

CONSERVATION COMMISSION



MEMORANDUM

TO: DEP Northeast Region Project Reviewer

FROM: Sherborn Conservation Commission
Steve Gaskin, Chair
Allary Braitsch, Agent

DATE: January 12, 2016

RE: The Fields at Sherborn (DEP File No. 283-0366) Appeal of Denial (dated November 17, 2015): Overcoming the Presumption That Title 5 Compliance Protects Interests of the Wetlands Protection Act

In addition to the Sherborn Conservation Commission's comments on the applicant/Trask, Inc. Appeal of Denial ("Appeal"), the Commission is submitting this memorandum in order to notify the Department of Environmental Protection (DEP) that, based on the septic design work submitted to date, the Commission is prepared to overcome the presumption that the design will protect the interests of the Wetlands Protection Act (WPA or the "Act") even if the design is found to be compliant with Title 5.

As a result, the Commission's position is that DEP should not consider issuing a superseding Order of Conditions until a Title 5 compliant septic system is approved and reviewed for any adverse wetland resource impacts. The lack of information as to a compliant system during the Commission's hearing did not enable an adequate assessment of whether a compliant system would protect the interests of the Act. This is a major gap even if the system meets the required set-backs and initial analysis indicates significant adverse wetland impacts.

The Commission is notifying the DEP of this position because:

- the septic system design proposed in the Notice of Intent (NOI) has yet to be approved as compliant with Title 5, and the Commission's denial is partly based on the lack of information arising from the lack of an approved system to review;
- initial analysis of the proposed, but not approved, septic system indicates that its effluent will significantly adversely affect the wetland resources adjacent to the project site as the nitrogen levels of effluent reaching wetlands greatly exceeds their carrying capacity and the area of impacted wetland is large (see below). Thus, the septic system *could* be a basis for a denial of an order of conditions (in addition to other bases already established in the Commission's denial); and

- the recently proposed changes to the septic system design (submitted to the Board of Health on 12/11/2015 after the Commission closed its hearing) appear to *increase* the potential for significant adverse impacts to the wetland resources compared to the original proposed design. It increases the volume of effluent from leach fields whose discharge flows downgradient to the adjacent wetland and increases nitrogen concentration in that effluent by removing previously proposed nitrogen reduction technology.

These factors lead to the Commission's position that an adequate analysis of the proposed system, if it is eventually approved by the Board of Health, should be undertaken *before* determining that Title 5 compliance would be sufficient to protect the interests of the Act (rather than to fall back on future violations and enforcement). As part of this position, the Town of Sherborn is moving forward on including wetland nitrogen analyses as part of ongoing hydrologic studies of the proposed septic system.

The Commission's intent to overcome the Title 5 presumption is based on the last paragraph of Section 10.03(3) of the WPA regulations quoted below:

"10.03: General Provisions

(3) Presumption Concerning 310 CMR 15.000: *The State Environmental Code, Title : Standard Requirements for the Siting, Construction, Inspection, Upgrade and Expansion of On-site Sewage Treatment and Disposal Systems and for the Transport and Disposal of Septage.* A subsurface sewage disposal system that is to be constructed in compliance with the requirements of 310 CMR 15.000: *The State Environmental Code, Title 5: Standard Requirements for the Siting, Construction, Inspection, Upgrade and Expansion of On-site Sewage Treatment and Disposal Systems and for the Transport and Disposal of Septage*, or more stringent local board of health requirements, shall be presumed to protect the eight interests identified in M.G.L. c. 131, § 40, but only if none of the components of said system is located within the following resource areas:

and only if the soil absorption system of said system is set back at least 50 feet horizontally from the boundary of said areas, as required by 310 CMR 15.211:

.....

This presumption may be overcome only by credible evidence from a competent source that compliance with 310 CMR 15.000: *The State Environmental Code, Title 5: Standard Requirements for the Siting, Construction, Inspection, Upgrade and Expansion of On-site Sewage Treatment and Disposal Systems and for the Transport and Disposal of Septage* or more stringent local requirements will not protect the interests identified in M.G.L. c. 131, § 40."

Initial Evidence of Significant Adverse Impacts

In the Commission's denial, the septic system was an issue due to lack of information regarding a compliant design as well as initial indications that the proposed design could create significant adverse impacts such that the project could not be conditioned to avoid such impacts. As to the latter, specifically the Commission found that "the combination of the large relative volume of effluent in the groundwater and its large contaminant loadings raises significant concerns about adverse impacts on...the wetlands and on their abilities to protect water quality...[and] wildlife habitat function due to changes in water and vegetation diversity and composition."

In pursuing the degree to which such impacts were likely in this project, the Commission began a more detailed analysis of the project as it relates to the interaction of septic discharge with wetlands adjacent to the site, and how the septic effluent would affect function and values of those wetlands. The Commission found the following:

1. In the scientific literature on “critical loading” of nitrogen in wetlands, the most universally accepted threshold for the type of wetlands adjacent to the site is, at its maximum, **35 kgN/hectare/year** (Bobbink, Ashmore, Braun, Flückiger, & Van den Wyngaert, 2003).
2. It is widely accepted that nitrogen loading higher than the critical loading threshold has clear, significant, and multiple adverse impacts on wetlands. In the context of the Act, this means a failure to protect of the interests of the Act.
3. For a section of adjacent wetland appearing to lay in the direct path of the septic discharge plume, the Commission performed some of its own calculations based on the applicant’s water budget and data submitted to the Board of Health and Conservation Commission by another hydrologist. The Commission calculated that preliminary nitrogen loading levels to this section of wetland, which the Commission estimated to be 35,000 square feet, would be about **650 kgN/hectare/year**. This level of nitrogen loading is more than *18 times the upper limit for critical loading* of nitrogen in this type of wetland. This would seem to point to a clear adverse impact, as the following effects on wetlands occur when nitrogen overloading occurs in nitrogen limited wetlands such as the section adjacent to the project site:
 - elevated nitrates in drinking water (affects water quality)
 - change in plant community structure (affects water quality and wildlife habitat)
 - alteration of species diversity and composition (affects water quality and wildlife habitat)
 - losses of nitrogen sensitive species
 - shifts in species dominance
 - losses of native species in favor of exotica and invasive species
 - nitrate leaching, which is migration of nitrogen into the surrounding soils and water bodies (affects water quality)
 - eutrophication, which is an explosion of growth of unwanted species such as algae (affects water quality and wildlife habitat).

The Appeal states that the 195-foot distance from the leaching fields to the adjacent wetlands is sufficient to address some concerns of pollutant loading. But, with highly permeable on-site soils and lack of vegetative uptake or other biological attenuation mechanisms (due to building cover and lack of deep-rooted vegetation in the path of the septic plume), the distance does not appear to be sufficient for the volume of discharge and concentration of pollutants/contaminants therein, particularly those pollutants dependent on biological attenuation mechanisms such as nitrates (see next three paragraphs for more detail). Further, standard practice in hydrological analyses for pollutant loading to wetlands ignores attenuation since the variability of it is so high, and thus difficult to predict. Thus, for the applicant to reference it as a reliably quantifiable mechanism of impact reduction is misplaced.

Other Contaminants: In addition to this initial analysis of the nitrogen loading and its adverse impact on the wetland resource, it should also be noted that septic effluent also contains a range of other contaminants (and what has been called “contaminants of emerging concern”) such as pharmaceuticals, personal care products, by-products of manufactured products, and trace

organic chemicals. The very high nitrogen levels can serve as a proxy for high levels of these other contaminants, which in parallel with nitrogen analysis, can be possibly handled by the wetlands up to a point before the magnitude of the loading creates significant adverse impacts to wetland functioning.

Analysis of Revised 12/11/2015 Septic Design

As mentioned above, on 12/11/2015 the applicant submitted a new site design to the Board of Health that included a significant redesign of the septic system. The redesign occurred after the close of the Commission's hearing, but analysis of the new design is directly relevant to the Commission's concerns, and thus its intent here to overcome the presumption in 310 CMR 10.03 (3).

New design features relevant to the Commission's jurisdiction

1. Enhanced nitrogen treatment is eliminated, raising the applicant-estimated concentration of nitrogen in the septic discharge from 25 mg/L to 35 mg/L.
2. Number of units reduced by four, reducing overall septic discharge from 9,240 gpd to 8,360 gpd.
3. Leach field #1 is eliminated. All septic discharge (8,360 gpd) is directed to leach fields #2 and #3 (renamed to Primary #1 and Primary #2). These two remaining fields more directly impact the adjacent wetlands.

Applicant's Nitrogen analysis

In the 12/11/2015 BOH submittal entitled "Septic and Well Updates" the Applicant's consultant, CLAWE (hereafter the "Applicant"), provides an analysis of nitrogen impacts on wells and adjacent wetlands. The Applicant presents five "scenarios" for nitrogen in the septic plume traveling to (groundwater) downgradient wetlands and wells. Only three of those scenarios (2, 4 and 5) pertain to nitrogen impact on downgradient wetlands. Specifically, they pertain to the area of wetland adjacent to the project site that the Applicant acknowledges is in the direct path of the septic plume. Of this wetland, the Applicant states, "The only concern of SAS AOI is the wetland in the central southwest area." The Applicant labels this wetland as the "impacted wetland" in its well diagram and measures its area at 27,825 square feet. (An additional matter is that the area of wetland resources that will be impacted will be significantly larger).

The Commission has done some review of this new design and the Applicant's nitrogen analysis and intends to obtain a separate professional hydrologist's review as well. At this point and as detailed below, the new design will also lead to nitrogen loadings in these impacted wetlands that still greatly exceed the critical loading level threshold of 35 kg N/ha/year, even with conservative assumptions. Depending on the parameters chosen, the estimated nitrogen loadings may be 20 to 40 times higher than this threshold, leading to significant adverse impacts. As noted below, such high levels are also presented by the Applicant's work, with the Applicant simply stating that the wetlands can denitrify such high nitrogen loadings. Therefore, the new design has increased concerns about the magnitude of adverse impacts to the wetlands from the septic system.

As part of the finding of extremely high and very detrimental nitrogen loadings resulting from the new design, the Commission presents the following comments on the Applicant's analysis of

nitrogen loading to the impacted wetland. (These comments are complicated by what appears to be some methodological and mathematical problems with the Applicant's work).

1. The Applicant's Scenario 2 is the only valid one because it uses nitrogen loading to the impacted wetland based on 100% of the septic system's design flow. This is the correct methodology in hydrological analyses of this type. Scenarios 4 and 5 assume 50% design flow based on anecdotal Applicant experience with his own past developments. Such flow amounts are not substantiated and are likely not appropriate for these analyses. The Commission thinks that Scenarios 4 and 5 should be disregarded.
2. In the calculation table for Scenario 2 on page 21 of the submittal, the Applicant calculates 890.38 lbs. of nitrogen loading into the impacted wetland per year. This closely matches Commission's calculations. It leads to a nitrogen loading of over 1,500 kgN/ha/year for the impacted wetland area of about 0.64 acre, which is over 40 times the estimated critical loading threshold of 35.
3. There are a number of methodological issues that can lead to different nitrogen loading under Scenario 2; however, at this point, all of them lead to loadings that are much higher than the threshold and beyond the uptake capacity of the wetlands.
 - The Applicant does not include an adjustment in Scenario 2 for the uptake of nitrogen by the wetlands, which the Applicant does do in Scenarios 4 and 5 where such uptake is estimated at 50 gN/m²/year (based on supposed range of 20-80) and 20 gN/m²/year respectively. At the high level of 50 in Scenario 4 (which is more advantageous than 20 to the Applicant), the nitrogen loading is reduced by about 30%, but it is still about 1,000 kgN/hectare/year, which is much higher than the threshold 35). However, the Commission notes below that an uptake level of 50 gN/m²/year cannot be substantiated in the scientific literature.
 - The Applicant does note that some sort of 10mg/L "capacity" or allowance can be applied, but the Commission comments below that any such allowance is not applicable or appropriate in this analysis. Nevertheless, applying this allowance would lower the loading by nearly 30%, but it is still over 1,100 kgN/hectare/year (compared to the threshold of 35).
 - Even though the Commission strongly challenges the use of either of these adjustments, the resulting nitrogen loading from incorporating both is still over 10 times the threshold level.
4. As noted above, the Applicant uses nitrogen uptake ranges of 20-80 gN/m²/year as proxy for protection of the interests of the Act. However, the Commission disagrees with this approach for the following reasons:
 - Nitrogen uptake capacity focuses only on water quality, on one contaminant (nitrogen) affecting water quality, and ignores other interests of the WPA such as wildlife habitat. Thus, capacity for nitrogen uptake does not appear to be a good measure of whether all the interests of the WPA are protected.
 - The Applicant's source for the 20-80 gN/m²/year range for nitrogen uptake capacity is a document by the U.S. Fishery & Wildlife Service "Predicting Wetland Functions at the Landscape Level for Coastal Georgia Using NWIplus Data" 2011. In turn, that

document indicates that the source of the 20-80 gN/m²/year range is Bowden et al. (1987), but an inspection of Bowden et al. does not yield this range. In particular:

- In all of the studies that Bowden et al. references, the highest value is 12 gN/m²/year. One of the lower values listed is for palustrine marshes in Harvard, MA where estimates for nitrogen fixation ranged from 0.2 to 1.0 gN/m²/year. These Harvard values convert to a range of 2 to 10 kgN/hectare/year, which fits comfortably within the critical loading threshold range of up to 35 kgN/hectare/year given in the Commission's reference to Bobbink et al. (2003) above.
- Even in their synthesis comments, Bowden et al. do not refer to a range of 20-80 gN/m²/year, but offer a lower range of "a few" gN/m²/year to ~35 gN/m²/year "with lowest values in cold northern and hydrologically stagnant systems" (p. 337).
- Furthermore, Bowden et al. suggest that much of this nitrogen uptake and sequestration likely does not occur for nitrogen entering the wetland from external sources, but as part of the internal nitrogen dynamics of the wetland, where nitrogen that is *already in the wetland* tends to stay in the system and be cycled between various states and mechanisms of uptake.

While the Commission does not fault the Applicant for use of a source that misrepresents another source, inspection of the original source by the Commission confirms the Commission's contention that a far lower quantity of nitrogen loading than is proposed in this project will be necessary to protect the interests of the Act.

- Critical loading metrics *do* appear to be good a measure of whether the interests of the Act are protected by providing a threshold above which wetland functions and values deteriorate. Therefore, when the critical loading thresholds in the literature are far lower than the nitrogen uptake capacities cited by the Applicant, the validity of such stated capacities is questionable.
5. As under point 3 above, the Commission thinks that making an allowance for 10mg/L of nitrogen in the waters of the wetland is not appropriate for this analysis. Regardless of allowable levels in drinking water regulations, in assessing the functioning of the wetlands and the interests of the WPA, the full nitrogen loading should be part of the analysis. It is physically present in the wetland and must be factored into the assessment of the wetland's capacity to take it up.
 6. In addition to problems with methodology/approach, there also appears to be a calculation error in the work for Scenario 4. Though the Commission does not find this scenario to be applicable, it includes a high wetland nitrogen uptake capacity value for 50 gN/m²/year, from which the Applicant incorrectly calculates a large uptake capacity of 936 lbs./year (at 0.64 acres and 50 gN/m²/year). The correct uptake capacity calculation is much lower, at only 285 lbs./year, which significantly affects the results.
 7. As a solution to the problem of nitrogen overloading in Scenario 2, the Applicant states that there is a "[n]eed to control fertilizer use or apply mitigation measures". But, the scenario states that no fertilizer is used. If that statement is in error and the fertilizer was included in the calculation, fertilizer only contributes 33 lbs. of nitrogen per year to the equation. Eliminating such a small amount from the overload is inconsequential. The other alternative offered by the Applicant is the application of mitigation measures, yet no mitigation for this

direct adverse impact to a wetland resource (not the buffer zone) is offered or discussed in the submittal.

8. The Applicant concludes his portion of the analysis in the 12/11/2015 submittal by stating the following: “The wetland has enough capacity for denitrification of the plume through uptake and biochemical process in the wetland.” With errors in his calculations and data from references corrected, this is no longer the case.
9. Using the value arrived at by both the Commission and applicant of about 890 lbs. of nitrogen per year entering the impacted wetland, and using the Applicant’s value of 0.64 acres (0.259 hectares) for its area, the loading of nitrogen to the wetland is approximately 1,500 kgN/hectare/year. This is **more than 42 times the upper threshold for critical loading of nitrogen to wetlands of this type**. The significant adverse impact from such an overloading indicates to the Commission that the presumption in CMR 10.03(3) should be overcome.

Hydrological Analysis Forthcoming

In analyzing the revised septic design of 12/11/2015, the Commission’s own calculations yielded a nitrogen loading of approximately 1,564 kgN/hectare/year. This matched very closely the Applicant’s estimate from Scenario 2 of approximately 1,570 kgN/hectare/year (890 lbs./year in a 0.64 acre wetland). These measures are approximately 44 times the critical loading threshold for nitrogen in wetlands of this type in this region.

That said, it is not the place of the Commission to qualify itself as a professional source for the “credible evidence” needed to overcome the presumption of in CMR 10.03(3). Thus, the Commission is in the process of hiring independent professional hydrologist to conduct a nitrogen budget analysis of the impacted wetland. We intend to present the consultant’s findings to the DEP in a follow-up memorandum as the means by which it intends to overcome that presumption.