

AECOM page 3-1:

" In nitrogen-limited shallow water ecosystems, the exchange of nitrogen between sediment and the overlying water can have a large effect on nitrogen balances and on the overall productivity of the ecosystem. The SMAST report provides relatively little information on sediment fluxes, with no breakdown of which nitrogen species (nitrate, ammonium, dinitrogen from denitrification), and no supporting oxygen and phosphorus flux data are provided...."

"One key issue with regard to illumination: if even a small amount of light reaches the sediment-water interface, benthic microalgae can grow. In general, such benthic microalgae can 1) inhibit denitrification by taking up ammonium otherwise used for denitrification and 2) inhibit rates of ammonium and/or nitrate efflux. Dark core incubations are insufficient to estimate daily fluxes of nitrogen when benthic microalgal production is moderate or high."

If I understand the last statement correctly (I am doing this to ensure that I have at least a fundamental understanding of what was said in the AECOM proposal and to ensure that we have a common understanding....after we understand it, the really interesting part is how can this be used to help develop an innovative alternative), what it is saying is that at the bottom of Meetinghouse the natural process is...

- in hours of daylight microalgae consume ammonium which gets incorporated into their biomass
- as the microalgal replicates itself and dies off, their biomass is incorporated into the sediments (nitrogen form? organic?)
- this process of microalgal growth
 - inhibits (reduces the rate of) the process of conversion of ammonium to dinitrogen (denitrification)
 - inhibits the rate of release of ammonium and/or nitrate from the sediment to the water column.
- it is this process that makes it important to know the breakdown of SMAST measured nitrogen flux by nitrogen components. PB Table IV-11 reports "net nitrogen return from sediments to the overlying water"; this sounds like the sum of all constituents
 - if the measurements were made in the dark (dark core), the transfer rate would be overstated as it would not account for ammonium conversion to dinitrogen (N₂ gas) or the reduction in efflux caused by the microalgae.
 - ??? does the transfer rate mgN/m²/d in Table VI-11 account for differences in transfer rate day time vs. night?

All this raises some interesting questions:

Threshold nitrogen concentrations are selected based on bioactive N = DIN + PON. Should the TMDL be in bioactive nitrogen terms; rather than total N?

Raw sewage is primarily ammonia and organic nitrogen (solids). If the ammonia in the septic tank effluent is converted to nitrate, what happens to the nitrate when it enters the saltwater estuary? Is it in a bioactive form...DIN? Can it be converted into a bioinactive form...mineral or refractory?