HILL LAW

December 20, 2016

BY ELECTRONIC MAIL: peggywn@aol.com
and FIRST CLASS MAIL

Carlisle Zoning Board of Appeals
Carlisle Town Hall
66 Westford Street
Carlisle, MA 01741

Re: Application for Comprehensive Permit – 100 Long Ridge Road

Dear Members of the Board:

As you know, I represent 26 families that are neighbors or abutters to the above-referenced proposed Chapter 40B project. Our hydrologist Scott Horsley and I have reviewed the latest submission from Dr. James Vernon of Nobis Engineering, Inc. dated December 8, 2016, reporting the results of hydrogeological testing that occurred on the Project Site and abutting properties over the last month. We are grateful that the Board ordered this testing and data collection, which we have been calling for over the last two years. Unfortunately, the Vernon Report confirms our fears that the Project's septic systems, even with its modest design revisions, will likely contaminate the wells of neighbors and abutters, and probably the wells of the future Project residents. This was further corroborated by the October 25, 2016 mass balance analysis performed by Dr. Vernon, which indicates that drinking water wells serving 200 Long Ridge Road and 68 Garnet Rock Drive will experience elevated levels of nitrogen from the combined effects of two of the Project's three septic systems (SDA1 and SDA2).

As discussed below, the evidence compiled from this additional data collection and modeling necessitates findings and conditions in the Board's Remand Decision that are at least as strong if not stronger than the Board's original comprehensive permit decision on this Project. This letter summarizes evidence you have received from Dr. Vernon. Also enclosed is a memorandum from Scott Horsley, providing his impressions of Dr. Vernon's latest report.

Summary of the Additional Evidence

(1) *Borings in the Vicinity of Sewage Disposal Area #1 Reveal No Restrictive Layer Between Overburden and Bedrock.*

- On November 23, 2016, Nobis Engineering, Inc. and its subcontractor performed soil borings at three locations on the Project Site, and at one location at 68 Garnet

Rock Drive. The purpose of the borings was to determine whether a "low permeability layer" of soil (i.e., glacial till deposits or clay) exists between the overburden aquifer (where wastewater from the Project's septic system will be discharged), and the bedrock aquifer where existing and proposed drinking water wells pull water from.

- Nobis explained that "low permeable deposits may restrict groundwater flow between overburden and bedrock," and therefore could "restrict and slow the downward movement or mixing of groundwater and dissolved wastewater components."

- Conversely, "if sandy deposits extend to bedrock this might allow flow of groundwater between overburden and bedrock and the possible transport of nitrates and other wastewater constituents into bedrock."

- Boring B1-16 (located at proposed SDA1) revealed no restrictive layer between the overburden aquifer and the bedrock aquifer, meaning that nitrates and other contaminants from Sewage Disposal Area 1 will flow uninhibited through the overburden directly into the bedrock aquifer approximately 175 feet upgradient from wells located at 200 Long Ridge Road and 68 Garnet Rock Drive.

- Boring B4-16 (located at the southern edge of Long Ridge Road at the boundary of 68 Garnet Rock Drive) produced similar findings, indicating that the soil typology is probably consistent between SDA1 and the closest abutter.

(2) *Borings in the Vicinity of Sewage Disposal Areas #2 and #3 Reveal a Restrictive Clay Layer, but the Lateral Extent of the Clay Layer is Limited or Unknown.*

- Borings B2 and B3 (in the locations of SDA2 and SDA3, respectively) revealed a restrictive layer between the overburden and bedrock aquifers that could inhibit downward flow of wastewater from those septic systems. Consequently, wastewater would flow laterally, in the direction of the natural groundwater flows in the overburden, which for SDA2 is presumed to be east and south, and for SDA3 is identified to be northeast and east.

- Dr. Vernon observed that the restrictive clay layer likely "pinches out or disappears somewhere between SDA3 and the location of monitoring wells MW-4 and MW-5," because logs from the drilling of those wells did not reveal any restrictive layers. Dr. Vernon opined that "[t]his raises the concern that in these downgradient locations (MW-4 and MW-5), impacted groundwater might infiltrate into bedrock fractures."

- MW-5 is in the same general location of the proposed water supply well field that would serve the 20-unit Chapter 40B project. Thus, the polluted wastewater

from SDA2 and SDA3 may remain perched above the bedrock aquifer in the location of those septic systems, but the wastewater will flow easterly towards the Project's wellfield and the 55 Suffolk Lane Extension well, and eventually percolate into the bedrock aquifer. The hydrogeological testing done on November 23, 2016 did not provide enough data to inform what the Nitrogen concentration would be in the location of these drinking water wells.

- If the restrictive layer found at SDA3 doesn't extend 300 feet to MW-4, it may not extend more than 300 feet in the direction of the well of 55 Suffolk Lane Extension (Colin Higgins), which is downgradient from SDA3 according to Dr. Vernon's groundwater contour maps.

- Similarly, Dr. Vernon observed that "if impacted groundwater flows south from SDA2, the dense till also probably pinches out, because it was not observed in boring B-1." Thus, polluted wastewater from SDA2 may remain above the bedrock aquifer in the location of that septic system, but if it flows south, it will eventually enter the bedrock aquifer in the direction of the private wells at 200 Long Ridge Road and 68 Garnet Rock Drive.

(3) *The October 25, 2016 Mass Balance Analysis Predicts SDA1 and SDA2 will Generate Nitrogen Concentrations at Abutting Wells Exceeding Safe Drinking Water Standards.*

- On October 25, 2016, Dr. Vernon performed supplemental mass balance calculations in accordance with the procedures set forth in the state Department of Environmental Protection Title 5 Guidelines. The calculations are the output from a predictive model that estimates the concentration of Nitrogen in the overburden groundwater at a specific geographical point downgradient from a pollution source – here, Sewage Disposal Areas #1 and #2. Nitrogen is a reliable marker of other contaminants that are commonly found in domestic wastewater, and which are also harmful to public health.

- The October, 2016 calculations supplemented previous calculations performed by Dr. Vernon, and were necessitated by the changes to the Project design made by the Applicant as well as new information concerning the topography of the site in the vicinity of SDA2.

- The new mass balance calculations indicate that Nitrogen levels from the combined effect of SDA1 and SDA2 will exceed the state's maximum safe drinking water standard of 10 mg/l at downgradient wells. Using the Town of Carlisle's conservative design assumption of 165 gpd for the Project's septic systems, the systems will cause a **14.3 mg/l** concentration of Nitrogen at an

abutter's well.[1]

- Given the results from the borings taken on November 23, 2016, the concentration of Nitrogen at the abutter's well **could be much higher than 14.3 mg/l.** The borings made at Sewage Disposal Area #1 and at 68 Garnet Rock Drive indicated that nothing would inhibit the downward flow of wastewater from the septic system into the bedrock aquifer. Hydrologists Vernon and Horsley have both said that groundwater tends to move more quickly in bedrock fractures than in soil, and that wastewater flowing through bedrock fractures is deprived of the "cleansing" faculties of sandy soils that naturally attenuate Nitrogen and other contaminants. (See, Horsley Letter enclosed herewith).

- Importantly, the hydrogeological testing that occurred on November 23, 2016, while informative, did not provide any additional information on the *direction* or *rate (speed)* of groundwater flow in the bedrock aquifer.

(4) *There May Be a Hydraulic Connection Between the Overburden and Bedrock Aquifers in the Location of MW-1 and MW-5.*

- Nobis installed transducers in the monitoring wells on the Project Site, to attempt to discern a hydraulic connection between the overburden (where the monitoring wells exist) and bedrock (from which abutter wells pull water). A hydraulic connection would be another indicator that polluted wastewater discharged into the overburden from the Project's septic system would enter the bedrock aquifer in the location of the existing wells.

- While the data collected by Nobis did not produce "conclusive" proof of a connection, "small fluctuations" in water levels in monitoring wells MW-1 and MW-5 were observed that could be evidence of a hydraulic connection.

(5) *Other Outstanding Design Issues*

- On October 18, 2016, the Board's peer review engineer (Nitsch Engineering) commented (Comment #31) that the Applicant should provide test pit data indicating the depth to seasonal high groundwater in the location of the drainage structures (detention basin and bioretention basin). This is a critical factor in the feasibility of a stormwater management system; basins function to store and recharge runoff, functions that would be inhibited if there is already groundwater within or just below the basin. The Applicant responded on October 25, 2016 that it had already provided test pit logs. There is no subsequent comment from

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[1/] It is unclear from Dr. Vernon's October 25, 2015 Memo which abutting well was used for this analysis – 200 Long Ridge Road or 68 Garnet Rock Drive. Both properties are in the Area of Impact (AOI) for Sewage Disposal Areas #1 and #2.

Nitsch indicating whether it has reviewed the test pit logs, and whether it finds the data reliable and in conformity with state stormwater rules and sound engineering practices.

- In its October 13th memorandum, Nitsch correctly observed (Comment #33) that the Applicant's drainage design needed to be modified to reflect the new gravel driveways and other impervious surfaces proposed on the east and west banks of the stream and Bordering Vegetated Wetland, in connection with the proposed new wellfield. In response, the Applicant refused to provide any drainage calculations or design details for managing this runoff, which is particularly important given how close this infrastructure would be the stream and wetlands.

- Similarly, Nitsch commented (Comment #35) that the Applicant's stormwater design certifies recharge for storm events up to .5 inches, but nothing greater. Given the concern with replenishing the aquifer that serves the Project's wells and the neighborhood's existing wells, Nitsch appropriately recommended that more recharge should be provided. The Applicant demurred, responding simply that recharge will occur for the 1-inch storm. There is no follow-up comment from Nitsch confirming that this standard will actually be met. We also question why the Applicant's recharge burden should be capped at the 1-inch storm, and not a higher storm event such as the 100-year storm (8 inches). This is particularly important given that the Applicant is refusing to attenuate peak *volumes* of runoff from the Site (See Comment #36 and Response), meaning that runoff will leave the Site in greater quantities under post-development conditions than under pre-development conditions. Given the proposed density and expected strain on the aquifer serving everyone's domestic water needs, the Applicant should, at a minimum, match the existing (pre-development) recharge rate in its post-development condition.

- Nitsch had a number of other concerns with the design of the drainage system and its conformity to state standards. In its October 25th response, the Applicant brazenly told the Zoning Board that it had no authority over stormwater management issues, summarily concluding that the revised Project complies with the state standards without offering any evidence or rebuttal to the Nitsch memorandum. The Applicant further stated, categorically, that "no additional submittals are intended by the Applicant."

- The state stormwater performance standards are incorporated within the Town's "Nonzoning Wetlands Bylaw" (§7.1). The local permitting contemplated under the Wetlands Bylaw is treated as consolidated within the comprehensive permitting process under Chapter 40B. Further, the Zoning Board's comprehensive permit regulations expressly require submission of stormwater management plans and supporting documentation that "demonstrate whether and to what extend the proposed facilities may have an adverse impact to off-site

drinking water wells ... " The regulations also require conformity with the Planning Board's Subdivision Rules and Regulations, which require compliance with the state stormwater standards (p. 50). Therefore, the Applicant is wrong to claim that the Board has no jurisdiction to review the Project's drainage system.

- It remains troubling that the Applicant has still not separated himself from the civil engineering design of his own project. As we have stated a number of times in the past, including in our appeal from the original comprehensive permit filed in Land Court, the Applicant's continuing practice of signing and stamping design plans and supporting memoranda for his own project breaches the professional standards of practice codified in state regulations, which, among things, prohibit engineers from engaging in conflicts of interest (see, 250 CMR 5.00). Because of the inherent conflict of interest, the Board should place no greater weight of reliability on plans and documents signed by Jeffrey Brem, P.E., than it would if they were signed by a layperson with no engineering degree or professional license.

- Finally, the fact that the Project's own wells will be subject to state regulatory review as a Public Water System does not diminish in any way the Board's role in ensuring that those wells will be viable and safe from contamination. The Town's bylaws and regulations that are designed to protect drinking water supplies do not fade away merely because there is a parallel state-level permitting process. This is no different than the parallel municipal and state regulation of septic systems (Title 5) and wetlands (Wetland Protection Act) – the Zoning Board appropriately considered Carlisle's local regulations governing septic systems and wetlands in rendering its original decision, imposing conditions and ruling on the waiver requests. There is no reason for the Board to abdicate its authority to apply local regulations for the protection of on-site wells.

Thank you for your continued diligence in reviewing this matter, and happy holidays.

Very truly yours,

Daniel C. Hill

Enc.

cc: Mark Bobrowski, Esq.
Chris Heep, Esq.
Board of Selectmen
Planning Board
Conservation Commission
Clients

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December 20, 2016

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Carlisle, MA 01741

Re: Application for Comprehensive Permit – 100 Long Ridge Road

Dear Members of the Board:

I have reviewed the December 8, 2016 Memorandum from Nobis Engineering, Inc. concerning the proposed Chapter 40B project at 100 Long Ridge Road. My comments and observations are as follows:

1. The report documents direct connections between the overburden and bedrock fractures at the Sewage Disposal Area (SDA) #1 location. This indicates that wastewater discharges can easily infiltrate into the underlying fractures and can travel relatively quickly without appreciable dilution or attenuation to downgradient wells. Once in the fractured bedrock the downgradient flow direction may or may not be consistent with the groundwater flow directions mapped by Nobis in the shallow water table.

2. The report identifies dense till (low permeability) at the interface between overburden and bedrock at borings B2 near SDA #2 and B3 near SDA #3. However this till layer is not noted in downgradient wells MW-4 and MW-5 suggesting that it is not continuous (the Nobis report describes it as "pinching out" and that wastewater discharged at this location will likely find its way into the underlying bedrock fractures at points downgradient from the sewage discharge. The wastewater will then flow relatively unimpeded through the bedrock fractures to downgradient wells.

3. The observed water levels over the November 18 - 24, 2016 period show small fluctuations. This includes small rises (ranging from 0.2 - 0.5 feet) in MW-1, MW-2, MW-3, and MW-4. These rises may be the result of precipitation events preceding and during the monitoring period and subsequent recharge to the underlying groundwater. According to the National Weather Service records for Boston, a relatively large event was recorded on November 15, 2016 (0.99 inches) and a smaller one on November 20, 2016 (0.08 inches). Although the rainfall amounts are smaller than the measured water level rises one must consider the porosity of the

soils. Assuming a porosity of 0.33 (33%) this would suggest that 1 inch of rainfall could translate into a water table rise of 3 inches (0.25 feet). A lag time of several days between the rain storm and the recorded groundwater levels is common as it can easily take this much time for the water to infiltrate downward.

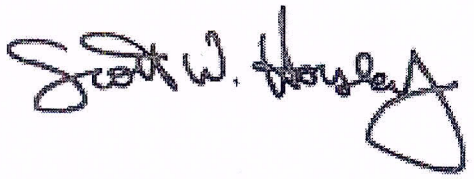
4. The updated water table map shows wastewater flow from SDA #2 directly towards the proposed public supply wells. Given the absence of a protective low permeability barrier between the overburden and the bedrock in the location of the public water supply wells, this represents a significant threat. Wastewater discharged at the SDA #2 location is likely to encounter fractures at the overburden interface and could then flow directly to downgradient bedrock wells without additional dilution within the overburden.

5. Previous nitrogen loading analyses may have overestimated the dilution in the overburden and underestimated the resulting concentrations in the wells. This is because once the plume of wastewater generated at the septic disposal area encounters an underlying fracture in the bedrock it will flow relatively fast and unimpeded without additional dilution for overlying recharge to the pumping well.

6 . Similarly, the absence of a restrictive clay or till layer in the location of SDA #1 and boring B4 across the street presents a significant threat to the abutting wells at 200 Long Ridge Road and 86 Garnet Rock Drive. Wastewater discharged from SDA #1 will flow downward through the overburden and into bedrock fractures, and could then flow towards downgradient bedrock wells without additional dilution. As such, Dr. Vernon's October 25, 2016 mass balance analysis, that attempts to predict nitrogen concentrations from SDA #1 and #2, may be underestimating the concentration at the abutters' wells, since the calculations assume groundwater transport through the overburden, not through bedrock fractures.

7. The proposed public supply wells are in close proximity to the stream and bordering wetlands. Pumping of these wells is likely to result in hydrologic impacts on the stream and wetlands.

Please contact me with any questions that you might have.



Scott W. Horsley