

GEOHYDROCYCLE, INC.

September 13, 2017

HAZARDOUS WASTE
WATER SUPPLY

ASSESSMENT
REMEDATION
ANALYSES
PERMITTING
MODELING
SOFTWARE

Mr. David Boyer, P.E.
MassDEP Central Regional Office
8 New Bond Street
Worcester, Massachusetts 01606

re: Revised Scope of Work
Geohydrologic Evaluation and
Groundwater Mounding Analysis
Residential Development
17 Lawrence Street
Norfolk, MA 02056
GHC #15029

Dear Mr. Boyer:

GeoHydroCycle, Inc. has been selected to perform a Geohydrologic Evaluation and Groundwater Mounding Analysis as part of the Groundwater Discharge Permit application for the proposed discharge of treated wastewater at the Abbyville Development at 17 Lawrence Street in Norfolk, MA 02056 (the Site), see Figures 1 and 2.

A Scope of Work was previously submitted to your office in December of 2015, but as a result of project changes that involve a reduction in wastewater discharge and a change in the location of the leaching area, GHC is submitting this revised Scope of Work. A Public Notice was submitted to MEPA and published in the December 23, 2015 Environmental Monitor.

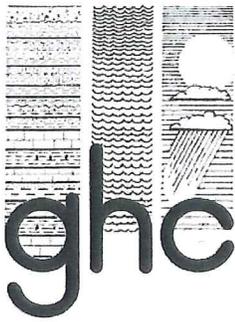
Introduction

Site plans are for a residential development that is proposed to be located on Lawrence Street in Norfolk, MA 02056. Currently, the land is mostly undeveloped and is made up of a rolling wooded terrain. An estimated 64,000 gallons per day of treated wastewater is planned to be discharged to groundwater under the state Groundwater Discharge Permit program.

As indicated by the Massachusetts GIS Online Data Viewer, the Site is within a Zone II wellhead protection area. As such, it will be necessary to estimate groundwater travel times between the proposed leach field and the public supply well(s) in the Zone II.

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The objective of GHC's services will be to conduct a hydrogeologic investigation and groundwater mounding analysis for the disposal area identified by the Client.

To accomplish this objective, GHC proposes the following tasks:

- Task 1 - Prepare Scope of Work, File a Public Notice, and Meet with DEP
- Task 2 - Drill and Install Five Monitoring Wells
- Task 3 - Collect Available Nearby Well and Septic Data at Town Offices
- Task 4 - Analyze Grain Size Curves for Hydraulic Conductivity (5)
- Task 5 - Develop Wells & Conduct and Analyze Aquifer Tests (5)
- Task 6 - Determine Seasonal High Groundwater
- Task 7 - Conduct Wastewater Mounding Analyses
- Task 8 - Conduct a Groundwater Time-of-Travel Analysis
- Task 9 - Prepare a Groundwater Monitoring Plan
- Task 10 - Prepare a Final Report and BRP WP-83

The following section describes each of these tasks in detail.

Scope of Services

Task 1 - Prepare Scope of Work, File a Public Notice, and Meet with DEP

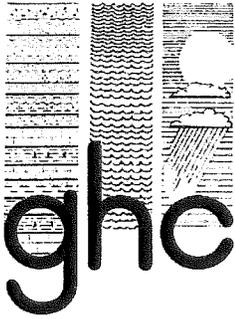
Under the 2009 Groundwater Discharge Permit Regulations (GWDP), Massachusetts DEP requires applicants to submit for approval a Scope of Work for the groundwater investigation and modeling portion of the permit application.

As required, GHC will also submit a Public Notice of the Scope of Work to the Environmental Monitor.

Task 2 - Drill and Install 5 Monitoring Wells

Upon DEP approval of the Scope of Work, GHC proposes the installation of five (5) groundwater monitoring wells in and around the proposed SAS location. The wells will be drilled to either 10 feet below the existing water table or to refusal in order to estimate a saturated thickness of the aquifer beneath the Site. Wells will be developed by the drilling contractor.

The wells will be surveyed to determine the location and top of casing elevations of the new wells. This information will be used in conjunction with the groundwater elevations in the monitoring wells for the purpose of creating groundwater contour maps.



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Task 3 - Collect Nearby Well and Septic Data at Town Offices

Another requirement for the Hydrogeologic Evaluation is to evaluate the likely impacts of the proposed discharge on current and potential down and cross gradient receptors. That list would include wells within 1 mile (public and private), wastewater discharges (such as septic systems), water supply protection areas (Zone I, Zone II and Zone A), and Outstanding Water Resources.

GHC will obtain a list of receptors from the town offices and any available online resources.

Task 4 - Analyze Grain Size Curves for Hydraulic Conductivity

GHC will contract with a soils laboratory, and five soil samples obtained during the advancement of the borings will be sent for grain size analysis. The resulting grain size curves will be analyzed using a method developed by Kasenow and Feng¹ to estimate values for hydraulic conductivity of the aquifer beneath the Site, and this data will be used to supplement the aquifer tests results.

Task 5 - Conduct and Analyze Aquifer Tests

GHC will conduct single well aquifer (slug) tests in each of the five newly installed monitoring wells. The objective of the aquifer tests is to estimate a representative hydraulic conductivity of the saturated soils that form the aquifer beneath the Site.

In addition to the data provided by the single well tests, GHC will estimate hydraulic conductivity using the grain size curves from the soil samples.

Task 6 - Determine Seasonal High Groundwater

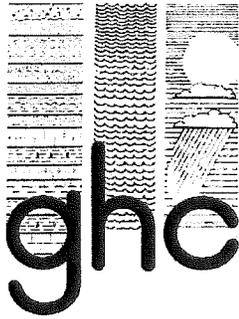
The regulations require determining seasonal high groundwater elevations beneath the discharge areas. To do this, GHC will use either mottling from Site test pits or the Mass DEP approved Frimpter² method. GHC will work with the Client in selecting an appropriate method.

Task 7 - Conduct Groundwater Mounding Analyses

GHC will calculate the increase in groundwater elevations resulting from wastewater disposal at the proposed discharge area using the computer model entitled MODFLOW to perform the calculations. The benefits of using this widely used and accepted groundwater model are such that the calculation method provides a more realistic estimate of the mound height than do the more simplistic analytic solutions.

¹ Kasenow, M, and Feng, H. "Determination of Hydraulic Conductivity from Grain Size." Water Resources Publications, LLC, 2001.

² Frimpter, M.H., 1981. Probable High Groundwater Levels in Massachusetts. USGS, WRI 80-1205.



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Task 8 - Conduct a Groundwater Time-of-Travel Analysis

The proposed wastewater discharge area is located within the Well Head Protection Area for a municipal well. As such, it is necessary to determine the time for groundwater to travel from the wastewater discharge area to the nearest well. GHC will accomplish this task using an analytic model to simulate groundwater flow to the well, and to calculate a groundwater travel time.

Task 9 - Prepare Groundwater Monitoring Plan

The purpose of a Groundwater Monitoring Plan is to outline how groundwater will be monitored prior to and during the operation of the wastewater treatment system in order to demonstrate to Mass DEP that the system is operating as designed. GHC will prepare a plan that describes the number, depth, and location of monitoring wells, the sampling frequency, and the groundwater sampling parameters.

Typically, three wells are sufficient, with one well located upgradient of the discharge points and two downgradient. Because the exploration wells are constructed differently from the required monitoring wells, they cannot be used for future monitoring. The groundwater monitoring plan will be submitted as part of the Final Report.

Task 10 - Prepare a Final Hydrogeologic Evaluation Report and BRP WP-83 Form

GHC will prepare a Final Hydrogeologic Evaluation Report summarizing the geohydrology, groundwater mounding, and groundwater monitoring plan, which are all required for a Groundwater Discharge Permit. Details will include: 1) description of all soil observations during boring and well installations; 2) review of the analyses of the single well and grain size test data; 3) review of the seasonal high groundwater analyses; 4) results of the groundwater mound height calculation with a predicted maximum elevation groundwater mound; 5) the results of the time-of-travel analysis; and 6) the number and location of monitoring wells, sampling frequency and analyses of samples for the Groundwater Monitoring Plan.

If you have any question, please call me.

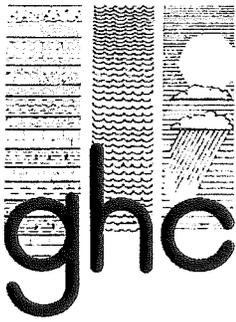
Sincerely,
GeoHydroCycle, Inc.

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

Enclosures: 1 - Figures

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cc: Mr. Tom DiPlacido, DiPlacido Development
Mr. Carlos Quintal, CAQ Engineering Associates, Inc.
Mr. Richard Goodreau, United Consultants, INC.

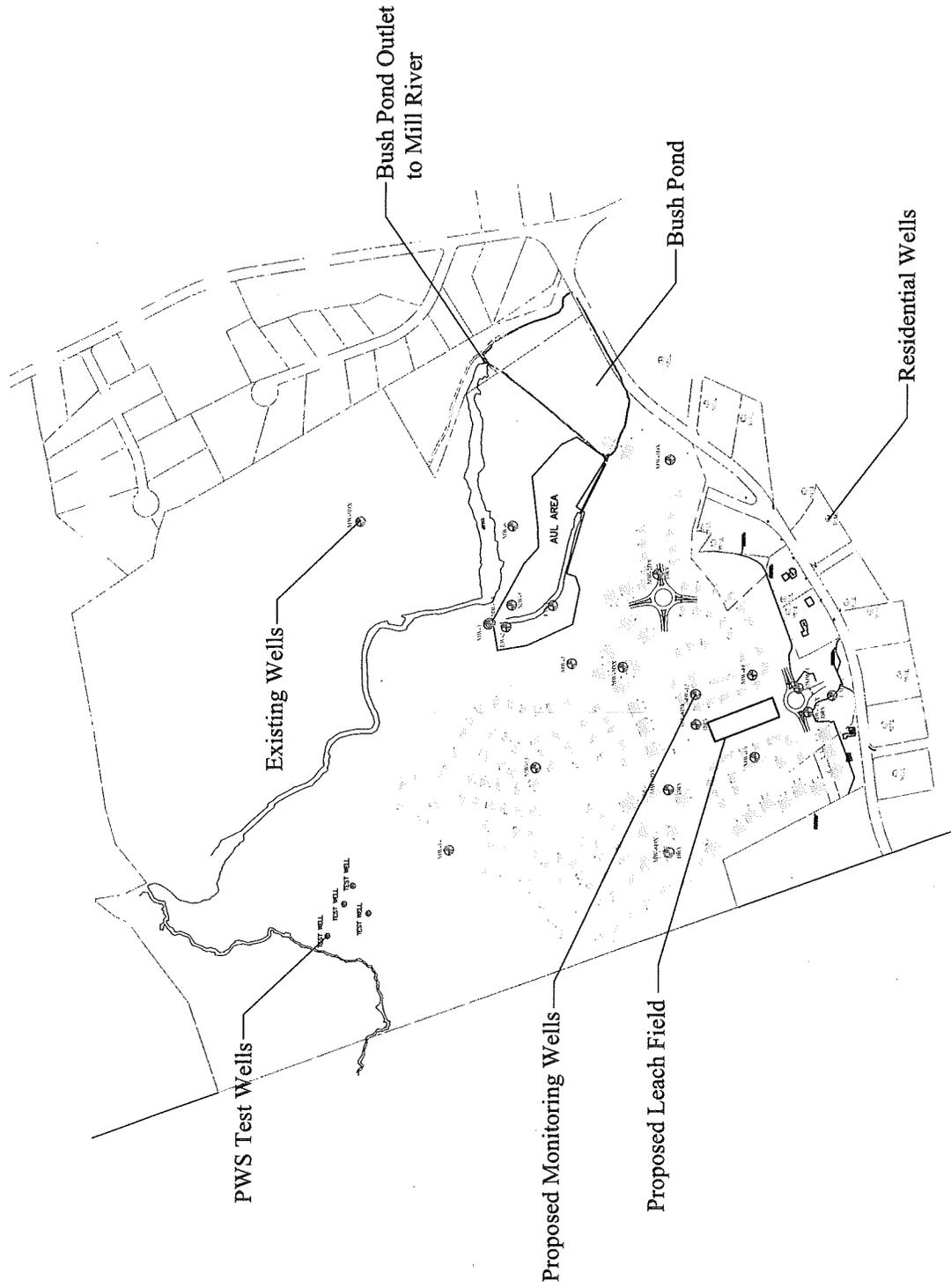
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Enclosure 1 - Figures

Abbyville Development
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Figure 2. Site Features.



Project No. GHC#15029

Drafted SWS Checked

Date 9/12/17 Rev 9/21/17

Base Map: CAD Files
Provided by UCI Engineers.

GeoHydroCycle, Inc.