February 5, 2008

Mr. Sidney Baines, Chairman
Sewer Commission
Town of Hooksett
16 Main Street
Hooksett, New Hampshire 03106

Subject: Antidegradation Water Quality Study
Hooksett Wastewater Treatment Facility
NPDES Permit No. NH0100129

Dear Mr. Baines:

On March 13, 2007 the New Hampshire Department of Environmental Services (NHDES) met with town officials, the town's consultant, and you to discuss the NHDES requirement that an antidegradation water quality study be conducted prior to Hooksett's planned upgrade and increase in design flow at the Hooksett Wastewater Treatment Facility (WWTF).

Background

The intent of the antidegradation water quality study was to gather water quality data from the Merrimack River and the WWTF and then use the resulting data in a mass balance equation (desktop model) to evaluate whether an increased discharge from the WWTF would impact the water quality and existing uses of the Merrimack River downstream of the WWTF. The antidegradation rules apply to every pollutant in the WWTF's discharge.

During the March 13 meeting, we discussed the concept of "loading" to the receiving water with respect to the mass of BOD, TSS, nutrients, toxic organics, and metals present in the WWTF effluent as it is discharged to the receiving water. The Town representatives at the meeting expressed that it is likely that the Hooksett WWTF upgrade (from 1.1 mgd to 2.2 mgd) will be designed such that the loading of BOD, TSS and nutrients would not increase after the upgrade is complete. In other words, the loadings (pounds per day) allowed under the current NPDES permit would be held. The current loading of these parameters, based on Hooksett's permit and application are:

- average monthly BOD and TSS loading is 275 pounds per day (based on the 2007 NPDES permit);
- average monthly ammonia nitrogen is 236.7 pounds per day (estimate based on 2004 NPDES application);
- average monthly phosphorus is 17.4 pounds per day (estimate based on 2004 NPDES application).

Please note that to hold the current loading, the permitted concentrations (mg/L) of these parameters will be reduced to 15 mg/L BOD/TSS, 12.9 mg/L total nitrogen, and 0.9 mg/L total phosphorus.

With respect to toxic organic compounds, NHDES expects, based on Hooksett's NPDES application data, that there are no volatile organic compounds or other organics present in the WWTF effluent. Therefore, NHDES would not expect any additional loading of organics after the upgrade is complete.

With respect to metals, the WWTF effluent contains elevated concentrations according to Hooksett's NPDES application data, and WET test data. Therefore, measurement of the concentration of metals in the Merrimack River and the effluent was needed to support Hooksett's antidegradation study. The results of the antidegradation study were used in a desktop model to find allowable future permit concentrations that would not degrade water quality in the Merrimack River. Also, the current WWTF data were used in calculations to determine whether there will be reasonable potential for the effluent to exceed the allowable future permit concentration.

Technical Approach

Metals samples were collected from the river on four separate dates. Flow in the Merrimack River varied from 1.6 times the 7Q10 flow to 13 times the 7Q10 flow (sampling at these flows was approved by NHDES). Samples were collected using clean sampling techniques, and the samples were analyzed using trace metal analyses in order to ensure the lowest possible detection limits. The resulting data obtained in this manner defines the existing water quality in the Merrimack River upstream of Hooksett's WWTF discharge. Four rounds of river data were averaged and used in a desktop model described below.

The Hooksett WWTF effluent was simultaneously sampled, though no trace metal analyses were performed. It is not necessary to use trace metal analyses with WWTF effluent since the metals concentrations are typically detectable with standard analytical techniques. Four rounds of effluent data were averaged and used in a desktop model described below.

Permit Limit Calculator Model: The Permit Limit Calculator model uses the mass balance equation and the water quality relationships in Figure 1 to compute:

- the downstream river assimilative capacity,
- the remaining assimilative capacity,
- the 10% reserve capacity concentration,
- the maximum allowable downstream river concentration to ensure that no more than 20% of the remaining assimilative capacity is used by the WWTF proposed increased discharge, and
- back calculates the allowable future WWTF discharge concentration.

Figure 1 shows the relationship between the terms "assimilative capacity", "remaining assimilative capacity", "10% reserve capacity", and "20% of the remaining assimilative capacity".

The maximum allowable downstream river concentration necessary to ensure that no more than 20% of the remaining assimilative capacity is used by the WWTF proposed discharge is calculated thus:

$$[\{0.9\,AssimilativeCapacityConcentration - ExistingWaterQualityConcentration\} * 0.2] + ExistingWaterQuality$$

Next, the allowable future permit concentration is calculated thus:

$$\frac{(proposedLoading) - (upstreamAmbientLoading)}{proposedWWTFflow * 8.34}$$

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Next, the allowable future permit concentration is calculated thus:

$$\frac{(proposedLoading)-(upstreamAmbientLoading)}{proposedWWTFflow*8.34}$$

Evaluating the Reasonable Potential: The current WWTF effluent data were used to evaluate whether there would be reasonable potential for the effluent to exceed the future maximum allowable permit concentration. This is achieved through the use of the statistical approach outlined in *Technical Support Document for Water Quality-Based Toxics Control*, March 1991, EPA/502/2-90-001 in Section 3. The table below shows the results of the Hillsborough WWTF reasonable potential evaluation:

Hooksett WWTF Antidegradation Study
Reasonable Potential for Metals in Effluent to Exceed NH Water Quality Standards

	Average (mg/L)	Max	Multiplication Factor	Max Value*Multiplication Factor	Maximum Allowable Permit Conc (mg/L)	Reasonable Potential?
Al	0.05	0.07	4.7	0.329	0.2760	yes
As*	0.00103	0.0013	4.7	0.00611	na	na
Sb	0.0005***	0.0007	4.7	0.00329	0.4530	no
Be	0.0005	0.0005	4.7	0.00235	0.0300	no
Cd	0.00013***	0.0001	4.7	0.00047	0.0230	no
Cr	0.00075	0.0005	4.7	0.00235	0.7680	no
Cu	0.01361	0.012	4.7	0.0564	0.0707	no
Pb	0.00065	0.0006	4.7	0.00282	0.0138	no
Hg	0.00009*	0.0001	4.7	0.00047	0.0249	no
Ni	0.00608	0.0061	4.7	0.02867	0.5150	no
Se	0.00063***	0.0012	4.7	0.00564	0.1410	no
Ag	0.00009***	0.0001	4.7	0.00047	0.0087	no
Th	0.0005	0.0005	4.7	0.00235	0.0550	no
Zn	0.08997	0.11	4.7	0.517	1.1370	no
CN	0.02***	0.02	4.7	0.094	0.1460	no

Hg?

*Merrimack impaired for arsenic. WQ Standards are too low for standard laboratory detection. "Monitoring only" requirements would be applied until a TMDL is approved.
***indicates average strongly influenced by detection limit

Conclusion

The Permit Limit Calculator model results and the reasonable potential evaluation show that Hooksett's proposed increased discharge may result in a significant lowering of water quality in the Merrimack River with respect to aluminum. As the footnote to the table explains, the effluent also contains arsenic at concentrations that would be deleterious to an already impaired river.

It is important to note that with only 4 samples, the Reasonable Potential statistical approach uses a high coefficient of variation (CV), which in turn, yields a high multiplying factor. The factor is multiplied to the maximum value in the dataset, so the resulting number is elevated. In the case of aluminum, it appears that more samples (greater "n") would have yielded a lower multiplying factor. It follows that there might not be reasonable potential to exceed the maximum allowable permit concentration. Collecting more samples may change the statistic, and the result might be "no reasonable potential to exceed" the calculated permit limit.

Because aluminum is determined to have reasonable potential, Hooksett would be subject to a permit limit. The limit would be based on the values listed in the table above under "Maximum Allowable Permit Concentrations". Since Hooksett already is covered under an existing permit, these new permit limits would not go into affect until Hooksett's next permit reissuance, or when the new plant upgrade is complete. When the new plant upgrade is complete, Hooksett's permit would need to be reissued.

Please feel free to contact me at (603) 271-2001 or Stergios Spanos at (603) 271-6637 with any questions, or if you wish to meet to discuss any issue related to the antidegradation study.

Sincerely,

Paul Heirtzler, P.E., Administrator
Water Division, Wastewater Engineering Bureau

cc: Harry Stewart, P.E., WD
Thomas Burack, Commissioner
Paul Currier, WD/WMD
Bruce Kudrick, Hooksett WWTF Superintendent
Stergios Spanos, P.E., WD/WWEB
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Brian Pitt, USEPA New England

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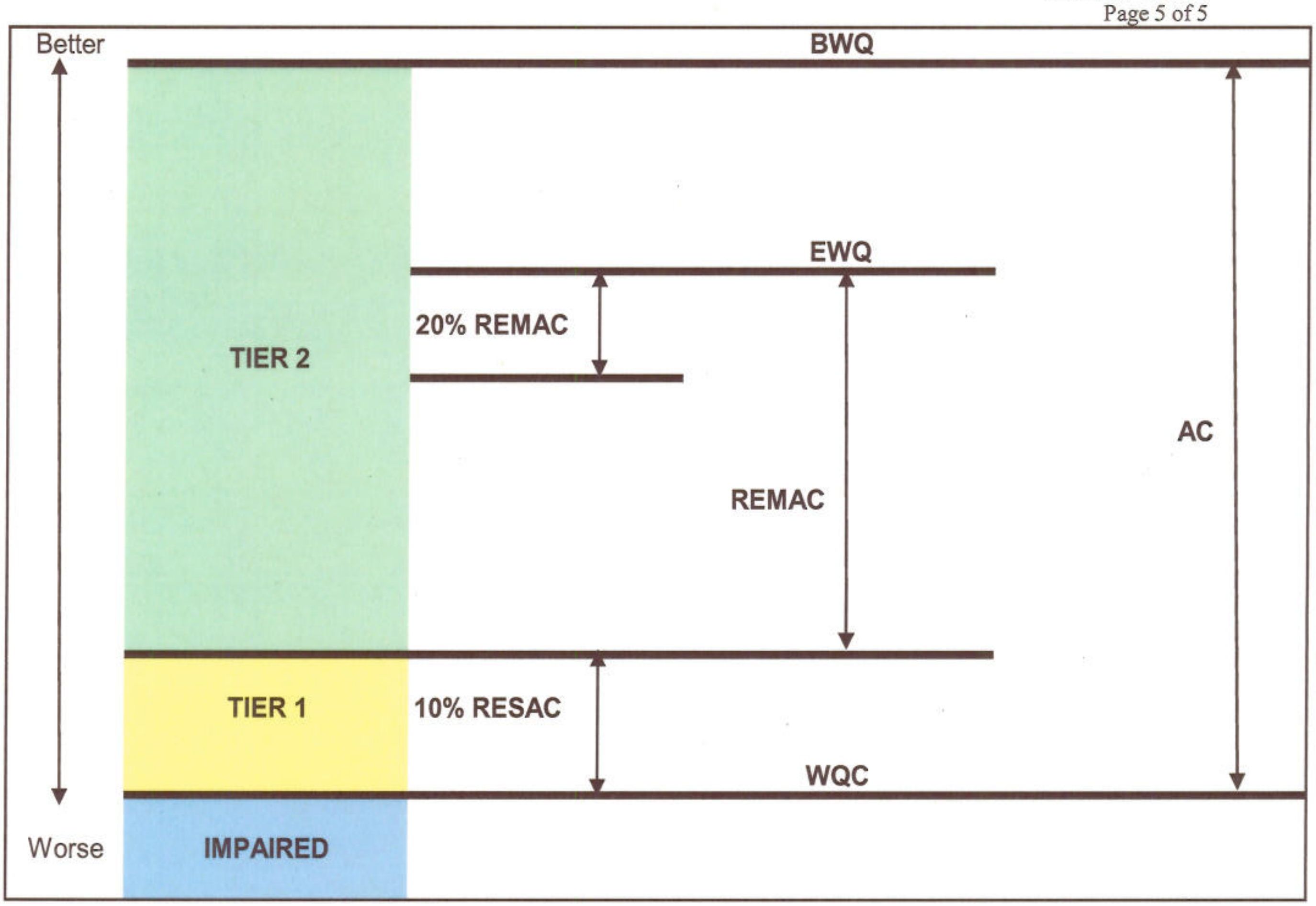

FIGURE 1. WATER QUALITY RELATIONSHIPS USED IN THE PERMIT LIMIT CALCULATOR MODEL

Where:
BWQ = Best Possible Water Quality (mass/L) – assumed to be zero
EWQ = Existing Water Quality downstream of WWTF at existing permitted load (mass/L)
WQC = Water Quality Criteria (mass/L)
AC = Assimilative Capacity (mass/L) = WQC – BWQ
10% RESAC = 10% Reserve Assimilative Capacity = AC * 0.9 (mass/L)
REMAC = Remaining Assimilative Capacity (mass/L) = (AC * 0.9) – EWQ
20% REMAC = 20% Remaining Assimilative Capacity (mass/L)

Maximum Allowable Downstream Concentration to be considered "Insignificant" = EWQ + (20% REMAC)