Nutrient TMDL Issues in Kentucky

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KY’s Nutrient Limits

- Where eutrophication problems may exist, nitrogen, phosphorus, carbon, and contributing trace element discharges shall be limited in accordance with:
  - The scope of the problem;
  - The geography of the affected area; and
  - Relative contributions from existing and proposed sources.
Minimum Criteria

• Surface waters shall not be aesthetically or otherwise degraded by substances that:
  - (c) Produce objectionable color, odor, taste, or turbidity;
  - (e) Produce undesirable aquatic life or result in the dominance of nuisance species;

• Biologists must interpret the information
Aquatic Life Impairment

Calculate DBI, MBI, and IBI scores from 0-100 based upon statewide reference dataset. Often only have MBI.

Each site is given a narrative rating (Excellent, Good, Fair, Poor, and Very Poor) for each community as compared to reference percentile distribution within the bioregion.

Narrative ratings of each community are compared (MBI may receive more weight than IBI, then DBI).

Do all 3 narrative ratings agree?

Yes

An overall narrative bioassessment rating is given to site based on agreement.

No

Do 2 of 3 community narrative ratings agree?

Yes

Examine landuse, geology, hydrologic conditions, habitat conditions, sampling conditions and effort, seasonality, and physicochemical information to identify causes of assessment differences.

Based upon best professional judgement, an overall bioassessment rating (Excellent, Good, Fair, Poor, or Very Poor) is given for the site.

No

Based upon best professional judgement, an overall bioassessment rating (Excellent, Good, Fair, Poor, or Very Poor) will be obtained by averaging the 3 community ratings for the site.

Use support is determined as follows:

Excellent and Good = Full Support
Fair = Partial Support
Poor and Very Poor = Non Support

Note: For cautionary purposes, a site may not be given a formal bioassessment rating if it does not fall into a discrete category that may list it as impaired or not impaired. In this instance, a resample of the stream segment may be warranted. This also results in a Category “3” assessment.
Nutrient Impairment

Habitat

Does Habitat score support designated uses?

No

Evaluate specific habitat metrics including embeddedness, epifaunal substrate, sediment deposition, riparian zone, bank stability. Is impairment habitat driven?

Yes

List cause code for habitat alteration. Include siltation, or flow alteration codes where appropriate. Check for other stressors.

Nutrient Impairment

Are nutrient data available?

No

No

Nutrient Impairment

Decision whether exceedence might be nutrient related (high or low DO, algal mats). Check for nutrient impairment (see below). Does pH, cond., temp, or DO exceed?

Yes

Check for nutrient impairment (see below)

No

Compare nutrient concentrations with regional benchmarks

Nutrient Impairment Indicators

Abiotic Factors

Instream Observations (algal mats, DO, odors, foam, “straight pipes”) Watershed and landuse information related to nutrient enrichment

Use GIS

Watershed Geology (calcareous versus sandstone) Land Use (pastures, rowcrops, CAFO’s, urban areas, golf courses) KPDES Permits (outfall locations, type and volume) Riparian Zone Width and Quality (immediate, upstream); Canopy Cover

Biotic Factors

Metric thresholds for diatoms, macroinvertebrates, and fishes

Diatoms

PTI

BG < 1.8
PR < 2.3
MT < 2.3
MVIR < 2.0

%NNS

BG > 78
PR > 45
MT > 35
MVIR > 72

%NUTTOL

BG > 51
PR > 15
MT > 12
MVIR-NA

mHBI

BG > 5.9
PR > 4.9
MT > 5.2
MVIR > 7.5

EPT

BG < 10
PR < 18
MT < 15
MVIR < 5

%NUTTOL

BG > 69
PR > 42
MT > 38
MVIR-NA

Macroinvertebrates

%NUTTOL

BG > 69
PR > 42
MT > 38
MVIR-NA

Fishes

No thresholds currently available
303(d) Listings

- Un-ionized Ammonia (8)
- Nitrate/Nitrite (14)
- Nitrates (1)
- Total Nitrogen (13)
- Nutrient/Eutrophication Biological Indicators (335)
- Total Phosphorus (34)
- Total Kjeldahl Nitrogen (6)

- 17% of current listings
Historic Nutrient TMDL Development

- 3 Approved TMDL documents for 4 segments and 1 lake (1997 and 2000)
- Wadeable Stream TMDLs
  - For low flow condition 7Q10=0, assumed LA=0.
  - Applied TP permit limit of 1 mg/L to get WLAs.
Historic Nutrient TMDL Development

• Taylorsville Lake
  – CE-QUAL-W2 model (COE Report)
  – 2 major point sources provide 4-7.5% of loading
  – High background load (phosphatic limestone)
  – 76% of land use is Agricultural
  – 50% reduction in existing loadings (89-100% reduction in NPS loadings)
  – 10-14 point change in Trophic State Index during average and wet years, 15-25 point change during dry years (measured at headwaters of lake).
## Historic Nutrient TMDL Development

### Taylorsville Lake TMDL

<table>
<thead>
<tr>
<th></th>
<th>Existing Loads (lbs/day)</th>
<th>Allowable Loads - TMDL (lbs/day)</th>
<th>WLA (lbs/day)</th>
<th>LA - Background (lbs/day)</th>
<th>MOS (lbs/day)</th>
<th>LA - Nonpoint Sources (lbs/day)</th>
<th>Existing NPS Load (lbs/day)</th>
<th>% NPS Reduction</th>
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</table>
Current Nutrient TMDL Development

- 34 under development; all by 3rd Party contractors
- 3 by EPA - one lake and one large watershed using BASINS/WASP
- 16 stalled pending KY nutrient targets -- HSPF/QUAL
- 15 using EPA national targets--HSPF
- Building in-house modeling capacity
- Load Duration Curves—WATERS?
Challenges to Nutrient TMDL Development

• Upper management
• No numeric criteria
  – Guidelines under development for wadeable streams
    • Multiple Lines of Evidence
      – Stressor-response (macroinvertebrates and diatoms)
      – Reference stream nutrient ranges (75th/90th percentile)
      – Passing MBI sites nutrient ranges (75th percentile)
      – Literature values for effects or trophic status
Draft Guidelines:
Bluegrass = .10 mg/l TP, 1.2 mg/l TN
Pennyroyal= .05 mg/l TP, 1.4 mg/l TN
Mountain= .025 mg/l TP, 0.65 mg/l TN
Miss Valley-Interior River Lowland= 0.07 mg/l TP, 1.4 mg/l TN

For info contact Lara Panayotoff:
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Challenges to Nutrient TMDL Development

• Watershed complexity
  – Urban landscape,
  – point sources,
  – CSOs, SSOs, straight pipes, leaking sewer lines
  – karst flow
Example of Karst Flows
Challenges to Nutrient TMDL Development

- Lack of flow gages
- Data gaps
  - Event mean concentrations
    - No storm event monitoring
  - Boundary conditions
  - Magnitude, frequency, duration and concentration for CSO & SSO events
Challenges to Nutrient TMDL Implementation

• Undetermined NPS loadings for specific entities
  – Stakeholders claim it’s not them
• Limited enforcement of the KY Agriculture Water Quality Act
• Cost associated with BMPS or facility upgrades
• Nutrient Reduction Strategy under development
  – Identify nutrient reduction efforts in Agriculture
    • 10 years post Ag Water Quality Act implementation
  – Provide Incentives for Nutrient Reductions
  – Establish Riparian Buffer Zones
  – Monitor for nutrients in major rivers at state borders
    • Identify amount entering from other states and amount leaving KY
Looking to the Future

– Use draft guidelines
  • As mechanism for stakeholder development
  • To prepare regulated community for eventual numeric criteria
  • As motivation for voluntary reductions
  • To set KPDES permit limits in negotiated settlements from enforcement actions
  • To establish TMDLs??
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