

# Development of Freshwater Nutrient Criteria for Virginia:

## Academic Advisory Committee Recommendations to DEQ

*EPA Region 3 Lakes Nutrient Criteria workshop  
3 November 2004*

*Sheperd University. Sheperdstown WV*

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**Purpose of Presentation:** Describe AAC's recommendations for Virginia's nutrient criteria process.

**Academic Advisory Committee to DEQ:**

- Organized by Virginia Water Resources Research Center in late 1990s (1999?).
- Comprised of faculty from state Universities.
- Works with DEQ in an advisory capacity, responds to specific requests by DEQ.

AAC Report:

## Introduction and Conceptual Basis

*Fundamental Question:*

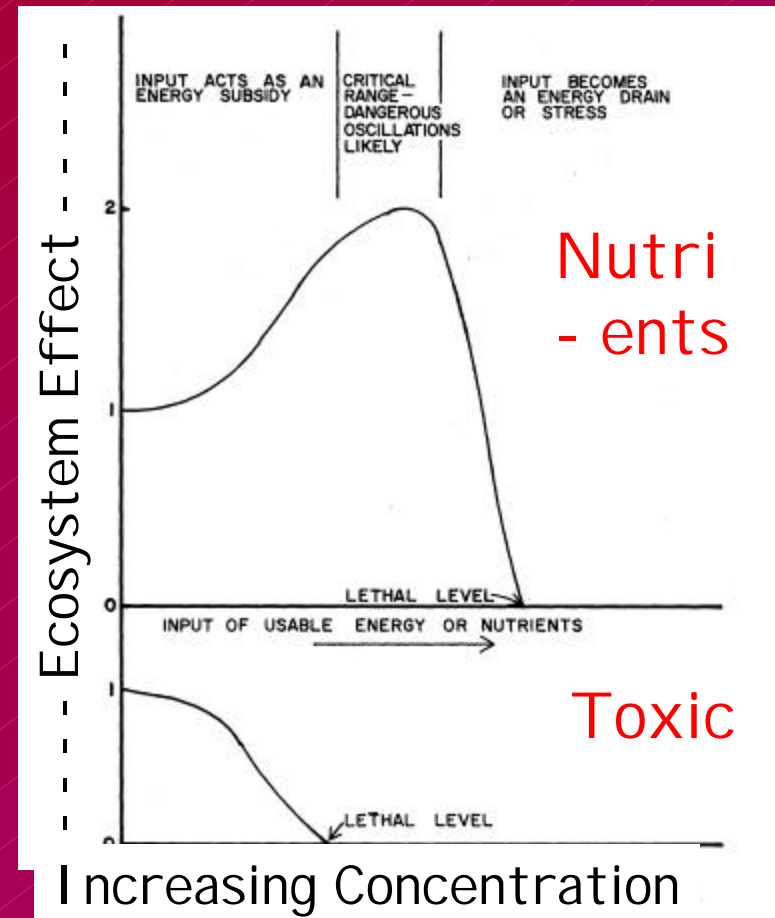
How should the presence or absence of “clean water” be determined?

What should be the basis for nutrient criteria establishment?

# Protection of designated use should be the basis for establishing criteria.

## Rationale:

- ✍ Language defining criteria in CWA Sec. 303, 40 CFR 131.3(b) .
- ✍ Fundamental nature of nutrients in aquatic systems.
- ✍ Most Virginia "lakes" are constructed impoundments.



CWA Sec.303: “ ... water quality **standard** shall consist of the **designated uses** of the navigable waters ... and the water quality **criteria** for such waters based upon such uses ... [shall] protect the public health or welfare, ... shall be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes ...

## Lakes and Reservoirs:

Natural lakes and constructed impoundments should be considered separately.

Rationale: Extensive scientific evidence that these systems respond differently to nutrient inputs (impoundments tend to have larger watersheds, lower retention times, more non-algal turbidity ... require greater management as a result of having been constructed ...)

From here forward: will discuss impoundments.

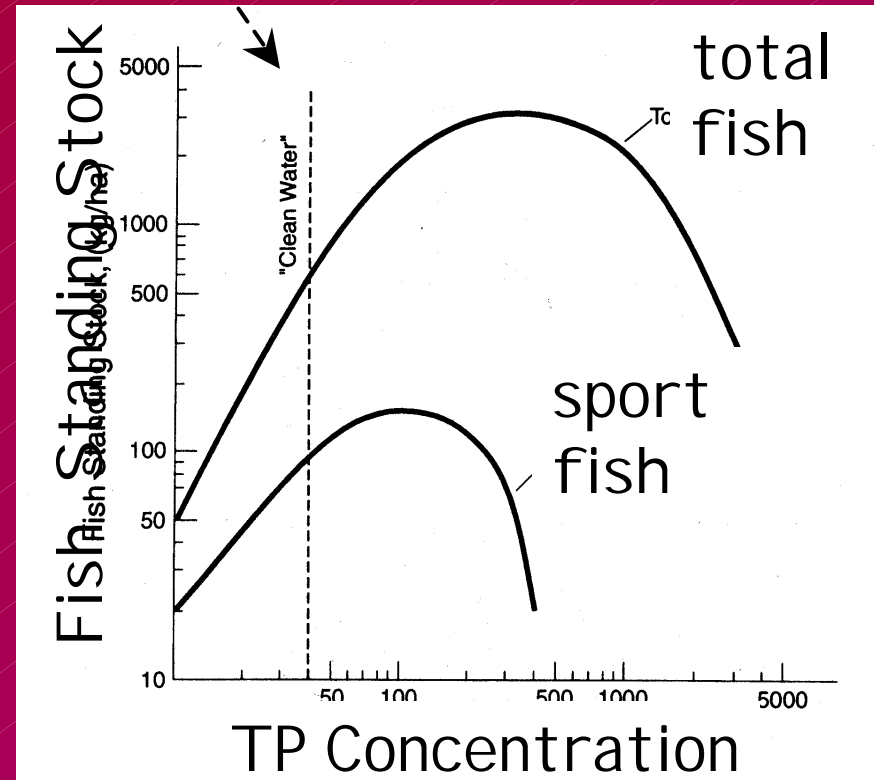
# Principal designated uses for impoundments:

- Aquatic life
- Recreation (swim, fish ...)
- Public water supply

Develop “candidate criteria” for each use.

Expect that conflicts between nutrient requirements of specific uses will arise.

“Clean water,” as perceived for swimming



In constructed impoundments, recreational fish population status can be an indicator of suitability for aquatic life.

*Rationale:*

✍ most impoundments are used or managed for recreational fishing.

✍ recreational fish species are generally the highest trophic level.

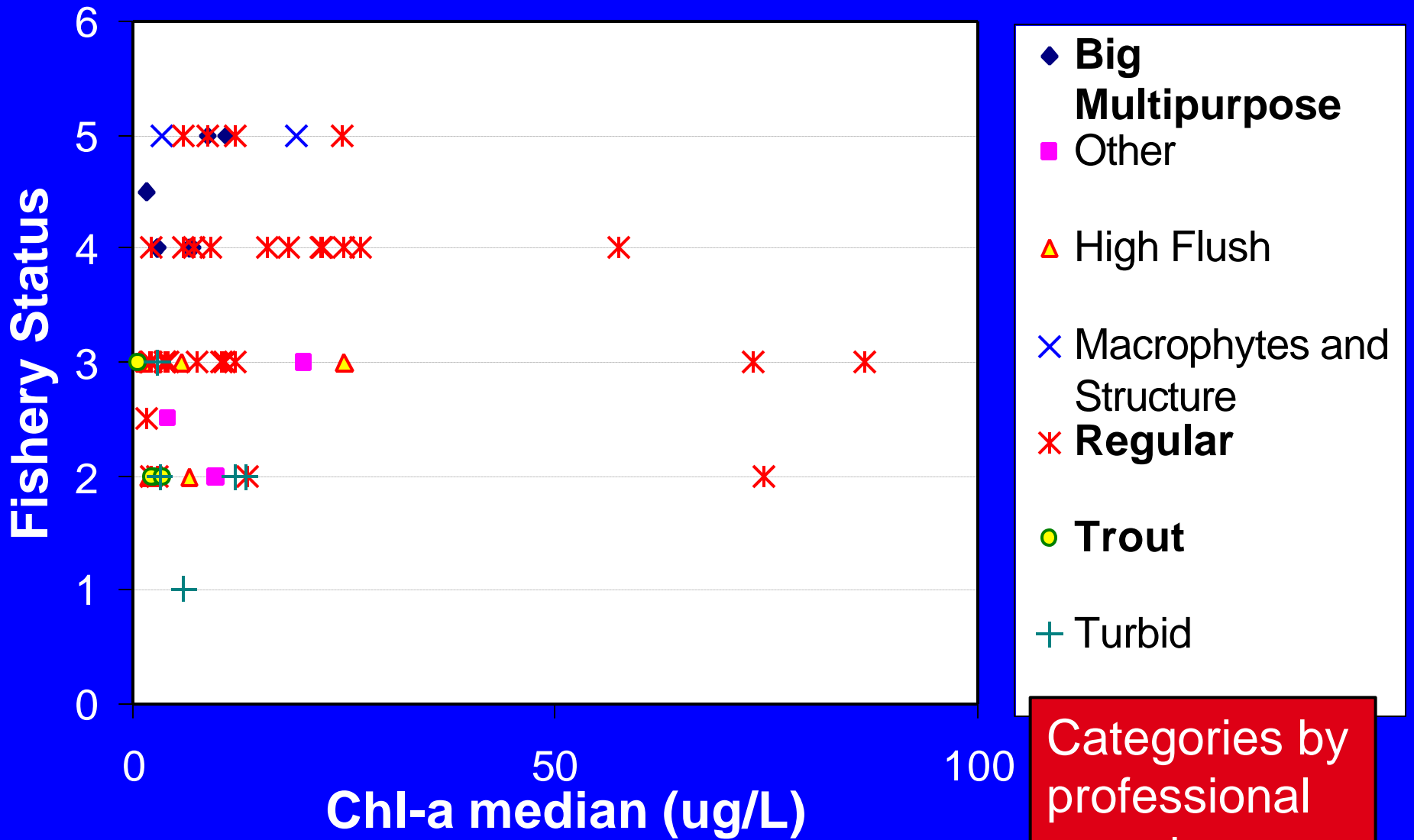


Recreational fish status can be assessed by obtaining VDGIF biologist ratings.

Rationale: Fish population data that represent a number of impoundments, and are comparable, are not available and would be expensive to gather.

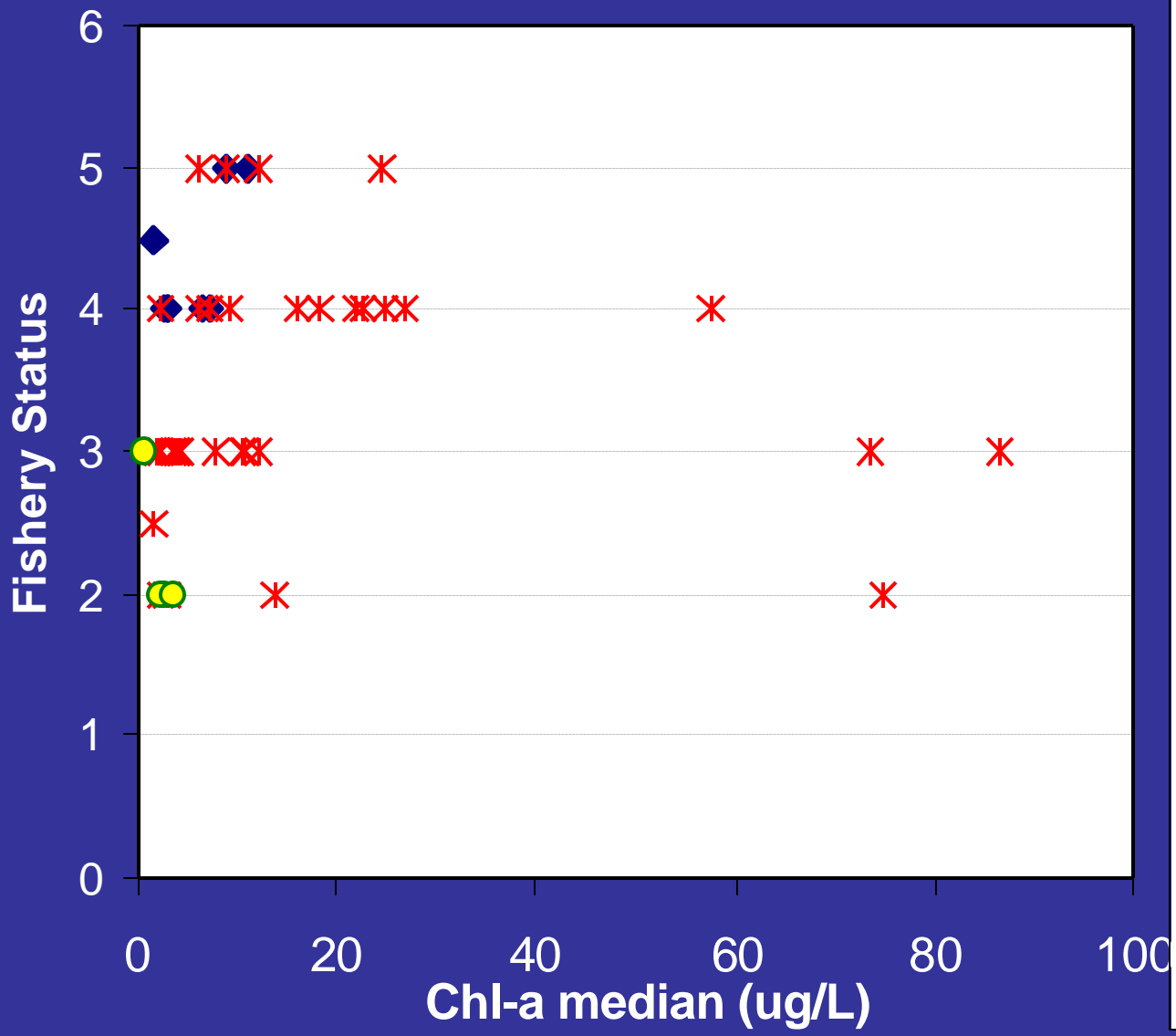
VDGIF ratings can be analyzed for nutrient effects by impoundment fishery type.

Warm water ... Cool water ... Trout



Categories by professional experience.

3 m or less; May-Sept.; > 4 chl-a observations.



- Big**  
◆ multipurpose, mixed warm and cool water habitat.
- Warm water habitat, no overt unusual features.**  
✱
- Managed for trout**  
●

User perception surveys, if designed, administered, and analyzed in a scientifically valid manner, would be an appropriate means for assessing suitability for recreational uses.

In light of DEQ staff expertise: AAC makes no recommendations regarding public water supply suitability.

AAC expects that nutrient criteria would be expressed as water column chlorophyll a.

Rationale: Chl<sub>a</sub> is an indicator of algal biomass, which can impair designated uses at excessive levels.

Possible disadvantage of using Chl<sub>a</sub>:  
Levels are more variable, difficult to assess using data obtained from standard monitoring protocols.

Criteria should be expressed as TP *only* if TP- $\text{chl}_a$  relationships are predictable.

Rationale: TP- $\text{chl}_a$  relationships are more variable in impoundments than in natural systems.

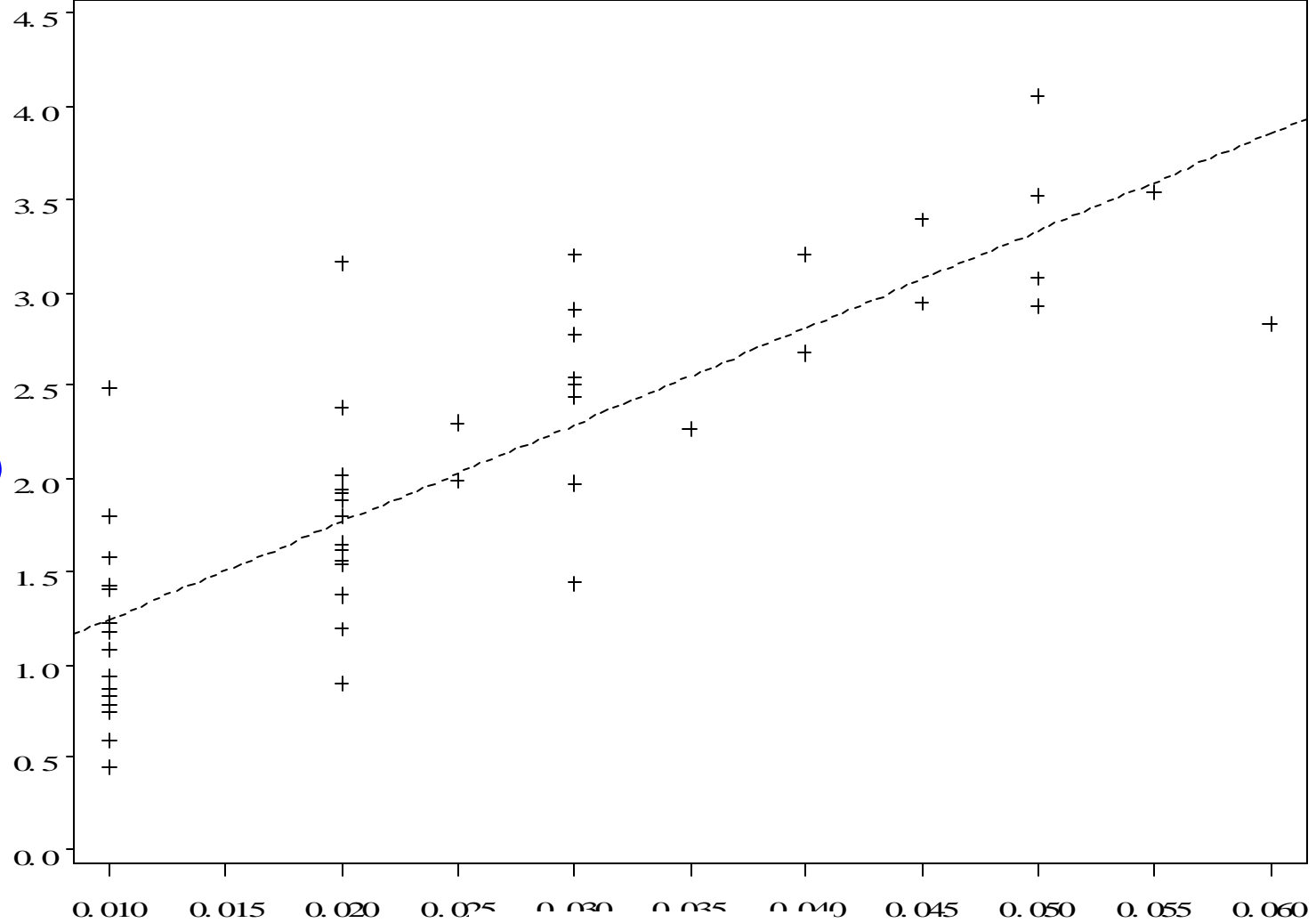
Nitrogen criteria should not be established.

Rationale: Potential for N reductions, if applied independently of P, to stimulate blue-green algae, which affect designated use negatively

Log chl-a

$$\log_{10} \text{chl-a} = 0.7213 + 52.179 \text{ TP median}$$

Truncated plot



N  
50  
Rsq  
0.6831  
Adj Rsq  
0.6765  
RMSE  
0.5103

TP median

Constructed impoundments vary ...

Do not consider downstream loading effects lakes & reservoirs, but do so for rivers & streams:

Rationale:

- ✍ Constructed impoundments often act as nutrient traps.
- ✍ Stream segments can contribute nutrients to downstream water-body impairments.



Problem: Data / modeling capability.



# Lakes/Reservoirs, and Rivers/Streams:

Build systematic evaluation / refinement of criteria and water-body classifications into the process.

✍ Evaluate numeric criteria violations: is designated use impaired?

✍ Evaluate waters through monitoring program or other means: is designated use impaired?

## Longer-term Recommendations:

Expand database describing water-body uses, features, physical conditions.

### Rationale:

- ✍ Water body characteristics will influence biological response to nutrient inputs.
- ✍ Classification and use designation are the tools available for refining criteria application.
- ✍ Better descriptive data will aid evaluation and refinement.

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