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NITROGEN MITIGATION FEE REDUCTION JUSTIFICATION

November 22, 2024

Should the Subcommittee or Board not grant the financial hardship requested, though the 2018 RPP and the Water Resource Technical Bulletin substantiate this as fair and just, then the maximum Nitrogen Mitigation Fee proposed is $30,457.00 versus the potential maximum fee of $377,620.00 described in the October 25th Staff Report.

There are three primary factors that contribute to this proposed fee:

1. A nitrogen fee reduction to $4,145 versus $8,290 per KG of nitrogen reduced, as the period of mitigation is 10 years or less, not 20 years which is the calculation basis for $8,290.
2. The flow basis for the fee calculation is overstated due to two primary reasons. 1) An assumed actual flow of 75% of Title V Design Flow overstates considerably the amount of nitrogen to mitigate. And 2) The facility incorporates the most efficient urinals and toilets currently available which will also significantly reduce the total nitrogen discharge to apply a mitigation fee towards. It is proposed that the calculation be based on 1102 GPD discharge, not 2603 GPD discharge.
3. A nitrogen fee reduction to $1,579 versus $4,145 per KG of nitrogen reduced, as the technical bulletin details that the nitrogen removal fee is based on a 26.25ppm-N initial level not the intended 10 ppm-N level to be implemented and discharged.

This progression to $30,457 from $377,620 is summarized in the following table:

System Capability (ppm-N)	Calculation Flow (GPD)	Years of Mitigation	Fee Basis for Cost per KG/Yr	Fee per KG	Potential Mitigation Fee
10	2603	20	26.25 ppm-N Effluent (WR Tech. Bulletin)	$8,290	$377,620
10	2603	10	26.25 ppm-N Effluent (WR Tech. Bulletin)	$4,145	$188,810
10	1102	10	26.25 ppm-N Effluent (WR Tech. Bulletin)	$4,145	$79,950
10	**1102**	**10**	**10 ppm-N Effluent (System Design)**	**$1,579**	**$30,457**

These three factors will be detailed further in the subsequent paragraphs.

1) Cost to remove a KG of Nitrogen for 10 not 20 years: Water Resources Technical Bulletin details how the value of $8,290 per KG load is defined as follows:

> *To promote the desired development density and facilitate future sewering, projects in Community Activity Centers, Maritime Areas, Industrial Activity Centers or Military and Transportation Areas without available sewer connections may contribute a monetary offset calculated as up to $8,290 per kilogram nitrogen load to be offset. The monetary offset is* ***based on the cost of removing one kilogram of nitrogen per year for 20 years*** *using a conventional sewer collection system and municipal wastewater treatment. The monetary offset is calculated based on reductions from 26.25 ppm, consistent with the MEP assumption for a standard septic system and with values used for planning purposes.*

The town of Mashpee is currently executing the town's Clean Water plan with Phase1 in transition to operations, Phase2 approved by town vote in May 2024 to proceed with detailed design, and Phase3 in initial planning. There is a high sense of urgency within Mashpee to fully incorporate all phases of the municipal sewer installation. This same urgency is also being taken at all towns of cape cod due to recent changes at MA DEP.

Per the MA DEP website - *"The Massachusetts Clean Water Act, M.G.L. c, 32, §§ 26 through 53, charges the MassDEP with the duty to protect public health and enhance the quality and value of the water resources in the Commonwealth. Watershed permits and the completion of critical projects to ensure mitigation at the municipal level is driving broad sweeping reform"*. While it is not certain when Evergreen Circle will receive town sewer, what is certain is that the total town system that will be prioritized and installed will dramatically reduce current Nitrogen loads in the Popponesset and Waquoit estuaries.

Per discussions with the town wastewater superintendent, the expectation is that Evergreen Circle will receive sewer treatment well before 20 years' time. While the timing is not certain, it is equally probable that it could occur either slightly earlier or slightly later than 10 years given this critical state mandated reform. In all cases, the transition of Evergreen Circle to town sewer will likely take place well before 20 years – and be preceded by significant Nitrogen mitigation to both the Popponesset and Waquoit estuaries. Therefore, a ten-year basis for the fee calculation is much more appropriate than a 20-year basis. This would reduce the calculation fee by 50%, or to $4,145 per KG/N from $8,290.

The mitigation fee calculated on the $4,145 basis is $188,810.

2) Flow Basis: Title V Design flows - which are the basis for mitigation fees - were originally established when toilets operated at 5 to 7 gallons per flush. To address this intentionally conservative assumption, Title V also defines what is called an Actual Flow - at

approximately 50% of Design Flow, or 2.5 to 3.5 GPF to use when assessing septic system design. While Title V creates intentional safety conformance for the implementation of system designs, it materially overstates the actual flow to base a mitigation fee upon, for today, state code is 1.28 GPF for toilets and 1.0 GPF for urinals.

As part of this DRI application preparation, the commission was provided an actual, metered water use study of 14 similar facilities of which eight were septic and six were municipal sewer installations. The median and average Title V Design Flow for the eight septic systems was 2,748 and 3,207 GPD respectively. Two years of actual water usage were also collected from municipal the DPW departments of these facilities and the peak reporting period flows were sited in this study. The average and median DPW reported actual water usage results were 35.9% and 39,4% of design flow respectively, which is in line with the overdesign intentions of Title V. From a septic design implementation these results are outstanding. But when 75% of Design flow is used for the basis of nitrogen mitigation when like facilities actual consumption per the study provided is less than 40% it further substantiates the overpayment of fees. (Note, the median water usage of all 14 facilities in the water study – which would include the six on municipal sewer was 1,301 GPD).

To further reduce output flows at this facility, neither 1.28 GPF toilets nor 1.0 GPF urinals will be used. Rather, 0.8 GPM toilets and zero water urinals will be installed. Disregarding zero water urinals – which in and of themselves will reduce at least 25% of water flow from the restrooms - the water reduction assuming all 0.8 GPF toilets provides a 37% reduction of usage from Title V Actual Flow. Such an implementation would reduce the water usage to 1,102 gallons per day. The nitrogen fee calculation is based upon 2,602 GPD – or the average of System Design Flow data - which is 75% of System Design Flow.

An estimate of 2,602 GPD for the nitrogen fee calculation – or 75% of system design flow - is not a realistic basis for effluent discharge on an annualized basis. And the BioBarrier I/A septic solution will keep effluent at 10ppm-N for any output flows. Rather, an 1,102 GPD basis is substantiated by the details summarized herein and is a much more appropriate basis for fee calculation.

A 1,102 GPD fee basis would reduce the nitrogen fee to $79,950 from $188,810.

3) The cost to remove one KG of Nitrogen: Water Resources Technical Bulletin details how the value of nitrogen removal per KG load was determined as follows:

> *To promote the desired development density and facilitate future sewering, projects in Community Activity Centers, Maritime Areas, Industrial Activity Centers or Military and*

Transportation Areas without available sewer connections may contribute a monetary offset calculated as up to $8,290 per kilogram nitrogen load to be offset. The monetary offset is based on the cost of removing one kilogram of nitrogen per year for 20 years using a conventional sewer collection system and municipal wastewater treatment. ***The monetary offset is calculated based on reductions from 26.25 ppm, consistent with the MEP assumption for a standard septic system*** *and with values used for planning purposes.*

The applicant respectfully disagrees with statements made at the October 30th hearing that the cost of nitrogen removal is not determined by the starting concentration of the nitrogen. In short – It significantly impacts the cost.

There are several sources of literature that detail that ***"the amount of nitrogen in wastewater significantly affects the cost of municipal sewer treatment, as removing excess nitrogen requires additional treatment processes, which can increase operational costs due to energy consumption, chemical usage, and potentially needed infrastructure upgrades to handle higher nitrogen levels".***

These sources include the following research publications:

- "A Comprehensive Review on Wastewater Nitrogen Removal", National Institute of Health, 2023,
- "Municipal wastewater treatment costs" with an emphasis on nitrogen removal, Ecological Engineering, 2019,
- "Nitrogen cycling during wastewater treatment", Advances in Applied Microbiology, 2019,
- "Phosphorus and Nitrogen Removal from Municipal Wastewater", RichardI. Sedlak, 2017,
- "Analysis of municipal sewage pollution" and denitrification treatment, Environmental Technology & Innovation, 2021.

The application of a fee that is based upon a starting nitrogen level of 26.25ppm-N overstates the cost of nitrogen removal for an effluent from this facility that has a starting level of 10 ppm-N.

On a ratio basis of 10 versus 26.25, the 10ppm N should reduce the monetary offset by 38% of $8,290, or to $3,158 per KG if the basis was 20 years of removal. However, it has already been stated that a 10-year basis is more appropriate. Therefore, a 38% reduction from the 10-year nitrogen removal basis of $4,145 per KG results in a fee of $1,579 per KG of nitrogen to be removed.

At $1,579 per KG, the nitrogen fee would reduce to $30,457 from $79,950.

Summary:

Should the Subcommittee or Board not grant the financial hardship requested, though the 2018 RPP, the Water Resource Technical Bulletin, and this document would substantiate this as fair and just, then the maximum Nitrogen Mitigation Fee proposed and quantified in this appendix is $30,457 versus the potential maximum fee of $377,620 described in the October 25th Staff Report. Additionally, as requested and discussed at the October 30th hearing, any fees not waived are requested to be deferred for payment until at least one year after the facility is open for business to allow for funds to be accrued without compromise.