

### **Cape Cod Aquifer Challenges Third Installment: Nutrient Pollution- 3**

Increasing levels of phosphorus in freshwater kettle hole ponds and nitrogen in coastal embayments from human activities in our watersheds has led to water quality problems (low dissolved oxygen levels in the bottom waters during the summer and diminished water clarity) and loss of habitats for aquatic wildlife. In Falmouth we have 14 "N" sensitive coastal watersheds, which have to be addressed via its Comprehensive Wastewater Management Plans (CWMP) to reduce excess nutrients generated by septic systems. Falmouth has 13 "N" sensitive watersheds that need to be addressed via Targeted Watershed Management Plans (TWMPs). The Waquoit Bay Watershed is shared by Falmouth, Mashpee and Sandwich which have their own CWMP endeavors that need to be integrated for this watershed.

The Little Pond Sewer Pilot Project was funded by \$37 million grant from the Massachusetts State Revolving Loan Fund. To fund this loan, a betterment fee of \$14,000 was imposed on 1424 homeowners which could be paid over 30 years at \$540 per home. The betterment fee was split 70/30 between the homeowners and town residents. To close their septic systems and hook up to the sewers would require an additional expenditure of \$3-5 k or more in extreme cases. Falmouth has explored alternative technologies (eco toilets; oyster aquaculture; innovative/alternative options to septic systems; inlet widening; etc.). Win Munro can provide an assessment of the effectiveness of these non-traditional technologies for removing "N" loading from septic systems which degrade water quality in coastal embayments and lead to hypoxia (low dissolved oxygen levels in the water column); loss of shellfish species; damage to salt marshes and eelgrass beds. A 2018 Master's Thesis by Carlos Alberto Rivero Lopez (Eutrophication and Wastewater Management: An Interdisciplinary Analysis of Falmouth and Cape Cod, Massachusetts) discusses this challenge in greater detail. (See link in references).

In 2015 the Cape Cod Commission published an update to the Cape Cod Area Wide Water Quality Management Plan which led to EPA Region 1 and the Massachusetts Department of Environmental Protection issuing a wastewater cleanup action under section 208 of the Federal Clean Water Act. The Massachusetts Estuaries Project (MEP) established total nitrogen load levels for over 52 impacted embayments that would reduce water quality problems and habitat losses and compared this to estimates of "N" loading from septic systems and proposed town traditional and non-traditional wastewater treatment options. This is referred to as the 208 Plan for which 6 towns have developed TWMPs which have various phases to be implemented over the next 20-30 years. The total cost could be \$2-8 billion of which 50% of the infrastructure costs are assumed to be covered by state/Federal grants. The Buzzards Bay Coalition, Association to Preserve Cape Cod and Conservation Law Foundation back the 208 Plan, while it is opposed by the Sierra Club for a variety of reasons.

More recently the Conservation Law Foundation (CLF) sued the towns of Barnstable and Mashpee plus the Cape Cod Commission for not implementing their CWMPs for

centralized wastewater treatment (sewers and new wastewater treatment plants) under the section 208 CWA jurisdiction. The lawsuit recommended in the interim that the towns utilize decentralized waste approaches to reduce "N" loading from septic systems. These approaches could include: Eco toilets; permeable reactive barriers; inlet widening to increase tidal flushing; oyster aquaculture, salt marsh restoration; etc. As mentioned above the Town of Falmouth conducted pilot tests on most of these alternative approaches.

The Town of Barnstable has a proposal to take over the Wastewater Treatment Plan at Joint Base Cape Cod and expand it to treat grey/black water from the base plus Upper Cape towns (Bourne; Falmouth; Mashpee and Sandwich). The current WWTP at JBCC discharges its treated effluent into the Cape Cod Canal. The proposed WWTP expansion might utilize an ocean outfall in Nantucket Sound off of Falmouth. The Town Wastewater Inter-municipal Agreement would have to get a new discharge permit covering nutrients and toxic chemicals (perflourinated chemicals) This endeavor was discussed at a recent meeting of the Joint Base Cape Cod MC3 (Military-Civilian Community Council) and cost and funding of this project and consultation with surrounding towns are still at an early stage. This could provide an integrated solution for the Waquoit Bay watershed CWMP.

In Ashumet pond, the nutrient pollutant of concern is Phosphorus which comes from the former Joint Base Cape Cod Wastewater Treatment Plant; septic systems from homes bordering the pond and its sediments. The military installed a permeable reactive barrier to intercept the "P" in the Ashumet Valley Plume and added alum to the sediments to reduce "P" loading from that source. This has led to reductions in the summer hypoxia in the bottom waters which requires introduction of hatchery fish each year for recreational fishermen/women and Wampanoag tribal hunters/fishers utilizing their traditional lands. Periodically the surface waters of Ashumet Pond have cyanobacteria blooms which produce toxins which make the shellfish unsafe to eat. These bacteria use atmospheric Nitrogen to support their blooms when nitrate becomes a limiting nutrient for other phytoplankton (microscopic primary producers) in the water column.

Phosphorus has less complicated nutrient pollution pathways than Nitrogen which has atmospheric input from distant regions. The Pitch Pine/Scrub Oak forests on Cape Cod depend on atmospheric "N" transport for their growth and environmental services/natural capital. As these atmospheric "N" deposits diminish from air pollution controls, these forest may become "oligotrophic" (limited by "N"). Thus aquatic ecosystems are polluted by excess "N" in Waquoit Bay and "P" in Ashumet Pond from human activities in the watershed, while "N" limitation causes cyanobacteria blooms in Ashumet Pond and exerts growth effects on Pitch Pine/Scrub Oak forests. Red tide algal toxins cause seafood consumption alerts in Cape Cod Bay and are stimulated by freshwater inputs. Even though most cleanup targets for Total Nitrogen and Total Phosphorus in the water column are based on concentrations, these chemicals turnover rapidly in the water column which can affect the aquatic food chain in unpredictable fashions (the Gulf of Maine being a good case study).

## References:

1. May 2, 2018 Bachelor of Arts with Honors Thesis from Dept. of Environmental at Studies at Amherst College: "Eutrophication and Wastewater Management : An Interdisciplinary Analysis of Falmouth and Cape Cod, Massachusetts by Carlos Alberto Rivero Lopez.

2. APCC's State of Cape Cod Water Report PDF: [waters@apcc.org](mailto:waters@apcc.org)

3. EPA Report on Nitrogen Issues on Cape Cod:

<https://www.epa.gov/water-research/reducing-excess-nutrients-research-pilot>

4. Jeffrey E. Hughes, Linda A. Deegan, Jason C. Wyda, Melissa J. Weaver, Amos Wright. 2002. Estuaries 25(2): 235-249. "The effects of eelgrass habitat loss on estuarine fish communities of southern New England": <https://link.springer.com/article/10.1007/BF02691311>

5. Buzzards Bay Coalition on Collapse of Bay Scallop Documentary:

Bay scallops were once to Buzzards Bay what oysters were to the Chesapeake Bay and Long Island Sound: highly valuable and deeply connected to our culture. But today, our once-abundant bay scallops have all but disappeared. This issue is highlighted in the new documentary *The Last Bay Scallop?*, which examines the declining Nantucket bay scallop fishery – the last commercially viable bay scallop fishery on the East Coast. The New Bedford Fishing Heritage Center will be co-hosting a screening of the documentary with the Coalition and the New Bedford Whaling National Historical Park on Friday, Oct. 21 as part of the [Dock-U-Mentaries series](#).

6. EPA Waquoit Bay Watershed Ecological Risk Assessment Report on "N" Levels and Eutrophication PDF:

<https://cfpub.epa.gov/ncea/risk/era/recordisplay.cfm?deid=15221>