Challenges Facing the Cape Cod Aquifer First Installment

The Unitarian Universalist Fellowship of Falmouth's Social and Environmental Justice Action Committee (UU Falmouth SEAC) has asked me to develop a series of short pieces on the "Cape Cod Aquifer Challenges". In the first installment, I wanted to define what constitutes a watershed approach using the Waquoit Bay Watershed as an example. The Sagamore Lens for groundwater runs from the Upper to Mid-Cape regions and is composed of multiple, separate waterbeds.

A number of years ago, I participated in an EPA-lead study on an Ecological Risk Assessment for this watershed (which surrounds the Yearling Meadows Development where I live). This study identified nutrients ("Nitrogen" in Waquoit Bay and "Phosphorus" in Ashumet Pond as the major human stressors in this watershed). These nutrients will be referred to as "N" and "P" later in this article. In more recent times public and private drinking water wells in Falmouth and Mashpee have been contaminated by PFOS and PFOA at levels exceeding EPA's Hard level of 70 parts per trillion. This toxic chemical contamination came from the Ashumet Valley Plume (AVP) which emanates from
Three sources at Joint Base Cape Cod (JBCC): former fire training area; old wastewater treatment plant (WWTP) and the water/sediments of Ashumet Pond itself.

The groundwater on Cape Cod occupies a saturated zone below the top of the water table and it discharges into the upper portion of Ashumet Pond adjacent to Joint Base Cape Cod and exits from the downgrading portion. The groundwater is replenished by the difference between the rain and evapotranspiration by vegetation (40 inches per year minus 13 inches equals 27 inches of recharge). There are 1000 freshwater kettle hole ponds on Cape Cod which are provided up gradient water from the drainage area on land and downgradient flow from the ponds back into the groundwater. As this groundwater lens approaches the coast, the saturated zone narrows and is underlain by saltwater. Further inland, this saturated zone of freshwater can be 200 feet thick. Overlying the saturated zone is porous soil layer (often mostly sand) which allows things spilled at the surface to move into the groundwater.

For Ashumet Pond the up gradient drainage zone includes Joint Base Cape Cod, so that water pollution occurs from "P" from the former wastewater treatment plant and toxic contaminants of concern (including per fluorinated chemicals; perchlorate; volatile organic BTEX chemicals; etc.) which shut down the Ashumet Valley Public Drinking Water well in Falmouth back in the mid-1980's. Thus the Ashumet Valley Plume (AVP) and Ashumet Pond itself are negatively affected by climate change; water pollution from "P"; and toxic contaminants of concern being mitigated under the Safe Drinking Water Act/Superfund program being overseen by the Air Force Civil Engineering Center (AFCEC). The Upper Cape Water Supply Reserve is located on the northern portion of JBCC where Camp Edwards is located and is critical for recharge of groundwater in the Sagamore Lens.

As the groundwater and surface water (i.e. Chllds River) flows towards Waquoit Bay, it carries "N" from septic systems and various pesticides/herbicides used by residents on their properties or along power line by rights of way by Eversource (which pass with through our sandy soil with the rain). Roughly 70% of the groundwater heads towards the coast and discharges into Waquoit Bay (with 25% flowing in streams and 6% being utilized by drinking water wells of which 85% are under public jurisdiction). During most of the year 25 million gallons per day are pumped out of the Sagamore Lens which increases to 54 mgd in the Summer due to irrigation and more people. In Waqiout Bay, this freshwater from the groundwater and rivers mixes with saltwater from the ocean which influences water quality and habitat for wildlife (subject of a future piece). The excess "N" loading from the surface and ground waters gets diluted as it mixes with surface seawater. This process is currently under active scientific investigation and is often discussed at the Reserve Webinars organized by the Waquoit Bay Watershed National Estuarine Research Reserve (WBNERR).

Under the Trump/Pence Administration changes to Waters of the US (WOTUS), this watershed would be restricted to Ashumet Pond, Childs and other rivers) and Waquoit Bay and its sub-embayment (i,e Sage Lot Pond). WOTUS determines the jurisdiction of the Clean Water Act section 208 program which supports the Comprehensive Wastewater Management Plan for the Waquoit Bay Watershed (which includes Falmouth; Mashpee and Sandwich) to reduce "N" loading from septic systems. In Waquoit Bay this has led to a loss of eelgrass beds and collapse of the bay scallop harvest (focus area for the EPA Ecological Risk Assessment study). A future piece will explore some of these potential links between surface and groundwater discharges; climate change; inshore Essential Fish Habitat for federally managed finfish and shellfish species; etc.

Tom Cambareri gave an informative webinar on the: "Hydrology of the Cape Cod Aquifer" on April 22 as part of the Cape Cod Community Water Forum series (partners include: Sustainable Practices; Association to Preserve Cape Cod; 350 Cape Cod; Blue Institute Lab and Sierra Club- Cape Cod Group). A Jeff Williams report for the US Geological Survey will provide more details on the geology and hydrology of the Cape Cod aquifer than my brief description above. The geology and hydrology interactions are key to understanding water quantity and quality challenges facing our aquifers here on Cape Cod.

This watershed based approach to defining an aquifer is supported by the US Water Alliance (a water & wastewater industrial group) and implemented by the Cape Cod Commission; Ma. DEP and EPA Region 1 for the Targeted and Comprehensive Wastewater Management Plans in the 15 (?) towns on Cape Cod that are required to reduce "N" loading from septic systems to improve water quality and reduce habitat loss in coastal embayments. The Upper Cape Water Supply Zone on the northern portion of JBCC is a key component for future increases for public drinking water supplies on Cape Cod. This has created controversy on the proposed

Multipurpose Machine Gun Range at Camp Edwards (which may run counter to the 2011 state legislation which created the Environmental Management Commission which oversees military training which is compatible with protection of our drinking water and conservation of the habitat of over 30 state listed species).

References:

1. USGS Coastal Processes Overview Report,

Coastal landforms and processes at the Cape Cod National Seashore, Massachusetts—A primer

Anyone who spends more than a few days on Cape Cod (the Cape) quickly becomes a coastal geologist, quickly learning the rhythms of daily tides and the seasonal cycles of beaches growing and being swept away by storms; swimmers and surfers track how the breakers appear, and dog-walkers notice the hard-packed sand blanketed overnight by an airy...

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2. EPA Waquoit Bay Watershed Ecological Risk Assessment Report:

https://uuffm.org/wp-content/uploads/2021/08/WAQUOIT.pdf

3. Link to Tom Cambareri's Webinar on "The Hydrology of the Cape Cod Aquifer" presentation at the Cape Cod Community Water Forum in April 2021

Here is a link to that
presentation: https://www.youtube.com/watch?v=KxffPxyppBE