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September 30, 2024

Mr. Zachary McBride, Chair
Sherborn Zoning Board of Appeals
19 Washington Street
Sherborn, MA 01770

Ms. Daryl Beardsley, Chair
Sherborn Board of Health
19 Washington Street
Sherborn, MA 01770

RE: 34 Brush Hill Road, Sherborn, MA

Dear Mr. McBride, Ms. Beardsley and Fellow Board Members:

I have been retained by abutters and residents of Sherborn to review the above-referenced project relative to hydrologic and water quality impacts. My clients include Andrew and Michelle Lauterback and Dennis and Vicki Natale.

Qualifications: I have over 30 years of professional experience in the fields of hydrology and water resources management. I have served as a consultant to federal, state, and local government agencies, non-governmental organizations (NGOs), and private industry throughout the United States, Central America, the Caribbean, the Pacific Islands, Bulgaria, and China. I have assisted in the development and presentation of a nationwide series of U.S. Environmental Protection Agency (USEPA) workshops on drinking water protection, wetlands management, and watershed management. I have served as a consultant to the Commonwealth of Massachusetts in the development of the Smart Growth Toolkit. I have also served on numerous advisory boards to the USEPA, the National Academy of Public Administration, Massachusetts Department of Environmental Protection (DEP), Massachusetts Executive Office of Energy and Environmental Affairs (EEA), and the National Groundwater Association. I have received national (USEPA) and local awards for his work in the water resources management fields.

I currently serve as Adjunct Faculty at Harvard University Extension School and Tufts University, where I teach courses in water resources policy, wetlands management, green infrastructure (GI), and low impact development (LID). These courses focus on the critical role of local governments who have the primary responsibility and authority of regulating land uses in critical water resource protection areas. I have served as an expert witness in state and federal courts as a hydrologist in matters relative to the federal Clean Water Act, the Massachusetts Wetlands Protection Act and Regulations, Massachusetts Environmental Code (Title 5), Massachusetts Surface Water Quality Regulations, Massachusetts Stormwater Standards, Massachusetts Wetlands Protection Regulations, and the Massachusetts Groundwater Discharge Permit Regulations.

I currently serve as a design consultant for three affordable housing projects in Massachusetts, all of which are 100% affordable units and all of which will result in net water quality restoration benefits. I am also working for multiple Massachusetts municipalities developing water quality restoration projects to mitigate excessive nutrient loading from wastewater and stormwater discharges to groundwater and surface waters to achieve compliance with the Clean Water Act.

General Comments: The proposed project includes a concentrated cluster wastewater disposal system, three stormwater infiltration systems, two stormwater detention systems, and a series of private drinking water wells. The project site is surrounded by abutters' private drinking water wells and wetlands. The wetlands include Course Brook and its tributary, which are not shown on the site plans. The soils are comprised of glacial till which is low permeability with shallow water table.

The proposed wastewater disposal system and stormwater infiltration systems are designed with bare minimum separation distances to the existing underlying water table (4.0 feet for wastewater and 2.0 feet for stormwater infiltration). The project will cause groundwater mounding (rises in the water table) which has not been accounted for. No assessment of these post-development conditions is provided by the Applicant.

My review and analysis indicates that the groundwater mounding will be significant and will compromise the functioning of the wastewater and stormwater systems. My specific comments are as follows.

1. Groundwater mounding will compromise the functioning of the proposed septic system.

Groundwater mounding refers to rises in the groundwater and water table caused by the subsurface infiltration of wastewater or stormwater (see figure 1). Title 5 requires a minimum separation distance of four (4.0) feet between the bottom of the soil absorption system and the high groundwater elevation. The separation distance provides an important water quality function including the filtration and attenuation of pathogens.

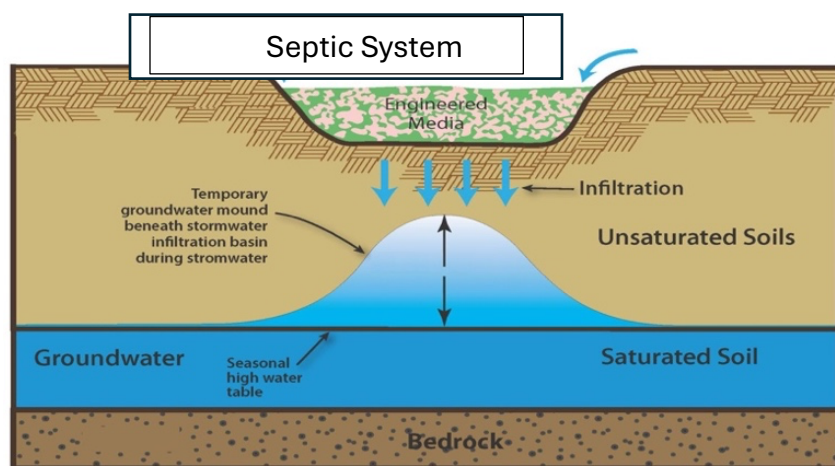


Figure 1 – Groundwater Mounding beneath an infiltration area

Title 5 also requires a groundwater mounding analysis for subsurface disposal systems with flows of 2000 gallons/day or greater to ensure separation of 4 feet is maintained¹. This clearly indicates that the intent of Title 5 is to maintain the 4 feet of separation from the mounded (post-development) water table. Although this system is designed at slightly less (12%) than 2000 gallons/day (1760 gallons/day), it will have significant groundwater mounding effects. The hydrogeology of the site is characterized as low permeability soils and shallow water table. These conditions exacerbate the impacts caused by groundwater mounding.

Furthermore, the proposed design is dependent upon an artificial impermeable barrier which will significantly alter hydrologic conditions and warrants a groundwater mounding analysis to ensure that the minimum 4-foot vertical separation between the bottom of the soil absorption system and the groundwater is maintained as required by Title 5.

Title 5 (310 CMR 15.003) provides flexibility for the Board of Health (Local Approving Authority) to apply “additional criteria” to ensure that the system is “protective of public health, safety, and the environment” (see excerpt below). In this case the Board should require the groundwater mounding analysis and require that the 4 feet of separation is maintained in post-development conditions.

15.003: Coordination with Local Approving Authorities

(1) In general, full compliance with the provisions of 310 CMR 15.000 is presumed by the Department to be protective of the public health, safety, welfare and the environment. Specific site or design conditions, however, may require that additional criteria be met in order to achieve the purpose or intent of 310 CMR 15.000.

I have conducted a preliminary groundwater mounding analysis using the Hantush model². I have utilized hydraulic conductivity and specific yield values published for this area by the Massachusetts Hydrogeologic Atlas and the dimensions of the soil absorption system and saturated thickness provided by the Applicant (see Appendices to letter). The resulting analysis indicates that the groundwater mounding beneath the system will rise 4.3 feet and will inundate the wastewater soil absorption system (see Figures 2 and 3).

The mounding analysis also indicates significant water table rises of approximately 2.5 feet at distances of 180 feet from the septic system. This mounding will have cumulative impacts on the functioning of the stormwater infiltration systems on the property

¹ 310 CMR 15.240 (12) (Title 5), states, “for systems with a design flow of 2,000 gpd or greater, the separation distance to the high groundwater elevation required by 310 CMR 15.212 shall be determined by adding the effect of groundwater mounding to the high groundwater elevation as determined pursuant to 310 CMR.”

² The Hantush model is recommended by MADEP in their “Guidelines for Title 5 Aggregation Of Flows and Nitrogen Loading 310 CMR 15.216”, page 10

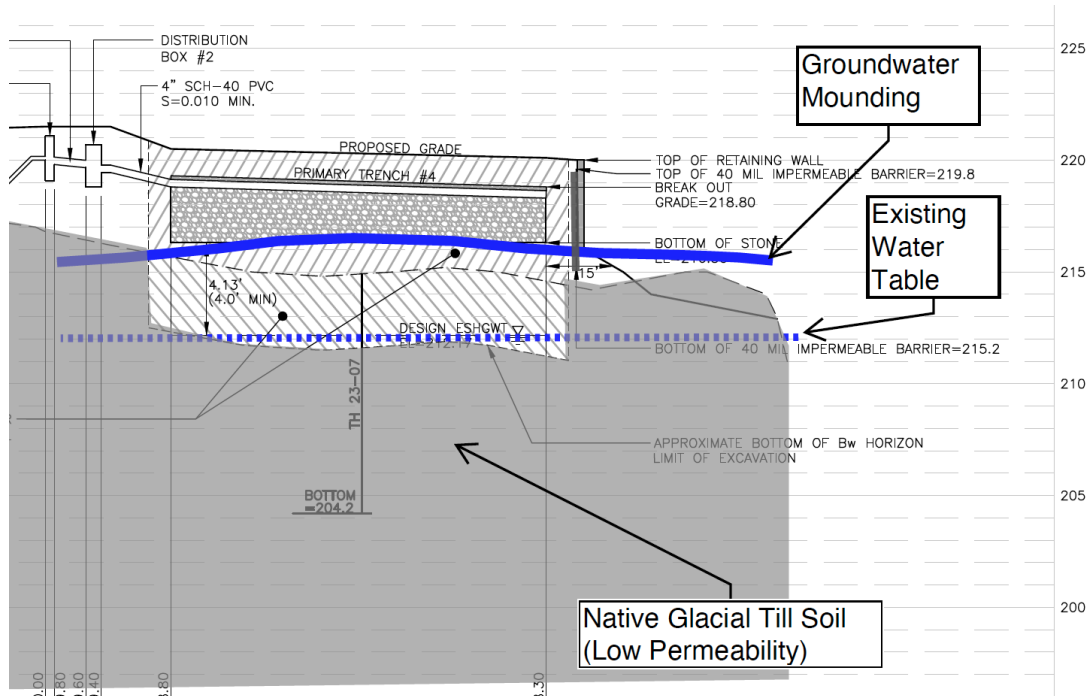


Figure 2 – Cross Section of Proposed Septic Soil Absorption System and Groundwater Mounding

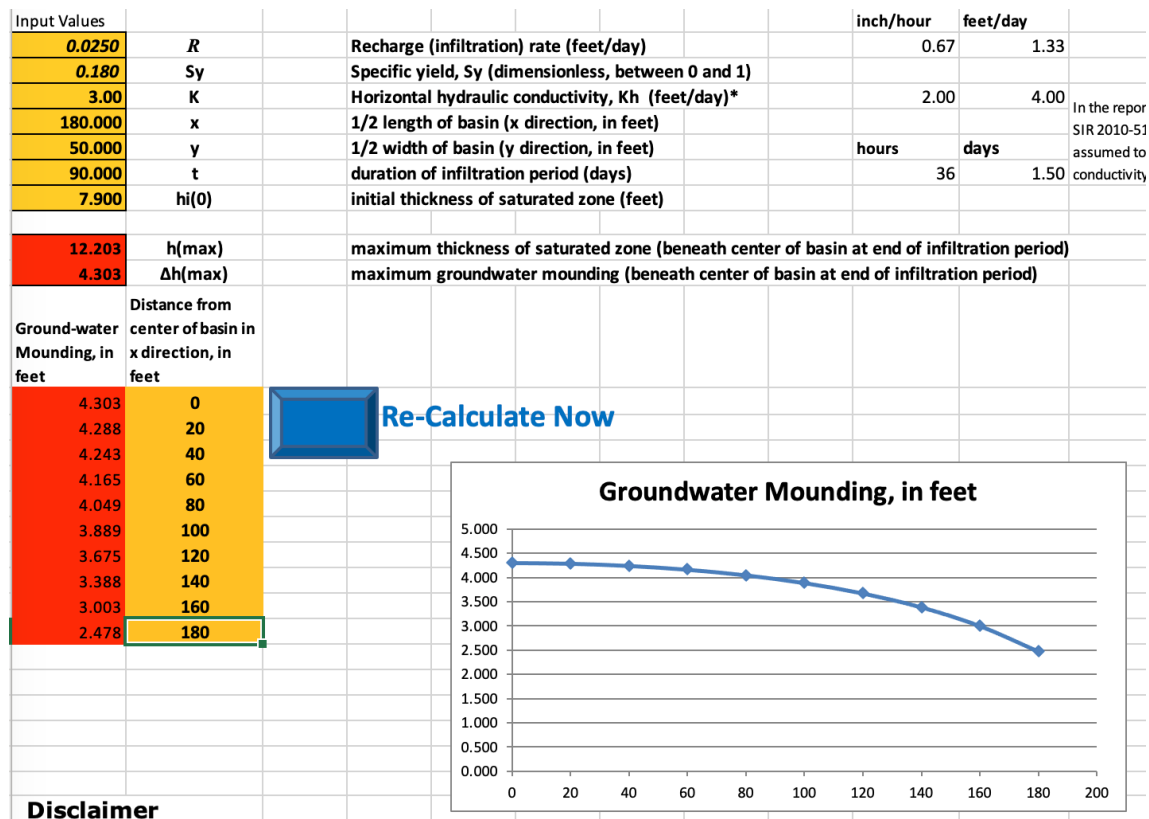


Figure 3 – Hantush Groundwater Mounding Calculations

2. The proposed septic system design includes an “impermeable barrier” surrounding much of its footprint that will constrain the lateral movement of wastewater away from the disposal site and cause it to back up vertically. Because the project site is not “generally suitable for subsurface sewage disposal³” using a conventional design, the proposed project relies upon an artificial impermeable barrier to contain the wastewater (see Figure 4). The proposed barrier will constrain the wastewater discharge and will preclude horizontal dissipation of the effluent (see Figure 5).

The impermeable barrier will cause additional groundwater mounding (beyond what I have modeled using the Hantush model). Additional modeling is required to assess these supplemental mounding conditions caused by the impermeable barrier. This will require an additional model such as MODFLOW that can incorporate boundary conditions (such as the impervious barrier).

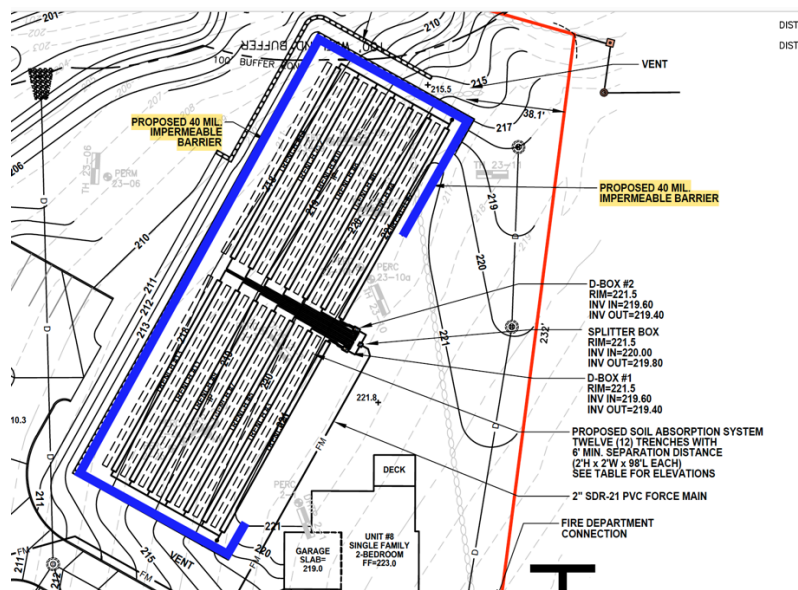


Figure 4 – Proposed septic system and surrounding impermeable barrier

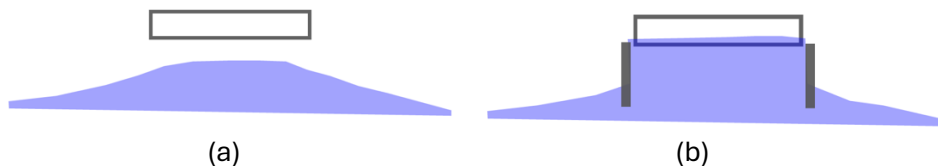


Figure 5 – Conceptual illustration of groundwater mounding (blue) beneath septic system (rectangle) without (a) and with vertical impermeable barriers (b).

³ Sherborn Health Regulations, Section 14, 2A.

3. The project does not comply with the MADEP Stormwater Standards. The Stormwater Report prepared by DGT Associates (revised September 19, 2024) claims that the proposed stormwater system complies with MADEP Stormwater Standards. However, the Standards require a groundwater mounding analysis for any infiltration system with less than 4.0 feet vertical separation to the estimated seasonal high groundwater elevation. According to the Site Plans the three “recharger” systems have exactly 2.0 feet separation (see Figure 5). The required groundwater mounding analysis has not been provided.

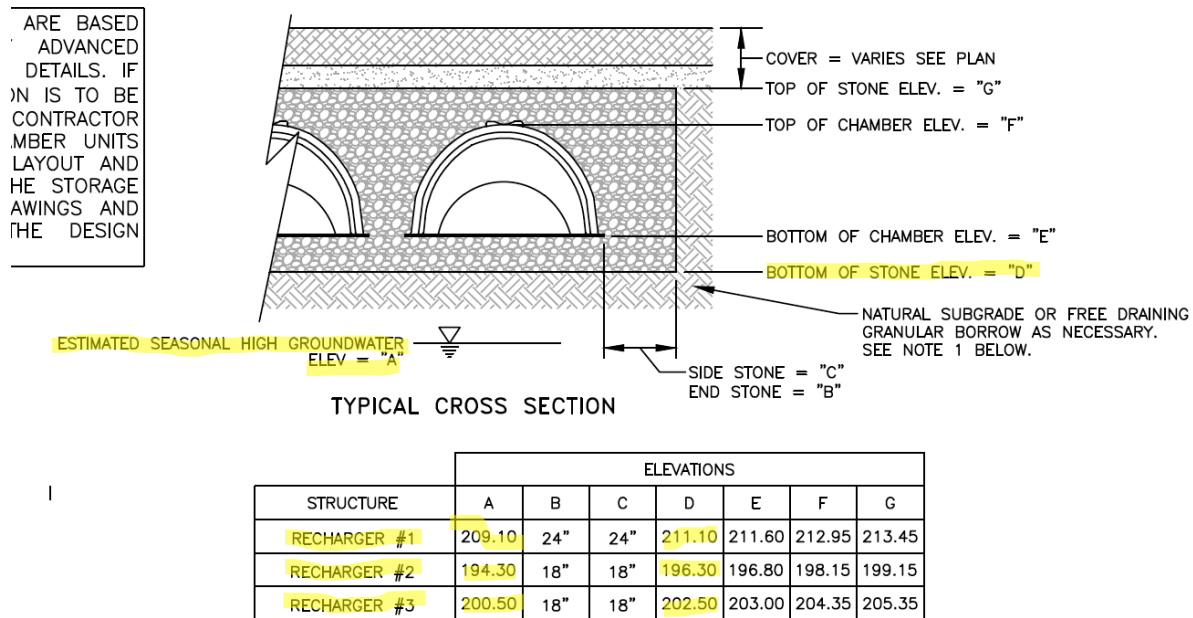


Figure 6 – Engineering design elevations for proposed stormwater infiltration systems (Source: DGT Associates, Site Plan, Sheet C-15, revised 9/19/24)

Additionally, the location of stormwater infiltration system "Recharger #2" does not comply with the MADEP Stormwater Standards. The MADEP Stormwater Handbook, Volume 1, Chapter 1, page 8 requires a setback of at least 100 feet between private wells and infiltration systems (see Figure 7). As you can see from Figure 7, "Recharger #2" is within 100 feet of the proposed well locations for Units 4 and 5.



Figure 7 – Recharger 2 Infiltration System and 100-foot required buffers to private wells

4. The proposed wastewater disposal will result in individual and cumulative water quality impacts to groundwater and surface waters. The project proposes to discharge 1760 gallons/day of sewage to groundwater. The site topography and test pit data suggests that existing groundwater flow direction in the vicinity of the wastewater disposal area is northwesterly towards wetlands and a tributary to Course Brook. Groundwater mounding will modify these flow directions resulting in more radial flow in multiple directions.

The discharge will contain concentrations of nitrogen of 35 – 100 mg/liter, in excess of and 3.5 – 10 times higher than federal and state drinking water standards (10 mg/liter). It will also discharge an estimated 3 – 6 mg/liter of phosphorus, in excess of and 100 – 200 times higher than surface water quality criteria (0.025 mg/liter). The septic system is surrounded by private drinking water wells and a nearby stream, Course Brook, (to the northwest) and its tributary to the northeast (see Figures 8 and 9).

Section 22, 3.1 (g) of the Sherborn Health Regulations requires that an Environmental Health Impact Report be prepared for “an application for approval of a Comprehensive Permit under

M.G.L. c. 40B, s. 20-23". In accordance with the Health Regulations, the required Report must demonstrate (among other things):

- "clearly that the soil conditions are generally suitable for subsurface sewage disposal" (Section 14 (2A)),
- "no deleterious individual or cumulative impact of subsurface sewage disposal upon groundwater quality" (Section 14 (4)), and
- "the effect on ground and surface waters" (Section 14 (7)).

The applicant has not provided an Environmental Health Report that would provide the necessary information for the Board of Health to determine water quality impacts on groundwater and surface waters.

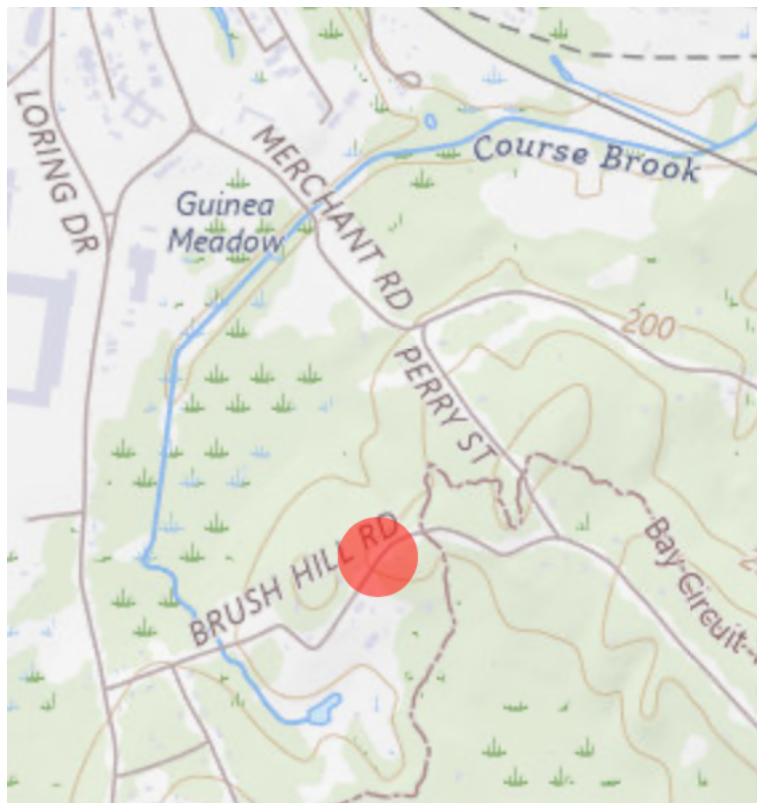


Figure 8 – Location of proposed project adjacent to Course Brook (Source USGS StreamStats)

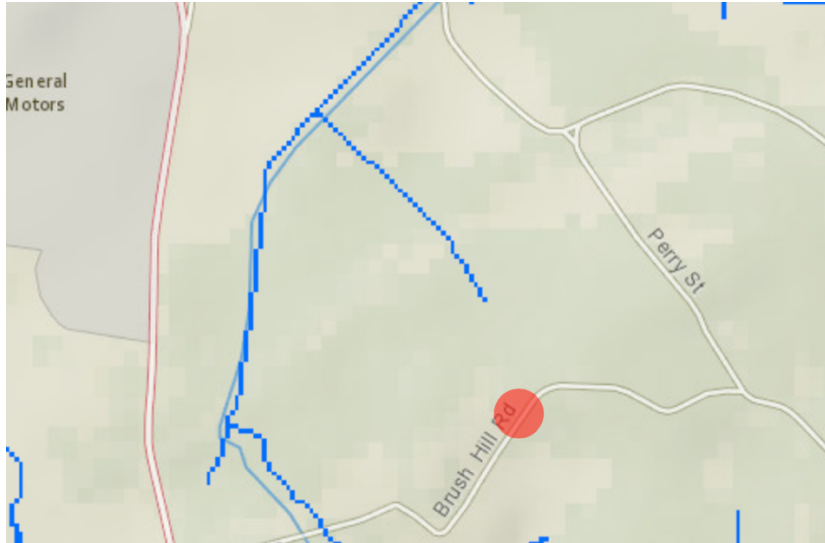


Figure 9 – Location of project adjacent to Course Brook and tributary (Source: USGS StreamStats)

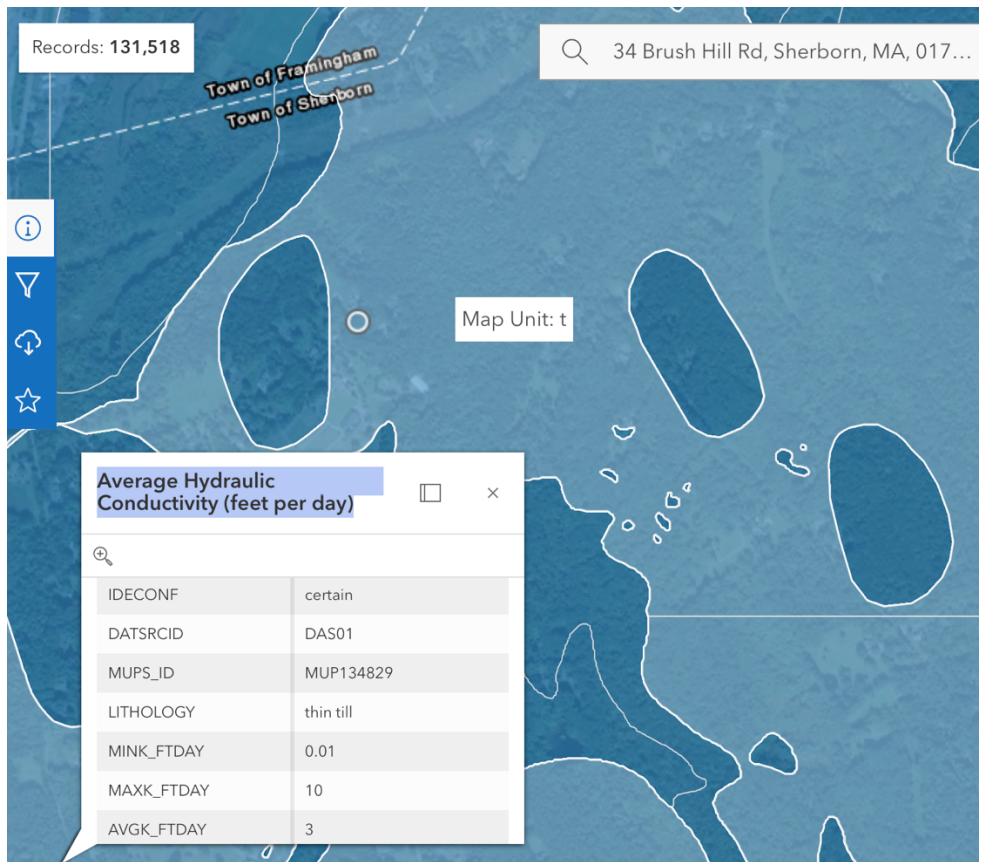
6. Recommendations. Based upon my review of the project I recommend the Board require the Applicant to do the following:

- a) Conduct a groundwater mounding analysis to determine the effects the proposed discharge of 1760 gallons/day of wastewater and the effects of the proposed impermeable liner that surrounds the wastewater infiltration area.
- b) Add Course Brook and its tributary to the site plans, determine groundwater flow directions, and conduct water quality impact assessment (including nitrogen and phosphorus loading).
- c) Conduct a groundwater mounding analysis for the three proposed stormwater infiltration systems. This analysis should include cumulative impacts of this mounding along with the wastewater infiltration system.
- d) Determine post-development groundwater flow directions and delineate areas of impact associated with the proposed septic system and stormwater infiltration systems.
- e) Prepare Environmental Health Impact Report in accordance with Sherborn Health Regulations.

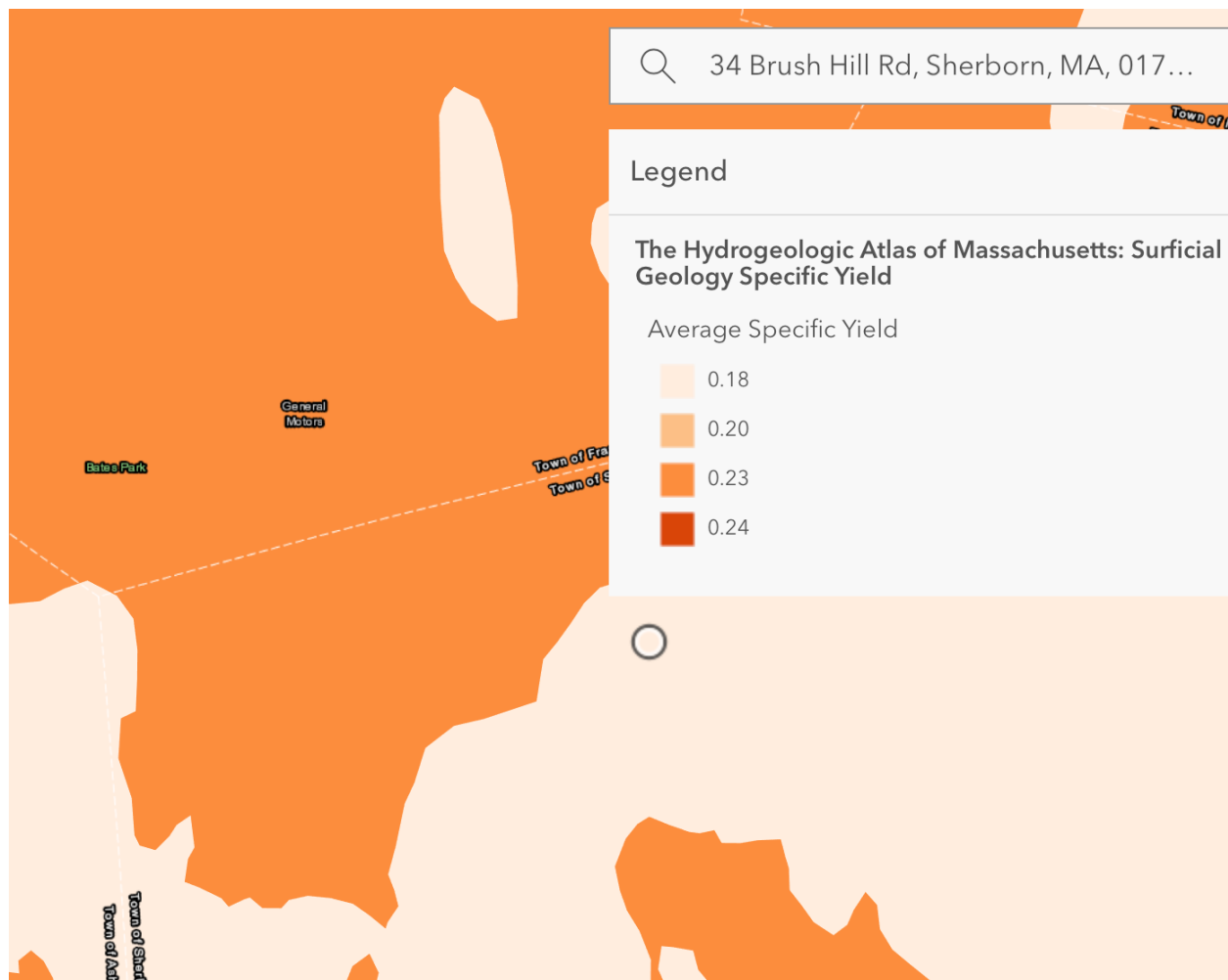
Please contact me directly with any questions that you have.

Sincerely,

Scott W. Horstley
Water Resources Consultant



Appendix A – Hydraulic conductivity (Source: Massachusetts Hydrogeologic Atlas)



Appendix B - Specific Yield (Source: Massachusetts Hydrogeologic Atlas)

