Nitrogen Modeling to Evaluate Management Strategies to Restore Suffolk County’s Estuaries

Restore America’s Estuaries 2016 Summit: Our Coasts, Our Future, Our Choice

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Suffolk County, New York

- Sole Source Aquifer for >1.5 million people

- > 800 community public supply wells

- 74% of Suffolk County is un-sewered
  - Risk of elevated nitrogen & other contaminants

- Drinking water and surface water concern
Brown Tide, Fish Kills*

From Newsday, 2015

LI nitrogen troubles

- Cesspools, septic systems blamed for pollution
- Study: Watersheds leading to LI Sound affected

BY RICH S. LABAR

Septic systems and cesspools are the greatest contributors to nitrogen pollution in North Shore watersheds leading to Long Island Sound, according to a recent report published by the Marine Conservation League.

Thirteen watersheds – from Little Neck Bay to Northport Harbor — were analyzed in the report released March 6.

In all but the Manhasset Bay watershed, septic systems and cesspools accounted for more nitrogen pollution than fertilizers, septic system runoff or sewage-treatment plants, the report found.

In December, the U.S. Environmental Protection Agency proposed a new nitrogen-pollution standard for Long Island Sound, warning New York and five other states that their current efforts to reduce the pollutant won’t be enough.

The proposal calls for changes at sewage-treatment plants that discharge to the Sound, and such that septic systems and cesspools accounted for more nitrogen pollution than fertilizers, septic system runoff or sewage-treatment plants, the report found.

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Nitrogen Load Estimates

- Nitrogen loading calculated using spreadsheet “models”
- Nitrogen Loading Model (NLM)
- NJ Nitrate Dilution Model
- Others...

Source: Kinney and Valiela 2008

after Lloyd, 2015
Nitrogen Load Estimates

- Assumptions, assumptions, assumptions....
Major Assumptions

- Vetted through Committee
  - SCDHS, NYSDEC, USGS, Stony Brook University, CDM Smith
- On-Site Wastewater Systems
  - Residential, Non-Residential
  - Attenuation factors (through tank, plume, aquifer)
- Fertilizer
  - Application rates, losses, leaching rates
  - Agriculture, turf (golf, residential, rec fields)
- Animals (dogs, cats)
- Atmospheric Deposition
  - NOAA station
- Geology
  - Till vs Outwash
Verification of N Loading Parameters

- Need to validate assumptions
  - Monitoring wells?
  - Community water supply wells

- Run nitrogen loading simulations and compare to observed [N] in shallow water supply wells

Source: Illinois EPA
County-Wide Application

- 188 Water bodies
  - 132 estuaries
  - 18 lakes
  - 38 streams

- Refine regional groundwater models

- Node discretization on the order of 50-100 feet near waterbodies
Baseflow Contributing Area (watershed)

- Travel time calculated for watershed
South Fork Example
Simulated TN (mg/L)
- ND to 1
- 1 to 4
- 4 to 6
- 6 to 10
- > 10

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Nitrogen load calculations using spreadsheet models OK for first approximation

Models allow for better evaluation of management strategies, especially for complex systems
- Allow for incorporation of hundreds of thousands of point sources
- Account for intertwined hydraulics (water supply wells, all water bodies that receive groundwater baseflow)
- Evaluate management scenarios & time to benefit

Assumptions need to be vetted by stakeholders and validated, preferably with supply wells
Evaluating Sewering

- Sewering of a portion of the watershed is proceeding
- Estimate duration needed to achieve full benefit
Next Steps

- Complete subwatershed and nitrogen load modeling for all 188 subwatersheds

- Rank subwatersheds county-wide using:
  - N load
  - Residence time
  - Water quality data

- Run scenarios
Thank You

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