Minutes

Technical Advisory Committee

Friday, December 7, 2007 9:30 AM to 12:30 PM

Newington Town Hall
205 Nimble Hill Road
Newington, NH 03801

Meeting Topic: Developing Nutrient Criteria for New Hampshire's Estuaries

Attendees

Phil Trowbridge, NHEP/DES
Jennifer Hunter, NHEP
Ed Dettmann, EPA
Jeannie Brochi, EPA
Jim Latimer, EPA
Phil Colarusso, EPA
Matt Liebman, EPA
Paul Currier, DES
Ted Diers, DES
Kevin Lucey, DES
Kathy Mills, GBNERR
Eileen Miller, NHACC
Tom Irwin, CLF
Ray Konisky, TNC
Steve Jones, UNH
Rich Langan, UNH
Jonathan Pennock, UNH
Fred Short, UNH
Bill McDowell, UNH
Art Mathieson, UNH
Valerie Giguere, Underwood Eng.
Peter Rice, City of Portsmouth
David Cedarholm, Town of Durham

1. Introductions and review of the agenda
Phil Trowbridge reviewed the agenda and led a round of introductions.

2. Preliminary results from light attenuation sensors on the Great Bay buoy and hyper-spectral imagery of Great Bay
Ru Morrison gave a presentation on the relationship between light attenuation and water quality measured by the Great Bay buoy in 2007. In summary, the data analysis showed that light attenuation is largely controlled by turbidity and CDOM. Chlorophyll-a only accounts for 8% of the overall light attenuation. Turbidity in the estuary can be predicted from stream flow and wind speed. The presentation and supporting documents are posted on the NHEP website (http://www.nhep.unh.edu/programs/nutrient.htm, under the 12/7/07 meeting).

The group made the following comments during the presentation:

- The light availability for eelgrass survival may be 22% but more light is needed for plants to "thrive" (34%) and to protect all stages of the life cycle (>50%).
- Turbidity measured by the buoy is best described as "non algal particles". Phytoplankton measured via the chlorophyll-a sensor are subtracted from the turbidity results. Zooplankton typically do not have an optical shading effect.

- While the results do not show a relationship between chlorophyll-a and light attenuation, it cannot be concluded that nitrogen does not have an effect on eelgrass. Rather, this study showed that the classic model of eelgrass shading by phytoplankton blooms does not describe the Great Bay Estuary. Other factors, such as proliferation of nuisance macroalgae and epiphytic shading, could still relate nitrogen loads to eelgrass loss. Some members also cited direct toxicity of ambient nitrate concentrations to eelgrass.
- The relationship between Kd, chlorophyll-a, turbidity, and CDOM in the middle of Great Bay could be used in another location in the estuary if the particle distributions were the same. However, the relationship should not be applied to other estuaries.

3. Nitrate concentration trends in the Lamprey River watershed
Bill McDowell gave a presentation on nitrogen geochemistry in the Lamprey River watershed. In summary, the data analysis showed that nitrate concentrations at the Packers Falls dam have a statistically significant, increasing trend between 2000 and 2007. The nitrate export from watersheds is best explained by human activity (e.g. population density, developed lands). However, the largest source of nitrogen to the watershed is regional atmospheric deposition. Ninety-four percent of the dissolved inorganic nitrogen that enters the watershed is retained or released to the atmosphere via denitrification. The presentation and supporting documents are posted on the NHEP website (http://www.nhep.unh.edu/programs/nutrient.htm, under the 12/7/07 meeting).

The group made the following comments during the presentation:
- Atmospheric deposition of nitrogen is not changing in the region. Therefore, human influence in the watershed is somehow increasing the delivery of nitrogen from the watershed. Increasing impervious surfaces speed up delivery of stormwater to river systems.
- The total nitrogen flux out of the watershed in 2006 was 3.25 kg/ha/year. This value is similar to the total nitrogen flux from the Great Bay watershed in 2002-2004 (3.9 kg/ha/yr).
- Mass balance is based on dissolved inorganic nitrogen. It would be interesting to compile a total nitrogen mass balance.

4. Antidegradation policies which could be used to limit nitrogen loading
Paul Currier gave a presentation on the antidegradation provisions of the Clean Water Act. The presentation and supporting documents are posted on the NHEP website (http://www.nhep.unh.edu/programs/nutrient.htm, under the 12/7/07 meeting).

5. (1) Nitrogen loading rates for Great Bay compared to other estuaries; (2) Estuarine nutrient criteria in other states, and (3) Deadline for establishing nutrient criteria for NH's estuaries
Phil Trowbridge gave a presentation on various topics. The nitrogen loading rates for the Great Bay Estuary are higher than would be expected for the amount of eelgrass still present. Four reference estuaries in the Gulf of Maine were identified based on EPA classifications and the Level III Ecoregions. Nitrogen yields from the watersheds draining to these estuaries decreased from south to north. The presentation and supporting documents are posted on the NHEP website (http://www.nhep.unh.edu/programs/nutrient.htm, under the 12/7/07 meeting).

The group made the following comments during the presentation:
- Comparisons of nitrogen yield from estuarine drainage areas are not appropriate because they do not normalize for the hydrology of the estuary.
- Reference estuaries in the Gulf of Maine are too different from Great Bay to be useful.
- Estuaries with colder temperatures are less susceptible to eutrophication, so comparisons to estuaries north of Great Bay would not be protective.

6. Develop group consensus on how to proceed in order to meet the deadline
The group discussed the best way to develop nutrient criteria by December 2008. Five options were considered. The pros and cons for each option were summarized in a handout (attached).

- Option 1: Develop a long-term trend of nitrogen and sediment loads to the estuary and compare to historic eelgrass distribution
- Option 2: Develop different nutrient criteria for different segments of the estuary
- Option 3: Designate the Great Bay Estuary as a Tier I waterbody for nitrogen and sediment
- Option 4: Reference concentration approach within Great Bay
- Option 5: Reference approach for other estuaries in the ecoregion

The group discussed the various options. There was not consensus on the way forward or even on using eelgrass as the indicator for nutrient criteria. In general, the group did not feel that options 3 and 5 would be effective. Research should continue on Options 1, 2, and 4. Major points from the discussion are summarized below.

- Are nitrogen loads now much higher than in the 1950s when raw sewage was dumped into the bay? Need to do Option 1 to figure this out. Get historical modeling methods from the Long Island Sound Study.
- Focus on subtidal eelgrass beds to determine the effect of water clarity/water quality changes on eelgrass. If subtidal eelgrass is being lost due to decreased clarity, determine whether nitrogen is the cause of the decline. Use deep edge research at subtidal beds.
- Investigate relationships between DOC delivery from watersheds and CDOM in the estuary.
- Do not spend time researching other estuaries for Option 5. The reference estuaries are too different from Great Bay to be useful. Use the available time and resources to study the Great Bay Estuary.
- Is there a way to combine the cumulative effects of multiple stressors on eelgrass: hydrology, nutrients, CDOM, sediments, sea level rise?
- The imagery for the 1981 eelgrass maps should be reviewed to determine the quality of the 1981 eelgrass distribution maps.
- Comparison of nitrogen yield between watersheds ignores differences in estuarine flushing. This approach will not be productive.
- The Great Bay-Little Bay part of the estuary is very different from the Piscataqua River-Portsmouth Harbor part of the estuary. The former is dominated by intertidal areas. The latter mostly has subtidal habitats. These two parts of the estuary should be studied separately. Different nutrient criteria (especially for water clarity) may be needed for each section.
- Research the direct effects of nitrogen on eelgrass. Journal articles are available from Burkholder (1992, 1994), van Katwijk et al. (1997, Mar. Ecol. Prog. Ser., Vol.157: 159-173), and Touchette (2002, Botanica Marina, Vol. 45: 23-34).

Phil Trowbridge requested that people send additional ideas for analysis or process to him after the meeting.

7. Proposal for updating the environmental indicator reports in 2008-2009 with limited staff time
This agenda item was not discussed due to time constraints. The NHEP will distribute a proposal to the TAC via email to get feedback on this topic.

8. Adjourn
The meeting was adjourned at 12:30 pm.