Scott Horsley
Water Resources Consultant
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September 13, 2023

Sean Fair, Chair
Wayland Conservation Commission
41 Cochituate Road
Wayland, MA 01778

RE: 24 School Street, Wayland NOI Application

Dear Mr. Fair and Commissioners:

The abutter George Bernard retained me to review the proposed project and to evaluate its associated wetlands and water resources impacts. I have submitted several comment letters over the last several years including one dated October 2, 2017 when I first raised the issue of the perennial status of the adjacent stream and a more recent letter dated July 11, 2023.

Qualificiations: I have over thirty years of experience as a consulting hydrologist working for government, nonprofit, and private organizations throughout the United States and abroad. As a consultant to the U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds (USEPA OWOW) I have developed Watershed Protection Guidance documents and provided related training in 43 states nationwide. I served as an expert witness in hydrology for USEPA on a wetlands enforcement case associated with the Weweantic River in Massachusetts. I also serve on multiple advisory committees for the MADEP including the Stormwater Advisory Committee, Sustainable Water Management Initiative (SWMI), Climate Change Advisory Committee, and the Title 5 Advisory Committee. I assisted in the preparation of the Massachusetts Smart Growth and Smart Energy Toolkit. I serve as an adjunct faculty at Tufts University and Harvard Extension School where I teach graduate-level courses in Water Resources Management, Low Impact Development, Wetlands Management, and Green Infrastructure.

My comments are as follows:

1. Perennial Stream and Riverfront Area. The Massachusetts Wetlands Protection Regulations provide for the protection of perennial streams and associated riverfront areas (310 CMR 58.00). Perennial streams include ***"streams that are perennial under natural conditions but are significantly affected by drawdowns of water supply wells…….or other human-made flow reduction shall be considered perennial"*** (310 CMR 58(2)1(f)) – see attached excerpt from the regulations below.

As I have provided in prior submittals to the Commission this stream should be designated as perennial (under natural conditions) for the following three reasons:

a) the stream was mapped as perennial by the USGS (1970 Quadrangle). The stream is depicted on the Quadrangle by a solid blue line, similarly to the depiction of Snake River. By contrast a different stream located next to Oak Stream is depicted as intermittent, by dashed lines.

b) The USGS StreamStats analysis identifies the stream as having a perennial probability of 0.65 (over the 0.56 criterion). This information was not included with the peer reviewer's (EcoTek) comment letter.

c) the stream is within a subwatershed identified as significantly de-watered (affected) by water supply withdrawals and impervious surfaces (-31%) by the USGS model of the Sudbury and Assabet Rivers. There are nine public water supply wells that withdraw water from this subwatershed that surround the project site (see attached excerpt from USGS report). Some of these wells withdraw in excess of 1 million gallons/day and have water level drawdowns that extend for thousands of feet. These individual drawdowns from each well are cumulative and additive. The pumping of Wayland wells has increased significantly over time (see attached graph). The creation of impervious surfaces (including the nearby school building and parking lot) within the watershed has also reduced groundwater recharge and baseflow in the stream (see attached map showing impervious surfaces).

Note: See documentation for each of these three points at the end of this letter

f. Rivers include perennial streams that cease to flow during periods of extended drought. Periods of extended drought for purposes of 310 CMR 10.00 shall be those periods, in those specifically identified geographic locations, determined to be at the "Advisory" or more severe drought level by the Massachusetts Drought Managment Task Force, as established by the Executive Office of Energy and Environmental Affairs and the Massachusetts Emergency Management Agency in 2001, in accordance with the Massachusetts Drought Management Plan (MDMP). Rivers and streams that are perennial under natural conditions but are significantly affected by drawdown from withdrawals of water supply wells, direct withdrawals, impoundments, or other human-made flow reductions or diversions shall be considered perennial.

2. Groundwater Mounding and Wetland Alterations. The Notice of Intent (NOI) includes Groundwater Mounding Analyses conducted by GHC and dated July 23, 2020. Among other concerns that I submitted previously in my prior comment letters I have the following two principal concerns with the current NOI submittal.

a) the modeling report indicates that the groundwater mounding assessment is limited to ***"3 days after the storm event"*** (see excerpt below). The analysis should report on groundwater mounding during the 100-year storm event.

b) the modeling report does not adequately evaluate water level alterations within the wetland (BVW). The report suggests that a constant head boundary was set within the wetland. This precludes any analysis of water level changes within the wetland. MADEP Stormwater Handbook Volume 3 requires that the mounding analysis determine water level changes with the BVW (see excerpt below).

Storm Water

Results of the MODFLOW groundwater mounding simulation for the 100-Year Storm Water discharge to the Infiltration Basin are shown in Figure 8 and indicate that 3 days after the storm the residual groundwater mound would be 0.36 feet beneath the Infiltration Basin. This value is less than the 2 foot design separation distance, showing that the basin has fully drained in 3 days.

MOUNDING ANALYSIS

Mounding analysis is required when the vertical separation from the bottom of an exfiltration system to seasonal high groundwater is less than four (4) feet *and* the recharge system is proposed to attenuate the peak discharge from a 10-year or higher 24-hour storm (e.g., 10-year, 25-year, 50-year, or 100-year 24-hour storm). In such cases, the mounding analysis must demonstrate that the *Required Recharge Volume* (e.g., infiltration basin storage) is fully dewatered within 72 hours (so the next storm can be stored for exfiltration). The mounding analysis must also show that the groundwater mound that forms under the recharge system will not break out above the land or water surface of a wetland (e.g., it doesn't increase the water sheet elevation in a Bordering Vegetated Wetland, Salt Marsh, or Land Under Water within the 72-hour evaluation period).

3. Water Quality Impacts. The NOI does not adequately address water quality impacts associated with the proposed septic system. The septic system has a design flow of 2860 gallons/day and is within the 100-foot buffer zone. It does not comply with the Wayland Health Regulations that require that systems in excess of 1000 gallons/day have a minimum setback of 100 feet. The MA Wetlands Regulations indicate that the presumption that the interests of the Regulations are met ***"only…if the soil absorption system is set back…..a greater distance as required by local regulation"*** – see excerpts below.

(3) Presumption Concerning 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*. 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:

(a) Coastal.
1. coastal bank;
2. coastal beach;
3. coastal dune;
4. salt marsh.

(b) Inland.

1. wet meadows		creek;
2. marsh	bordering	river;
3. swamp	on any	stream;
4. bog		pond;
		lake.

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: *Minimum Setback Distances*, or a greater distance as may be required by more stringent local ordinance, by-law or regulation. To protect wildlife habitat within riverfront areas, the soil absorption system shall not be located within 100 feet of the mean annual high-water line unless there is no alternative location on the lot which conforms to 310 CMR 15.000: *The State Environmental Code, Title 5: Standard Requirements for the Siting, Construction, Inspection, Upgrade and Expansion of On-site*

7. **Offset Distances:** The minimum offset distances to an SAS shall be in accordance with 310 CMR 15.211, Title 5, and as follows:
   a) Irrigation only, or closed loop geothermal wells, to all leach areas shall be 50' feet.
   b) Drinking water or open loop geothermal wells to all leach areas shall be 100' feet.
   c) No leaching facility having a design flow of 1000 gpd, or less, shall be constructed within 75' feet of any pond, stream, brook, river, swamp or Wetland Resource Area (as defined in 310 CMR 10.00, or the Town of Wayland Wetlands Bylaw), whichever is more stringent. The distance shall be 100' feet for facilities with design flows greater than 1000 gpd.

Thank you for the opportunity to submit these comments. Please contact me with any questions that you may have.

Sincerely,

Scott W. Horsley
Water Resources Consultant

References:

Effects of Water Use and Land Use on Streamflow and Aquatic Habitat in the Sudbury and Assabet River Basins, Massachusetts (Scientific Investigations Report 2010-5042), United States Geological Survey, 2010.

A Revised Logistic Regression Equation and an Automated Procedure for Mapping the Probability of a Stream Flowing Perennially in Massachusetts, Gardner C. Bent and Peter A. Steeves, United States Geological Survey, Scientific Investigations Report 2006-5031.

Massachusetts Wetlands Protection Regulations (310 CMR 10.00).

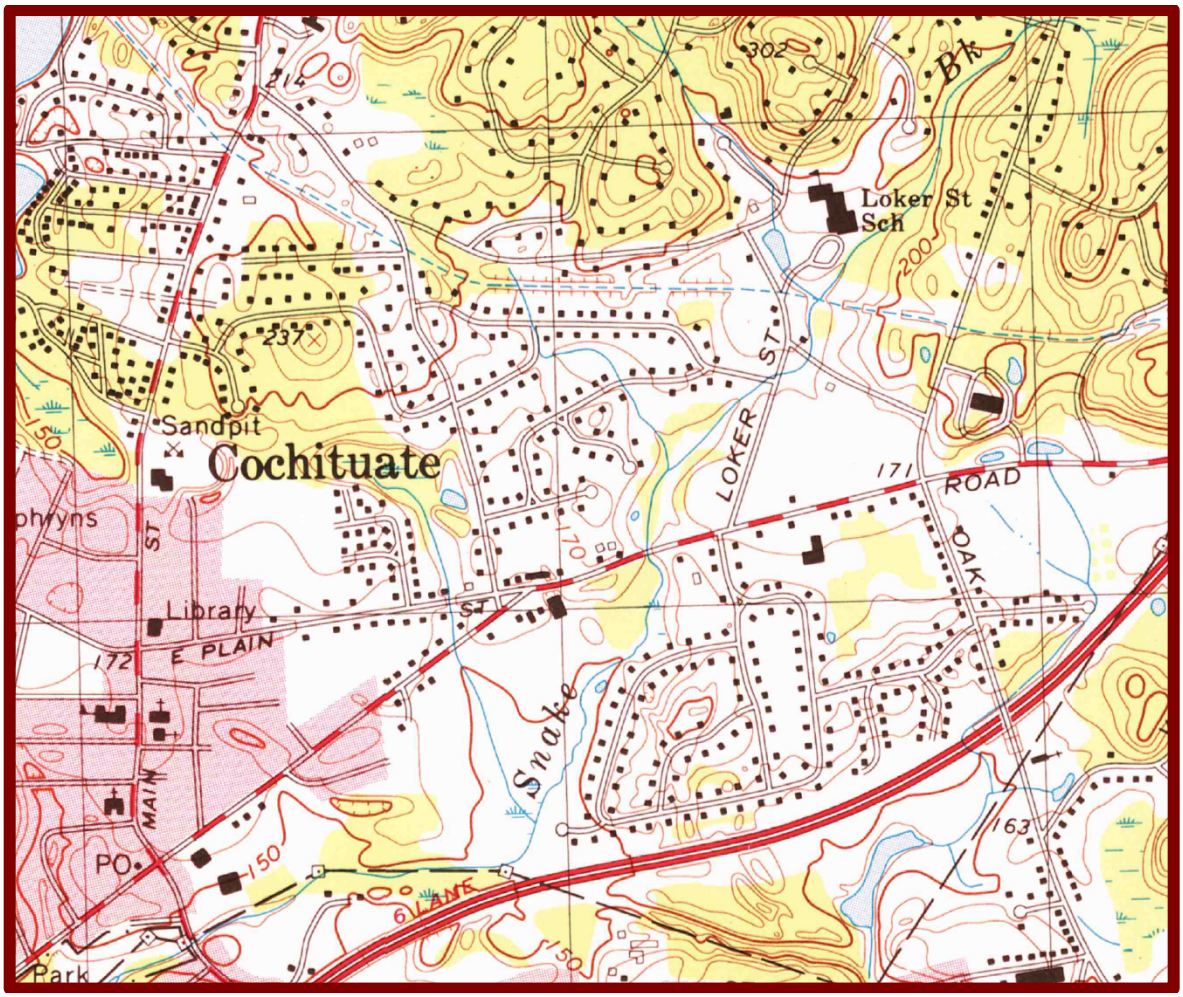


Figure 1 - USGS Topographic Quadrangle 1970

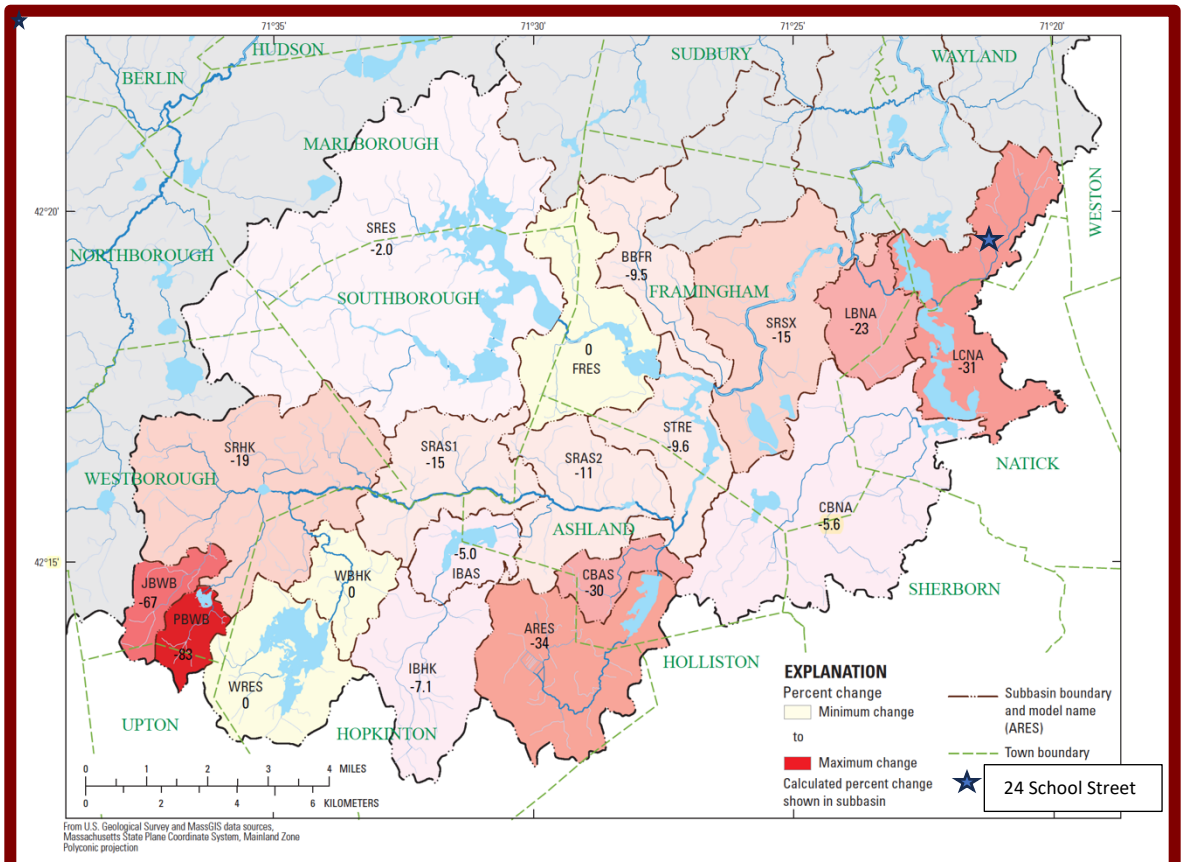
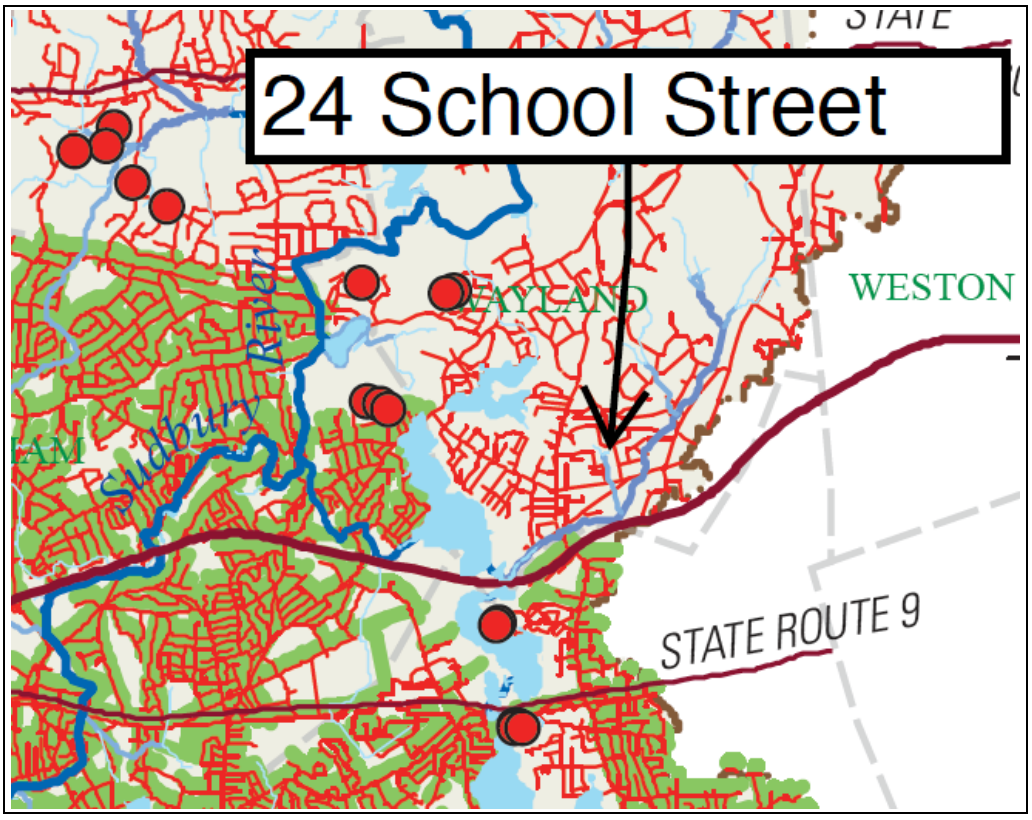
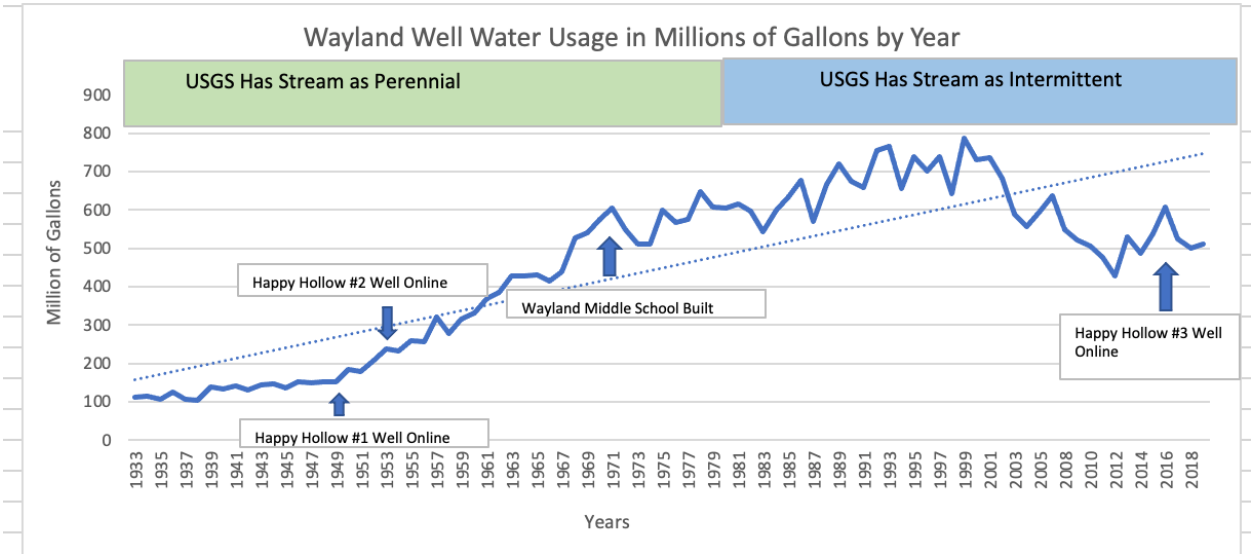
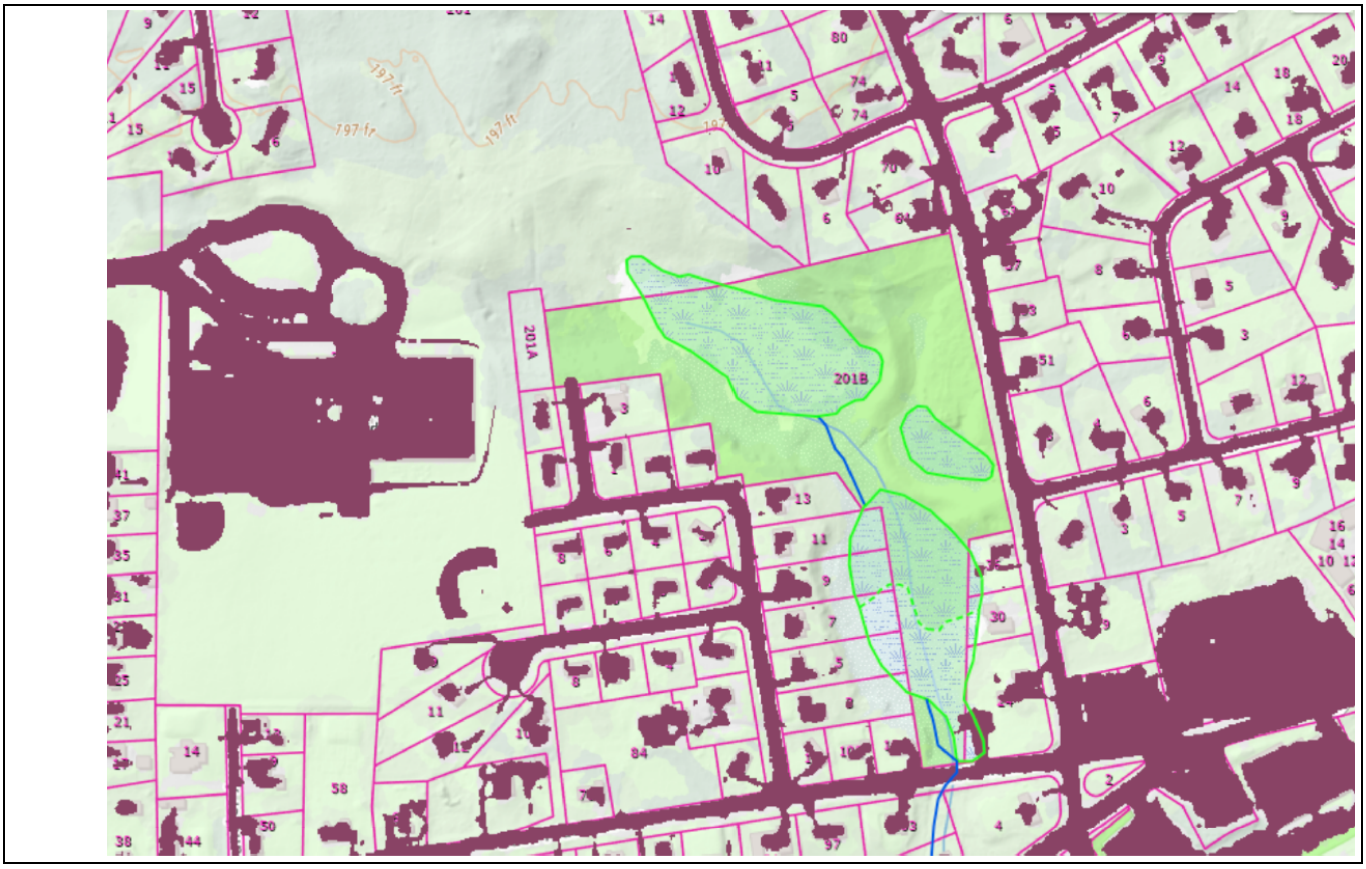


Figure 21. Percent change in the simulated long-term (1960–2004) median of the August mean streamflows with average 1993–2003 withdrawals (AVGWU) relative to no withdrawals (NOWU) in the upper Sudbury River Basin, Massachusetts.

Figure 2 - Effects of Water Use and Land Use on Streamflow and Aquatic Habitat in the Sudbury and Assabet River Basins, Massachusetts" (Scientific Investigations Report 2010-5042)

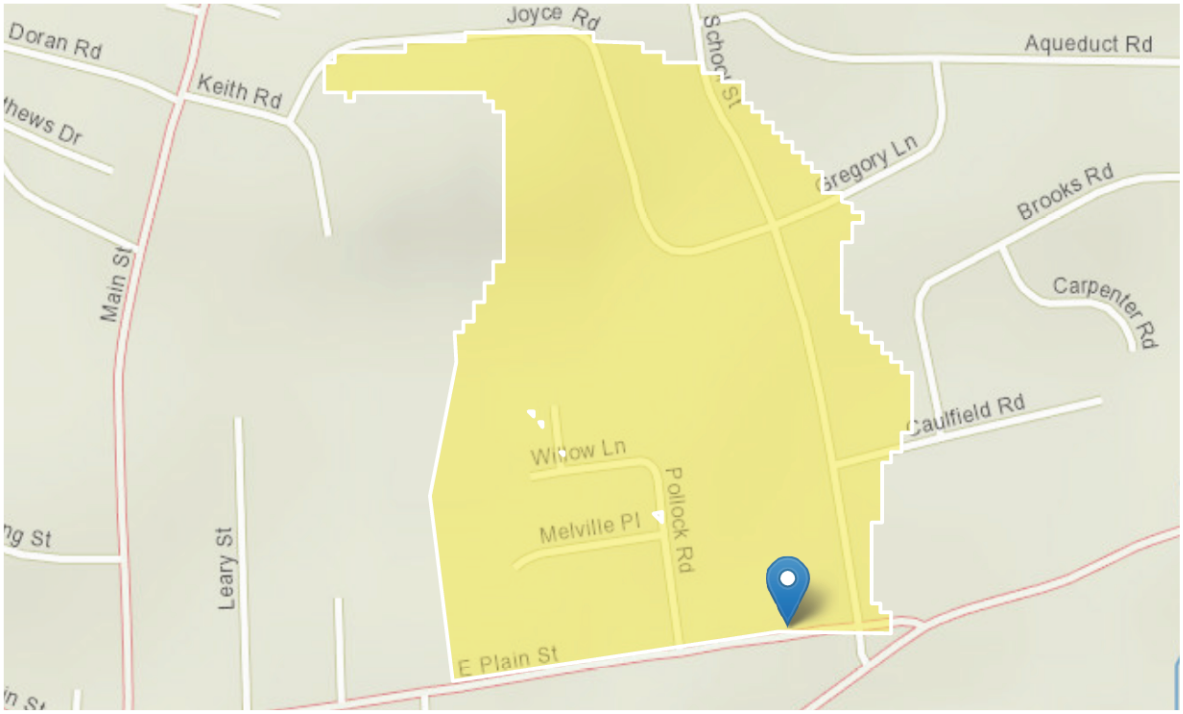

24 School Street
WESTON
STATE ROUTE 9


Wayland Well Water Usage in Millions of Gallons by Year
USGS Has Stream as Perennial
USGS Has Stream as Intermittent
Million of Gallons
Years
Happy Hollow #2 Well Online
Wayland Middle School Built
Happy Hollow #3 Well Online
Happy Hollow #1 Well Online


201A
201B

Wayland Stream Analysis 071321

Region ID:	MA
Workspace ID:	MA20210713115331289000
Clicked Point (Latitude, Longitude):	42.32232, -71.35637
Time:	2021-07-13 07:54:00 -0400



including drainage from East Plain Street

Probability Statistics Parameters [Perennial Flow Probability]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0928	square miles	0.01	1.99
PCTSNDGRV	Percent Underlain By Sand And Gravel	56.28	percent	0	100
FOREST	Percent Forest	19.59	percent	0	100
MAREGION	Massachusetts Region	0	dimensionless	0	1

Probability Statistics Flow Report [Perennial Flow Probability]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PC
Probability Stream Flowing Perennially	0.652	dim	71

Probability Statistics Citations

Bent, G.C., and Steeves, P.A.,2006, A revised logistic regression equation and an automated procedure for mapping the probability of a stream flowing perennially in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2006–5031, 107 p. (http://pubs.usgs.gov/sir/2006/5031/pdfs/SIR_2006-5031rev.pdf)

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21 January 2021

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

RE: 24 School Street, Wayland

Dear Chairman Fair and Fellow Commissioners:

I have been retained by Mr. George Bernard, an abutter to the proposed project located at 24 School Street Wayland to review the application materials presented and to provide comments regarding impacts to wetland resource areas that are subject to the Massachusetts Wetlands Protection Regulations.

Qualifications

I have thirty years of experience as a consulting hydrologist working for government, nonprofit, and private organizations throughout the United States and abroad. As a consultant to the U.S. Environmental Protection Agency (USEPA) and the U.S. Department of Justice (USDOJ) I served as an expert witness on wetland hydrology in a Clean Water Act enforcement case in federal court. As a consultant to USEPA I have developed Watershed Protection Guidance documents and provided related training in 43 states nationwide. I have served on the Massachusetts DEP's Stormwater Advisory Committee, Title 5 Advisory Committee, and Sustainable Water Management Initiative (SWMI). I also assisted in the preparation of the Massachusetts Smart Growth and Smart Energy Toolkit. I currently serve as an adjunct faculty member at Tufts University and Harvard Extension School where I teach graduate-level courses in Water Resources Management, Low Impact Development, and Green Infrastructure.

Introduction

I reviewed the Notice of Intent prepared by MetroWest Engineering dated December 2020 and the Stormwater Report prepared by MetroWest Engineering dated December 2020. I have also reviewed the attachments to these two documents including the MODFLOW analysis prepared by Creative Land Development dated August 16, 2020, revised November 9, 2020 and the associated letter from GeoHydroCycle dated July 23, 2020. Additionally, I consulted with relevant federal, state and municipal resources including United States Geological Survey (USGS) watershed models and long-term hydrographic data, MADEP guidance documents, and MAGIS datalayers.

This project is located adjacent to a small headwater stream and associated bordering vegetated wetland (BVW). The project Applicant proposes to locate 12 residential units on 0.87 acres and includes a wastewater discharge of 2870 gallons/day and a stormwater infiltration system that will discharge 426,000 gallons/year (or an average of 1170 gallons/day) within jurisdiction of the MA Wetlands Protection Regulations.

The proposed project is constrained by its proximity to sensitive wetland resource areas (including the headwater stream), shallow water table conditions, and an undersized lot for the level of development that is proposed. My specific comments are as follows:

1. Wetland Resource Areas: Headwater Stream and Bordering Vegetated Wetland (BVW)

The stream adjacent to the project site is a headwater stream. It is tributary to the Snake Brook and Lake Cochituate. Headwater streams have been identified as priority wetlands by the MADEP. According to recent publications from MADEP, headwater streams are critical to downstream ecosystems and water supplies. MADEP's website states, *"Massachusetts is the most populous state in New England, and 98% of our state's population is served by drinking water supply systems that rely on isolated waters, including ephemeral, intermittent, and headwater streams"* (https://www.mass.gov/guides/mapping-and-protecting-vulnerable-wetlands-and-stormwater-management-planning-project#-headwater-streams-). Headwater streams are vulnerable to both hydrologic and water quality alterations in part due to their low flow and limited dilution capacity. Their protection is critical relative to their cumulative contribution to downstream water supplies and ecosystems.

This stream is tributary to Snake Brook and ultimately to Lake Cochituate. The Town of Natick draws a portion of its public water supply from wells that induce infiltration from Lake Cochituate. Therefore, the stream contributes to several interests articulated in the Wetlands Protection Regulations including protection of public and private water supply, protection of groundwater supply, prevention of pollution, protection of fisheries, and protection of wildlife habitat (310 CMR 10.01 (2).

The MA Wetland Regulations and associated MADEP guidance documents provide for the protection of naturally-occurring perennial streams that may have been impacted by water withdrawals. These streams are afforded a 200-foot Riverfront Protection Area. This appears to be one of those streams.

There is conflicting information regarding the stream's perennial status. The Regulations indicate that if the stream is shown on the USGS map is perennial it is to be presumed perennial (regardless of watershed size). The guidance provided in the Wetlands Protection Regulations Appendix states, "Under the new regulations, streams that are shown as perennial on USGS topographic maps are classified as perennial. Streams that are shown as intermittent, or not shown at all, are classified based upon watershed size".
r

The stream is shown as perennial on the 1970 topographic map published by the United States Geological Survey (USGS) – (see attached figure 1). This figure shows the subject stream as a solid line (indicating perennial) and for comparison another small stream to the east shows as a dashed line (indicating intermittent). There is another small headwater stream to the east that shows as perennial. Note that the two perennial streams have ponds at their source. The intermittent headwater stream does not have a pond. The ponds function to store water and sustain flow during the drier season thus maintaining the perennial flow.

The 1987 topographic map published by USGS shows the stream as intermittent. This change from perennial to intermittent suggests that the stream may have had perennial flow naturally, but does not currently, possibly as a result of human-induced hydrologic modifications including water withdrawals and impervious surfaces in the area both of which serve to dewater the stream.

The Applicant has submitted documentation of "no-flow" conditions that they observed in the stream as part of their prior Notice of Intent submittal. However, the Regulations (310 CMR 10.58 (2), 1, f) state that, "Rivers and streams that are perennial under natural conditions but are significantly affected by drawdown from withdrawals of water supply wells, direct withdrawals, impoundments, or other human-made flow reductions or diversions shall be considered perennial."

The subject area is affected by both water withdrawals and impervious surfaces constructed as a function of urbanization of the area. Large-scale groundwater withdrawals at public supply wells operated by the towns of Wayland and Natick surround the site. Urbanization in the immediate neighborhood of the stream includes roads, rooftops, driveways, parking lots and the Wayland Middle School. This urbanization has resulted in the construction of widespread impervious surfaces that preclude groundwater recharge (that previously provided baseflow to the stream).

These types of human-induced withdrawals and land use developments and their impacts on stream flow were analyzed and documented by the USGS in their report, "Effects of Water Use and Land Use on Streamflow and Aquatic Habitat in the Sudbury and Assabet River Basins, Massachusetts" (Scientific Investigations Report 2010-5042). The study evaluated the cumulative effects of water withdrawals and land use changes throughout the Sudbury and Assabet River Basins on stream flow. Within the Lake Cochituate basin (LCNA) that includes the subject stream, the USGS study evaluated the impacts of 6 public supply wells in Natick (to the south of the subject project) and 8 public supply wells in Wayland (to the north of the site). Figures 20 and 21 of that report (attached) show reductions to annual stream flow and to August median flows as a result of water withdrawals. August median flows are analyzed as the low flow or baseflow condition of a perennial stream. The subject property is located in basin 17 – LCNA, which shows a -31% decline in August median streamflow and is rated as a "maximum change" (emphasis added). This study also concluded that, "simulations indicated that the average 1993 – 2003 withdrawals most altered streamflow relative to no withdrawals

in small headwater subbasins…" Both of these findings support my interpretation that the subject stream has been altered due to water withdrawals and land use changes.

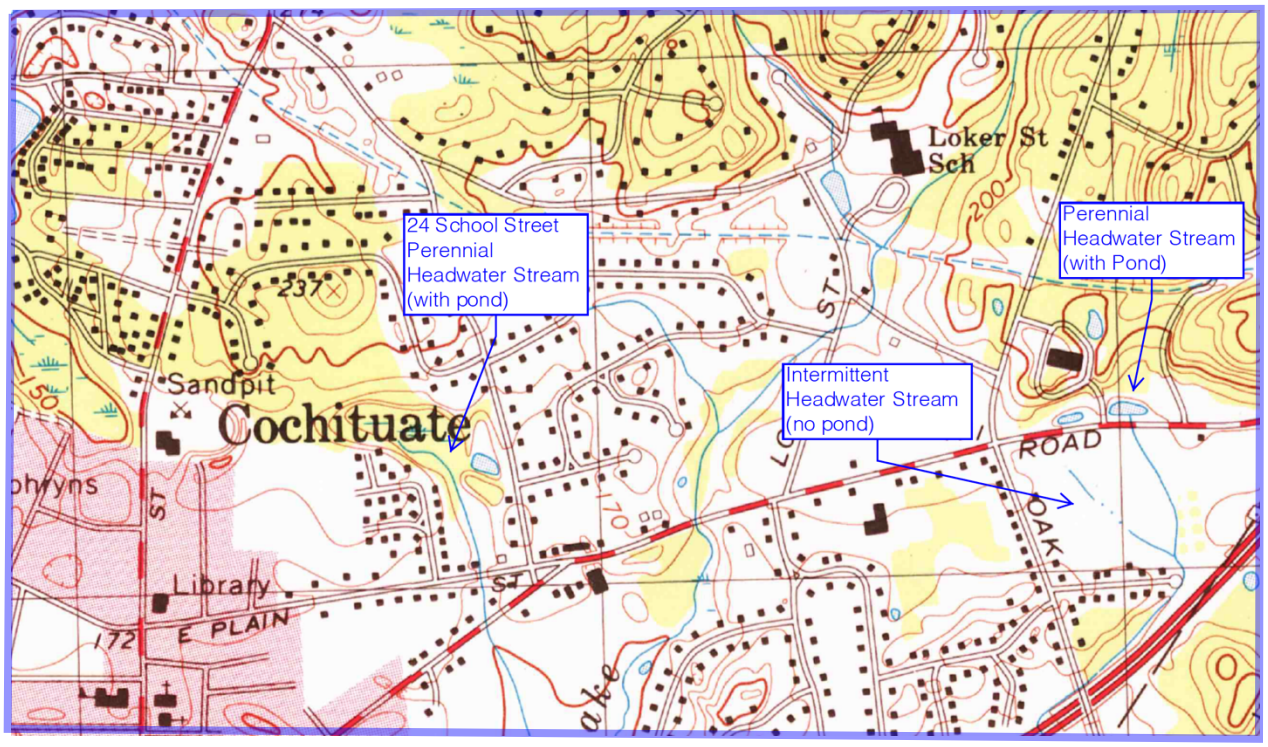


Figure 1 - Topographic Map, USGS (1970)

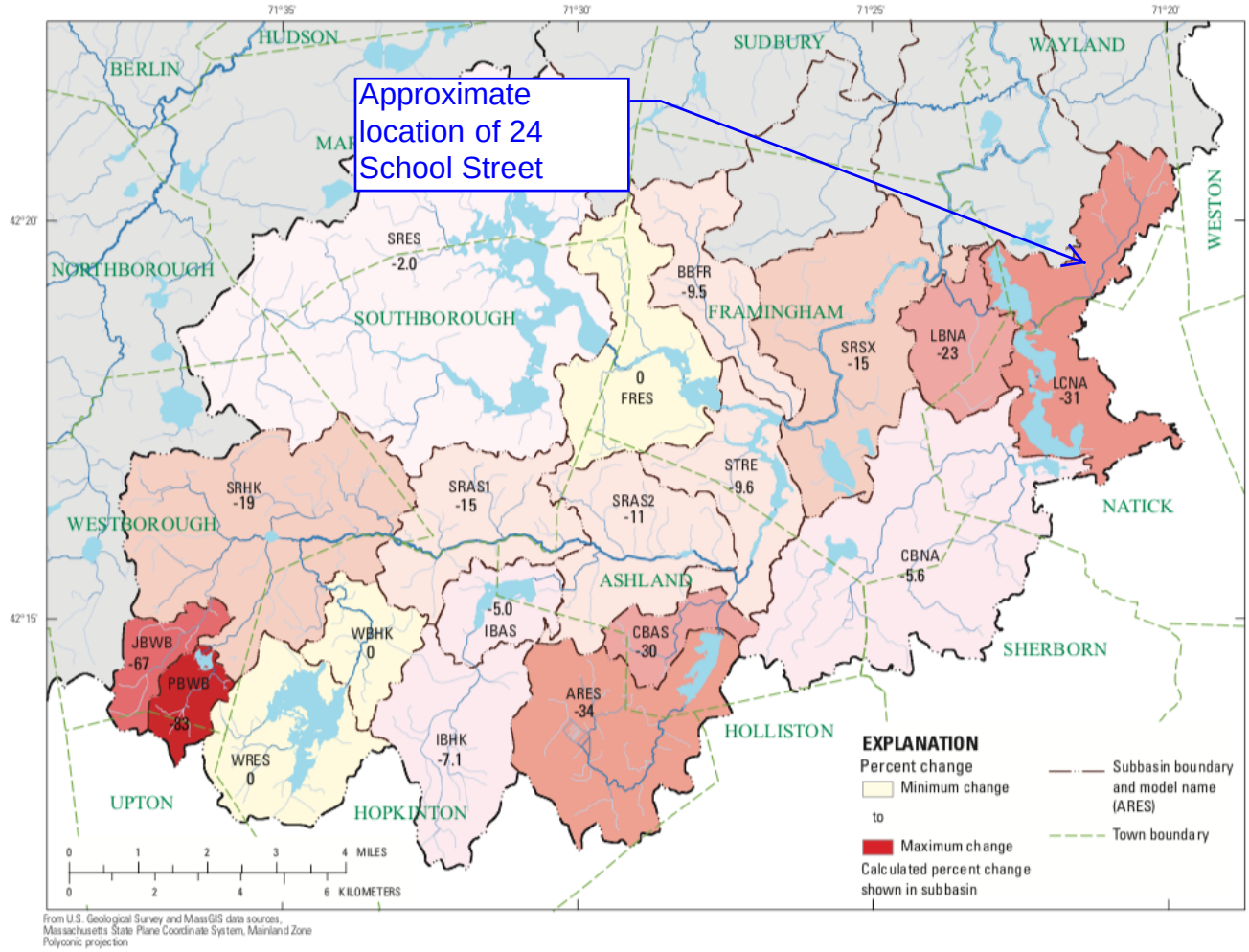


Figure 21. Percent change in the simulated long-term (1960–2004) median of the August mean streamflows with average 1993–2003 withdrawals (AVGWU) relative to no withdrawals (NOWU) in the upper Sudbury River Basin, Massachusetts.

Figure 2 - Watershed Modeling Results (USGS)

2. Groundwater Levels

The project site is constrained by shallow water table conditions. It is important that the project be designed and evaluated by taking into account the most conservative assessment of "high groundwater" levels in designing the wastewater and stormwater facilities and in evaluating the groundwater mounding impacts as required by the Wayland Conservation Commission and the MADEP. MADEP requires the use of long-term "seasonal high groundwater" as the base level to design minimum vertical separation distances from. This is particularly important at this site in that the aforementioned USGS Study indicates de-watering in this area as a result of regional pumping and withdrawals.

The Applicant has made some measurements of the water table and proposes to use the levels that they have measured during the past couple of years. However, they are not taking into account the more conservative, long-term hydrologic records available from the United States

Geological Survey (USGS). These records include an "Index Well" in Wayland that provides a long-term record.

MADEP Stormwater Handbook, Volume 3, Chapter 3, Page 12 states, "Seasonal high groundwater represents the highest groundwater elevation. Depth to seasonal high groundwater may be identified based on redox features in the soil (see Fletcher and Venneman listed in References). When redox features are not available, installation of temporary push point wells or piezometers should be considered. Ideally, such wells should be monitored in the spring when groundwater is highest and results compared to nearby groundwater wells monitored by the USGS to estimate whether regional groundwater is below normal, normal or above normal (see: http://ma.water.usgs.gov)".

In their August 15, 2018 letter, CLAWE discusses the use of the USGS method to estimate high water table conditions. Their letter states, "We checked USGS monitoring well WKW 2 in Wayland, which would be located in the same weather zone. The monitoring data showed that the water table recorded on 3/12/18 is 14.95 ft from grade, while the highest water table recorded in April 2018 is 14.74 ft (4/28/18), and in May 2018 is 14.79 ft (5/2/18)." It goes on to say that the margin of error is 6-7" and that "the 2018 water table recorded exceeded the history high 14.80 ft (depth to water level), at the USGS monitoring well" It then states that "if the project had been done in 2016, the highest water table monitored would be more than 6" lower than what we had that year".

However, the USGS database on this well (WKW2) shows that the highest water level (depth) recorded is 13.39 (depth to water level at the index well) measured on March 26, 2010 (see record below from USGS website). This is 1.41 feet higher than the measurement that they cite in their letter. This differential should be added to their on-site water levels in designing the septic and stormwater infiltration systems and effectively would require them to raise their base water table elevations, resulting in a re-design of the site. This higher groundwater level should be used as the static pre-development condition in the MODFLOW modeling (discussed below).

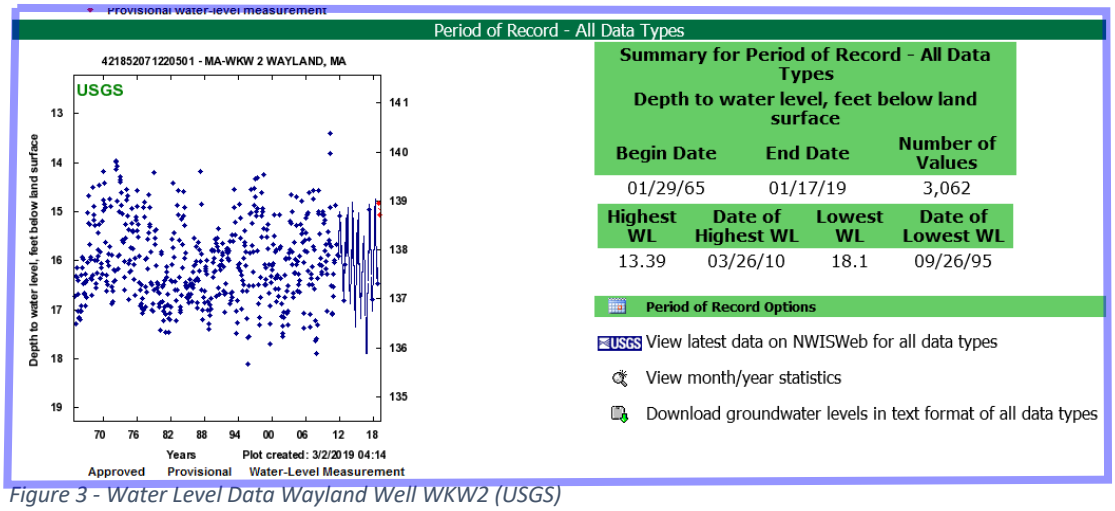


Figure 3 - Water Level Data Wayland Well WKW2 (USGS)

3. Groundwater Modeling (MODFLOW)

The NOI provides a brief summary of a MODFLOW analysis. The analysis provides some preliminary information about the impacts of the proposed projects. However, the report is incomplete and does not provide sufficient model documentation. On page 2 a "System Profile" is presented but it is illegible. We have requested a clearer copy but have not received it as of this date.

It is important to understand the potential value and limitations of modeling in answering the important questions before the Conservation Commission about the impacts of the proposed wastewater and stormwater discharges on the adjacent wetlands. The MODFLOW model that was applied in this case was developed by the United States Geological Survey (USGS). The USGS has published a report, "Guidelines for Evaluating Ground-Water Flow Models". It states, "Ground-water flow modeling is an important tool frequently used in studies of ground-water systems. Reviewers and users of these studies have a need to evaluate the accuracy or reasonableness of the ground-water flow model. This report provides some guidelines and discussion on how to evaluate complex ground-water flow models used in the investigation of ground-water systems".

These USGS MODFLOW Guidelines stress the importance of several key elements including 1) boundary conditions, 2) calibration and 3) sensitivity analysis. The boundary conditions of a model identify the relationship of the project site to surrounding features such as wetlands and streams. Calibration refers to validating the model by comparing modeled water levels and actual on-site measured levels. Sensitivity analysis refers to providing multiple runs of the model using a range of numerous input variables to test various scenarios. No information is provided on these key elements of the model. Without this information the reliability of the model is unknown.

The model presents the simulated water levels at only one time – 72 hours <u>following</u> the 100-year storm event. The report does not provide the peak mounding associated with the 100-year event. To evaluate the impacts on the wetland a more comprehensive analysis of the mounding is required. The MADEP Stormwater Handbook, Volume 3, Chapter 3, Page 28 states, "The mounding analysis must also show that the groundwater mound that forms under the recharge system will not break out above the land or water surface of a wetland (e.g., it doesn't increase the water sheet elevation in a Bordering Vegetated Wetland, Salt Marsh, or Land Under Water <u>within</u> the 72-hour evaluation period" (emphasis added)).

The term "within" implies that the modeling should include simulated groundwater levels throughout the storm event including at its peak and for the following 72 hours. The highest groundwater levels directly under the infiltration system can be expected near the peak of the storm. The impacts on wetlands could occur anytime during the storm and the following 72 hours. As the peak mound dissipates water levels will rise in the surrounding areas.

The model does not take into account a post-development (static) water table as a starting point for simulating the 100-year storm. The Stormwater Report indicates that the stormwater "infiltration system has been designed to handle runoff from all storms up through and including the 100-year storm with little overflow". It also states, "a rain garden is designed to store and recharge runoff from the easterly half of the roof of building A" (PDF page 56). The Report provides a comparison of pre-development and post-development recharge volumes. It indicates that the pre-development ("required") recharge volume is 585 cubic feet and that the proposed post-development volume is between 4842 (including the 25-year storm) to 5479 cubic feet (for the 100-year storm). See Table 1 below.

This means that they have designed as system that will infiltrate and recharge approximately ten (10) times the volume that is required to match existing (pre-development) recharge rates. In other words, the project will infiltrate and recharge significantly more water into the subsurface than presently occurs. This will result in corresponding rises in the underlying groundwater (water table) prior to the 100-year storm. A new (post-development) steady-state (equilibrium) condition will be reached as a result of the increased infiltration/recharge. The new (post-development) water table should be used as the foundation for the event-based groundwater mounding analysis.

Table 1 – Recharge Calculations = Excerpt from Stormwater Report prepared by MetroWest Engineering, dated December, 2020 (page 60)

Standard 3: Recharge

- **Soil Data is provided in Chapter 2 of Stormwater Report, Chapter 1, and on the Existing Conditions Plan**
- **The required recharge volume calculations:**

  The required Recharge Volume is based on loamy sand with a NRCS Hydrologic Group rating of B and a Target Depth Factor (F) of 0.35-inch. Below is the calculation for the required recharge volume for the entire site:

  Required Recharge Volume
  Rv = (F) x (Impervious Area)
  Rv = (0.35 inch /12) x (20,063 square feet)
  Rv = 585 cubic feet.

Recharge Volumes from Hydrologic Analysis, Chapter 1.

Subsurface Infiltration System 1 and Rain Garden 1
2-Year Recharge Volume = 3,407 cubic feet
10-Year Recharge Volume = 4,399 cubic feet
25-Year Recharge Volume = 4,842 cubic feet
100-Year Recharge Volume = 5,479 cubic feet

With the goal of clarifying the model I have developed the following list of recommendations and suggested questions for the Applicant:

1. Describe the boundary conditions including constant head, no flow, and head-dependent flow cells. How were the vegetated wetlands (BVW) and stream modeled? Were DRAIN cells used?
2. Provide calibration analysis that compares modeled and observed/measured water levels.
3. Provide sensitivity analyses for a range of hydraulic conductivity values and other input variables.
4. Provide post-development water table conditions using higher annual recharge rates as proposed with the infiltration systems. Use this post-development (static) water table to simulate the groundwater mounding associated with the 100-year storm.
5. Provide modeled water levels throughout the 100-year storm and the 72-hour period following the event.
6. Use the higher pre-development (static) groundwater level as indicated by the USGS Index well Wayland WKW2 as stated previously in this letter.
7. There was a retaining wall proposed for the septic system. Was this structure included in the model?

4. Water Quality Impacts

The proposed wastewater system is located 50 feet from the wetland boundary and has a design flow of 2860 gallons/day. The Applicant proposes to rely on the "Title 5 Presumption" contained within the Wetland Regulations to avoid providing any water quality impact assessment of the project. However, this presumption only applies 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: Minimum Setback Distance, or greater distance as may be required by more stringent local ordinance, by-law or regulation" (emphasis added, 310 CMR 10.03 (3)).

The Wayland Board of Health Regulations require that, "No sewage disposal system leaching area having a design flow of 1000 gallons per day or less, shall be constructed within 75 feet of any pond, stream, brook, river, swamp or wetland. The distance shall be 100 feet for a facility having a design flow of greater than 1000 gallons per day. Such distances are considered minimum and may be increased for multiple dwellings or higher volume sewage discharges" (emphasis added).

Therefore, the Title 5 presumption does not apply and a water quality impact assessment is required to determine the impacts (or alterations) of the proposed wastewater discharge on wetland resources under the Wetlands Protection Regulations.

Furthermore the MA Wetland Regulations state that, "this presumption may be overcome only by credible evidence from a competent source that compliance with ….Title 5…will not protect the interests identified in M.G.L. 131, Section 40".

Whereas no water quality assessment is provided by the Applicant I therefore have prepared the following analysis.

To determine the impact of the proposed project on the stream and downstream waters I have conducted phosphorus and nitrogen loading assessments in accordance with MADEP's Nutrient Loading Approach (MADEP, 1999). This approach focuses on the impacts associated with nitrogen and phosphorus loading and incorporates the sensitivity of the receiving water. Two assessment methods are presented. One approach (recharge method) calculates the average concentrations of nitrogen and phosphorus in the groundwater underlying the site that discharges to and provides critical baseflow in the stream. The second method (7Q10 flow method) integrates the assimilative capacity of the receiving water by including the baseflow rate of the stream. I have applied both methods.

The phosphorus loading analysis utilizes a concentration of 2.9 mg/liter for the proposed FAST septic system (Heufelder, 2004) and a nitrogen concentration of 19 mg/liter (MADEP Approval). These values take into account nutrient attenuation provided by the FAST system (including the leaching field).

USEPA has provided recommended threshold concentrations of phosphorus (0.31 mg/liter) and nitrogen (0.7 mg/liter) to prevent eutrophication of streams (USEPA, 2000). The results of the analysis (see Tables 2 and 3 below) indicate that the proposed project will result in phosphorus and nitrogen concentrations significantly higher than the EPA recommended. A combination of additional treatment and reduction in flows are required to meet the EPA thresholds in the stream.

Table 2 - Nutrient Loading Results (Recharge Method)

	Phosphorus	Nitrogen
Wastewater Flow	2860 gals/day	2860 gals/day
Phosphorus Concentration	2.9 mg/liter	19 mg/liter
Phosphorus Load	31393 mg/day	205677 mg/day
Parcel Size	0.87 acres	0.87 acres
Recharge Rate	18 inches/year	18 inches/year
Recharge	1168 gals/day	1168 gals/day
Predicted Concentration	2.06 mg/liter	13.5 mg/liter
EPA Threshold	0.031 mg/liter	0.71 mg/liter

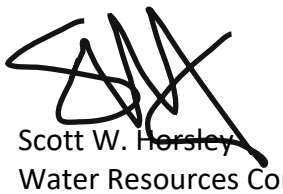
Table 3 - Nutrient Loading Results (7Q10 Flow Method)

	Phosphorus	Nitrogen	
Wastewater Flow	2860 gals/day	2860 gals/day	
Phosphorus Concentration	2.9 mg/liter	19 mg/liter	
Phosphorus Load	31393 mg/day	205677 mg/day	
StreamStats 7Q10 Flow	0.000996 cubic fee/second	0.000996 cubic fee/second	
	596 gals/day	596 gals/day	
Predicted Concentration	2.4 mg/liter	15.5 mg/liter	
EPA Threshold	0.031 mg/liter	0.71 mg/liter	

The Wetland Regulations define alterations to include, "the changing of water temperature, biochemical oxygen demand (BOD), and other physical, biological or chemical characteristics of the receiving water" (310 CMR 10.04). Eutrophication of surface water causes excessive plant growth (including algal blooms), depleted dissolved oxygen, and damage to aquatic habitat. Harmful algal blooms (HABs) including cyanobacteria (known as blue-green algae) has become a significant public health hazard throughout the Commonwealth. A prime example is the Wayland Town Beach on Lake Cochituate which was closed last summer due to these algal blooms. These blooms are believed to be caused by excessive nitrogen and phosphorus loads.

Thank you for your attention and the opportunity to submit these comments. Please contact me with any questions that you might have.

Sincerely,



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