Assessing Nutrient Impacts in New Jersey Waters

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OVERVIEW

• Surface Water Quality Standards
• History of New Jersey’s Freshwater Nutrient Criteria
• Implementation through NPDES Permitting
• Water Quality Assessment Methods—303(d) and 305(b)
• Nutrient Criteria Enhancement Plan
Water Resource Management: Role of Standards, Monitoring and Assessment

- Compliance & Enforcement
- SWQ Standards
- NPDES Permits and Nonpoint Source Controls
- Monitoring
- Public Participation
- Assessment
- TMDLs
- Integrated Report*
- 303d List*

*Integrated Water Quality Monitoring and Assessment Report – 303(d) and 305(b)
Water Quality Standards

- CWA Section 303(c) - **States** required to adopt WQS
- Standards must include:
  - designated **uses**,
  - water quality **criteria** (should include magnitude, frequency and duration)
  - **antidegradation** policy and other **policies**
- States required to review & revise WQS 1x/3yrs
- After formal consultation with USFWS, EPA can approve or disapprove State Water Quality Standards
- If EPA disapproves, Agency can establish standards for State
New Jersey Surface Water Quality Standards - N.J.A.C. 7:9B

• Classify waters based on uses, including:
  – Aquatic life
  – Drinking water
  – Recreation
  – Fish and Shellfish consumption
  – Agricultural and Industrial supplies

• Water Quality Criteria to protect uses
  – Numeric criteria
  – Narrative criteria

• Policies
  – Antidegradation
  – Mixing zone
  – Variances
  – General and Technical
History of NJ Freshwater Numeric Phosphorus Criteria

1974 - 0.05 mg/L for lakes, reservoirs and tributaries
1981 - 0.1 mg/L for freshwater rivers and streams
1985 - Adopted effluent standard of 1.0 mg/L
1996 - 1999 - SWQS Stakeholder process
2001 - Adopted provision to establish watershed-specific criteria
2002 - Imposed WQBEL based on numeric criteria for discharges to 303(d) listed waterbodies
2002 – Developed a technical manual (guidance) to evaluate narrative criteria for individual dischargers
NJ Freshwater Criteria

Narrative Criteria
Nutrients shall not be allowed in concentrations:
• that cause objectionable algal densities
• nuisance aquatic vegetation
• abnormal diurnal fluctuations in dissolved oxygen or pH
• changes to composition of aquatic ecosystems
• or otherwise render the waters unsuitable for designated uses

Phosphorus Numeric
• Lakes: 0.05 mg/L
• Streams: 0.1 mg/L
Nutrient Policy

Watershed-specific translation of the narrative criteria (e.g. chl $a$ concentration) or site-specific numeric criteria for phosphorus can be adopted into NJ’s SWQS as part of the Total Maximum Daily Load (TMDL) process.

Non-tidal Passaic River TMDL - adopted 2008
Phosphorus Technical Manual – NPDES Permit Limits

- Specified monitoring requirements and study design for NPDES facilities
- Required demonstration that waterbody was not impacted by nutrients to remove the WQBEL based on numeric criteria
- Established conservative thresholds to interpret narrative criteria
- Provided important information on response indicators to develop nutrient assessment method for narrative nutrient criteria in freshwater wadeable streams
PHOSPHORUS TECHNICAL MANUAL – NPDES PERMIT LIMITS - THRESHOLDS

Must meet all thresholds to demonstrate compliance with narrative criterion under summer (growing season) and low flow conditions

- Dissolved Oxygen criteria (continuous monitoring)
  DO criteria 90% of the time
  Daily average DO criteria
- Phytoplankton concentration:
  24 µg/L chl-a seasonal mean, or
  32 µg/L chl-a 2-week mean
- Periphyton density:
  150 mg/m² chl-a seasonal mean, or
  200 mg/m² chl-a single sample event
Development of 2010 Narrative Nutrient Assessment Method

- Weight of evidence approach is needed
- Critical to incorporate biological conditions (benthics, diurnal DO)
- Statewide numeric criterion may need to be augmented with site-specific factors
- 2009 – proposed method in 2010 Water Quality Monitoring and Assessment Methods for developing 2010 Integrated Report (303(d) 305(b))
## Biological Thresholds of Macroinvertebrate Metric Index

<table>
<thead>
<tr>
<th>Category</th>
<th>High Gradient</th>
<th>Coastal Plains</th>
<th>Pinelands</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>63 - 100</td>
<td>22 - 30</td>
<td>63 - 100</td>
<td>Not Impaired</td>
</tr>
<tr>
<td>Good</td>
<td>42 - &lt; 63</td>
<td>12 - 20</td>
<td>56 - &lt; 63</td>
<td>Not Impaired</td>
</tr>
<tr>
<td>Fair</td>
<td>21 - &lt; 42</td>
<td>10 - 6</td>
<td>34 - &lt; 56</td>
<td>Impaired</td>
</tr>
<tr>
<td>Poor</td>
<td>&lt; 21</td>
<td>&lt; 6</td>
<td>&lt; 34</td>
<td>Impaired</td>
</tr>
</tbody>
</table>

NJDEP Water Monitoring and Standards
Diurnal DO Swing
(< 3mg/L)

DO Swing > 6ppm

DO minimum exceeded

Min. DO Criteria  Lamington  Passaic

Time
## 2010 Narrative Nutrient Criteria Example Assessment Results

<table>
<thead>
<tr>
<th>Benthic Index Assessment</th>
<th>DO Criteria</th>
<th>Diurnal DO Swing</th>
<th>Narrative Nutrient Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Impaired</td>
<td>Met</td>
<td></td>
<td>Met</td>
</tr>
<tr>
<td>Impaired</td>
<td>Exceeded</td>
<td>&gt; 3 mg/L</td>
<td>Exceeded*</td>
</tr>
<tr>
<td>Impaired</td>
<td>Met</td>
<td>&gt; 3 mg/L</td>
<td>Exceeded* if Chl a &gt; 150 mg/sq meter</td>
</tr>
</tbody>
</table>

*Where narrative nutrient criteria exceeded – phosphorus is listed on the 303(d) list*
NJ Nutrient Criteria Enhancement Plan

• Documents State’s Strategy to develop assessment methods and numeric criteria for all waterbody types
• Current criteria and assessment limited to non-tidal wadeable freshwater rivers/streams
• Under Development:
  – Coastal Waters (estuaries, ocean waters)
  – Freshwater Non-Wadeable Rivers
  – Lakes
Nutrient Criteria Enhancement Strategy

• Enhance monitoring and data collection on nutrients and response variables

• Research cause/response relationships and select appropriate indicators of aquatic life use impairment

• Develop enhanced assessment methodologies based on ecosystem response variables (e.g. DO, diatoms, SAV)

• Implement enhanced assessment methods through Integrated Report
  – Listing/Delisting
  – TMDLs

• Develop/promulgate new numeric nutrient site-specific criteria through TMDLs
Projects Under Development for Freshwaters*

- Trophic Diatom Index – complete
- Using BCG to set nutrient thresholds using diatoms based on eco-regions
- Lake Diatom Index – under development using sediment cores collected as part of our probabilistic lake survey work
- Paleolimnological Analysis of Nutrient Enrichment for Criteria Development in New Jersey Lakes

*These projects completed in conjunction with the Philadelphia Academy of Natural Science
Nutrient Criteria Development for Coastal Waters

- Benthic Index for Near Shore Ocean Waters
- Benthic Index for shallow coastal bays
- Nutrient and Ecological Histories in Barnegat Bay
- Ecological health for shallow coastal bays to incorporate several factors – benthic index, SAV, and algal blooms
Conclusions

• New Jersey is currently implementing both narrative and numeric criteria in freshwater wadeable streams

• Need to rely more on biological responses using a weight of evidence approach to evaluate nutrient impacts

• More work is needed to develop cause-response relationships before we adopt numeric criteria for all waters.
Comments/Questions

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