Scott W. Horsley
Water Resources Consultant
65 Little River Road
Cotuit, MA 02635
Telephone: 508-364-7818

September 10, 2018

Mr. Sean Fair
Wayland Conservation Commission
41 Cochituate Road
Wayland, MA 01778

RE: 24 School Street, Wayland 40B Application

Dear Mr. Fair and Conservation Commissioners:

As you know I have previously submitted review comments regarding the probable hydrologic impacts of the proposed project located at 24 School Street, Wayland. In these submittals I have suggested that the proposed increased volumes of stormwater and wastewater at this site will significantly raise water levels compromising the feasibility of the proposed infiltration structures and resulting in alterations to the wetlands. Specifically, I maintain that the applicant's submittals to date do not take into account the long-term (steady state) hydrologic impacts of these discharges. Rather, the applicant has only evaluated the short-term impacts of rare stormwater events such as the 25-year and 100-year storms. They have argued that these are the only "required" analyses. However, given the magnitude of the proposed project and the sensitive site constraints I believe that the Conservation Commission is warranted to require a more comprehensive analysis that includes long-term impacts.

To clarify these points I have prepared a table showing and comparing the existing amount of water that is recharged on the site to the proposed amounts over a long-term annual basis. From this analysis (see Table 1) it is apparent that the amount of water being discharged to groundwater on the site (recharge) and ultimately to the adjacent

wetland increases by a factor of 5.5 (from an existing rate of 0.3 million gallons/year to a proposed rate of 1.65 million gallons/year.

Table 1 - Recharge Calculations

	square feet	rech rate in/yr	recharge gals/year	recharge M gals/year	
EXISTING					
total lot	37865				
pervious	29085	16.5	299939	**0.30**	
impervious	8780	0			
PROPOSED					
pervious	17802	16.5	183583	0.18	
impervious	20063	34	426339	0.43	
wastewater (2860 gal/day)			1043900	1.04	
Total			1653822	**1.65**	**5.51**

Notes:
Impervious areas from MWE Stormwater Report
Recharge rates for pervious areas for Hydro Group B Soils

Undoubtedly, these substantial increases in infiltration and recharge will result in significant rises of groundwater (water table) levels that have not been taken into account in the project design. Per our discussions at the last Conservation Commission hearing on August 23, 2018 a numerical groundwater model (such as the USGS MODFLOW code) would be an appropriate method to evaluate these impacts. As was evident from the discussions at the last hearing developing and running such a model would be difficult to achieve in the short time period since that meeting.

To provide a preliminary idea for the scale of the likely impacts associated with the large increases in infiltration and groundwater recharge I have applied an analytical equation know as Darcy's Law. Darcy's law is a universally-accepted groundwater principle that relates water table gradients (slope) to flow rates and soil permeability characteristics. The law holds that increases in flow or discharge (Q) to

a defined discharge area (A) – in our case the adjacent wetland, and a constant soil permeability (K), the water table slope and elevations must increase. Mathematically, Darcy's Law is described by the following formula:

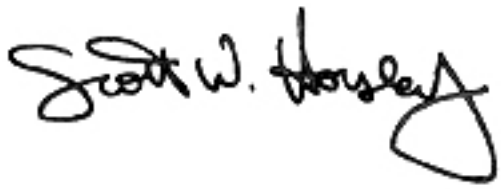
$Q = KiA$

Q = discharge rate (flow)
K = permeability (hydraulic conductivity
i = water table slope (gradient)
A = cross sectional area (discharge area)

I have applied this formula to the project site in two iterations – first, one representing average conditions across the entire site, and secondly, focusing on the proposed stormwater infiltration area. I have utilized the appicant's permeability (hydraulic conductivity) estimate of 6.5 feet/day, the applicant's water table levels, and the applicant's site plans showing the proposed locations of the wastewater and stormwater infiltration areas, and the adjacent wetland/stream system. My calculations are presented in Table 2.

The results of this analysis suggest that the proposed project will result in significantly higher water table slopes (gradients), higher water levels and greater discharge (flow) rates to the adjacent wetlands. These changes represent hydrologic alterations to the groundwater system and the wetland system that must be taken into account. The Darcy's Law analysis suggests that water table increases at the wastewater and stormwater infiltration facilities may be in the range of 1.8 to 4.2 feet. A more detailed analysis using a numerical flow model such as the USGS MODFLOW code is warranted.

Please contact me directly with any questions that you might have.



Scott W. Horsley

Table 2 - Darcy's Law Q = KiA

Q = discharge (flow)
K = hydraulic conductivity
I = water table slope
A = cross section area

			Site-Wide	Stormwater
Existing Conditions	Q (discharge)	cf/day	862	168
	K (hydraulic conductivity)	ft/day	6.5	6.5
	I (water table slope)		0.033	0.035
	length of cross section	feet	234	44
	aquifer thickness	feet	17	17
	A (area of cross section)	sq ft	3978	748
Post Development Conditions	wastewater discharge	gal/day	2860	
		cf/day	382	
	stormwater infiltration	cf/day	156	156
	Additional Recharge	cf/day	538	156
	Post Dev Recharge	cf/day	1400	324
	I = Q/KA		0.054	0.067
	water rise at W SAS	feet	**1.8**	
	water rise at E SAS	feet	**3.3**	
	water rise at Stormwater	feet	**2.7**	**4.2**
	Existing Water Table		160	158.84
	Wetland Elevation		154	154