Brem_139-12.24.2014

GeoHydroCycle, Inc.

Hazardous Waste
Water Supply

Assessment
Remediation
Analyses
Permitting
Modeling
Software

December 30, 2014

Mr. Steven Ventresca, P.E.
Nitsch Engineering
2 Center Plaza, Suite 430
Boston, MA 02108

re: The Birches
100 Long Ridge Road
Carlisle, MA
GHC #14015

Dear Mr. Ventresca:

GeoHydroCycle, Inc. (GHC) provides the following recommendations and comments for the proposed The Birches (Birches) development located at 100 Long Ridge Road (the Site).

My comments and recommendations are based on a review of the following:

- Lifetime Green Homes letter to Carlisle Zoning Board of Appeals dated 9/12/14,
- Northeast Geosciences, Inc. letter to Jeffrey Brem dated 9/15/14,
- Hill Law letter to Carlisle Zoning Board of Appeals dated 10/3/14,
- Horsley Witten Group letter to Hill Law dated 10/3/14,
- ENSR memorandum to Carlisle Zoning Board of Appeals dated 4/19/07,
- The Benfield Farms project,
- A site visit and meeting on November 5, 2014 with the applicant, Jeffrey Brem, and the applicant's hydrogeologist, Joel Frisch,
- GHC's comment letters dated 10/19/14 and 11/14/14, and
- Meeting comments and emails from abutters.

Understanding the Technical Issues

Based on Carlisle regulations and comments from abutters and their consultant Scott Horsley, it is clear that the protection of Carlisle groundwater, the Birches proposed 11 wells, and the private wells of homeowners abutting the Birches is the primary issue. The issue relates to groundwater quantity and groundwater quality, putting the task of insuring that the yields of existing wells are not significantly reduced and that wells do not draw in contaminated groundwater from the Birches three proposed leach fields.

151B California Street
Newton, Massachusetts
02458

(617) 527-8074 (v)
(617) 527-8668 (f)

GeoHydroCycle, Inc.

As currently proposed, the Birches represent an approximate tenfold increase in well/septic system density over the existing density in that area. The three proposed septic leach fields are located close to many of the proposed Birches' wells and several abutter wells. Several options have been recommended to provide protection for the wells, but without an understanding of groundwater flow, planning options like long-term monitoring and dye testing cannot be done.

Monitoring and dye testing require an understanding of existing groundwater conditions and a prediction of those groundwater conditions that will exist when the development is built and in full operation. These predictions include groundwater mounding created by the discharge of wastewater at the three proposed leach fields, groundwater drawdown created by the pumping of the 11 proposed wells, and the changes in groundwater from the pumping and septic discharge of abutters.

GHC's Recommendations

Because wastewater is discharged to the surficial aquifer (overburden soils) and drinking water is obtained from the bedrock aquifer, a detailed understanding of both aquifers is required to produce any predictions of future groundwater conditions that would be used to design groundwater protection options.

The following are GHC's recommendations for the Hydrogeologic Investigation. Several of the recommendations refer to notes that follow the numeric list.

Geohydrologic Investigations

1. Determine groundwater flow directions in the surficial and bedrock aquifers,
2. Determine the hydraulic conductivity, saturated thickness and storage properties for the surficial aquifer and determine a transmissivity and storage property for the bedrock aquifer[a],
3. Estimate seasonal high groundwater for the surficial aquifer,
4. Evaluate Site soils according to Title 5 requirements,
5. Conduct a 48-hour pump test of the proposed Birches wells[b],
6. Based on the results of the surficial aquifer investigation, the pump test and the abutter well testing, a groundwater impact model should be developed to predict how the proposed Birches wells will impact each other and abutter's wells. The model should include: drawdowns from the Birches and abutter wells; groundwater mounding from the proposed three leach fields and abutter leach fields; and a groundwater plume analysis to show how nitrate plumes will develop downgradient of the three proposed leach fields[c].
7. Based on the results of the groundwater modeling showing the predicted shape of the water table under build-out of the Birches, a 5-year groundwater monitoring plan should be developed showing the location of monitoring wells and the types and frequency of analyses of well water samples.

Geohydrologic Investigation Notes

a. Mr. Brem has agreed to conduct well pump tests and water quality testing of abutter's bedrock wells within 500 feet of the property.

b. The goals of the 48-hour pump test are: to determine whether the aquifer can yield sufficient water to meet the Birches demand; to

151B California Street
Newton, Massachusetts
02458

(617) 527-8074 (v)
(617) 527-8668 (f)

GeoHydroCycle, Inc.

estimate impacts to abutting wells; and to determine aquifer characteristics. A 48-hour test is reasonable increase in timing from Carlisle's regulations considering that 11 wells will be needed to meet the project demand, and their potential impact on each other and abutter's wells.

c. The plume analysis modeling will serve as an indicator of down gradient wells (on site and abutter) that due to their location may be at risk, and as an aid in locating downgradient monitoring wells. This analysis was part of the required work for the Benfield Farms project.

As a general note, it is my understanding that Mr. Brem has agreed to the all of the above recommendations, except for the 48-hour pump test and a 5-year monitoring period, which Mr. Brem thought should be 24 hours and 2 years, respectively.

Post Geohydrologic Investigations

The results of the Geohydrologic Investigations may show that either Birches wells or abutter wells are at risk due to their locations downgradient of the proposed leach fields. For example, a downgradient well could receive wastewater contaminants that enter bedrock through the fracture network that supplies water to the well.

For wells that are determined to be at risk, a dye test (as proposed by Scott Horsley) should be conducted to determine the sensitivity of the bedrock aquifer to quickly transport wastewater contaminants to the well. Dye tests are used regularly to determine groundwater flow directions and rates in parts of the United States where the bedrock geology is dominated by large open fractures and caverns. Dye testing in overburden soils, due to the particulate nature of soils, are more likely to encounter problems with the test or problems in the analysis of the test data. For Carlisle, a dye test that focuses on flow in bedrock and minimizes flow in the overburden is recommended. It is my understanding that Scott Horsley has been developing a dye testing protocol, and GHC would like the opportunity to review the protocol when it becomes available.

Once the project has been built and the groundwater monitoring program is in operation, Mr. Brem agreed to establish a replenishing escrow fund in the amount of $15,000 to cover the costs of well replacement(s) should the monitoring program indicate a need. The money could be used for well drilling, pump replacement, hydro-fracking, water quality sampling and analysis, well disinfection, and costs related to connecting the new well to the home.

If you have any questions, please call me.

Sincerely,
GeoHydroCycle, Inc.

Stephen W. Smith, P.E., P.HGW., L.S.P.

151B California Street
Newton, Massachusetts
02458

(617) 527-8074 (v)
(617) 527-8668 (f)

GHC Comments 12-30-14.lwp