A Review of Delaware’s Total Maximum Daily Loads (TMDL) Program

Listing, Development, Implementation, and Tracking

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Outline

- DNREC’s water quality management tools
- What is a TMDL?
- When and how a TMDL is developed?
- TMDL implementation Plan (Pollution Control Strategy-PCS)
- Tracking TMDL implementation and Post TMDL monitoring
- A few monitoring results
Some of DNREC’s Water Quality Management Tools

- Water quality standards
- Water quality monitoring
- Water quality assessment
- Listing of impaired waters (303(d) List)
- Establishing Total Maximum Daily Loads (TMDLs)
- TMDL implementation Plan – PCS
Water Quality Standards

- Water quality standard for each water body includes:
  - Designated use (fishable, swimmable, etc.)
  - Narrative and/or numeric criteria to support designated use

- Generally DNREC reviews and, if necessary, updates Water Quality Standards once every 3 years
Water Quality Monitoring

• DNREC’s surface water quality monitoring program includes:
  – Grab sampling
  – Continuous monitoring
  – Special surveys
Surface Water Quality Program (Grab samples)

- More than 130 monitoring sites
- Monitoring frequency:
  - Monthly at C1 sites (22 sites)
  - Monthly or bi-monthly at C2 sites (111 sites) based on 5-year rotating basin schedule
    - 2 Years monthly
    - 3 years bi-monthly
Water Samples are Analyzed for:

- **Nutrients**
  - Phosphorus (dissolved, total)
  - Soluble Ortho-phosphorus
  - Nitrogen (dissolved, total)
  - Ammonia Nitrogen (dissolved, total)
  - Nitrite + Nitrate N (dissolved, total)

- **Carbon and Organics**
  - Organic Carbon (dissolved, total)
  - BOD$_5$, N-Inhib (CBOD5)
  - BOD$_{20}$, N-Inhib (CBOD20)
  - Chlorophyll-a

- **Bacteria**
  - Enterococcus

- **General**
  - Dissolved oxygen
  - Total Suspended Solids
  - Alkalinity
  - Hardness
  - pH
  - Specific Conductance
  - Salinity
  - Temperature
  - Secchi Depth
  - Light Attenuation
  - Turbidity

- ** Metals (dissolved and total) **
  - Copper
  - Lead
  - Zinc
Water Quality Assessment

- Water quality data collected by DNREC is used to assess water quality condition of the State’s waters and to prepare bi-annual Assessment Reports (per Section 305(b) of the Federal Clean Water Act).
Listing of Impaired Waters

- If the result of monitoring shows that a stream is not meeting its applicable water quality standards, the stream is placed on the list of impaired waters (303(d) List) and is targeted for TMDL development.
What is a TMDL?

• When the amount of pollutants in a waterbody exceeds its natural assimilative capacity, it becomes impaired.

• TMDL is the maximum amount of a pollutant that a water body can receive and still meet water quality standards

• Establishment of TMDL is required under Federal and State Laws and Regulations
To Develop a TMDL

• A multi-year intensive monitoring is conducted
• A computer model of the watershed and receiving water is prepared. The model relates pollutant loads to water quality conditions
• Using the model, a loading condition is determined that would result in meeting the water quality standards
TMDL

• A TMDL generally has 3 parts:
  – Load allocation for point sources (WLA)
  – Load allocation for nonpoint sources (LA)
  – Margin of Safety

TMDL = WLA + LA + MOS
Established TMDLs in Delaware

• In 1998, DNREC started development of TMDLs for all waters of the State that were impaired because of high nutrients, low DO, or high bacteria.
• Establishment of nutrient and bacteria TMDLs were completed by 2006
The Inland Bays TMDL
Inland Bays TMDL

• Was adopted in 1998 for tidal portions of the Rehoboth Bay, Indian River, and Indian River Bay

• In 2005, the TMDL was expanded to cover the entire watershed.

• Requirements of the Inland Bays TMDL:
  • Systematic elimination of all point sources of nutrients
  • Reduction of nonpoint source nitrogen load by 40-85%
  • Reduction of nonpoint source phosphorus load by 40-65%
  • Reduction of atmospheric deposition of N by 20%
How TMDLs Are Implemented?

- TMDLs are implemented through development of Pollution Control Strategies (PCS).
- PCS for the Inland Bays was adopted in 2008.
- Currently, PCS for several other watersheds within the State are under development.
- In addition, DE is involved in a multi-state effort to implement the requirements of an newly established TMDL for the Chesapeake Bay through a Watershed Implementation Plan (WIP).
The Inland Bays Pollution Control Strategy

• Addresses:
  – Point Sources (via regulatory means)
  – Nonpoint Sources (via voluntary & regulatory means)
    • Wastewater
    • Urban/Suburban
    • Stormwater
    • Agriculture
The PCS “Technical Document”

• Introduction & Background
  – Sources of Pollutants
  – PCS Development Process
• Progress to date
  – Point Source
  – Nonpoint Source
• Recommendations for future actions
• How the PCS should achieve the TMDL
• Costs
• Implementing Organizations
• Appendices

http://www.dnrec.delaware.gov/swc/wa/Pages/InlandBaysPCS.aspx
Tracking TMDL Implementation

• Programmatic tracking
• Tracking changes in water quality conditions and annual pollutant loads through post TMDL monitoring
Some Results re. annual nitrogen and phosphorus loads
State-wide Annual Nitrogen Load
(2006-2010)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total N (lbs/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>18.3</td>
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<tr>
<td>2007</td>
<td>15.3</td>
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<td>2008</td>
<td>10.5</td>
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<td>2009</td>
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<td>2010</td>
<td>20.3</td>
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</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Total N (lbs/yr)</th>
<th>Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>18.3</td>
<td></td>
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<tr>
<td>2007</td>
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<td>2009</td>
<td>22.5</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>20.3</td>
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</tr>
</tbody>
</table>
Total Nitrogen Concentration at Various Monitoring Sites in Inland Bays

[Graph showing total nitrogen concentration over time for different sites with data points for Blackwater Creek (308361) and Millsboro Pond (308071)].

Water Quality Monitoring Sites Stream Gauging Sites

Blackwater Creek - 308361

Millsboro Pond, 308071
Total Phosphorous Concentration at Various Monitoring Sites in Inland Bays

- Wharton Branch - 309041
Total Phosphorous Concentration at Various Monitoring Sites in Inland Bays

Flow (cts)

Total Phosphorous (mg/l)

Jan-10 Feb-10 Mar-10 Apr-10 May-10 Jun-10 Jul-10 Aug-10 Sep-10 Oct-10 Nov-10 Dec-10

Pepper Creek @ Rt. 26 Bridge - 308091
How are we doing compare to nutrient load estimates for late 80’s and late 90’s?
Annual Nitrogen Load over the Years

<table>
<thead>
<tr>
<th>Year</th>
<th>Load (1000 lb/yr)</th>
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<tbody>
<tr>
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<td>2,923</td>
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<tr>
<td>2007</td>
<td>2,140</td>
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<tr>
<td>2008</td>
<td>1,612</td>
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<td>2009</td>
<td>3,664</td>
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<tr>
<td>2010</td>
<td>3,150</td>
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</tbody>
</table>

TMDL Baseline using '88-'90 data
TMDL Baseline using '98-'00 data

Annual Mean Flow (cfs)
Annual Phosphorus Load over the Years

- **TMDL Baseline using '88-'90 data**
  - 59
  - 63

- **TMDL Baseline using '98-'00 data**
  - 31
  - 50

- **2006**
  - 21

- **2007**
  - 21

- **2008**
  - 21

- **2009**
  - 50

- **2010**
  - 53

**Annual Mean Flow (cfs)**

- 0
- 100
- 200
- 300
- 400
- 500
- 600

**Load (1000 lb/yr)**

- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
To Summarize

- TMDL is an important water quality management tool that DNREC uses to address State’s water quality impairments
- Requirements of the TMDLs are implemented through PCS or WIP (Ches. Bay)
- Post TMDL monitoring tracks water quality and loading changes
- From the available data, it appears that we are making some progress with regard to P control and holding the line with regard to N
Thank You! and Questions?

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