

STORMWATER MANAGEMENT SYSTEM: NITROGEN REMOVAL EFFECTIVENESS AND WATER QUALITY FOR OYSTER RIVER

August 8, 2022

Conservation Commission
8 Newmarket Road
Durham, NH 03824

RE: 19-21 Main Street – Parking Lot. Formal application for site plan and conditional use for parking lot on four lots and reconfiguration of the entrance. Toomerfs, LLC c/o Pete Murphy and Tim Murphy, property owners. Mike Sievert, engineer. Robbi Woodburn, Landscape Architect. Map 5, Lots 1-9, 1-10, 1-15, and 1-16. Church Hill District.

Greetings,

Below is the set of comments (almost verbatim) that I made during the special meeting of the Commission on August 8.

Given time constraints, I'll state my conclusion up front: I believe that the Conservation Commission should advise the Planning Board to require as a formal Condition of Approval that: "The soil mix to be used as the filter media for the stormwater management system shall be chosen according to the UNH Stormwater Center's research."

It is my understanding that the stormwater management system proposed for this project—a "chamber" detention and infiltration model, designed to manage peak volume runoff—is an excellent system for that purpose and often used for parking lots. If sized correctly, the system could also be efficient in removing total suspended solids (TSS).

However, I do not believe that adequate attention has been paid by the Planning Board to the system's weakness in removing nitrogen, and as we know, excess nitrogen is a concern for the Oyster River and Great Bay.

Nothing in the proposed technologies would remove nitrogen to anywhere near the degree that the wooded area does today.

A comparison of nitrogen removal

Dr. Wil Wollheim, UNH Associate Professor and Co-Director of UNH's Water Systems Analysis Group (WSAG), has provided expert testimony on this proposal.

In my conversation with him today, he noted that a typical forest retains 90 to 95% of (organic) nitrogen. The 5 to 10 percent nitrogen that does leave the vegetated area is a more reactive form of nitrogen (in inorganic forms), which I loosely call "bad" for water quality. Wil noted that we could see a big increase in nitrogen to the Oyster River just from that little patch of forest.

In other words, the natural system is highly efficient.

By contrast, we can have significantly less confidence in the engineered system's capability for nitrogen removal. The vendor provides a report on the proposed pollutant removal of the Isolator Row. (I've sent one page from that to you, showing a table of results.) Three of the four testing entities did not test for nitrogen. The entity that did test for nitrogen removal found that only 35% of nitrogen was removed by the combined StormTech system and Isolator Row (leaving 65% of the nitrogen to flow out of the system toward College Brook.)

One of the third-party testing entities was the UNH Stormwater Center. Its 2010 report notes:

As would be expected for non-vegetated filtration systems, dissolved inorganic nitrogen (DIN = NO₃, NO₂, NH₄) removal efficiencies and effluent EMCs [event mean concentrations] reveal poor performance and high effluent concentrations relative to influent values.

Choice of soil mix underlying the chamber is critical

So, what to do.

According to the UNH Stormwater Center's 2020 Triennial Report, successful removal of nutrients depends on the chosen filter media underlying the stormwater management system chamber:

...UNH Stormwater Center research has found that the right filter media is key to meeting nutrient removal targets for the bioretention systems commonly found in urban and suburban settings.

I also spoke today with Michael Hansen, technical review engineer for the Alteration of Terrain permits at NHDES. He stated that his team reviews the research of the UNH Stormwater Center and refers project engineers to that.

Altus Engineering reviewed the February 2022 site plan. (I do not believe there has been a third-party review of the current site plan.) In that review, Altus noted:

7. We understand that the specifications for the fill behind the retaining wall and under the Stormtech systems are in the process of being designed by a geotechnical engineer. We suggest that the Town have this reviewed prior to construction.

While the site plan has changed somewhat from February, it is my impression that the design of the stormwater management system remains similar enough that this advisory remains relevant.

Conclusion

In a different location, not near a brook leading to a waterbody that is impaired by excess nutrients, including nitrogen, this combination would probably be considered "stellar."

But I believe that the Conservation Commission should advise the Planning Board to require as a formal Condition of Approval that: "The soil mix to be used as the filter media for the stormwater management system shall be chosen according to the UNH Stormwater Center's research."

Sincerely yours,

Robin Mower

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Addendum—Nitrogen from parking lots

While not the main contributor, roads and parking lots can flush nitrogen into our waterbodies:

Nitrogen ["N"] in vehicle exhaust, emitted as nitric oxide, nitrogen dioxide, nitrous acid, and ammonia, is a source of N both to the air and to road surfaces, which in turn can enter aquatic systems as atmospheric deposition and as road runoff during precipitation events. Increasing density of impervious surfaces within watersheds has been shown to be related to increased concentrations of streamwater N (Kaushal et al. 2008; Wollheim et al. 2005) and salinity (Kaushal et al. 2005), and has been related to declines in stream biodiversity (Paul and Meyer 2001).

["Nitrogen in Runoff from Residential Roads in a Coastal Area." July 2010 *Water Air and Soil Pollution* 210(1):3-13. DOI: 10.1007/s11270-009-0218-2]

* *ADS describes its StormTech Isolator Row PLUS as "a row of StormTech chambers wrapped in woven geotextile fabric (with two layers at the bottom), is a filter strip that

provides enhanced suspended solids and pollutant removal while providing surface area for infiltration and runoff reduction." <<https://www.adspipe.com/water-management-solutions/detention-infiltration/isolator-row#additional-assets>>