Establishing Nutrient Trends in Iowa’s Rivers in Support of Iowa’s Nutrient Reduction Strategy

Mary Skopec and Calvin Wolter
Iowa Department of Natural Resources

10th National Water Quality Monitoring Conference
Tampa, FL
Background

November 2012, Iowa releases the Nutrient Reduction Strategy in response to the Gulf Hypoxia Action Plan 2008, which called for the 12 states along the Mississippi River to reduce delivery of nutrients to the Gulf by 45%.
Strategy documents

Progress reports

- 2014-2015 Annual Progress Report (PDF, 37 pages, 1.8 MB)
  - Progress Report Attachment: WRCC/WPAC Activities (PDF, 106 pages, 4.3 MB)
- 2013-2014 Annual Progress Report (PDF, 19 pages, 373 KB)
  - Progress report appendix (PDF, 10 pages, 421 KB)
- 2014 Update to Science Assessment Practice List (PDF, 2 pages, 195 KB)

Revised version - October 1, 2014

- Complete strategy document (PDF, 207 pages, 4.3 MB)
  - Executive Summary and Section 1: Policy Considerations and Strategy
    (PDF, 32 pages, 338 KB)
  - Section 2: Nonpoint Source Nutrient Reduction Science Assessment
    (PDF, 160 pages, 3.6 MB)
  - Section 3: Point Source Nutrient Reduction Technology Assessment
    (PDF, 15 pages, 393 KB)

Revised version - May 29, 2013

http://www.nutrientstrategy.iastate.edu/documents
The strategy is a science and technology based approach to reducing nutrients in Iowa’s water and is based on two science assessments to guide and formulate the policy for Iowa.

“The Iowa strategy proposes a pragmatic, strategic and coordinated approach for reducing nutrient loads discharged from the state’s largest wastewater treatment plants, in combination with targeted practices designed to reduce loads from nonpoint sources now while evaluating the need for nutrient water quality standards long-term.”
Water Quality Monitoring was a key component in developing the nutrient reduction strategy:

1. What are the baseline conditions?
2. How will we know if we are making progress?
Step 1: Establishing the Baseline
Iowa’s Ambient Monitoring Network

- 98 Sites in Iowa – varying consistency of sampling through time.
- Includes Sites Upstream and Downstream of Urban Centers
- Monitored on a fixed, monthly basis
- Mostly paired with USGS Gage locations
- Data from 2000-2011
- Only sites with “nearby” USGS gages, covering the length of record desired (2000-2011) were included. Using three load estimation methods.
Mean NO3-N Loads 2000-2011

NO3-N Loads lbs/ac
- Not assessed
- 0.1 - 5.0
- 5.1 - 10.0
- 10.1 - 15.0
- 15.1 - 20.0
- 20.1 - 33.0
Total N and P Loads for Iowa

- Sum up loads for 24 outer basins
- Total N = NO3-N/0.82
- Sum area of outer basins (83% of state)
- Scale up to State area

<table>
<thead>
<tr>
<th></th>
<th>Stream load</th>
<th>Nutrient Yield</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total N</strong></td>
<td>280,000</td>
<td>16.0</td>
<td>7.9</td>
</tr>
<tr>
<td><strong>Total P</strong></td>
<td>13,800</td>
<td>0.77</td>
<td>0.38</td>
</tr>
</tbody>
</table>
Point Source Load Calculation

- For 102 Major Municipal and 28 Industrial Facilities
- Load = Flow * Concentration
- Use Average Annual Flow = 2/3 Wet Weather Design Flow
- Use 25 ppm N and 4 ppm P in discharge from “Wastewater Engineering” Metcalf & Eddy
Non-point Source Calculation

- Total State Load minus Point Source Load

<table>
<thead>
<tr>
<th></th>
<th>Total stream load</th>
<th>NPDES load</th>
<th>Non-point source load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tons N/yr</td>
<td>280,000</td>
<td>18,300 (6.5%)</td>
<td>261,700 (93.5%)</td>
</tr>
<tr>
<td>Tons P/yr</td>
<td>13,800</td>
<td>2,900 (21%)</td>
<td>10,900 (79%)</td>
</tr>
</tbody>
</table>

Final Nonpoint Sources Reduction Goals:
- Total Nitrogen 41%
- Total Phosphorus 29%
The Nutrient Reduction Strategy Contained Two Key Components:

1. The Water Resources Coordinating Council (WRCC) will prioritize watersheds for nitrogen and phosphorus reduction.

WRCC convened a subgroup to identify “priority” HUC8s for Water Quality Initiative Funding.
Subgroup identified the following factors to set priorities:
   1. Elevated N and P loads
   2. “Significant” Urban Impact
   3. Geographic Distribution
   4. Existing Watershed groups OR watersheds with little activity to date.
HUC 8 Priority Watersheds

[Map showing various watershed projects and initiatives.]
2. The Water Resources Coordinating Council will set measures of success and relate these to watershed improvement based on a mutually agreed upon set of indicators.

Task Force Team was convened to identify how Iowa would measure load reduction/progress

• Iowa Department of Natural Resources
• Iowa Department of Agriculture and Land Stewardship
• University of Iowa
• Iowa State University
• USGS
• Iowa Soybean Association
The team examined three different load estimation techniques:
   1. Weighted Regression on Time, Discharge and Season
   2. AutoBeale Ratio Estimator (Richards, 1998)
   3. Linear Interpolation

Evaluation of Method was Based on:
   1. Ease of Use (ability to generate loads and trends annually)
   2. Accessible to non-technical audiences
   3. “One” answer
   4. How “stable” the answer is…
Boone River at Webster City, IA
North Raccoon River at Sac City, IA
Change in FW Nitrate Concentration 2000-2013

- Increase
- Decrease
- No Change
North Raccoon River at Sac City

Nitrate plus Nitrite as N, mg/L

Next Steps

1. Continue to Revise/Refine Load Estimation Methods
2. Explore use of surrogate measures for Total P
3. Expand Sensor Networks
Iowa Nutrient Sensor Network

Iowa WQIS (http://iwqis.iowawis.org/)
Mary Skopec  
(515) 725-3434  
Mary.Skopec@dnr.iowa.gov  
www.iowadnr.gov