient Streams	Medium, High- Gradient Streams	Warm- Water, Medium- Gradient Streams	Lakes and Reservoirs	All Other Waters
Nutrient Concentrations					
Total Phosphorus ($\mu\text{g/L}$)	12	15	27	18	
Nutrient Response Conditions					
Secchi Disk Depth (meters)				2.6	
Chlorophyll-a ($\mu\text{g/L}$)				7.0	
pH	Not to exceed 8.5 standard units.				
Turbidity	Consistent with the criteria in Section 3-04 B.1 of these rules.				
Dissolved Oxygen	Consistent with the criteria in Section 3-04 B.2 of these rules.				
Aquatic Biota, Wildlife, and Aquatic Habitat	Consistent with the criteria in Section 3-03 B.4 of these rules, implemented according to the numeric thresholds established in the Vermont Department of Environmental Conservation Biocriteria for Fish and Macroinvertebrate Assemblages in Vermont Wadeable Streams and Rivers - Implementation Phase, dated February 10, 2004 or as more recently updated.				

Nutrient Criteria Decision Framework

	Phosphorus \leq Criterion	Phosphorus $>$ Criterion
All Response Conditions Met	A	B
Not All Response Conditions Met	C	D

Example assessment – Saxton’s R.



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Location: Saxtons River						Location ID: 501283				
Town: Rockingham						Bio Site ID: 060000000045				
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Proposed Vermont Nutrient Criteria Decision Framework

Assessment and Listing Decisions	
A. Phosphorus concentration less than or equal to criterion. All nutrient response conditions met.	
	Not impaired by nutrients. Rotational basin monitoring on an approximate five-year schedule will be conducted.
B. Phosphorus concentration greater than criterion. All nutrient response conditions met.*	
	Not impaired by nutrients. Annual monitoring will be conducted for phosphorus concentration and all nutrient response conditions at sites affected by permitted discharges. Rotational basin monitoring on an approximate five-year schedule will be conducted at other sites.
C. Phosphorus concentration less than or equal to criterion. Not all nutrient response conditions met.	
	Impaired, but not necessarily by nutrients. Site will be studied to determine the cause of impairment. If found to be impaired by nutrients, an alternate (lower), site-specific nutrient criterion may need to be established for permitting purposes.
D. Phosphorus concentration greater than criterion. Not all nutrient response conditions met.	
	Impaired by nutrients. Annual monitoring will be conducted for phosphorus concentration and all nutrient response conditions at sites affected by permitted discharges.

* If data are unavailable for any applicable response condition, then the waterbody would be assessed as impaired by nutrients, pending further data collection.

Proposed Vermont Nutrient Criteria Decision Framework

Discharge Permitting Decisions

A. Phosphorus concentration less than or equal to criterion. All nutrient response conditions met.

If a new or increased discharge is proposed, the permit will limit the phosphorus concentration increase according to the anti-degradation policy. No new or increased phosphorus discharge would be permitted that would cause the phosphorus concentration to be greater than the criterion. If a current discharge has reasonable potential to produce a phosphorus concentration above the criterion value, then annual monitoring will be conducted at the site for phosphorus concentration and all nutrient response conditions. If response conditions are worsening or indicate a likelihood that an impairment will develop, more stringent permit limits will be applied in order to prevent the impairment.

B. Phosphorus concentration greater than criterion. All nutrient response conditions met.

If a new or increased discharge is proposed, the permit will limit the effluent phosphorus concentrations and loads to the existing amounts or less. If response conditions are worsening or indicate a likelihood that an impairment will develop, more stringent permit limits will be applied in order to prevent the impairment.

C. Phosphorus concentration less than or equal to criterion. Not all nutrient response conditions met.

If the site is determined not to be impaired by nutrients but a new or increased discharge is proposed, the permit will limit the nutrient increase according to the anti-degradation policy. In no case will amounts be permitted that would cause the phosphorus concentration criterion to be exceeded. If the site is determined to be impaired by nutrients, then more stringent permit limits will be applied in order to correct the impairment.

D. Phosphorus concentration greater than criterion. Not all nutrient response conditions met.

More stringent permit limits will be applied in order to correct the impairment. A Total Maximum Daily Load (TMDL) designed to achieve the phosphorus concentration criterion may be required.

Intent of this language is to maintain loads at existing permitted amounts.

Process to move forward with the VT WQS changes.

- Stakeholder outreach:
 - WQAC
 - Rollout to State/Fed Agencies
 - Rollout to affected parties
 - Individual sector specific meetings
- Initiate public rulemaking
 - Spring – possibly seek ICAR concurrence for June.