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November 16, 2021
File: 195601874

Attention: Mr. Michael Santoro
Assistant DPW Director
Town of Belmont
121 Grove Street
Belmont, MA 02478

Reference: Hydrogeologic Evaluation: Highland Meadow Cemetery, 700 Concord Avenue, Belmont, MA

Dear Mr. Santoro,

Stantec Consulting Services in Auburn, NH has prepared this report describing our evaluation of the hydrogeological conditions at the Highland Meadow Cemetery property (the Site) located at 700 Concord Avenue in Belmont, MA. The work was conducted in accordance with our proposal dated October 14, 2019. We understand that in February-March 2018 Cemetery personnel observed groundwater seeping into graves that subsequently required pumping prior to use. To evaluate a potential high water table issue at the Site, Stantec over saw the drilling and construction of seven monitoring wells at the Site. Water level measurements and permeability tests were conducted to derive groundwater elevation, flow direction, and velocity data. The Site specific groundwater data were also compared to long term data obtained from an USGS observation well located in Winchester, MA to evaluate potential trends and to estimate the seasonal high water table at the Site. Additional work was conducted in the storm water detention pond to evaluate infiltration rates and groundwater level elevations.

1.0 BACKGROUND

Stantec understands that the Site is 4 acres in size, was constructed in 2005 and opened in 2007. As shown on Figure1, the Site is located on Concord Avenue in the west-central portion of Belmont, MA. As shown on Figure 2, an access road enters the northwest corner of the Site, trends towards the southeast across the Site, and loops around the main part of the cemetery. A detention pond, located on the northern portion of the cemetery adjacent to Concord Avenue, was designed to capture and subsequently infiltrate stormwater runoff. A discharge pipe is located within the stone wall that abuts Concord Avenue, which allows surface water within the detention pond to drain out once it reaches the height of the pipe as an additional means of drainage.

Ground surface slopes slightly downward from south to north from the cemetery towards the detention pond. The detention pond is the lowest portion of the Site. Southwest of the access road, ground surface slopes downwards to a wetlands area outside of the cemetery. Southeast of the access road, the ground surface slopes upwards to the abutting property (identified as the Belmont Day School).

It is reported that in February and March 2008, cemetery personnel observed that some opened graves in the western portion of the cemetery contained water the day after their opening and required pumping prior to use. Groundwater was observed seeping into open graves at depths of approximately four feet below ground during this time and then filling the graves. In June 2008, Fay, Spofford & Thorndike, LLC (FST) oversaw the excavation of test pits (by cemetery personnel) at the Site. In their report entitled Evaluation of Soil Conditions, Highland Meadow Cemetery, dated October 2008, FST noted that these test pits did not show or encounter groundwater.

The test pits typically encountered three layers of soil; a layer of topsoil overlying two layers of till. The upper till layer was described as brown, dense fine to coarse sand, gravel, and cobbles and extended to approximately 4 to 5 feet below land surface (bls). The brownish color was suggested to be indicative of oxidizing water flow. The lower till was described as grayish, very dense fine to coarse sand, gravel, and cobbles with lenses of looser brown sand and extended to the bottoms of the test pits at depths of 6 to 8 feet bls. The lenses of looser brown sand were suggested to be indicative of preferential pathways of groundwater flowing within the lower till unit or layer and that the lower till unit acts as a confining layer. In February and March 2008, groundwater was observed to enter the graves at four feet below ground and then fill the graves to ground surface supporting the concept of groundwater flow under confined conditions. Groundwater was not encountered in the June 2008 test pits, suggesting a wide seasonal fluctuation of water table conditions.

2.0 WORK PERFORMED

The field work conducted at the Site for this investigation was conducted from February 2020 to May 2021. Four general tasks were completed for this investigation. These were:

Monitoring Well Installation

Field Hydrology

Double Ring Infiltrometer Testing

Seasonal High Water Table Estimation.

The field techniques for these tasks are discussed in this section. The results of the work are described in Section 3.0

2.1 SOIL BORING AND WELL INSTALLATION

Using drive and wash techniques, seven borings were drilled at locations selected by Stantec. The drilling occurred from February 24 to 28, 2020. The borings were drilled to obtain information on the stratigraphy of the site, to provide a means for measuring groundwater levels from the various strata that underlie the site, and to determine the depth to bedrock (if encountered). Soil samples were

Reference: Hydrogeologic Evaluation: Highland Meadow Cemetery, 700 Concord Avenue, Belmont, MA

collected with a split spoon sampler at continuous intervals where possible and were classified by visual inspection by Stantec.

Shallow overburden borings were advanced to approximately 5 to 7 feet below the field-identified water table. At two locations (MW-2/2Rand MW-4), bedrock was encountered at relatively shallow depths of 10.5 and 8 feet bls, respectively. Water table was identified in the field at the MW-2/2R within the overburden at a depth of 3 ft bls, but not identified at MW-4. At these two locations, the borings were continued into the bedrock by roller bit and/or HQ core to reach the desired depth for well screening within the bedrock. Due to the highly fractured nature of the bedrock the core barrel was continuously jammed so using the roller cone through the rock was the most efficient method. Bedrock cores were, therefore, not collected.

Monitoring wells were then constructed in the boreholes using 2-inch flush joint threaded schedule-40 PVC. Two wells (MW-2R and MW-4) were finished as bedrock wells. Due to rock caving into the bore holes, MW-2R and MW-4 were constructed with 2 feet and 5 feet of screened intervals, respectively. As mentioned above, at the MW-2/2R location, water table was encountered at about 3 feet bls so an overburden well (MW-2) was also drilled and constructed. At the remaining four locations, bedrock was not encountered so the wells were completed as water table wells. The overburden wells were constructed with 5 to 10 of screen set. Well construction details are presented in Table 1. Boring logs and well completion details are presented as Appendix A. Well locations are shown on Figure 2.

In October 2020, a staff gauge (identified as SG-1) was installed within the detention basin. Cemetery personnel initially excavated a test pit to 5 ft bls to evaluate the soil stratigraphy within the basin for conducting double ring infiltrometer tests (see Section 2.2.3 below). The soils encountered consisted of approximately 1 foot of topsoil, overlying a 6-inch layer of gray-brown fine sandy silt. Below the silt a dark gray silty fine sand with gravel was encountered. Groundwater was not encountered in this test pit. SG-1, constructed as a 1-inch diameter PVC gauge with 1-foot of screen (set from 4 -5 feet bls), was set within the test pit and held in place as the test pit was backfilled. The location of SG-1 is also shown on Figure 2.

After the wells had stabilized, the wells were developed by Stantec on March 11, 2020 to remove any fine grain particles which had accumulated during the drilling and well construction process. Development was achieved by pumping a minimum of five well volumes of standing water from each well using a submersible whale pump and tubing. The pump and tubing were lowered and raised through the water column to pump and surge each well.

In October 2020, a Massachusetts licensed surveyor (Control Point Associates) mobilized to the Site to conduct an elevational and horizontal survey of each well and staff gauge. Ground surface and top of PVC well riser were surveyed and tied into the National Geodetic Vertical Datum (mean sea

level). These data are also presented in Table 1. Horizontal locations were surveyed and subsequently plotted as depicted on Figure 2.

2.2 FIELD HYDROLOGY

2.2.1 Water Level Measurements – Hand Levels

Depths to static groundwater level were measured from the tops of PVC risers at each well and at the staff gauge periodically from February 28, 2020 to May 5, 2021. The levels were then compared to the surveyed measuring point elevations provided by CPA to obtain water level elevations, which were then used to develop ground water elevation contour and flow direction maps. These data are presented in Table 2.

2.2.2 Permeability Testing

Permeability tests were conducted after the wells were developed and had stabilized to static water levels on March 11, 2020. Once the sediment was flushed out and the water was flowing clear, the pump was lowered to just off the bottom for an additional several minutes until a stabilized pumping level was achieved. The measured pumping rate (cubic centimeters per minute), the change in water level from static to stabilized pumping level, as well as the geometry of the well (diameter, screened interval, etc.) were then analyzed using the Constant Head formula prepared by Hvorslev (1953) to estimate the hydraulic conductivities of the screened material. These tests were conducted in three of the wells (MW-1, MW-2R, and MW-3).

At the remaining wells, due to difficulties in achieving stabilization, the pump was turned off and the subsequent rise of the water table back to static was then carefully measured over time with a Solinst (brand) water level meter. These data, along with the geometry of the wells were used to calculate hydraulic conductivity utilizing the Rising Head method developed by Hvorslev.

Permeability data and calculations are contained in Appendix B. Permeability results are presented in Table 4.

2.2.3 Double Ring Infiltrometer Testing

The double ring infiltrometer (DRI) method is a simple, but rigorous approach to assessing infiltration rates in soils. The use of the double-ring apparatus allows the flow of water from the outer ring to essentially saturate the underlying soils thereby allowing water from the inner ring to flow vertically downward and not laterally, which provides a more realistic estimate of the likely infiltration rate associated with a larger discharge. Two large tanks or reservoirs provide the inflow of water into the tanks. The volume of water lost from the tanks is recorded at specific time intervals throughout the tests, which are run for six hours. During the first one to two hours, measurements of the volumes lost are taken every 5 to 15 minutes. Over the last few hours, measurements are taken every 30 minutes.

Stantec performed two DRI tests (DRI-1 and DRI-2) within the detention basin on October 15, 2020. As mentioned above, Cemetery personnel excavated the initial test pit to 5 feet. The identified stratigraphy was topsoil (from ground surface to 14-inches bls), a gray-brown fine sandy silt (from 14- to 20 inches bls), and a dark gray silty fine sand with gravel and cobbles (from 20-inches to 5-feet bls). Based on this information Stantec instructed the excavator to dig a second shallow test pit to 20-inches bls where DRI-1 was set up. DRI-2 was then set up several feet away at the ground surface. The two tests were conducted to determine the infiltration rates of the surficial soils and the underlying grayish till.

The tabulated data and plots of the resultant data, showing incremental infiltration rates versus elapsed time, are presented in Appendix C.

3.0 RESULTS

3.1 REGIONAL HYDROGEOLOGIC SETTING

The Site is located at the approximate top of the southern portion of a till covered hill identified as Wellington Hill in the west-central portion of Belmont. At the cemetery, the ground surface elevation slopes downwards from the south to the north from an approximate elevation of 280 feet above Mean Sea Level (ft MSL) to 261 ft MSL at the base of the detention pond. Ground surface in the southwest portion of the site slopes downwards to the west and southwest towards Mill Street and Beaver Brook, at elevations of approximately 200 and 150 ft MSL, respectively. Ground surface slopes upwards to the east and southeast to the abutting Day Care at an approximate elevation of 290 ft MSL.

According to the Massachusetts Geological Survey (MGS), the Site sits on the drainage divide between the Mystic River Watershed (to the north and east) and the Charles River Water Shed (to the west and south). Maps showing the Site location, in correlation to the watershed boundaries are presented in Appendix D. The nearest surface water feature is Beaver Brook, about 1.5 miles to the west-southwest. Beaver Brook flows south then east and ultimately discharges into the Charles River. Surface water features to the east include several ponds (Spy Pond, Little Pond, Clay Pit Pond, and Fresh Pond). Drainage from these Ponds appears to be towards Alewife Brook, which then flows to the north-northeast and ultimately discharges into the Mystic River.

3.2 BEDROCK GEOLOGY

According to the MGS, the bedrock that underlies the Site is igneous rock comprised of dark gray granite and granodiorite. The Bedrock Geologic Map of Massachusetts (Goldsmith et al, 1983) includes these rocks within the Dedham Granite formation.

During the drilling of the new wells, bedrock was encountered at two locations, MW-2 and MW-4. Attempts were made to core through the rock, but due to the highly fractured and dense nature

of the rock, the core barrel was continuously jammed and so the borings were advance using roller cone. No cores were collected

Bedrock was encountered are relatively shallow depths of 10.5 ft bls and 8 ft bls at MW-2 and MW-4, respectively. These data, along with the bedrock elevations presented in Table 1, indicate that the bedrock slopes downwards from west to east at the Stie. Since rock was only encountered at the two locations, a bedrock surface contour map cannot be generated.

3.3 SURFICIAL GEOLOGY

According to the Surficial Materials Map of the Lexington Quadrangle (Stone and Cohen, 2018), the soils at, and in the vicinity of, the Site are comprised of till. Glacial till is defined as a heterogeneous deposit with clasts ranging in size from large cobbles and boulders to silt and clay, which is deposited directly from glacial ice. Bedrock outcrops are identified in the northwest portion of the Site near the intersection of the access road and Concord Avenue to the northwest as well as to the south towards the downtown area.

The surficial materials encountered in the borings drilled at this Site consisted of dense gray till overlying very dense olive-gray till. Cobbles and boulders were encountered in each unit or layer of till. Blow counts observed during the spilt spoon sampling typically ranged from 50 – 75 blows per foot in the upper tiill and from 100 to >100 blows per foot in the lower till unit. Groundwater was encountered during the well drilling within the till units.

3.4 SITE HYDROGEOLOGY

3.4.1 Water Levels

Water levels were measured in the seven monitoring wells and the staff gauge periodically from February 20, 2020 through May 7, 2021. Table 2 presents the measured depths (from top of PVC and land surface) and water table elevation data for these time periods. Depths to the water table were measured at levels ranging 0.62 to 13.98 feet below top of PVC (ft PVC) (or from 0.99 to 14.20 ft bls) in the five overburden wells, and from 1.75 to 11.92 ft PVC (1.89 to 12.10 ft bls) in the two bedrock wells. Water levels in bedrock well MW-4 were consistently measured at depths below the field observed bedrock interface indicating the water table at this location is within the bedrock. At SG-1, the depth to water measured from inside the gauge represent depths to water table and ranged from 2.69 to 3.07 ft PVC, whereas depth to water measured from outside the gauge represent depths to standing/surface water and ranged from 2.93 to 3.04 ft PVC. The data from SG-1 indicate both water table and surface water were measured above ground surface during this investigation. The recorded depths to water (in feet below PVC) were subsequently converted to groundwater elevations given the surveyed measuring point elevations and measured depths to water and are also presented in Table 2.

Reference: Hydrogeologic Evaluation: Highland Meadow Cemetery, 700 Concord Avenue, Belmont, MA

A plot of water table levels below ground surface over time at the wells and staff gauge is presented as Figure 3. The plot shows groundwater levels fluctuating quite uniformly at the wells and staff gauge, except at bedrock well MW-4R, over the investigation time period. The plot also shows that levels typically fluctuated by 2 to 3 feet over this time period. This suggests the water table at the site within the overburden fluctuates on a seasonal basis, likely due to precipitation/infiltration evets. Water levels are shown to be somewhat shallow in the wells (MW2S/2R and MW-3) in close proximity to the detention pond, ranging in depths from about 1 foot bls at MW-3 to 4 feet at MW-2. Measured levels in the wells located in the approximate center (MW-1) and in the western portion of the Stie (MW-4, MW-5, and MW-6) are shown to be deeper ranging from about 4 feet to 14 feet bls. As the plot also shows, the lowest and highest water levels were measured on March 11, 2020 and May 7, 2021, respectively.

3.4.2 Shallow Overburden Horizontal Flow and Gradients

The derived water level elevations from the lowest and highest water level periods measured by Stantec were also used to develop groundwater flow contour maps as shown on Figures 4 and 5, respectively. Note that these contour maps were developed using the actual field measured data along with the known concept that the Site sits on the drainage divide between the Mystic River and Charles River water sheds, as previously described. During both low and high periods, groundwater is interpreted to flow towards the center of the cemetery from the northwest and from the southeast. In the approximate center of the cemetery, flow is interpreted to diverge to the southwest and to the northeast and the NNE. Flow from the northwest is shown to be discharging from the bedrock into the overburden till unit.

Horizontal gradients are about 0.01 ft/ft (1 percent) and 0.025 ft/ft (2.5 percent) in the western and eastern portions of the Site, respectively.

3.4.3 Bedrock Horizontal Flow and Gradients

Since there are only two bedrock monitoring wells (MW-2R and MW-4R) a bedrock groundwater contour map cannot be developed. The relative water level elevations measured at these two wells indicate flow is from MW-4R towards MW-2R at a gradient of about 0.007 ft/ft (0.7 percent).

3.4.4 Vertical Hydraulic Flow and Gradients

Vertical gradients indicate upward or downward flow between the abutting till and bedrock units. In general, flow is from high to low elevation (or hydraulic head). Vertical gradients have been calculated for the single well pair (MW-2/MW-2R) and the staff gauge (SG-1) at the cemetery and are presented in Table 3.

At the MW-2/MW-2R pair, vertical gradients are slight, and the vertical flow direction is shown to fluctuate. Flow is shown to be downwards to neutral in February and March 2020 and upwards in December 2020 and April-May 2021. As shown on Figure 3, the latter three time periods represent

relatively high water level elevations. At the Staff Gauge, the vertical gradient is determined by comparing water levels measured inside the gauge (indicative of water table elevation) to the levels measured outside the gauge (indicative of surface water or standing water in the detention pond). Vertical gradients at SG-1 are shown to be downwards in December 2020 (indicating water is seeping or infiltrating from the detention pond to the water table) and upwards in April and May 2021 (indicating groundwater is discharging into the detention pond).

Profiles of the subsurface stratigraphy have been hand-sketched on geologic cross-sections as depicted on Figures 6a to 6c. Cross-section A - A' (Figure 6a) is a profile drawn along the western side of the cemetery) (from MW-4 to MW-6). Cross-section B - B' (Figure 6b) is a profile drawn along the southeastern side (from MW-6 to the detention pond, and section C – C' is a profile along the northern side (from MW-4 to the detention pond. The locations of the geologic cross-sections are shown on Figure 2.

Each section shows the simplified stratigraphic units, till overlying bedrock, encountered at the Site. Section A-A' shows the water table at MW-4 (within the bedrock) and at MW-6 flowing towards MW-5. The water table levels are shown to be uniform during both the low and high periods measured in March 2020 and May 2021, respectively. Since bedrock was only encountered at MW-4, it is difficult to depict the till/bedrock contact underlying MW-5 and MW-6. Section B – B' shows both ground surface and water table sloping from southwest (at MW-6) to northeast (at the detention pond). This section also shows the connection of the water table and surface water at the detention pond further indicating groundwater underlying the cemetery discharges into the pond. Along this portion of the Site, bedrock was only encountered at MW2/MW-2R. Section C – C' also shows ground surface and water table sloping from northwest (at MW-4) to northeast (at the detention Pond and the connection of water table and surface water at the detention pond.

3.4.5 Permeabilities

Results of the constant head and rising head permeability (hydraulic conductivity) testing conducted in the monitoring wells are shown in Table 4. Hydraulic conductivities in the overburden wells were varied, ranging from 0.23 ft/day (7.99 x 10^{-5} cm/sec) at MW-6 to 20.3 ft/day (7.17 x 10^{-3} cm/sec) a MW-3. The geometric mean of the overburden hydraulic conductivities was calculated at 1.7 ft/day (6.07 x 10^{-4} cm/sec).

The calculated hydraulic conductivities in the bedrock wells were more variable, ranging from 0.10 ft/day (3.56 x 10^{-5} cm/sec) and 0.26 ft/day (8.99 x 10^{-5} cm/sec) at MW-4R to 238 ft/day (8.40 x 10^{-2} cm/sec) at MW-2R. The geometric mean value was calculated at 1.8 ft/day (6.45 x 10^{-4} cm/sec) 7.2 x 10-5 cm/sec (0.20 ft/day).

Reference: Hydrogeologic Evaluation: Highland Meadow Cemetery, 700 Concord Avenue, Belmont, MA

3.4.6 Groundwater Flow Velocities

Seepage velocities can be derived from the hydraulic gradients on the site and the permeabilities obtained for the various units by the formula:

$$V = \frac{Ki}{n_e}$$

where K is the hydraulic conductivity, i is the hydraulic gradient, and n_e is the effective porosity. For example, a high water table (Figure 5) flow line from southeast to northwest travels in the overburden from off-Site towards the center of the cemetery. The length of this flowline is approximately 180 feet and the drop in head is about 4.5 feet, leading to a horizontal hydraulic gradient of 0.025 ft/ft (2.5 percent). From the center of the cemetery, the flow line is interpreted to diverge towards the detention pond. The length of this portion of the flow line is approximately 190 feet with a drop in head of about 2.5 feet, leading to a horizontal hydraulic gradient of 0.013 ft/ft. Resulting in an average hydraulic gradient of 0.019 ft/ft.

The permeabilities measured in the vicinity of this flowline were 0.23 ft/day (MW-6), 14.0 ft/day (MW-1), 0.69 ft/day (average at MW-2S) and 20.3 ft/day (MW-3), with a geometric mean of 2.6 ft/day. The effective porosity of the dense till observed at the Site is difficult to assess but, based on published values, a conservative value of 0.15 (unitless) was selected.

Using the formula presented above and a geometric mean of 2.6 ft/day, a hydraulic gradient of 0.019, and an effective porosity of 0.15, a flow velocity of 0.33 feet per day (120 ft/year) was calculated. Therefore, from the flowline's point of entry at the southeastern property line to the detention pond s(370 feet), flow should take approximately 3 years.

3.4.6 Infiltration Rates

As described in Section 2.2.3, Stantec performed two DRI tests (DRI-1 and DRI-2) within the detention basin on October 15, 2020. DRI-1 was conducted at a depth of 20 inches bls and DRI-2 was conducted at ground surface to estimate the infiltration rates of the surficial soils and the underlying grayish till.

The tabulated data and plots of the resultant data, showing incremental infiltration rates versus elapsed time are presented in Appendix C. The results are shown in the table below.

Location	Infiltration Rate (cm/sec)	Notes
DRI-1 @ 20-inches	8.33E-04	average of last 5 recorded values, over last two hours of test
DRI-2 At ground surface	1.59E-03	average of last 5 recorded values, over last two hours of test

As the table shows, the infiltration rate of the surficial materials was slightly higher (1.59 x 10^{-3} cm/sec or 4.5 ft/day at DRi-2) than the underlying till materials (8.33 x 10^{-4} cm/sec or 2.4 ft/day at DRI-1).

3.4.6 Estimated Seasonal High Water Table

To estimate the seasonal high water table levels at the Highland Meadow Cemetery Site, historical water level data from one USGS well was evaluated. The USGS has conducted monthly gauging of dozens of observation wells in Massachusetts since the early 1940s. Stantec selected one of these wells in close proximity to the Site, a water table well screened in till and located in Winchester, MA (identified as MA-XOW 14 Winchester - approximately 6 miles from the Site). This well appears to be in a similar setting – it is at a ground surface elevation of 160 ft MSL and is located on a hill side in an undeveloped area along Forest Street in the Winchester Highlands section of Winchester. The data from this well is an excellent expression of water level variations in till in this area of Massachusetts.

Review of the historical data indicates water levels in this well typically range from about 6 feet to 13 feet bls on an annual basis, with high water levels generally measured in the winter and spring months and low water levels in the late summer and fall months.

The monthly water levels from the Winchester well (from June 1940 to September 2021) were tabulated and then sorted from highest to lowest water level for each year. These data are presented in Appendix E. The highest and lowest water levels for each year were then determined and tabulated (see Table 4). For example, in 1940, the highest water level was measured on December 28th at 9.29 ft bls, and the lowest water level was measured on November 2nd at 13.27 bls; in 1941, the high level was measured on February 1st at 9.72 ft bls, and the low level was measured on November 29th at 14.97 ft bls; and so on.

A plot of the Annual High and Low Water Levels over time for the USGS well is presented as Figure 7. As the plot shows, annual high water levels in this till well are shown to range from approximately 4 ft to 8.5 ft bls. The highest water level at this well was recorded in March 1969 at 4.03 ft bls. The long term average annual high water level was determined to be 6.82 feet bls. Conversely, the annual low water levels are shown to range from approximately 12 to 15 ft bls, with a long term average annual low water level of 13.55 ft bls. These data show that water levels can fluctuate several feet in till in this area of Massachusetts.

Reference: Hydrogeologic Evaluation: Highland Meadow Cemetery, 700 Concord Avenue, Belmont, MA

As a means to compare the recent water levels measured in the Site wells with this USGS well, the following analysis was conducted. As described in Section 3.4.1 above, the highest water table levels at the Site were measured on May 7, 2021. The closest data point at the USGS well was on April 22, 2021, where the actual water level in the Winchester USGS well was measured at 7.70 ft bls. These data, tabulated below, suggest the April 22, 2021 level at the Winchester well was 0.88 feet (11 inches) lower than the long term average annual high water level in this well (i.e., that water levels measured in April 2021 are likely to rise an additional 0.88 feet to meet the average annual high levels). This correlation suggests that the water levels measured in the Site wells in May 2021 are also likely to rise and additional 0.88 feet to meet long term average levels.

Location	USGS ID	Well Type	Aquifer	Apr 22, 2021 WL (ft BLS)	Avg. Annual. High WL (ft BLS)	Dif. (ft)
Winchester	MA-XOW 14	Water Table	Till	7.70	6.82	0.88

Conversely, the April 22, 2021 water level in the Winchester well (7.07 ft bls) shows that level was 5.85 feet higher than the long term average annual low water level in the USGS well (13.55 ft bls). In other words, water levels in April 2021 are likely to drop an additional 5.85 feet to meet the average annual low levels. Again, the correlation is that the levels measured in the Site wells in May 2021 are also like to drop an additional 5.85 feet.

Location	USGS ID	Well Type	Aquifer	Apr 22, 2021 WL (ft BLS)	Avg. Annual. Low WL (ft BLS)	Dif. (ft)
Winchester	MA-XOW 14	Water Table	Till	7.70	13.55	5.85

A plot of monthly water levels at the Winchester well over the past thirteen years, from January 2008 to September 2021, is presented as Figure 8. This plot shows the seasonal fluctuation with highest water levels typically measured in winter/early spring and the lowest levels measured in summer/fall. Of note are the water levels in 2008. As shown on the plot, the measured levels in the Winchester well in February-March 2008 were about 0.7 feet (8.4 inches) below the long term average high. This was the time period that cemetery personnel observed groundwater seeping into the graves. In June 2008, the water level in the Winchester well was about 4.5 feet below the long term average high. This was the time period that FST conducted their test pitting work and did not observe groundwater in the test pits. The plot also shows the water level in the Winchester well in October 2020 was about 7.5 feet lower that the long term average high. This was the time period that Stantec conducted the DRI work in the detention pond and observed no standing water in the Pond or groundwater in the initial test pit.

Reference: Hydrogeologic Evaluation: Highland Meadow Cemetery, 700 Concord Avenue, Belmont, MA

3.0 FINDINGS AND RECOMENDATIONS

The geologic materials encountered at the monitoring wells drilled at the Site consisted of thin layers of till overlying bedrock. Consistent with previous test pit work at this Site, an upper layer of dense grayish till overlies a very dense olive-gray till. Highly fractured bedrock was encountered at relatively shallow depths of 10.5 ft bls and 8 ft bls at MW-2R and MW-4, respectively. Water levels were measured in the Site wells during the course of this investigation from February 2020 to May 2021. The water table was determined to be within the overburden at all well locations, except at MW-4, located in the northwestern portion of the cemetery. At MW-4, water table is shown to be within the bedrock. The data showed that the measured water table fluctuated within the till on the order of approximately 2 to 2.5 feet during Stantec's limited monitoring over this time period. The lowest and highest levels were measured in March 2020 and May 2021, respectively. The data also show that the water table tends to fluctuate uniformly at the Site.

During this investigation, water table was measured at relatively shallow depths in wells in the vicinity of the detention pond, ranging from about 1 to 4 feet below ground surface. During the March 2020 low water period, water table was observed in MW-3 and MW-2 at about 3 and 4 ft bls, respectively. During the May 2021 high water period, water table was observed in MW-3 and MW-2 at about 1 and 2 ft bls, respectively. Water table was measured at deeper levels in the wells located in the western portion of the Site, ranging from 11 to 9 ft bls at MW-5 and from 11 to14 ft bls at MW-6. Levels at MW-1, located in the approximate center of the Site, ranged from about 4 to 6 ft bls.

These data show that the "high-water occurrence" in the Spring of 2008 was likely a natural springtime occurrence of water level fluctuation and is quite likely to reoccur. However, these data may be valuable in development of a minimization of future occurrences. Groundwater, during both the low and high periods, is shown to flow towards the center of the cemetery from the northwest and the southeast. The data indicate that groundwater flow from the northwest is within the shallow bedrock and discharges to the overburden at the cemetery. The area to the northwest that is likely contributing groundwater to the Site extends to Wellington Hill, beyond Concord Avenue. The area contributing groundwater from the southeast is suggested to extend to the abutting property. Beyond this property, ground surface, and most likely groundwater, slopes steeply downwards towards Pleasant Street. From a regional perspective, the data show that the Site sits on the drainage divide between the Mystic River Watershed (generally to the east) and the Charles River Water Shed (generally to the west and south). The groundwater flow nets indicate that groundwater flows towards the cemetery from the northwest and southeast and then diverges to the southwest and to the northeast. Groundwater flow to the northeast is shown to discharge into the detention pond during high water periods. During low water table periods stormwater that enters the detention pond will infiltrate to the water table. However, during high water table periods groundwater is shown to discharge into the pond, so stormwater will drain out, or infiltrate, as the water table drops throughout the Site.

Reference: Hydrogeologic Evaluation: Highland Meadow Cemetery, 700 Concord Avenue, Belmont, MA

Potential remedies to lower the water table at the cemetery could include a French drain type system installed under the access road around the cemetery. A portion of the collected water could be directed to the west, via pipe, in the vicinity of MW-5. The remaining collected water could also be directed to the detention pond. However, as mentioned above, during high water table periods any standing water in this pond will not infiltrate until the water table drops throughout the Site. A potential method of limiting the volume of standing water in the pond could be to lower the discharge pipe that is located within the stone wall that abuts Concord Avenue, a few feet. A detailed ground surface topographic survey would also seem to be required if proper elevations of a drainage system were to be designed.

We hope this information meets your needs. If you have any questions regarding these results, don't hesitate to call the undersigned.

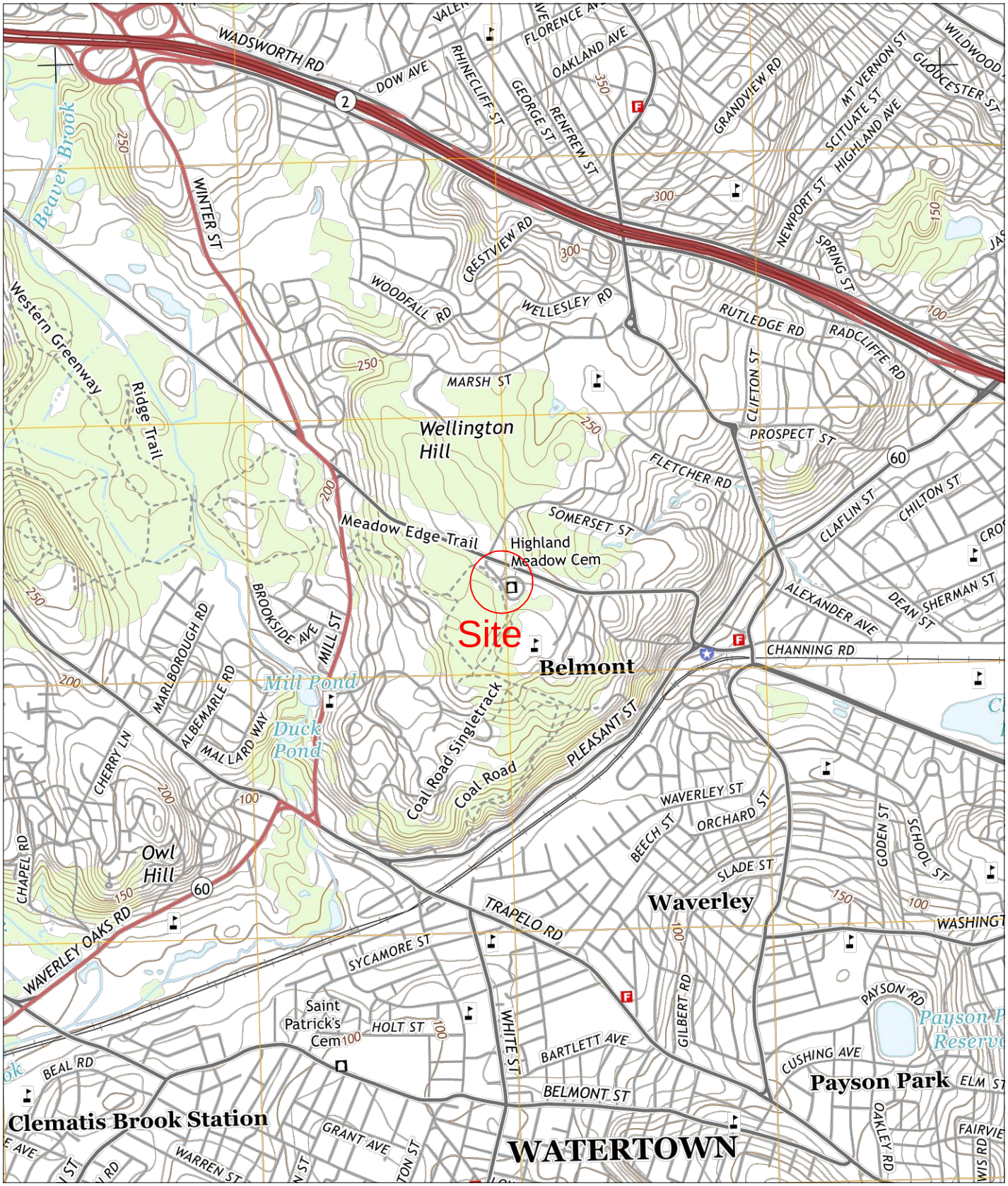
Sincerely,
STANTEC CONSULTING SERVICES INC.

Donald Moore, P.G.
Associate/Hydrogeologist
Phone: (603) 669-8672
Cell: (603) 498-3244
Donald.moore2@stantec.com

Attachment: Figures 1 - 8
Tables 1 – 5
Appendix A - E

c.

Figures



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Auburn NH 03032-3984
Tel: (603) 669-8672
www.stantec.com

Client/Project
Belmont

Highland Meadow Cemetery

Project No.

Title
Site Location

Revision
1

Date
2019.08.06

Reference Sheet

Figure No.
1

c:\users\jacpoirier\documents\highland meadow cemetery\highland meadow cemetery

2019.08.06 1:12:49 PM

Legend

- APPROXIMATE SITE BOUNDARY
- WELL LOCATION
- Section Line

A A'

1) SITE PLAN GENERATED FROM HIGHLANDS MEADOWS CEMETERY PLOT MAP DATED MAY 26, 2016 AND CONTROL POINT ASSOCIATES PLAN DATED OCTOBER 20, 2020

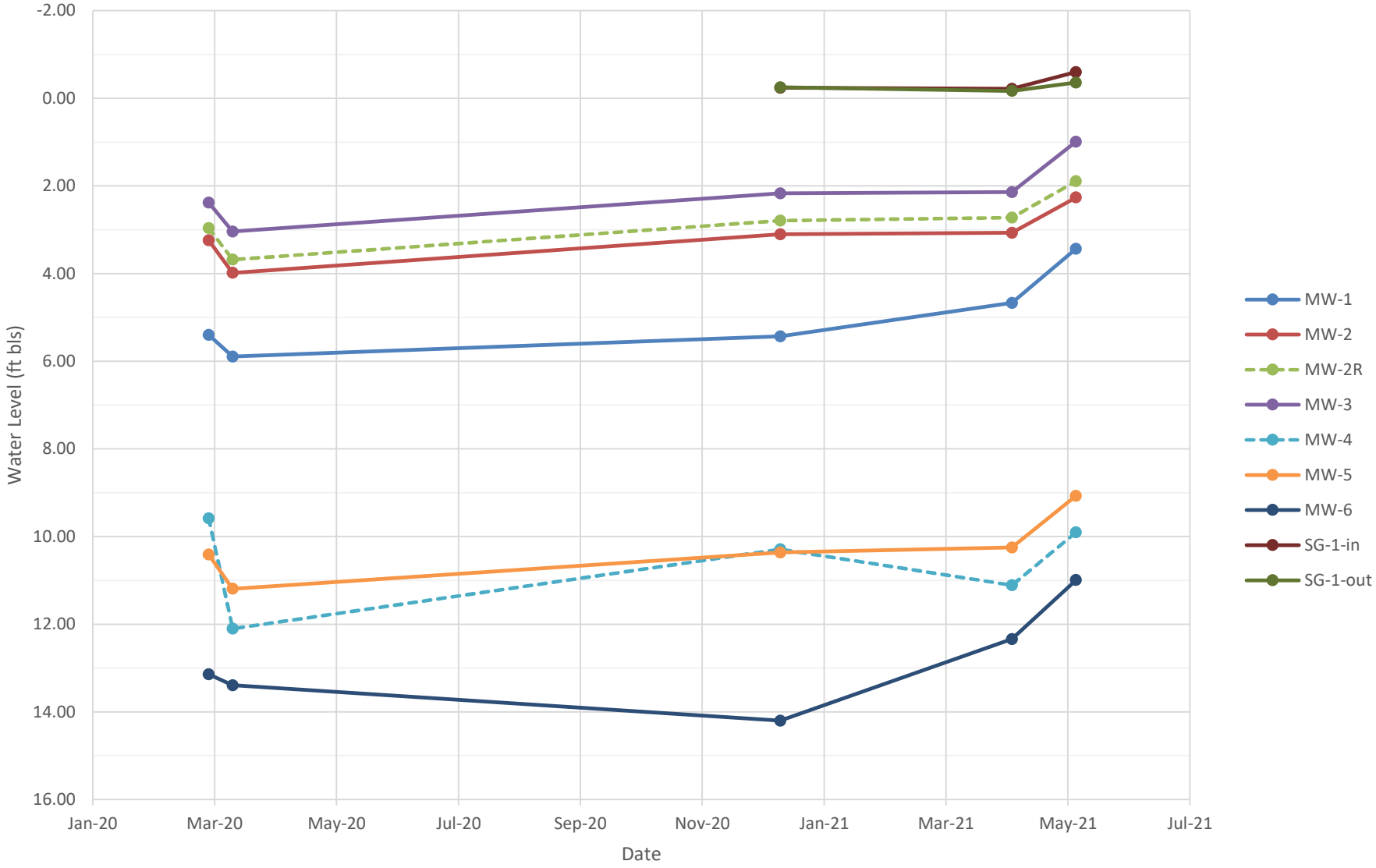
0 60' 120'

Stantec

Stantec Consulting Services Inc.

STANTEC OFFICE LOCATION:					DRAWING TITLE:
AUBURN, NEW HAMPSHIRE					**SITE PLAN**
DATE PREPARED:	DESIGNED BY:	DRAWN BY:	CHECKED BY:	REVIEWED BY:	HIGHLAND MEADOW CEMETERY
8-5-21	JJW	JJW	DFM	DFM	148 MAIN STREET
REVISION DATE:	REVISION NO:	DRAWN BY:	CHECKED BY:	REVIEWED BY:	BELMONT, MA
PROJECT NAME/FILE NAME:		PROJECT NUMBER/PHASE:	SCALE:	PREPARED FOR:	FIGURE NO.
HIGHLAND MEADOW		191711XXX	AS SHOWN	TOWN OF BELMONT	2

Figure 3
Depth to Water Table: Below Land Surface
Highland Meadow Cemetery



Negative (-) values indicate water is above land suface

Legend

- APPROXIMATE SITE BOUNDARY
- WELL LOCATION
- STAFF GAUGE LOCATION
- 266.81 – MEASURED WATER TABLE ELEVATION (BASED ON WELL GAUGING DATA COLLECTED ON 3/11/21)
- 264 – GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
- INFERRED DIRECTION OF GROUNDWATER FLOW

1) SITE PLAN GENERATED FROM HIGHLANDS MEADOWS CEMETERY PLOT MAP DATED MAY 26, 2016 AND CONTROL POINT ASSOCIATES PLAN DATED OCTOBER 20, 2020

0 60' 120'

Stantec

Stantec Consulting Services Inc.

STANTEC OFFICE LOCATION: AUBURN, NEW HAMPSHIRE					DRAWING TITLE: GROUNDWATER ELEVATION CONTOUR MAP: LOW WATER
DATE PREPARED: 8-5-21	DESIGNED BY: JJW	DRAWN BY: JJW	CHECKED BY: DFM	REVIEWED BY: DFM	HIGHLAND MEADOW CEMETERY 148 MAIN STREET BELMONT, MA
REVISION DATE:	REVISION NO:	DRAWN BY:	CHECKED BY:	REVIEWED BY:	
PROJECT NAME/FILE NAME: HIGHLAND MEADOW		PROJECT NUMBER/PHASE: 195601874		SCALE: AS SHOWN	PREPARED FOR: TOWN OF BELMONT

FIGURE NO. 4

Legend

- APPROXIMATE SITE BOUNDARY
- WELL LOCATION
- STAFF GAUGE LOCATION
- 266.81 – MEASURED WATER TABLE ELEVATION (BASED ON WELL GAUGING DATA COLLECTED ON 5/7/21)
- 264 – GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
- INFERRED DIRECTION OF GROUNDWATER FLOW

1) SITE PLAN GENERATED FROM HIGHLANDS MEADOWS CEMETERY PLOT MAP DATED MAY 26, 2016 AND CONTROL POINT ASSOCIATES PLAN DATED OCTOBER 20, 2020

0 60' 120'

Stantec

Stantec Consulting Services Inc.

STANTEC OFFICE LOCATION: AUBURN, NEW HAMPSHIRE					DRAWING TITLE: GROUNDWATER ELEVATION CONTOUR MAP:HIGH WATER
DATE PREPARED: 8-5-21	DESIGNED BY: JJW	DRAWN BY: JJW	CHECKED BY: DFM	REVIEWED BY: DFM	HIGHLAND MEADOW CEMETERY 148 MAIN STREET BELMONT, MA
REVISION DATE:	REVISION NO:	DRAWN BY:	CHECKED BY:	REVIEWED BY:	
PROJECT NAME/FILE NAME: HIGHLAND MEADOW		PROJECT NUMBER/PHASE: 195601874		SCALE: AS SHOWN	PREPARED FOR: TOWN OF BELMONT

FIGURE NO. 5

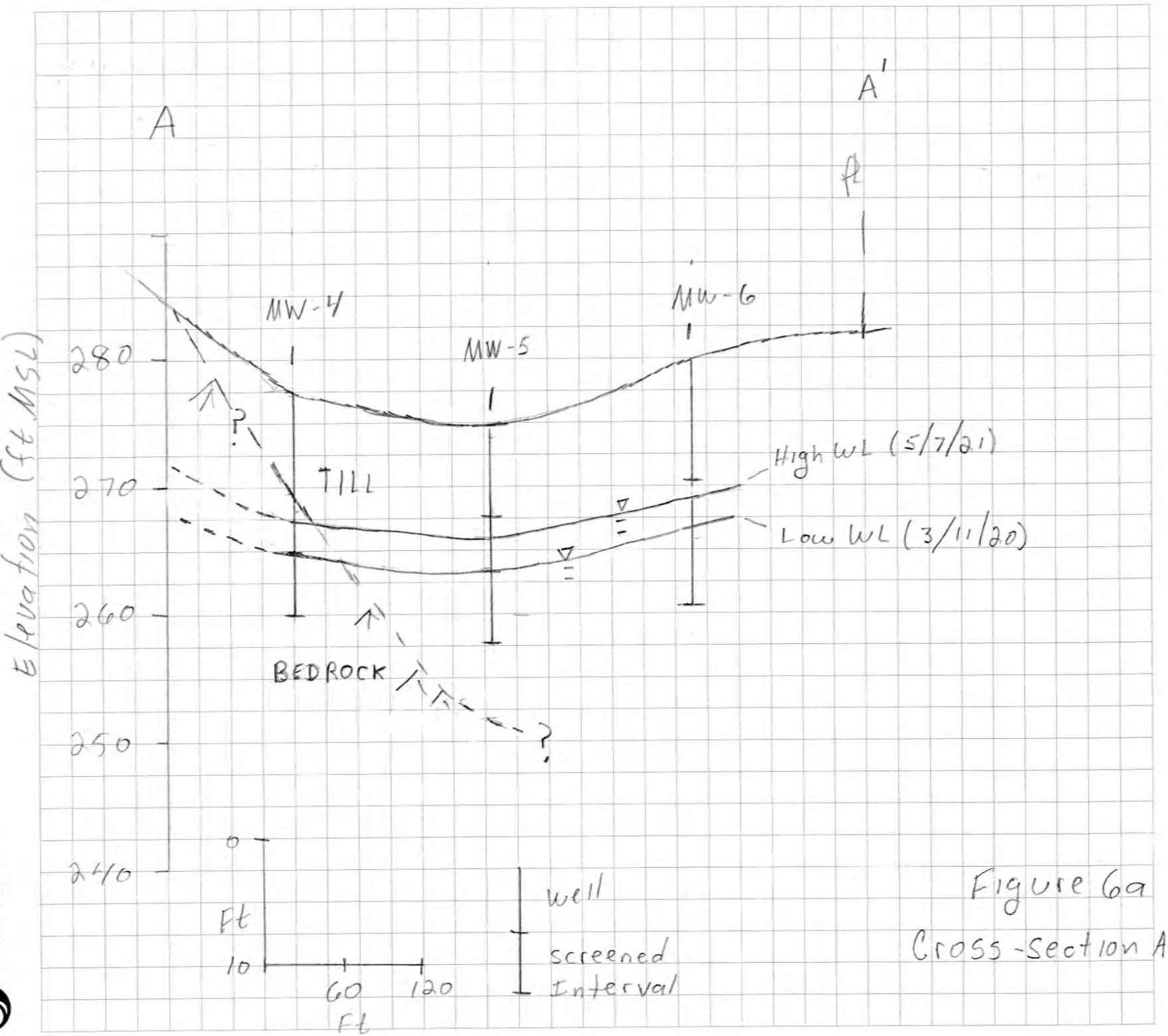


Figure 6a

Cross-Section A-A'

Stantec

Designed by:

Checked by:

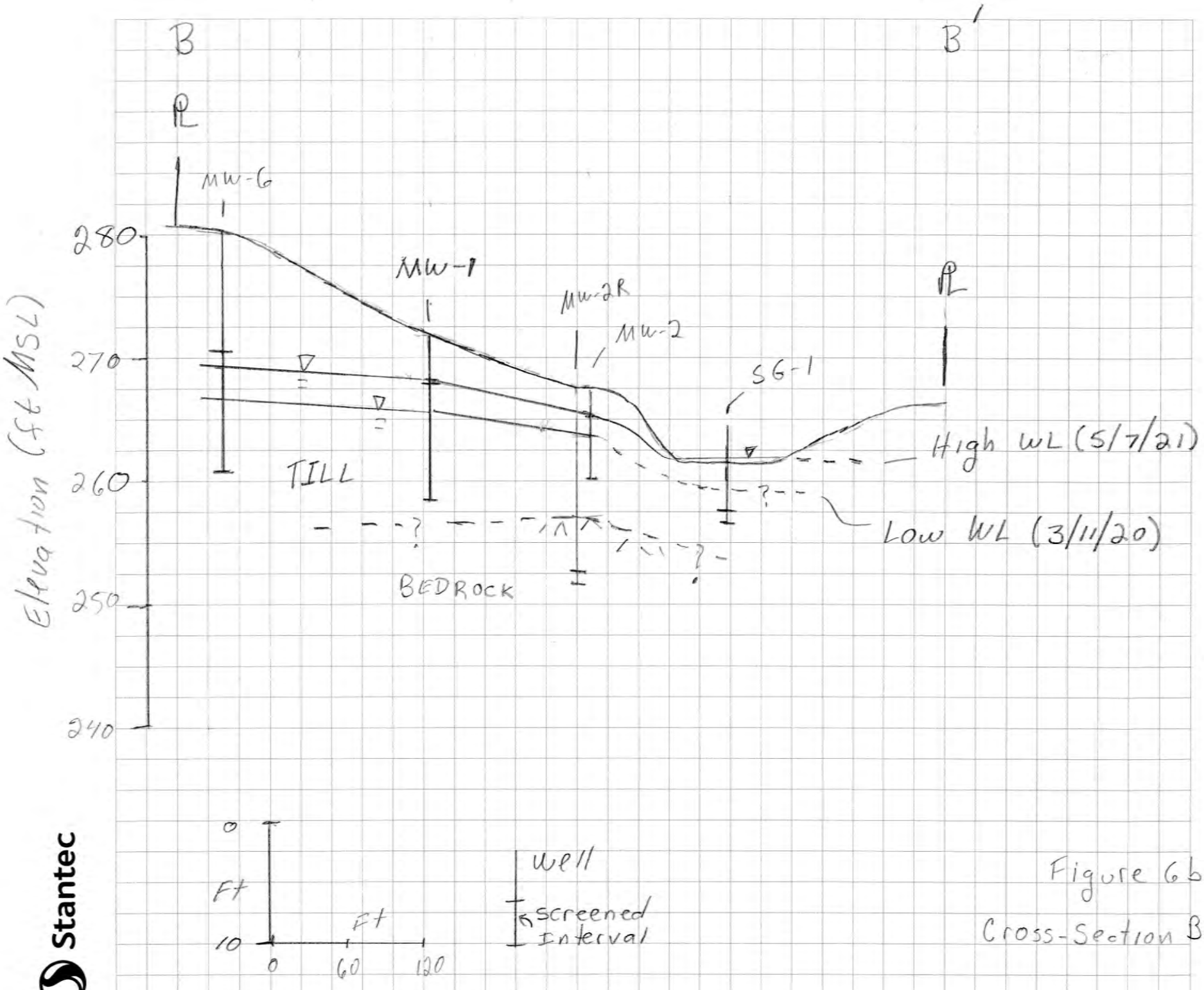


Figure 6b

Cross-Section B-B'

Stantec

Checked by:

Designed by:

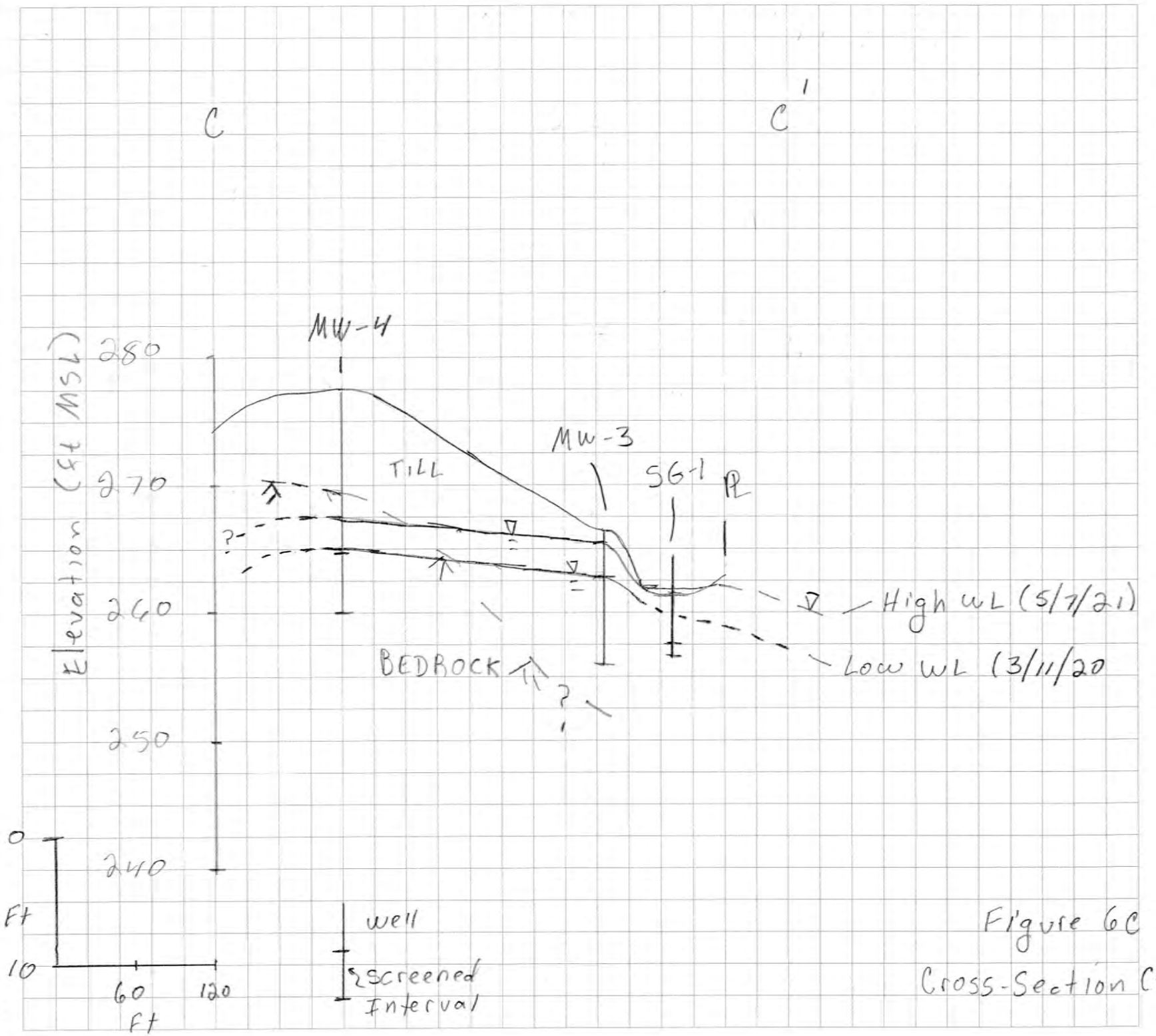


Figure 6C

Cross-Section C-C'

Stantec

Designed by:

Checked by:

Figure 7
Annual Water Levels
Winchester, MA: 1940 - 2021

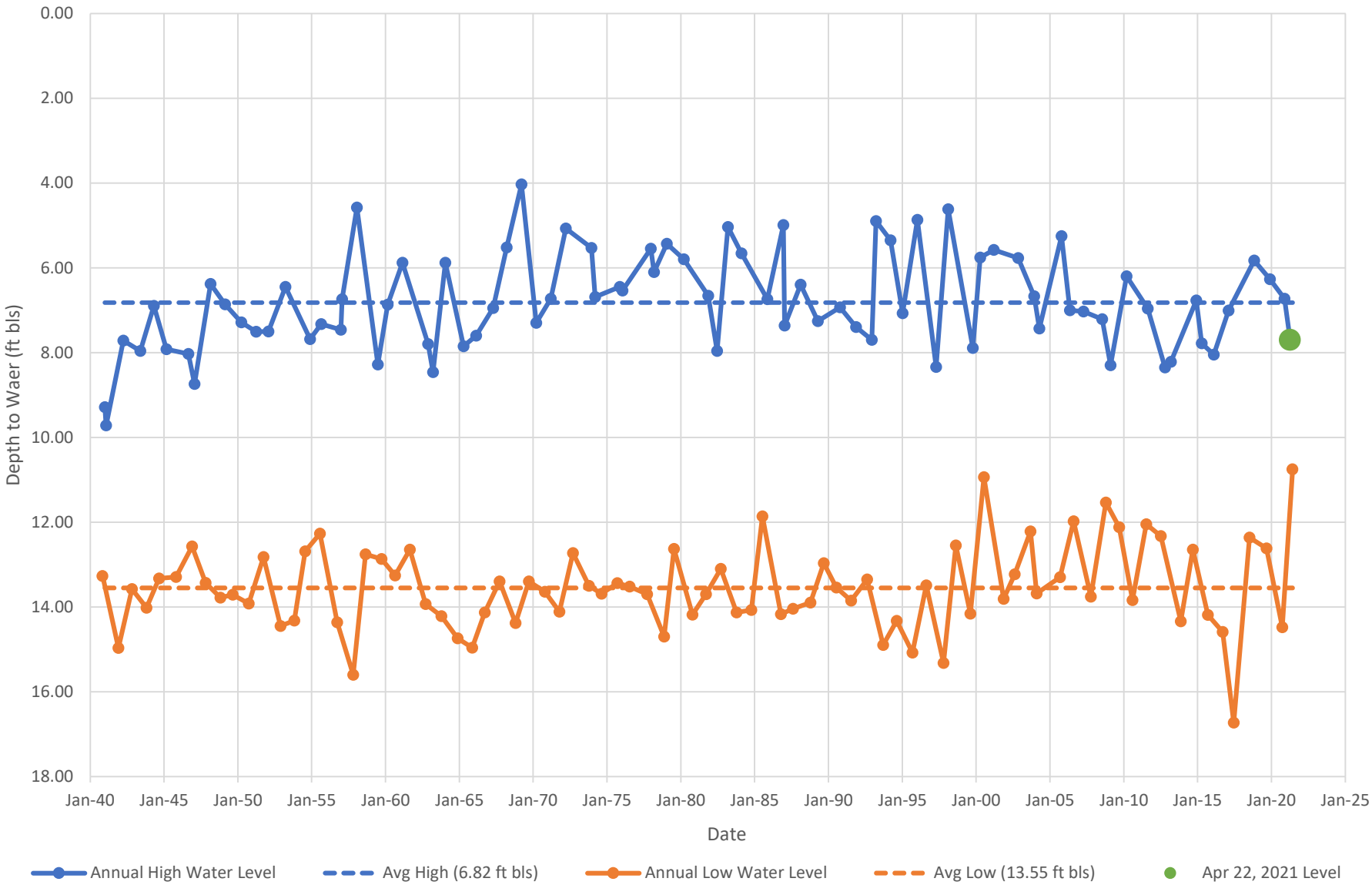
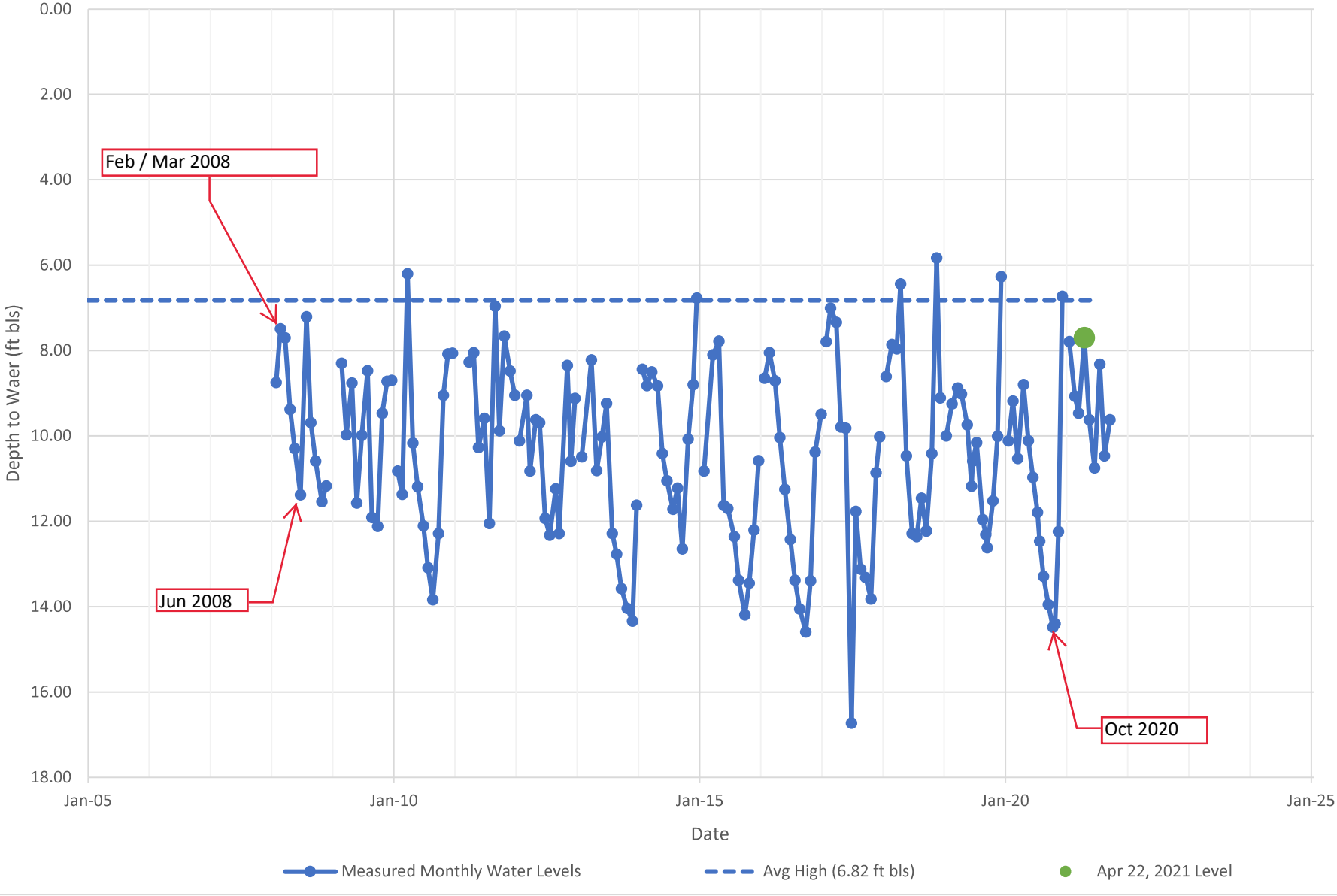


Figure 8
Monthly Water Levels
Winchester, MA: 2008 - 2021



Tables

Table 1
Well Construction Details
Highland Meadow Cemetery
Belmont, MA

Well No	Well Type	Well Diameter (in)	Date of Installation	Grnd Surf Elev (ft MSL)	Top of PVC (ft MSL)	Total Depth (ft bls)	Depth to Bedrock (ft bls)	Depth to Screened Interval Bot (ft bls)		Depth to Screened Interval Top (ft bls)	Bedrock Elevation (ft MSL)	Elevation of Screened Interval Bot (ft MSL)		Elevation of Screened Interval Top (ft MSL)
MW-1	OB	2	2/26/2020	271.8	271.52	13.5	NE	13.5	-	3.5	NE	258.3	-	268.3
MW-2	OB	2	2/25/2020	267.7	267.28	9	NE	7.5	-	2.5	NE	260.2	-	265.2
MW-2R	BR	2	2/24/2020	267.4	267.26	18	10.5	15.6	-	13.6	256.9	251.8	-	253.8
MW-3	OB	2	2/26/2020	266.4	266.03	11.5	NE	10.5	-	3.5	NE	255.9	-	262.9
MW-4	BR	2	2/28/2020	277.4	277.22	17.4	8	17.4	-	12.4	269.4	260.0	-	265.0
MW-5	OB	2	2/27/2020	275.0	274.11	17.5	NE	17.2	-	7.2	NE	257.8	-	267.8
MW-6	OB	2	2/27/2020	280.2	279.98	19.5	NE	19.5	-	9.5	NE	260.7	-	270.7
SG-1	SG	1	10/15/2020	261.4	264.69	5	NE	5	-	4	NE	256.4	-	257.4

Notes:

OB = Overburden
BR = Bedrock
SG = Staff Gauge
ft MSL = feet above Mean Sea Level
ft bls = feet below land surface
NE = Not Encountered
NA = Not Available

Table 2
Water Level Data
Highland Meadow Cemetery
Belmont, MA

Well No	Well Type	Well Diameter (in)	Date of Installation	Grnd Surf Elev (ft MSL)	Top of PVC (ft MSL)	Depth to Water									
						02/28/20 (ft PVC)	03/11/20 (ft PVC)	12/10/20 (ft PVC)	04/05/21 (ft PVC)	05/07/21 (ft PVC)	02/28/20 (ft bls)	03/11/20 (ft bls)	12/10/20 (ft bls)	04/05/21 (ft bls)	05/07/21 (ft bls)
MW-1	OB	2	2/26/2020	271.8	271.52	5.12	5.61	5.15	4.39	3.15	5.40	5.89	5.43	4.67	3.43
MW-2	OB	2	2/25/2020	267.7	267.28	2.82	3.56	2.68	2.65	1.84	3.24	3.98	3.10	3.07	2.26
MW-2R	BR	2	2/24/2020	267.4	267.26	2.82	3.54	2.65	2.58	1.75	2.96	3.68	2.79	2.72	1.89
MW-3	OB	2	2/26/2020	266.4	266.03	2.01	2.67	1.80	1.77	0.62	2.38	3.04	2.17	2.14	0.99
MW-4	BR	2	2/28/2020	277.4	277.22	9.40	11.92	10.11	10.93	9.72	9.58	12.10	10.29	11.11	9.90
MW-5	OB	2	2/27/2020	275.0	274.11	9.52	10.30	9.47	9.36	8.18	10.41	11.19	10.36	10.25	9.07
MW-6	OB	2	2/27/2020	280.2	279.98	12.92	13.17	13.98	12.12	10.77	13.14	13.39	14.20	12.34	10.99
Dug Well	OB	24	Unk	-	270.61	NM	NM	6.07	6.08	5.14	-	-	-	-	-
SG-1-in	SG	1.5	10/15/2020	261.4	264.69	NYI	NYI	3.05	3.07	2.69	NYI	NYI	-0.24	-0.22	-0.60
SG-1-out	SG	1.5	10/15/2020	261.4	264.69	NYI	NYI	3.04	3.12	2.93	NYI	NYI	-0.25	-0.17	-0.36

Notes:
ft MSL = Feet ablove Mean Sea Level
ft PVC = feet below top of PVC riser (aka measuring point)
NM = Not Measured
NYI = Not yet installed

OB = Overburden
BR = Bedrock
SG = Staff Gauge

(-) values for ft bls indicate water is above ground surface

Survey Data from Control Point Associates, October 2020

Table 2
Water Level Data
Highland Meadow Cemetery
Belmont, MA

Well No	Well Type	Well Diameter (in)	Date of Installation	Grnd Surf Elev (ft MSL)	Top of PVC (ft MSL)	Water Level Elev.				
						02/28/20 (ft MSL)	03/11/20 (ft MSL)	12/10/20 (ft MSL)	04/05/21 (ft MSL)	05/07/21 (ft MSL)
MW-1	OB	2	2/26/2020	271.8	271.52	266.40	265.91	266.37	267.13	268.37
MW-2	OB	2	2/25/2020	267.7	267.28	264.46	263.72	264.60	264.63	265.44
MW-2R	BR	2	2/24/2020	267.4	267.26	264.44	263.72	264.61	264.68	265.51
MW-3	OB	2	2/26/2020	266.4	266.03	264.02	263.36	264.23	264.26	265.41
MW-4	BR	2	2/28/2020	277.4	277.22	267.82	265.30	267.11	266.29	267.50
MW-5	OB	2	2/27/2020	275.0	274.11	264.59	263.81	264.64	264.75	265.93
MW-6	OB	2	2/27/2020	280.2	279.98	267.06	266.81	266.00	267.86	269.21
Dug Well	OB	24	Unk	-	270.61	NM	NM	264.54	264.53	265.47
SG-1-in	SG	1.5	10/15/2020	261.4	264.69	NYI	NYI	261.64	261.62	262.00
SG-1-out	SG	1.5	10/15/2020	261.4	264.69	NYI	NYI	261.65	261.57	261.76

Notes:
ft MSL = Feet ablove Mean Sea Level
ft PVC = feet below top of PVC riser (aka measuring point)
NM = Not Measured
NYI = Not yet installed

Survey Data from Control Point Associates, October 2020

Table 3

Vertical Hydraulic Gradients at Well Pair and Staff Gauge
Highland Meadow Cemetery
Belmont, MA

Well No.	Well Type	Mid-Pt Screen Elevation (ft MSL)	Water Level Elevations					Vertical Hydraulic Gradients				
			02/28/20 (ft MSL)	03/11/20 (ft MSL)	12/10/20 (ft MSL)	04/05/21 (ft MSL)	05/07/21 (ft MSL)	02/28/20 (ft/ft)	03/11/20 (ft/ft)	12/10/20 (ft/ft)	04/05/21 (ft/ft)	05/07/21 (ft/ft)
MW-2	OB	267.7	264.46	263.72	264.60	264.63	265.44	-1.34E-03	0.00E+00	6.71E-04	3.36E-03	4.70E-03
MW-2R	BR	252.8	264.44	263.72	264.61	264.68	265.51					
SG-1-in	SG	256.9	NYI	NYI	261.64	261.62	262.00	NYI	NYI	-2.22E-03	1.11E-02	5.33E-02
SG-1-out	SG	261.4	NYI	NYI	261.65	261.57	261.76	NYI	NYI			

NOTES

ft MSL = ft above Mean Sea Level Datum

ft/ft = feet per foot

NYI = Not Yet Installed

- = Downward vertical gradient

"Mid-Pt Screen Elevation" for SG-1 out is ground surface

Table 4

Hydraulic Conductivities: Monitoring Wells

Highland Meadow Cemetery
Belmont, MA

Well Identification	Date of Test	Type of Test	Material	Hydraulic Conductivity (K) (cm/sec)	Hydraulic Conductivity (K) (ft/day)
Overburden Wells					
MW-1	03/11/20	Constant Drawdown	TILL - Saturated	4.93E-03	14.0
MW-2	03/11/20	Rising Head	TILL - Saturated	2.14E-04	0.61
MW-2	03/11/20	Rising Head	TILL - Saturated	3.65E-04	1.04
MW-2	03/11/20	Rising Head	TILL - Saturated	1.50E-04	0.43
MW-3	03/11/20	Constant Drawdown	TILL - Saturated	7.17E-03	20.3
MW-5	03/11/20	Rising Head	TILL - Saturated	9.15E-04	2.61
MW-6	03/11/20	Rising Head	TILL - Saturated	7.99E-05	0.23
Bedrock Wells					
MW-2R	03/11/20	Constant Drawdown	Bedrock	8.40E-02	238
MW-4R	03/11/20	Rising Head	Bedrock	8.99E-05	0.26
MW-4R	03/11/20	Rising Head	Bedrock	3.56E-05	0.10
			Geometric Mean: Overburden	6.07E-04	1.7
			Geometric Mean: Bedrock	6.45E-04	1.8

Notes:
cm/sec = centimeters per second
ft/day = feet per day

Table 5

Annual High and Low Water Levels

USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Annual High Water Level (ft bls)		Date	Annual Low Water Level (ft bls)
12/28/1940	9.29		11/2/1940	13.27
2/1/1941	9.72		11/29/1941	14.97
3/31/1942	7.72		10/31/1942	13.58
5/29/1943	7.96		10/29/1943	14.02
4/28/1944	6.90		8/31/1944	13.33
3/1/1945	7.92		10/30/1945	13.29
8/31/1946	8.03		11/30/1946	12.57
1/29/1947	8.74		10/30/1947	13.43
2/28/1948	6.38		10/30/1948	13.78
2/25/1949	6.86		8/30/1949	13.71
3/31/1950	7.29		9/30/1950	13.92
3/30/1951	7.51		9/29/1951	12.82
2/2/1952	7.50		11/28/1952	14.45
3/28/1953	6.45		10/31/1953	14.32
11/27/1954	7.68		7/31/1954	12.69
8/30/1955	7.33		7/28/1955	12.27
12/29/1956	7.46		9/29/1956	14.36
1/28/1957	6.74		10/31/1957	15.60
1/31/1958	4.58		8/28/1958	12.76
6/29/1959	8.28		9/30/1959	12.87
2/29/1960	6.87		8/31/1960	13.26
3/1/1961	5.88		9/1/1961	12.65
11/28/1962	7.80		9/27/1962	13.93
3/27/1963	8.46		10/24/1963	14.22
1/28/1964	5.88		11/28/1964	14.74
4/23/1965	7.85		11/24/1965	14.96
2/26/1966	7.60		9/28/1966	14.13
4/27/1967	6.95		9/27/1967	13.40
3/26/1968	5.52		10/28/1968	14.38
3/26/1969	4.03		9/25/1969	13.40
3/27/1970	7.30		10/28/1970	13.64
3/23/1971	6.73		10/21/1971	14.11
3/24/1972	5.07		9/22/1972	12.73
12/20/1973	5.53		10/24/1973	13.50
3/25/1974	6.69		8/26/1974	13.69
11/24/1975	6.45		9/23/1975	13.44
1/30/1976	6.54		7/26/1976	13.52
12/28/1977	5.55		9/29/1977	13.70
3/22/1978	6.10		11/27/1978	14.70
1/29/1979	5.43		7/26/1979	12.63
3/24/1980	5.80		10/23/1980	14.18
11/22/1981	6.66		9/24/1981	13.70
6/25/1982	7.96		9/26/1982	13.10

Table 5

Annual High and Low Water Levels

USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Annual High Water Level (ft bls)		Date	Annual Low Water Level (ft bls)
3/23/1983	5.04		10/21/1983	14.13
2/22/1984	5.66		10/23/1984	14.07
11/21/1985	6.74		7/22/1985	11.86
12/22/1986	4.99		10/22/1986	14.17
1/21/1987	7.36		8/21/1987	14.04
2/24/1988	6.40		10/24/1988	13.90
4/24/1989	7.26		9/21/1989	12.97
10/26/1990	6.93		7/24/1990	13.54
11/25/1991	7.40		7/30/1991	13.85
12/22/1992	7.70		8/28/1992	13.35
4/1/1993	4.90		9/29/1993	14.90
3/30/1994	5.35		8/29/1994	14.33
1/25/1995	7.07		9/26/1995	15.08
1/25/1996	4.87		8/29/1996	13.49
4/29/1997	8.34		10/29/1997	15.32
2/26/1998	4.62		9/2/1998	12.55
10/29/1999	7.89		8/27/1999	14.16
4/26/2000	5.76		7/25/2000	10.94
3/27/2001	5.58		11/28/2001	13.81
11/19/2002	5.77		8/27/2002	13.23
12/22/2003	6.67		9/22/2003	12.22
4/28/2004	7.43		2/24/2004	13.68
10/27/2005	5.25		9/22/2005	13.30
5/24/2006	7.00		8/24/2006	11.98
4/24/2007	7.03		10/23/2007	13.76
7/29/2008	7.21		10/29/2008	11.54
2/24/2009	8.30		9/28/2009	12.12
3/26/2010	6.20		8/23/2010	13.84
8/31/2011	6.96		7/27/2011	12.05
11/5/2012	8.35		7/23/2012	12.33
3/28/2013	8.22		11/29/2013	14.34
12/18/2014	6.77		9/23/2014	12.65
4/29/2015	7.78		10/1/2015	14.19
2/26/2016	8.05		9/30/2016	14.59
2/24/2017	7.01		6/30/2017	16.73
11/21/2018	5.83		7/24/2018	12.36
12/12/2019	6.27		9/19/2019	12.62
12/11/2020	6.73		10/16/2020	14.48
4/22/2021	7.70		6/22/2021	10.75
AVERAGE	6.82			13.55

ft bls = feet below ground surface

Appendix A

BORING LOGS AND WELL CONSTRUCTION DETAILS

MONITORING WELL LOG

MW-1

CLIENT **Highland Meadows Cemetary**

LOCATION **700 Concord Ave., Belmont, MA**

DATES: BORING **2/26/2020 to 2/26/2020** WATER LEVEL **5**

PROJECT No. **195601784**

BOREHOLE No. **MW-1**

DATUM

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (in.)	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
0		Dark brown TOPSOIL				SS	S-1	19	11	
		Light brown fine sandy SILT								
		Light brown fine SAND and SILT				SS	S-2	13	13	
		Olive brown fine SAND, some fine gravel								
		Grey silty fine SAND, fine to coarse gravel. Till		▽		SS	S-3	20	42	
5		Grey silty fine SAND, fine to coarse gravel. Till				SS	S-4	22	42	
		Olive silty fine SAND, fine-coarse gravel, some medium -coarse sand. Till				SS	S-5	9	126	
10		Boulder								
					Bottom of boring					
15										
20										

Driller: NEB(Mark and Cody); Stantec Field Representative: Bruce Bline

STN13-MON-I BELMONT HMC.GPJ JW NHP.GDT 8/25/21

Stantec

MONITORING WELL LOG

MW-2

CLIENT **Highland Meadows Cemetary**

LOCATION **700 Concord Ave., Belmont, MA**

DATES: BORING **2/25/2020 to 2/25/2020** WATER LEVEL **3**

PROJECT No. **195601784**

BOREHOLE No. **MW-2**

DATUM

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY in.	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
0		Dark brown TOPSOIL								
		Light brown SILT and fine SAND				SS	S-1	14	10	
		Grey SILT SAND and GRAVEL (till)		▽		S-2	S-2	18	24	
5		Grey TILL				S-3	S-3	12	37	
		Grey TILL				S-4	S-4	12	100+	
		Grey TILL				S-5	S-5	12	150	
10										
15										
20										

Driller: NEB(Mark and Cody); Stantec Field Representative: Bruce Bline

STN13-MON-I BELMONT HMC.GPJ JW NHP.GDT 8/25/21

Stantec

MONITORING WELL LOG

MW-2R

CLIENT **Highland Meadows Cemetary**

LOCATION **700 Concord Ave., Belmont, MA**

DATES: BORING **2/24/2020 to 2/25/2020** WATER LEVEL **3**

PROJECT No. **195601784**

BOREHOLE No. **MW-2R**

DATUM

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (in.)	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
0		Dark brown TOPSOIL								
		Light brown SILT and fine SAND				SS	S-1	14	10	
		Grey SILT SAND and GRAVEL (till)		▽		SS	S-2	18	24	
		Grey TILL				SS	S-3	12	37	
5		Grey TILL				SS	S-4	12	100+	
		Grey TILL				SS	S-5	12	150	
10		Grey TILL				SS	S-6	3	100	
		Well fractured BEDROCK			Probable bedrock					
15										
20										

Driller: NEB(Mark and Cody); Stantec Field Representative: Bruce Bline

STN13-MON-I BELMONT HMC.GPJ JW NHP.GDT 8/25/21

MONITORING WELL LOG

MW-3

CLIENT Highland Meadows Cemetary

LOCATION 700 Concord Ave., Belmont, MA

DATES: BORING 2/25/2020 to 2/26/2020 WATER LEVEL 2

PROJECT No. 195601784

BOREHOLE No. MW-3

DATUM

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (in.)	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
0		Dark brown TOPSOIL								
		Grey and brown silty fine SAND, some gravel				SS	S-1	14	9	
		Brown and olive silty fine SAND		▽						
		Grey silty fine SAND, trace fine gravel				SS	S-2	13	27	
		Dense grey silty fine SAND, coarse angular Gravel (till)				SS	S-3	9	78	
5										
		Dense grey/olive brown silty fine SAND, fine to coarse angular gravel, some medium to coarse sand (till)				SS	S-4	16	175	
10										
					Bottom of Boring					
15										
20										

Driller: NEB(Mark and Cody); Stantec Field Representative: Bruce Bline

STN13-MON-I BELMONT HMC.GPJ JW NHP.GDT 8/25/21

MONITORING WELL LOG

MW-4

CLIENT **Highland Meadows Cemetary**

LOCATION **700 Concord Ave., Belmont, MA**

DATES: BORING **2/28/2020 to 2/28/2020** WATER LEVEL **10.5**

PROJECT No. **195601784**

BOREHOLE No. **MW-4**

DATUM

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (in.)	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
0		TOPSOIL								
		Dark brown fine-medium SAND, some fine-coarse gravel				SS	S-1	13	10	
		Olive silty fine SAND, some fine-coarse angular gravel				SS	S-2	9	15	
5						SS	S-3	18	62	
						SS	S-4	9	100+	
10		Well fractured BEDROCK								
15										
					Bottom of Boring					
20										

Driller: NEB(Mark and Cody); Stantec Field Representative: Bruce Bline

STN13-MON-I BELMONT HMC.GPJ JW NHP.GDT 8/25/21

MONITORING WELL LOG

MW-5

CLIENT **Highland Meadows Cemetary**

LOCATION **700 Concord Ave., Belmont, MA**

DATES: BORING **2/27/2020 to 2/27/2020** WATER LEVEL **9**

PROJECT No. **195601784**

BOREHOLE No. **MW-5**

DATUM

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (in.)	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
0		TOPSOIL								
		Fine sandy TILL				SS	S-1	14	13	
		Light brown silty fine SAND, some coarse angular gravel, trace medium-coarse sand				SS	S-2	8	11	
5		Dense grey sandy TILL				SS	S-3	18	43	
		Dense grey sandy TILL				SS	S-4	23	69	
10				▽						
15		Dense grey-olive TILL				SS	S-5	19	116	
					Bottom of Boring					
20										

Driller: NEB(Mark and Cody); Stantec Field Representative: Bruce Bline

STN13-MON-I BELMONT HMC.GPJ JW NHP.GDT 8/25/21

Stantec

MONITORING WELL LOG

MW-6

CLIENT Highland Meadows Cemetary

LOCATION 700 Concord Ave., Belmont, MA

DATES: BORING 2/26/2020 to 2/27/2020 WATER LEVEL 13

PROJECT No. 195601784

BOREHOLE No. MW-6

DATUM

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (in.)	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
0		TOPSOIL								
		Grey Silty grey fine SAND, fine-coarse angular gravel, some medium to coarse sand				SS	S-1	11	31	
		Grey and orange silty fine SAND, some angular gravel				SS	S-2	14	12	
		Grey and orange silty fine SAND, some angular gravel								
5		Grey dense fine silty SAND and fine-coarse GRAVEL (till)				SS	S-3	21	61	
		Grey dense fine silty SAND and fine-coarse GRAVEL (till)				SS	S-4	7	100+	
10		Olive grey TILL, iron staining noted		∇		SS	S-5	16	58	
15		Olive grey TILL, iron staining noted				SS	S-6	12	28	
20					Bottom of Boring					

Driller: NEB(Mark and Cody); Stantec Field Representative: Bruce Bline

STN13-MON-I BELMONT HMC.GPJ JW NHP.GDT 8/25/21

Appendix B

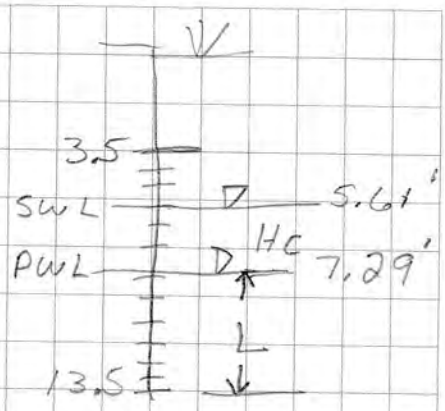
PERMEABILITY TEST RESULTS

Stantec

MW-1 Constant Head Test

2 Tests $Q = 0.96$ gpm, 0.99 gpm

Avg $= 0.98$ gpm $= 61.83 \frac{cm^3}{s}$



$D = 2$ in $= 5.08$ cm

$m = \sqrt{\frac{kh}{kv}}$ assume $\sqrt{\frac{3}{1}} = 1.73$

Static Water Level $= 5.61$ ft TOP

Pumping Water Level $= 7.29$ ft TOP

$H_c = 7.29 - 5.61 = 1.68$ ft $= 51.21$ cm

$L = 13.5 - 7.29 = 6.21$ ft $= 189.28$ cm

$$k_h = \frac{Q \ln\left[\left(\frac{mL}{D}\right) + \sqrt{1+\left(\frac{mL}{D}\right)^2}\right]}{2\pi L H_c}$$

$$K_h = \frac{61.83 \ln\left[\frac{(1.73)(189.28)}{5.08} + \sqrt{1+\left(\frac{(1.73)(189.28)}{5.08}\right)^2}\right]}{2\pi(189.28)(51.21)}$$

$K_h = 61.83 \ln(128.93)/60903.1$

$K_h = (61.83)(4.86)/60903.1$

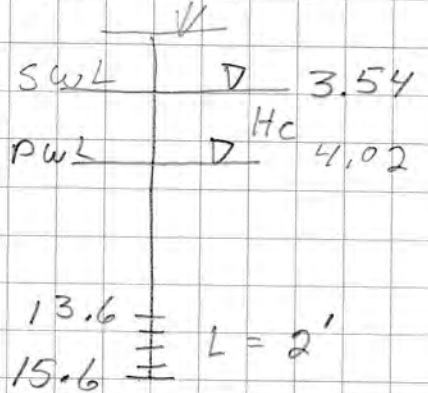
$K_h = 4.93 \times 10^{-3} \frac{cm}{s} = 14.0$ ft/d

Designed by:

Checked by:

Stantec

MW-2R Constant Head Perm Test



4 Tests Q = 2.06 gpm
2.08 gpm
1.94 gpm
1.97 gpm

Avg = 2.01 gpm = (126.81 cm^3/s)

D = 2 in = (5.08 cm)

$m = \sqrt{\frac{K_h}{K_v}}$ assume $\sqrt{\frac{10}{1}}$ = (1.73)

Static Water level = 3.54 ft TOP
Pumping Water level = 4.02 ft TOP

H_c = 4.02 - 3.54 = 0.48 ft = (14.63 cm)

L = 2 ft = (60.96 cm)

$$K_h = \frac{Q \ln\left[\frac{mL}{D} + \sqrt{1+\left(\frac{mL}{D}\right)^2}\right]}{2\pi L H_c}$$

$$K_h = 126.81 \ln\left[\frac{(1.73)(60.96)}{5.08} + \sqrt{1+\left(\frac{(1.73)(60.96)}{5.08}\right)^2}\right] \Big/ (2)(\pi)(60.96)(14.63)$$

$K_h = (126.81) \ln (41.54) / 5603.78$

$K_h = (126.81)(3.73)/5603.78$

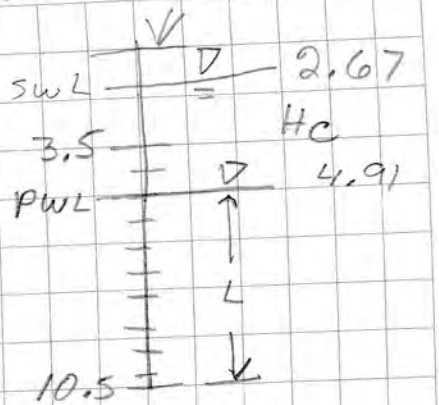
K_h = (8.4×10^{-2} cm/s) = 238 ft/d

Designed by:

Checked by:

Stantec

MW-3 Constant Head Test



2 Tests $Q = 1.79$ gpm
1.71 gpm

Avg $= 1.75$ gpm $= 110.41\ cm^3/s$

$D = 2\ in = 5.08\ cm$

$m = 1.73$

Static Water Level = 2.67 ft TOP
Pumping Water Level = 4.91 ft TOP

$Hc = 4.91 - 2.67 = 2.24\ ft = 68.28\ cm$

$L = 10.5 - 4.91 = 5.59\ ft = 170.38\ cm$

$$K_h = \frac{Q \ln\left[\frac{mL}{D} + \sqrt{1+\left(\frac{mL}{D}\right)^2}\right]}{2\pi L Hc}$$

$$K_h = \frac{110.41 \ln\left[\frac{(1.73)(170.38)}{5.08} + \sqrt{1+\left(\frac{(1.73)(170.38)}{5.08}\right)^2}\right]}{(2)(\pi)(170.38)(68.28)}$$

$K_h = 110.41 \ln(116.06) / 73095.7$

$K_h = (110.41)(4.75) / 73095.7$

$K_h = 7.17 \times 10^{-3} \frac{cm}{s} = 20.3\ ft/d$

Designed by: Checked by:

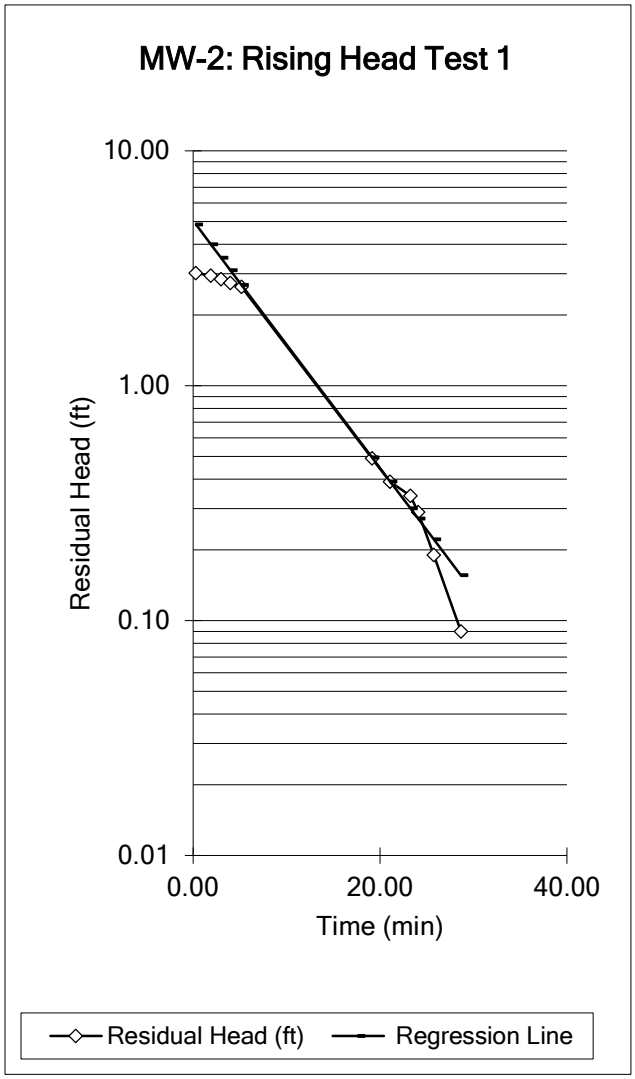
Permeability Test Analysis — Well/Boring #: MW-2: Rising Head Test 1

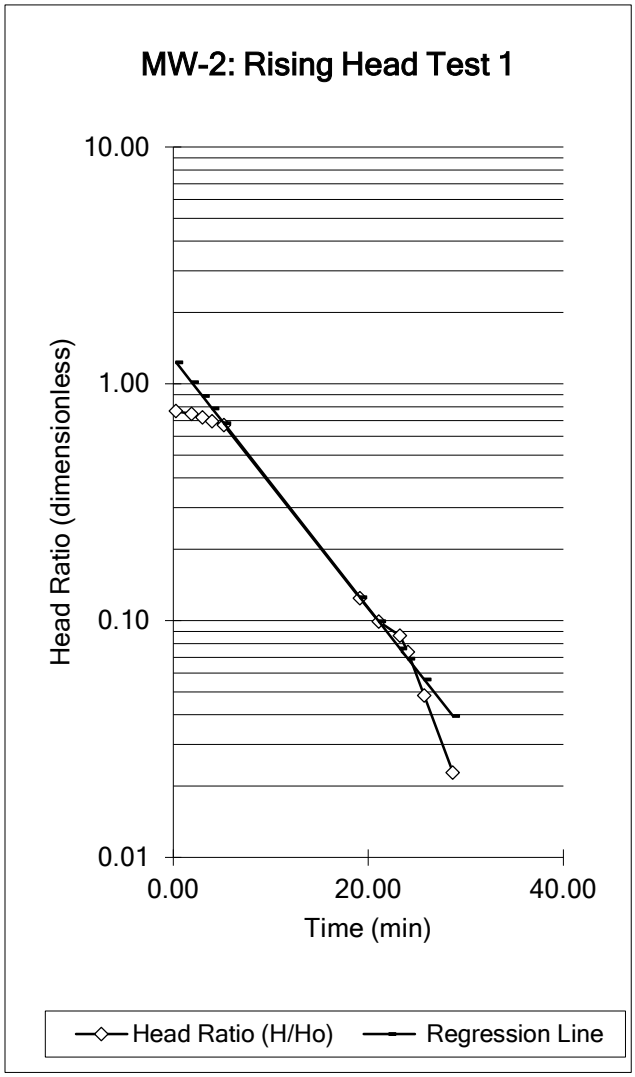
Type of test: Rising Head - Hand Logged

Static Head :	3.56	(ft TOC)
Head @ T(0):	7.50	(ft TOC)
Initial Residual Head:	3.94	(ft TOC)

Elapsed Time (min)	Water Level (ft TOC)	Residual Head (ft)	Variable Head Regression Line	Head Ratio (H/Ho)	Basic Time Lag Regression Line
0.30	6.58	3.02	4.86	0.77	1.23
1.90	6.50	2.94	4.00	0.75	1.02
3.00	6.40	2.84	3.50	0.72	0.89
4.00	6.30	2.74	3.10	0.70	0.79
5.20	6.20	2.64	2.68	0.67	0.68
19.15	4.05	0.49	0.49	0.12	0.13
21.08	3.95	0.39	0.39	0.10	0.10
23.25	3.90	0.34	0.30	0.09	0.08
24.07	3.85	0.29	0.27	0.07	0.07
25.75	3.75	0.19	0.22	0.05	0.06
28.67	3.65	0.09	0.16	0.02	0.04

	Variable Head Model	Basic Time Lag Model	
Regression "m" - value:	0.885822528	0.885822528	
Regression "b" - value:	5.040629609	1.279347617	
H1(ft)	2.64	Basic time lag "T" (min):	8.20
H2 (ft)	0.19	Basic time lag "T" (sec):	492.05
t2 (min)	25.75		
t1 (min)	5.20		
Hole diameter (D) (cm):	10.16		
Well diameter (d) (cm):	5.08		
Screen length (L) (cm):	118.87		
m - value = (Kh/Kv)^1/2:	1.73		
	Kh=d^2*ln(2mL/D)*ln(H1/H2)/8*L*(t2-t1)	Kh=d^2*ln(2mL/D)/8*L*T	
Kh=	2.14E-04 cm/sec	2.04E-04 cm/sec	
Kh=	0.61 ft/day	0.58 ft/day	


MW-2: Rising Head Test 1
10.00
1.00
0.10
0.01
Residual Head (ft)
0.00
20.00
40.00
Time (min)
Residual Head (ft)
Regression Line


MW-2: Rising Head Test 1
10.00
1.00
0.10
0.01
Head Ratio (dimensionless)
0.00
20.00
40.00
Time (min)
Head Ratio (H/Ho)
Regression Line

Belmont HMC

Date:3/11/20

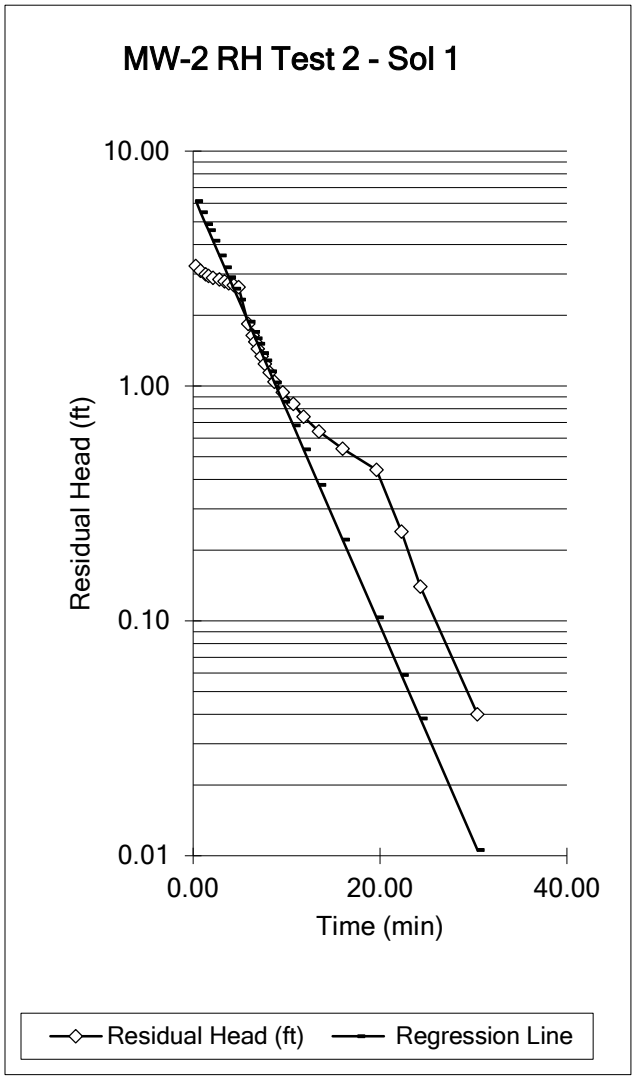
Permeability Test Analysis Well/Boring #: MW-2 RH Test 2 - Sol 1

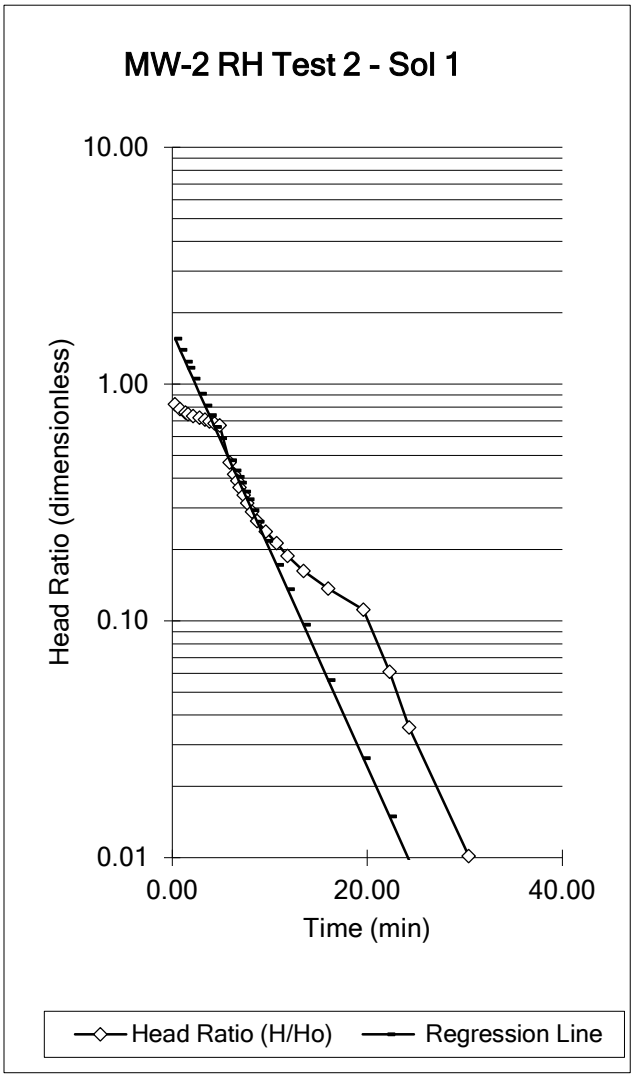
Type of test: Rising Head - Hand Logged

Static Head :	3.56	(ft TOC)
Head @ T(0):	7.50	(ft TOC)
Initial Residual Head:	3.94	(ft TOC)

Elapsed Time (min)	Water Level (ft TOC)	Residual Head (ft)	Variable Head Regression Line	Head Ratio (H/Ho)	Basic Time Lag Regression Line
0.30	6.80	3.24	6.13	0.82	1.56
0.82	6.65	3.09	5.50	0.78	1.39
1.37	6.55	2.99	4.89	0.76	1.24
1.65	6.50	2.94	4.61	0.75	1.17
2.15	6.45	2.89	4.15	0.73	1.05
2.83	6.40	2.84	3.59	0.72	0.91
3.38	6.35	2.79	3.20	0.71	0.81
3.83	6.30	2.74	2.91	0.70	0.74
4.37	6.25	2.69	2.60	0.68	0.66
4.88	6.20	2.64	2.33	0.67	0.59
5.90	5.40	1.84	1.88	0.47	0.48
6.37	5.20	1.64	1.70	0.42	0.43
6.67	5.10	1.54	1.60	0.39	0.41
6.93	5.00	1.44	1.51	0.37	0.38
7.35	4.90	1.34	1.38	0.34	0.35
7.70	4.80	1.24	1.28	0.31	0.33
8.20	4.70	1.14	1.16	0.29	0.29
8.73	4.60	1.04	1.03	0.26	0.26
9.62	4.50	0.94	0.86	0.24	0.22
10.72	4.40	0.84	0.68	0.21	0.17
11.83	4.30	0.74	0.54	0.19	0.14
13.47	4.20	0.64	0.38	0.16	0.10
16.02	4.10	0.54	0.22	0.14	0.06
19.62	4.00	0.44	0.10	0.11	0.03
22.30	3.80	0.24	0.06	0.06	0.01
24.32	3.70	0.14	0.04	0.04	0.01
30.42	3.60	0.04	0.01	0.01	0.00

	Variable Head Model		Basic Time Lag Model	
Regression "m" - value:	0.809576424		0.809576424	
Regression "b" - value:	6.534743879		1.658564436	
H1(ft)	2.64		Basic time lag "T" (min):	4.71
H2 (ft)	0.94		Basic time lag "T" (sec):	282.40
t2 (min)	9.62			
t1 (min)	4.88			
Hole diameter (D) (cm):	10.16			
Well diameter (d) (cm):	5.08			
Screen length (L) (cm):	118.87			
m - value = (Kh/Kv)^1/2:	1.73			
	Kh=d^2*ln(2mL/D)*ln(H1/H2)/8*L*(t2-t1)		Kh=d^2*ln(2mL/D)/8*L*T	
Kh=	3.65E-04	cm/sec	3.56E-04	cm/sec
Kh=	1.04	ft/day	1.01	ft/day


MW-2 RH Test 2 - Sol 1
10.00
1.00
0.10
0.01
Residual Head (ft)
0.00
20.00
40.00
Time (min)
Residual Head (ft)
Regression Line


MW-2 RH Test 2 - Sol 1
10.00
1.00
0.10
0.01
Head Ratio (dimensionless)
0.00
20.00
40.00
Time (min)
Head Ratio (H/Ho)
Regression Line

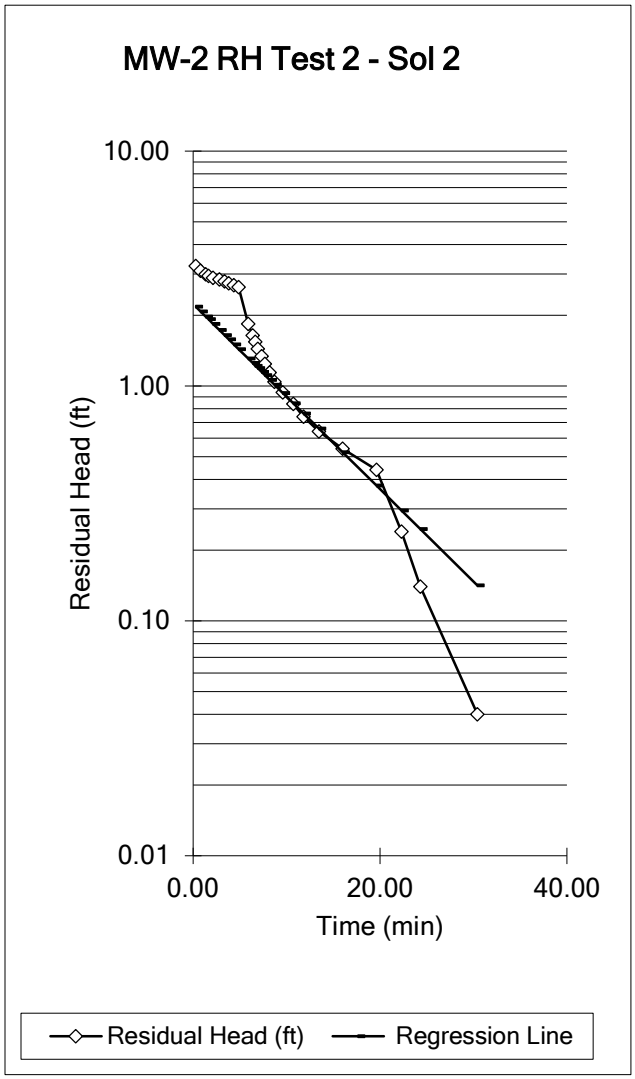
Permeability Test Analysis Well/Boring #: MW-2 RH Test 2 - Sol 2

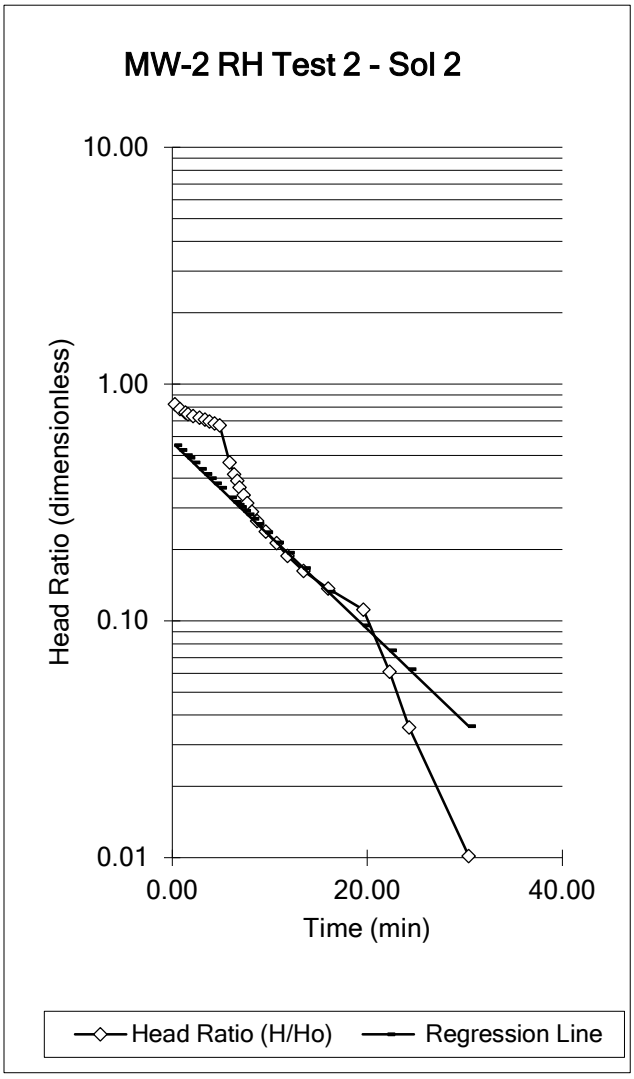
Type of test: Rising Head - Hand Logged

Static Head : 3.56 (ft TOC)
Head @ T(0): 7.50 (ft TOC)
Initial Residual Head: 3.94 (ft TOC)

Elapsed Time (min)	Water Level (ft TOC)	Residual Head (ft)	Variable Head Regression Line	Head Ratio (H/Ho)	Basic Time Lag Regression Line
0.30	6.80	3.24	2.18	0.82	0.55
0.82	6.65	3.09	2.07	0.78	0.53
1.37	6.55	2.99	1.97	0.76	0.50
1.65	6.50	2.94	1.92	0.75	0.49
2.15	6.45	2.89	1.84	0.73	0.47
2.83	6.40	2.84	1.73	0.72	0.44
3.38	6.35	2.79	1.64	0.71	0.42
3.83	6.30	2.74	1.58	0.70	0.40
4.37	6.25	2.69	1.50	0.68	0.38
4.88	6.20	2.64	1.44	0.67	0.36
5.90	5.40	1.84	1.31	0.47	0.33
6.37	5.20	1.64	1.25	0.42	0.32
6.67	5.10	1.54	1.22	0.39	0.31
6.93	5.00	1.44	1.19	0.37	0.30
7.35	4.90	1.34	1.15	0.34	0.29
7.70	4.80	1.24	1.11	0.31	0.28
8.20	4.70	1.14	1.06	0.29	0.27
8.73	4.60	1.04	1.01	0.26	0.26
9.62	4.50	0.94	0.93	0.24	0.24
10.72	4.40	0.84	0.85	0.21	0.21
11.83	4.30	0.74	0.76	0.19	0.19
13.47	4.20	0.64	0.66	0.16	0.17
16.02	4.10	0.54	0.52	0.14	0.13
19.62	4.00	0.44	0.38	0.11	0.10
22.30	3.80	0.24	0.30	0.06	0.08
24.32	3.70	0.14	0.25	0.04	0.06
30.42	3.60	0.04	0.14	0.01	0.04

	Variable Head Model	Basic Time Lag Model	
Regression "m" - value:	0.913263519	0.913263519	
Regression "b" - value:	2.235189228	0.567306911	
H1(ft)	1.04	Basic time lag "T" (min):	10.96
H2 (ft)	0.54	Basic time lag "T" (sec):	657.50
t2 (min)	16.02		
t1 (min)	8.73		
Hole diameter (D) (cm):	10.16		
Well diameter (d) (cm):	5.08		
Screen length (L) (cm):	118.87		
m - value = (Kh/Kv)^1/2:	1.73		
	Kh=d^2*ln(2mL/D)*ln(H1/H2)/8*L*(t2-t1)	Kh=d^2*ln(2mL/D)/8*L*T	
Kh=	1.50E-04 cm/sec	1.53E-04 cm/sec	
Kh=	0.429 ft/day	0.435 ft/day	


MW-2 RH Test 2 - Sol 2
10.00
1.00
0.10
0.01
Residual Head (ft)
0.00
20.00
40.00
Time (min)
Residual Head (ft)
Regression Line


MW-2 RH Test 2 - Sol 2
10.00
1.00
0.10
0.01
Head Ratio (dimensionless)
0.00
20.00
40.00
Time (min)
Head Ratio (H/Ho)
Regression Line

Belmont HMC

3/11/2020

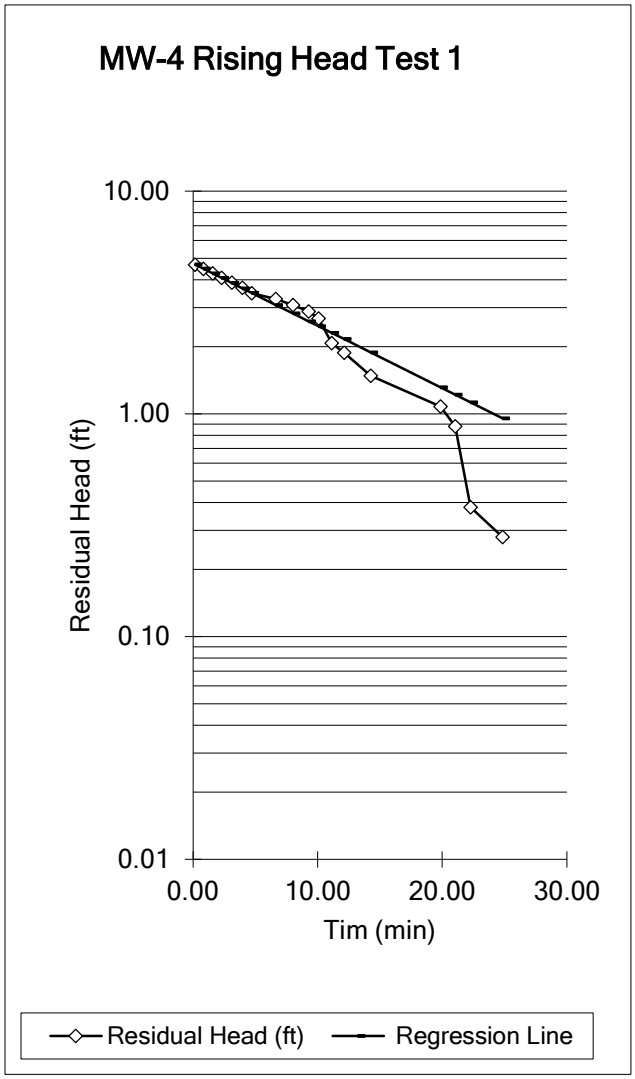
Permeability Test Analysis — Well/Boring #: MW-4 Rising Head Test 1

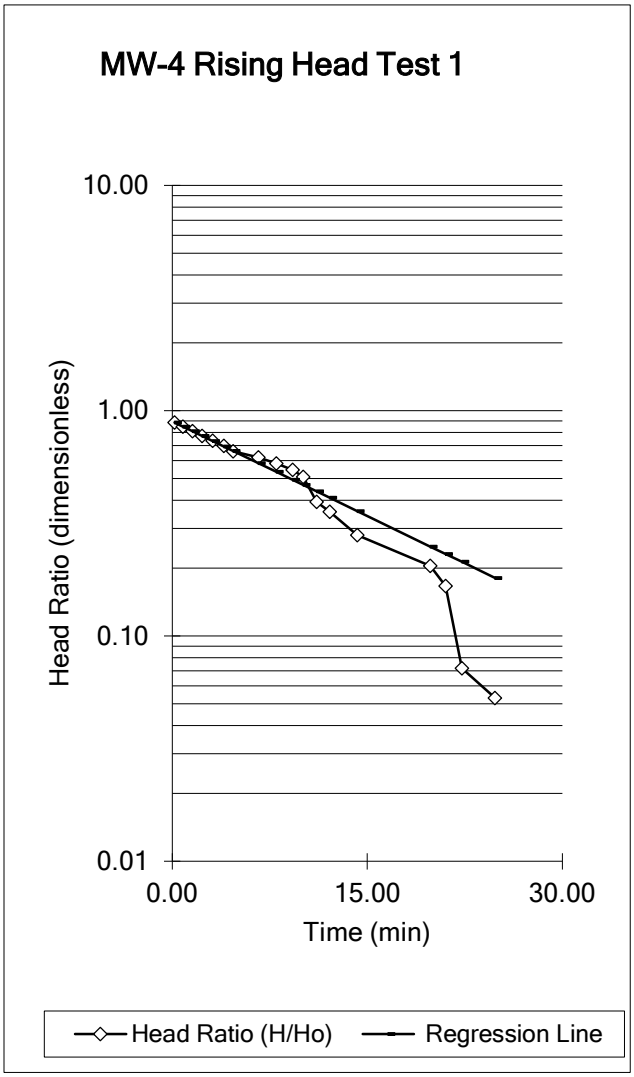
Type of test: Rising Head - Hand Logged

Static Head :	11.92	(ft TOC)
Head @ T(0):	17.20	(ft TOC)
Initial Residual Head:	5.28	(ft TOC)

Elapsed Time (min)	Water Level (ft TOC)	Residual Head (ft)	Variable Head Regression Line	Head Ratio (H/Ho)	Basic Time Lag Regression Line
0.18	16.60	4.68	4.68	0.89	0.89
0.83	16.40	4.48	4.49	0.85	0.85
1.58	16.20	4.28	4.28	0.81	0.81
2.30	16.00	4.08	4.08	0.77	0.77
3.13	15.80	3.88	3.87	0.73	0.73
3.98	15.60	3.68	3.66	0.70	0.69
4.70	15.40	3.48	3.50	0.66	0.66
6.65	15.20	3.28	3.08	0.62	0.58
8.02	15.00	3.08	2.82	0.58	0.53
9.28	14.80	2.88	2.60	0.55	0.49
10.08	14.60	2.68	2.47	0.51	0.47
11.12	14.00	2.08	2.31	0.39	0.44
12.12	13.80	1.88	2.17	0.36	0.41
14.25	13.40	1.48	1.89	0.28	0.36
19.85	13.00	1.08	1.32	0.20	0.25
21.03	12.80	0.88	1.22	0.17	0.23
22.28	12.30	0.38	1.13	0.07	0.21
24.83	12.20	0.28	0.96	0.05	0.18

	Variable Head Model	Basic Time Lag Model	
Regression "m" - value:	0.937574164	0.937574164	
Regression "b" - value:	4.735237786	0.896825338	
H1(ft)	4.68	Basic time lag "T" (min):	15.42
H2 (ft)	3.48	Basic time lag "T" (sec):	925.47
t2 (min)	4.70		
t1 (min)	0.18		
Hole diameter (D) (cm):	10.80		
Well diameter (d) (cm):	5.08		
Screen length (L) (cm):	152.40		
m - value = (Kh/Kv)^1/2:	1.73		
	Kh=d^2*ln(2mL/D)*ln(H1/H2)/8*L*(t2-t1)	Kh=d^2*ln(2mL/D)/8*L*T	
Kh=	8.99E-05 cm/sec	8.89E-05 cm/sec	
Kh=	0.26 ft/day	0.25 ft/day	


MW-4 Rising Head Test 1
10.00
1.00
0.10
0.01
Residual Head (ft)
0.00
10.00
20.00
30.00
Tim (min)
Residual Head (ft)
Regression Line


MW-4 Rising Head Test 1
10.00
1.00
0.10
0.01
Head Ratio (dimensionless)
0.00
15.00
30.00
Time (min)
Head Ratio (H/Ho)
Regression Line

Belmont HMC

3/11/2020

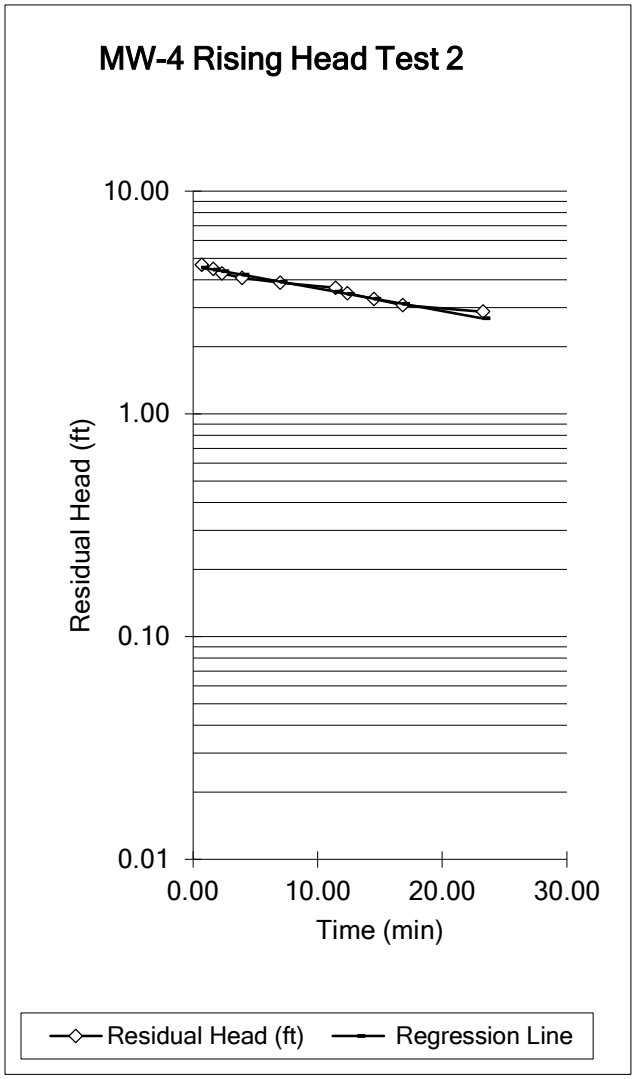
Permeability Test Analysis — Well/Boring #: MW-4 Rising Head Test 2

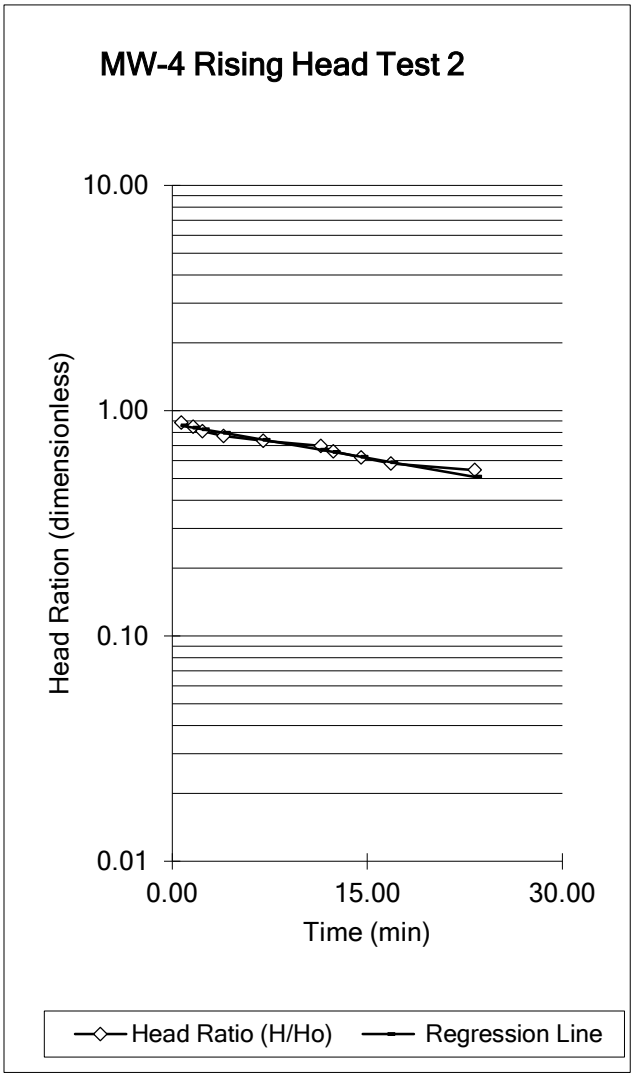
Type of test: Rising Head - Hand Logged

Static Head :	11.92	(ft TOC)
Head @ T(0):	17.20	(ft TOC)
Initial Residual Head:	5.28	(ft TOC)

Elapsed Time (min)	Water Level (ft TOC)	Residual Head (ft)	Variable Head Regression Line	Head Ratio (H/Ho)	Basic Time Lag Regression Line
0.72	16.60	4.68	4.54	0.89	0.86
1.62	16.40	4.48	4.45	0.85	0.84
2.33	16.20	4.28	4.37	0.81	0.83
3.95	16.00	4.08	4.21	0.77	0.80
7.00	15.80	3.88	3.92	0.73	0.74
11.43	15.60	3.68	3.54	0.70	0.67
12.40	15.40	3.48	3.46	0.66	0.66
14.53	15.20	3.28	3.29	0.62	0.62
16.82	15.00	3.08	3.12	0.58	0.59
23.27	14.80	2.88	2.69	0.55	0.51

	Variable Head Model	Basic Time Lag Model	
Regression "m" - value:	0.977031642	0.977031642	
Regression "b" - value:	4.616458268	0.874329217	
H1(ft)	4.68	Basic time lag "T" (min):	42.79
H2 (ft)	3.08	Basic time lag "T" (sec):	2567.33
t2 (min)	16.82		
t1 (min)	0.72		
Hole diameter (D) (cm):	10.80		
Well diameter (d) (cm):	5.08		
Screen length (L) (cm):	152.40		
m - value = (Kh/Kv)^1/2:	1.73		
	Kh=d^2*ln(2mL/D)*ln(H1/H2)/8*L*(t2-t1)	Kh=d^2*ln(2mL/D)/8*L*T	
Kh=	3.56E-05 cm/sec	3.21E-05 cm/sec	
Kh=	0.10 ft/day	0.09 ft/day	


MW-4 Rising Head Test 2
10.00
1.00
0.10
0.01
Residual Head (ft)
0.00
10.00
20.00
30.00
Time (min)
Residual Head (ft)
Regression Line


MW-4 Rising Head Test 2
10.00
1.00
0.10
0.01
Head Ration (dimensionless)
0.00
15.00
30.00
Time (min)
Head Ratio (H/Ho)
Regression Line

Belmont Highland Meadow Cemetary

Date: 3/11/20

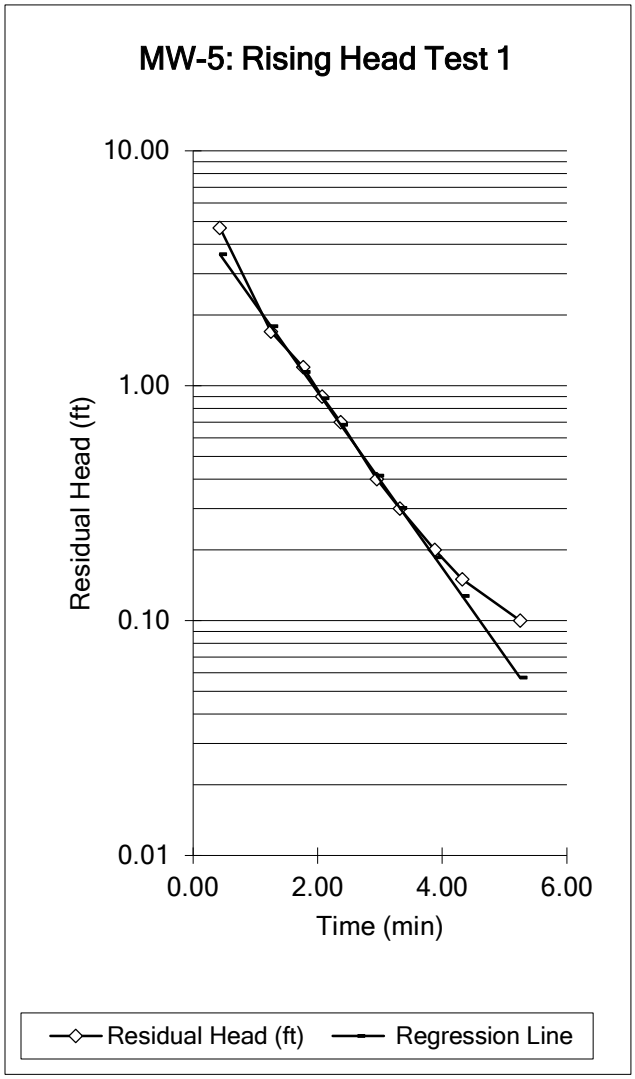
Permeability Test Analysis — Well/Boring #: MW-5: Rising Head Test 1

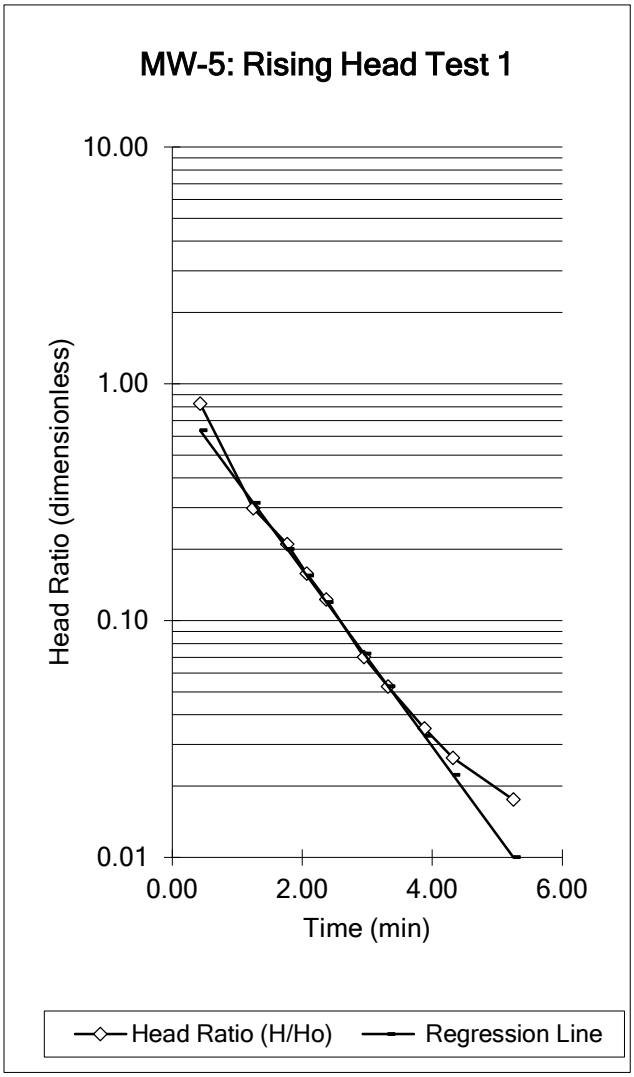
Type of test: Rising Head - Hand Logged

Static Head :	10.30	(ft TOC)
Head @ T(0):	16.00	(ft TOC)
Initial Residual Head:	5.70	(ft TOC)

Elapsed Time (min)	Water Level (ft TOC)	Residual Head (ft)	Variable Head Regression Line	Head Ratio (H/Ho)	Basic Time Lag Regression Line
0.43	15.00	4.70	3.63	0.82	0.64
1.25	12.00	1.70	1.79	0.30	0.31
1.77	11.50	1.20	1.14	0.21	0.20
2.07	11.20	0.90	0.88	0.16	0.16
2.37	11.00	0.70	0.68	0.12	0.12
2.95	10.70	0.40	0.41	0.07	0.07
3.32	10.60	0.30	0.30	0.05	0.05
3.88	10.50	0.20	0.19	0.04	0.03
4.32	10.45	0.15	0.13	0.03	0.02
5.25	10.40	0.10	0.06	0.02	0.01

	Variable Head Model	Basic Time Lag Model	
Regression "m" - value:	0.422703055	0.422703055	
Regression "b" - value:	5.253487261	0.921664432	
H1(ft)	1.70	Basic time lag "T" (min):	1.15
H2 (ft)	0.30	Basic time lag "T" (sec):	69.28
t2 (min)	3.32		
t1 (min)	1.25		
Hole diameter (D) (cm):	10.16		
Well diameter (d) (cm):	5.08		
Screen length (L) (cm):	210.31		
m - value = (Kh/Kv)^1/2:	1.73		
	Kh=d^2*ln(2mL/D)*ln(H1/H2)/8*L*(t2-t1)	Kh=d^2*ln(2mL/D)/8*L*T	
Kh=	9.15E-04 cm/sec	9.46E-04 cm/sec	
Kh=	2.61 ft/day	2.69 ft/day	


MW-5: Rising Head Test 1
10.00
1.00
0.10
0.01
Residual Head (ft)
0.00
2.00
4.00
6.00
Time (min)
Residual Head (ft)
Regression Line


MW-5: Rising Head Test 1
10.00
1.00
0.10
0.01
Head Ratio (dimensionless)
0.00
2.00
4.00
6.00
Time (min)
Head Ratio (H/Ho)
Regression Line

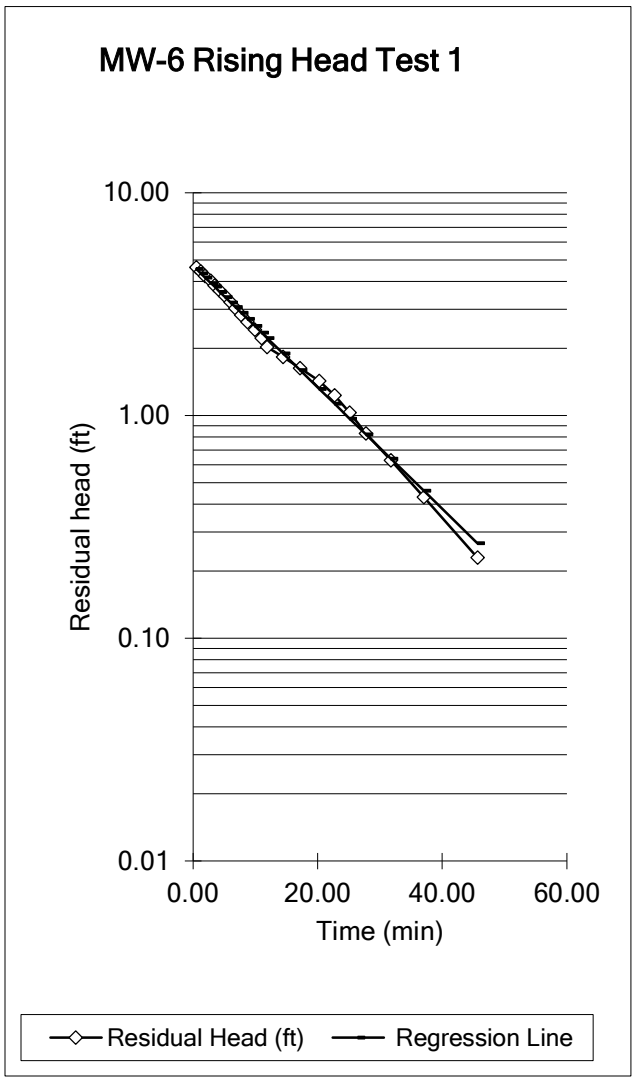
Permeability Test Analysis Well/Boring #: MW-6 Rising Head Test 1

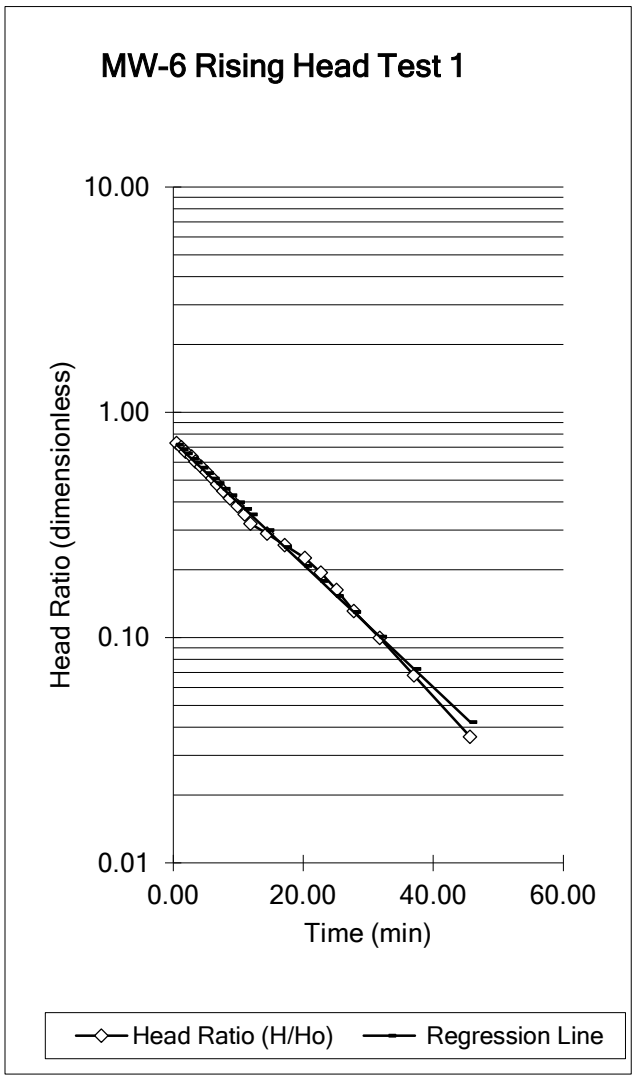
Type of test: Rising Head - Hand Logged

Static Head :	13.17	(ft TOC)
Head @ T(0):	19.50	(ft TOC)
Initial Residual Head:	6.33	(ft TOC)

Elapsed Time (min)	Water Level (ft TOC)	Residual Head (ft)	Variable Head Regression Line	Head Ratio (H/Ho)	Basic Time Lag Regression Line
0.53	17.80	4.63	4.55	0.73	0.72
1.28	17.60	4.43	4.34	0.70	0.69
1.93	17.40	4.23	4.17	0.67	0.66
2.83	17.20	4.03	3.94	0.64	0.62
3.45	17.00	3.83	3.79	0.61	0.60
4.30	16.80	3.63	3.59	0.57	0.57
5.15	16.60	3.43	3.40	0.54	0.54
6.06	16.40	3.23	3.21	0.51	0.51
6.80	16.20	3.03	3.07	0.48	0.48
7.73	16.00	2.83	2.89	0.45	0.46
8.75	15.80	2.63	2.71	0.42	0.43
9.92	15.60	2.43	2.52	0.38	0.40
11.00	15.40	2.23	2.36	0.35	0.37
11.90	15.20	2.03	2.23	0.32	0.35
14.45	15.00	1.83	1.90	0.29	0.30
17.18	14.80	1.63	1.60	0.26	0.25
20.28	14.60	1.43	1.32	0.23	0.21
22.72	14.40	1.23	1.13	0.19	0.18
25.15	14.20	1.03	0.97	0.16	0.15
27.78	14.00	0.83	0.82	0.13	0.13
31.77	13.80	0.63	0.64	0.10	0.10
37.03	13.60	0.43	0.46	0.07	0.07
45.67	13.40	0.23	0.27	0.04	0.04

	Variable Head Model	Basic Time Lag Model	
Regression "m" - value:	0.939115319	0.939115319	
Regression "b" - value:	4.704006673	0.743129016	
H1(ft)	4.63	Basic time lag "T" (min):	15.83
H2 (ft)	0.43	Basic time lag "T" (sec):	949.67
t2 (min)	37.03		
t1 (min)	0.53		
Hole diameter (D) (cm):	10.80		
Well diameter (d) (cm):	5.08		
Screen length (L) (cm):	176.78		
m - value = (Kh/Kv)^1/2:	1.73		
	Kh=d^2*ln(2mL/D)*ln(H1/H2)/8*L*(t2-t1)	Kh=d^2*ln(2mL/D)/8*L*T	
Kh=	7.99E-05 cm/sec	7.76E-05 cm/sec	
Kh=	0.23 ft/day	0.22 ft/day	


MW-6 Rising Head Test 1
10.00
1.00
0.10
0.01
Residual head (ft)
0.00
20.00
40.00
60.00
Time (min)
Residual Head (ft)
Regression Line


MW-6 Rising Head Test 1
10.00
1.00
0.10
0.01
Head Ratio (dimensionless)
0.00
20.00
40.00
60.00
Time (min)
Head Ratio (H/Ho)
Regression Line

Appendix C

DOUBLE RING INFILTROMETER TEST RESULTS

DOUBLE RING INFILTROMETOR TEST SHEET

Project Identification: Highland Meadow Cemetery
Test Location: DRI-1 (20-inches)

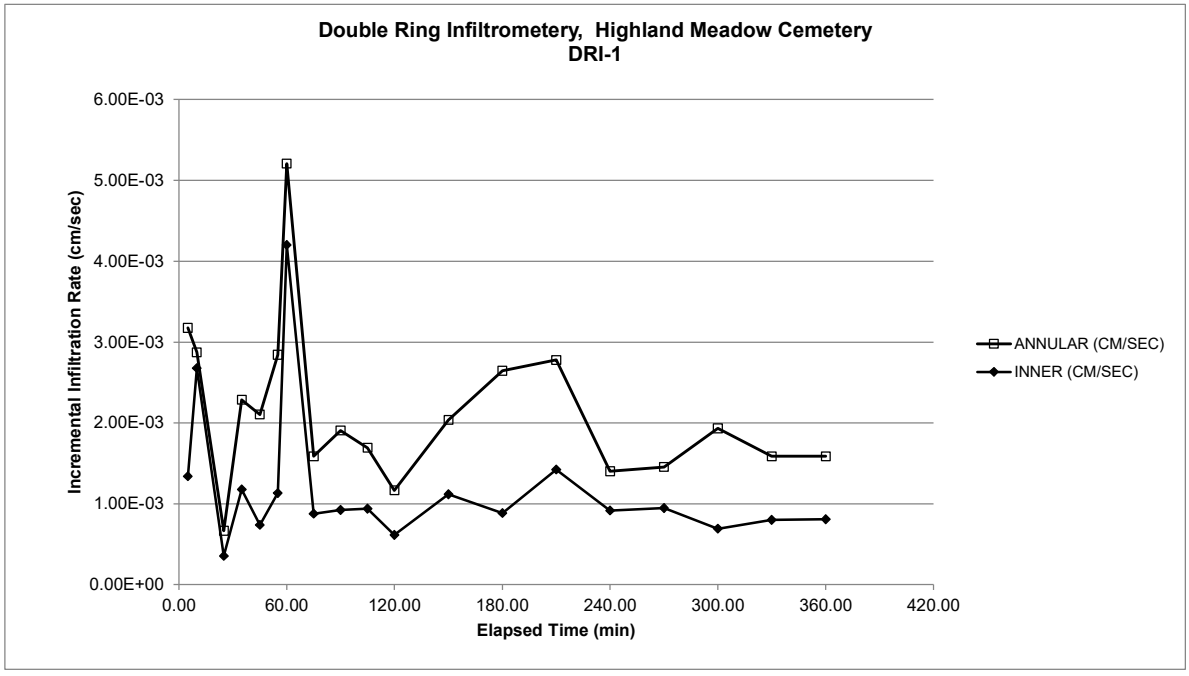
Infiltrometer Constants	Area ($cm^{2)}$	Depth of Liquid (cm)
Inner Ring:	722	15.2
Annular Space:	2100	15.2

Liquid Level Maintained With	
Float Valve	x
Flow Valve	
Mariotte Tube	

Tested By: BPB

Penetration of Rings: (inches)		
Inner:	6.5	
Outer:	6.5	

Trial Number	Start/End	Date	Time	Elapsed Time (min)	Flow Readings: Inner Reading	Inner Flow (ml)	Annular Reading	Annular Flow (ml)	Liquid Temperature	Incremental Infiltration Rate: Annular (cm/sec)	Inner (cm/sec)	Comments
	S		1015	5		290		2000		3.17E-03	1.34E-03	
1	E	10/15/2020	1020	5								
	S		1020	5		580		1810		2.87E-03	2.68E-03	
2	E	10/15/2020	1025	10								
	S		1025	15		230		1260		6.67E-04	3.54E-04	
3	E	10/15/2020	1040	25								
	S		1040	10		510		2880		2.29E-03	1.18E-03	
4	E	10/15/2020	1050	35								
	S		1050	10		320		2650		2.10E-03	7.39E-04	
5	E	10/15/2020	1100	45								
	S		1100	10		490		3580		2.84E-03	1.13E-03	
6	E	10/15/2020	1110	55								
	S		1110	5		910		3280		5.21E-03	4.20E-03	
7	E	10/15/2020	1115	60								
	S		1115	15		570		3000		1.59E-03	8.77E-04	
8	E	10/15/2020	1130	75								
	S		1130	15		600		3600		1.90E-03	9.23E-04	
9	E	10/15/2020	1145	90								
	S		1145	15		610		3200		1.69E-03	9.39E-04	
10	E	10/15/2020	1200	105								
	S		1200	15		400		2200		1.16E-03	6.16E-04	
11	E	10/15/2020	1215	120								
	S		1215	30		1450		7700		2.04E-03	1.12E-03	
12	E	10/15/2020	1245	150								
	S		1245	30		1150		10000		2.65E-03	8.85E-04	
13	E	10/15/2020	1315	180								
	S		1315	30		1850		10500		2.78E-03	1.42E-03	
14	E	10/15/2020	1345	210								
	S		1345	30		1190		5300		1.40E-03	9.16E-04	
15	E	10/15/2020	1415	240								
	S		1415	30		1230		5500		1.46E-03	9.46E-04	
16	E	10/15/2020	1445	270								
	S		1445	30		900		7300		1.93E-03	6.93E-04	
17	E	10/15/2020	1515	300								
	S		1515	30		1040		6000		1.59E-03	8.00E-04	
18	E	10/15/2020	1545	330								
	S		1545	30		1050		6000		1.59E-03	8.08E-04	
19	E	10/15/2020	1600	360								



DOUBLE RING INFILTROMETOR TEST SHEET

Project Identification: Highland Meadow Cemetery
Test Location: DRI-2 (Land Surface)

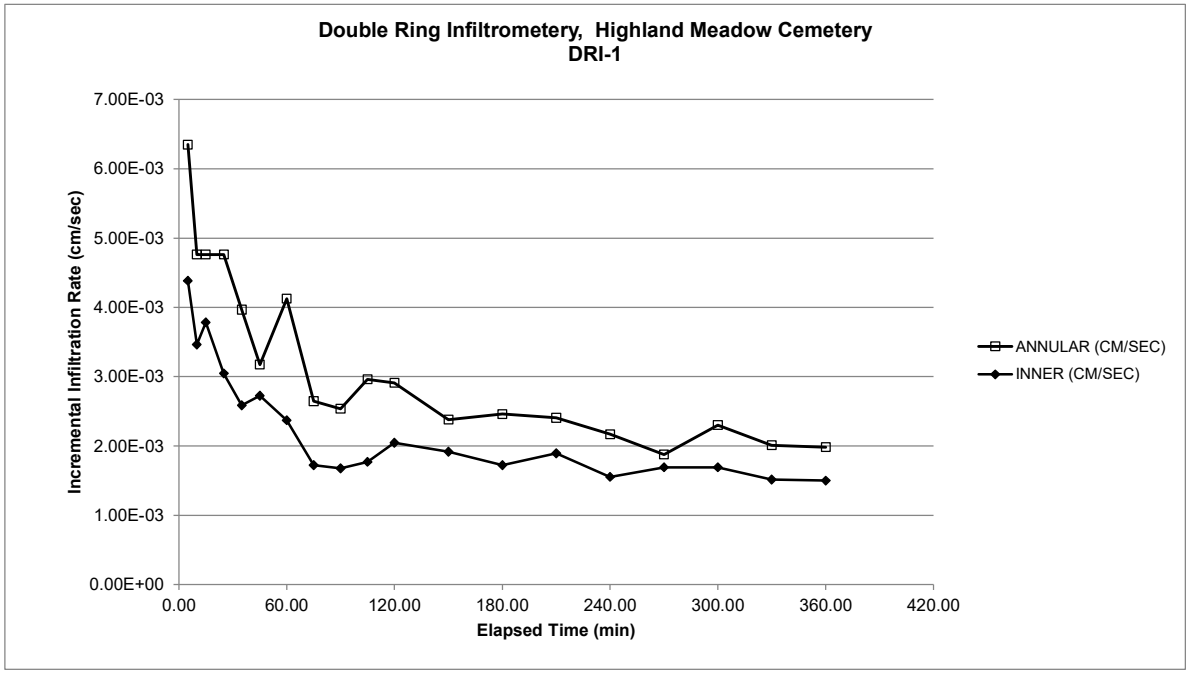
Infiltrometer Constants	Area ($cm^{2)}$	Depth of Liquid (cm)
Inner Ring:	722	15.2
Annular Space:	2100	15.2

Liquid Level Maintained With	
Float Valve	x
Flow Valve	
Mariotte Tube	

Tested By: BPB

Penetration of Rings: (inches)		
Inner:	6.5	
Outer:	6.5	

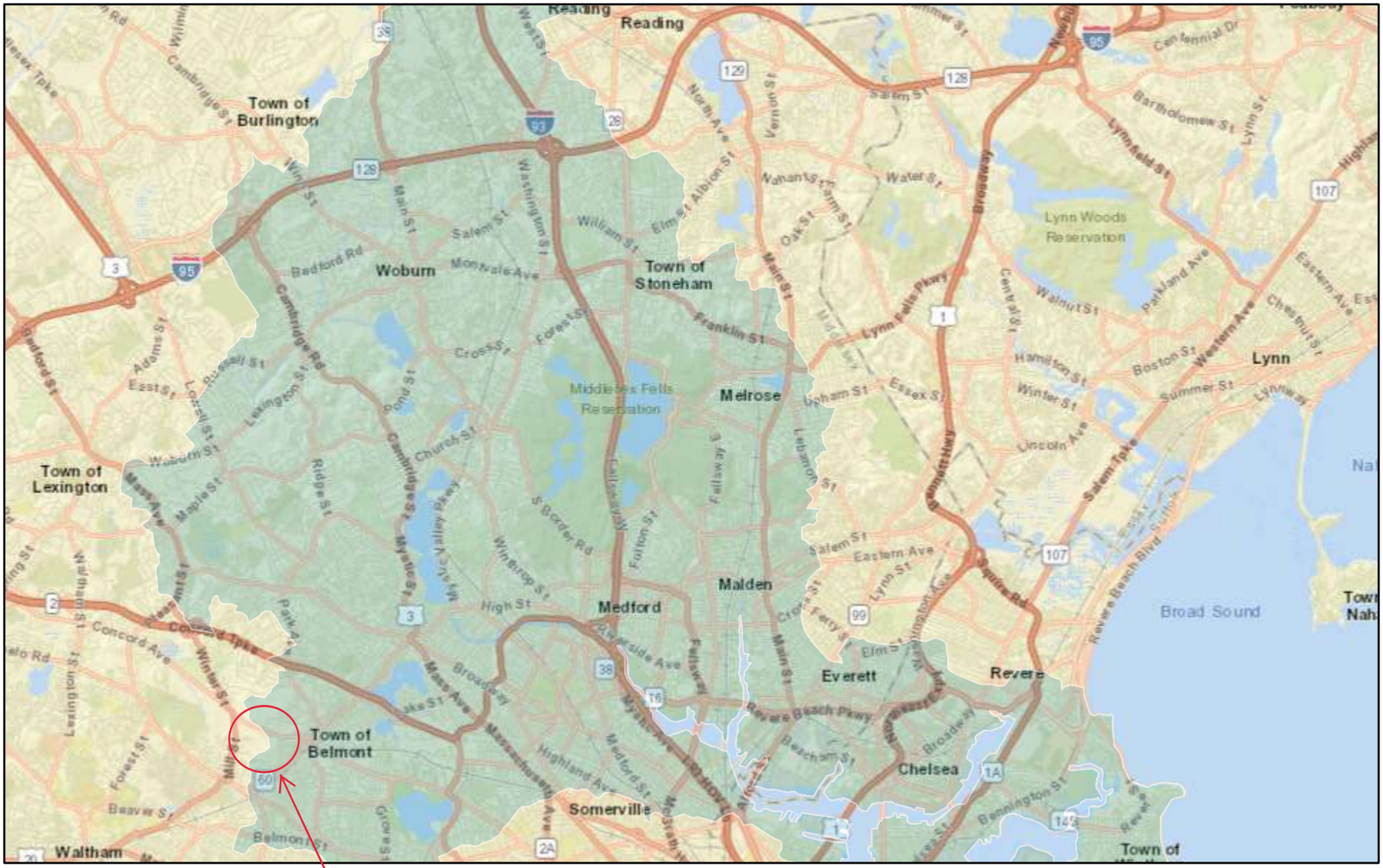
Trial Number	Start/End	Date	Time	Elapsed Time (min)	Flow Readings: Inner Reading	Inner Flow (ml)	Annular Reading	Annular Flow (ml)	Liquid Temperature	Incremental Infiltration Rate: Annular (cm/sec)	Inner (cm/sec)	Comments
	S		1055	5		950		4000		6.35E-03	4.39E-03	
1	E	10/15/2020	1100	5								
	S		1100	5		750		3000		4.76E-03	3.46E-03	
2	E	10/15/2020	1105	10								
	S		1105	5		820		3000		4.76E-03	3.79E-03	
3	E	10/15/2020	1110	15								
	S		1110	10		1320		6000		4.76E-03	3.05E-03	
4	E	10/15/2020	1120	25								
	S		1120	10		1120		5000		3.97E-03	2.59E-03	
5	E	10/15/2020	1130	35								
	S		1130	10		1180		4000		3.17E-03	2.72E-03	
6	E	10/15/2020	1140	45								
	S		1140	15		1540		7800		4.13E-03	2.37E-03	
7	E	10/15/2020	1155	60								
	S		1155	15		1120		5000		2.65E-03	1.72E-03	
8	E	10/15/2020	1210	75								
	S		1210	15		1090		4800		2.54E-03	1.68E-03	
9	E	10/15/2020	1225	90								
	S		1225	15		1150		5600		2.96E-03	1.77E-03	
10	E	10/15/2020	1240	105								
	S		1240	15		1330		5500		2.91E-03	2.05E-03	
11	E	10/15/2020	1255	120								
	S		1255	30		2490		9000		2.38E-03	1.92E-03	
12	E	10/15/2020	1325	150								
	S		1325	30		2240		9300		2.46E-03	1.72E-03	
13	E	10/15/2020	1355	180								
	S		1355	30		2460		9100		2.41E-03	1.89E-03	
14	E	10/15/2020	1425	210								
	S		1425	30		2020		8200		2.17E-03	1.55E-03	
15	E	10/15/2020	1455	240								
	S		1455	30		2200		7100		1.88E-03	1.69E-03	
16	E	10/15/2020	1525	270								
	S		1525	30		2200		8700		2.30E-03	1.69E-03	
17	E	10/15/2020	1555	300								
	S		1555	30		1970		7600		2.01E-03	1.52E-03	
18	E	10/15/2020	1625	330								
	S		1625	30		1950		7500		1.98E-03	1.50E-03	
19	E	10/15/2020	1655	360								



Appendix D

WATERSHED MAPS

Mystic River Watershed



Mystic River Watershed

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

City of Boston, Esri, HERE, Garmin, INCREMENT P, Intermap, NGA, USGS

Appendix E

HISTORICAL WATER LEVEL MEASUREMENTS

USGS MONITORING WELL (MA-XOW-14) WINCHESTER, MA

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
6/1/1940	10.00		12/28/1940	9.29
7/29/1940	11.80		6/1/1940	10.00
9/2/1940	12.66		11/30/1940	10.15
9/28/1940	12.80		7/29/1940	11.80
11/2/1940	13.27		9/2/1940	12.66
11/30/1940	10.15		9/28/1940	12.80
12/28/1940	9.29		11/2/1940	13.27
2/1/1941	9.72		2/1/1941	9.72
3/1/1941	9.94		3/1/1941	9.94
3/29/1941	10.07		3/29/1941	10.07
5/3/1941	10.24		5/3/1941	10.24
5/31/1941	11.18		5/31/1941	11.18
6/28/1941	12.06		6/28/1941	12.06
8/2/1941	13.15		8/2/1941	13.15
8/30/1941	13.77		8/30/1941	13.77
9/27/1941	14.20		9/27/1941	14.20
11/1/1941	14.78		11/1/1941	14.78
11/29/1941	14.97		11/29/1941	14.97
1/3/1942	13.38		3/31/1942	7.72
1/31/1942	9.49		1/31/1942	9.49
2/28/1942	10.20		5/2/1942	9.50
3/31/1942	7.72		12/24/1942	9.56
5/2/1942	9.50		2/28/1942	10.20
5/30/1942	10.87		5/30/1942	10.87
6/27/1942	11.65		11/28/1942	11.32
8/1/1942	12.19		6/27/1942	11.65
8/29/1942	12.74		8/1/1942	12.19
10/3/1942	13.45		8/29/1942	12.74
10/31/1942	13.58		1/3/1942	13.38
11/28/1942	11.32		10/3/1942	13.45
12/24/1942	9.56		10/31/1942	13.58
1/23/1943	10.08		5/29/1943	7.96
2/24/1943	10.44		3/29/1943	8.37
3/29/1943	8.37		4/29/1943	8.87
4/29/1943	8.87		12/28/1943	9.90
5/29/1943	7.96		1/23/1943	10.08
6/29/1943	11.19		2/24/1943	10.44
7/30/1943	12.52		11/26/1943	10.64
8/30/1943	13.26		6/29/1943	11.19
9/28/1943	13.88		7/30/1943	12.52

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
10/29/1943	14.02		8/30/1943	13.26
11/26/1943	10.64		9/28/1943	13.88
12/28/1943	9.90		10/29/1943	14.02
1/28/1944	11.42		4/28/1944	6.90
2/25/1944	11.16		11/30/1944	8.12
3/31/1944	8.84		3/31/1944	8.84
4/28/1944	6.90		12/30/1944	9.70
5/31/1944	11.00		6/30/1944	10.38
6/30/1944	10.38		5/31/1944	11.00
7/31/1944	12.24		2/25/1944	11.16
8/31/1944	13.33		1/28/1944	11.42
9/29/1944	12.16		10/31/1944	11.85
10/31/1944	11.85		9/29/1944	12.16
11/30/1944	8.12		7/31/1944	12.24
12/30/1944	9.70		8/31/1944	13.33
1/27/1945	10.71		3/1/1945	7.92
3/1/1945	7.92		12/28/1945	8.36
3/30/1945	8.52		3/30/1945	8.52
5/1/1945	10.16		6/28/1945	8.62
5/28/1945	9.33		11/28/1945	9.07
6/28/1945	8.62		5/28/1945	9.33
7/31/1945	11.62		5/1/1945	10.16
8/30/1945	11.30		1/27/1945	10.71
9/28/1945	12.65		8/30/1945	11.30
10/30/1945	13.29		7/31/1945	11.62
11/28/1945	9.07		9/28/1945	12.65
12/28/1945	8.36		10/30/1945	13.29
1/30/1946	9.66		8/31/1946	8.03
2/27/1946	10.47		5/29/1946	8.95
3/28/1946	9.75		1/30/1946	9.66
4/30/1946	10.62		3/28/1946	9.75
5/29/1946	8.95		2/27/1946	10.47
6/28/1946	10.74		4/30/1946	10.62
7/30/1946	12.47		12/27/1946	10.69
8/31/1946	8.03		6/28/1946	10.74
9/28/1946	11.16		9/28/1946	11.16
10/31/1946	12.39		10/31/1946	12.39
11/30/1946	12.57		7/30/1946	12.47
12/27/1946	10.69		11/30/1946	12.57

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
1/29/1947	8.74		1/29/1947	8.74
2/28/1947	10.83		11/29/1947	9.05
3/31/1947	10.14		4/30/1947	9.12
4/30/1947	9.12		5/29/1947	10.06
5/29/1947	10.06		12/30/1947	10.13
6/28/1947	11.64		3/31/1947	10.14
7/31/1947	12.07		2/28/1947	10.83
8/29/1947	12.12		6/28/1947	11.64
9/30/1947	12.62		7/31/1947	12.07
10/30/1947	13.43		8/29/1947	12.12
11/29/1947	9.05		9/30/1947	12.62
12/30/1947	10.13		10/30/1947	13.43
1/30/1948	9.86		2/28/1948	6.38
2/28/1948	6.38		4/3/1948	8.50
4/3/1948	8.50		6/28/1948	9.52
5/1/1948	9.90		6/1/1948	9.55
6/1/1948	9.55		1/30/1948	9.86
6/28/1948	9.52		5/1/1948	9.90
7/29/1948	10.85		12/30/1948	10.34
8/30/1948	12.50		11/27/1948	10.72
10/1/1948	13.19		7/29/1948	10.85
10/30/1948	13.78		8/30/1948	12.50
11/27/1948	10.72		10/1/1948	13.19
12/30/1948	10.34		10/30/1948	13.78
1/31/1949	9.43		2/25/1949	6.86
2/25/1949	6.86		4/30/1949	9.05
3/30/1949	9.16		3/30/1949	9.16
4/30/1949	9.05		1/31/1949	9.43
5/29/1949	10.77		12/30/1949	10.38
6/29/1949	11.82		5/29/1949	10.77
8/1/1949	13.00		6/29/1949	11.82
8/30/1949	13.71		12/2/1949	12.12
10/1/1949	13.49		8/1/1949	13.00
10/29/1949	13.35		10/29/1949	13.35
12/2/1949	12.12		10/1/1949	13.49
12/30/1949	10.38		8/30/1949	13.71
1/30/1950	8.20		3/31/1950	7.29
2/25/1950	8.50		1/30/1950	8.20
3/31/1950	7.29		2/25/1950	8.50
4/29/1950	10.02		12/2/1950	9.42

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
5/29/1950	11.08		12/29/1950	9.44
7/1/1950	12.13		4/29/1950	10.02
7/29/1950	13.22		5/29/1950	11.08
9/2/1950	13.74		7/1/1950	12.13
9/30/1950	13.92		7/29/1950	13.22
10/29/1950	13.75		9/2/1950	13.74
12/2/1950	9.42		10/29/1950	13.75
12/29/1950	9.44		9/30/1950	13.92
1/30/1951	8.36		3/30/1951	7.51
2/27/1951	7.84		2/27/1951	7.84
3/30/1951	7.51		12/31/1951	8.29
4/28/1951	9.46		1/30/1951	8.36
5/31/1951	9.07		12/1/1951	8.54
6/30/1951	9.82		5/31/1951	9.07
7/28/1951	11.66		4/28/1951	9.46
9/1/1951	11.90		6/30/1951	9.82
9/29/1951	12.82		10/27/1951	11.64
10/27/1951	11.64		7/28/1951	11.66
12/1/1951	8.54		9/1/1951	11.90
12/31/1951	8.29		9/29/1951	12.82
2/2/1952	7.50		2/2/1952	7.50
3/1/1952	9.74		3/29/1952	7.66
3/29/1952	7.66		5/3/1952	7.90
5/3/1952	7.90		5/31/1952	8.86
5/31/1952	8.86		3/1/1952	9.74
6/29/1952	11.48		6/29/1952	11.48
8/2/1952	13.02		12/30/1952	12.41
8/31/1952	13.16		8/2/1952	13.02
9/27/1952	13.67		8/31/1952	13.16
11/1/1952	14.22		9/27/1952	13.67
11/28/1952	14.45		11/1/1952	14.22
12/30/1952	12.41		11/28/1952	14.45
1/30/1953	6.81		3/28/1953	6.45
2/28/1953	8.00		1/30/1953	6.81
3/28/1953	6.45		11/28/1953	7.49
5/2/1953	8.05		2/28/1953	8.00
5/29/1953	9.90		5/2/1953	8.05
7/4/1953	12.00		12/30/1953	8.69
7/31/1953	12.61		5/29/1953	9.90
8/31/1953	13.27		7/4/1953	12.00

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
10/3/1953	14.00		7/31/1953	12.61
10/31/1953	14.32		8/31/1953	13.27
11/28/1953	7.49		10/3/1953	14.00
12/30/1953	8.69		10/31/1953	14.32
1/30/1954	9.48		11/27/1954	7.68
2/27/1954	7.69		2/27/1954	7.69
3/27/1954	8.21		12/30/1954	8.08
5/1/1954	8.53		3/27/1954	8.21
6/2/1954	8.78		9/26/1954	8.27
6/26/1954	11.24		5/1/1954	8.53
7/31/1954	12.69		6/2/1954	8.78
8/28/1954	12.25		1/30/1954	9.48
9/26/1954	8.27		10/30/1954	11.10
10/30/1954	11.10		6/26/1954	11.24
11/27/1954	7.68		8/28/1954	12.25
12/30/1954	8.08		7/31/1954	12.69
2/1/1955	10.86		8/30/1955	7.33
2/27/1955	9.36		3/31/1955	7.68
3/31/1955	7.68		10/31/1955	8.52
4/29/1955	9.61		2/27/1955	9.36
6/2/1955	11.47		12/1/1955	9.58
6/30/1955	11.43		4/29/1955	9.61
7/28/1955	12.27		2/1/1955	10.86
8/30/1955	7.33		12/28/1955	10.91
9/29/1955	11.32		9/29/1955	11.32
10/31/1955	8.52		6/30/1955	11.43
12/1/1955	9.58		6/2/1955	11.47
12/28/1955	10.91		7/28/1955	12.27
1/30/1956	8.94		12/29/1956	7.46
2/27/1956	8.67		3/27/1956	8.34
3/27/1956	8.34		2/27/1956	8.67
4/26/1956	8.80		4/26/1956	8.80
5/28/1956	11.06		1/30/1956	8.94
6/27/1956	11.98		5/28/1956	11.06
7/31/1956	13.15		11/29/1956	11.43
8/30/1956	14.05		6/27/1956	11.98
9/29/1956	14.36		7/31/1956	13.15
10/30/1956	13.65		10/30/1956	13.65
11/29/1956	11.43		8/30/1956	14.05
12/29/1956	7.46		9/29/1956	14.36

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
1/28/1957	6.74		1/28/1957	6.74
2/26/1957	10.02		12/30/1957	8.26
3/30/1957	8.56		3/30/1957	8.56
4/30/1957	9.92		5/31/1957	9.36
5/31/1957	9.36		4/30/1957	9.92
6/30/1957	12.33		2/26/1957	10.02
7/29/1957	13.63		6/30/1957	12.33
8/30/1957	15.17		11/29/1957	13.31
9/28/1957	15.39		7/29/1957	13.63
10/31/1957	15.60		8/30/1957	15.17
11/29/1957	13.31		9/28/1957	15.39
12/30/1957	8.26		10/31/1957	15.60
1/31/1958	4.58		1/31/1958	4.58
2/27/1958	9.72		3/28/1958	5.28
3/28/1958	5.28		4/30/1958	7.77
4/30/1958	7.77		11/30/1958	9.48
5/29/1958	9.95		2/27/1958	9.72
6/30/1958	11.59		10/30/1958	9.79
7/31/1958	12.18		5/29/1958	9.95
8/28/1958	12.76		12/30/1958	10.39
9/30/1958	11.48		9/30/1958	11.48
10/30/1958	9.79		6/30/1958	11.59
11/30/1958	9.48		7/31/1958	12.18
12/30/1958	10.39		8/28/1958	12.76
1/29/1959	10.96		6/29/1959	8.28
2/26/1959	11.00		7/30/1959	8.45
3/31/1959	9.02		4/30/1959	8.61
4/30/1959	8.61		3/31/1959	9.02
5/29/1959	10.93		11/30/1959	9.31
6/29/1959	8.28		12/31/1959	9.35
7/30/1959	8.45		5/29/1959	10.93
8/31/1959	12.22		1/29/1959	10.96
9/30/1959	12.87		2/26/1959	11.00
10/30/1959	12.66		8/31/1959	12.22
11/30/1959	9.31		10/30/1959	12.66
12/31/1959	9.35		9/30/1959	12.87
2/1/1960	9.78		2/29/1960	6.87
2/29/1960	6.87		3/31/1960	8.09
3/31/1960	8.09		12/29/1960	8.44

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
4/29/1960	9.80		2/1/1960	9.78
5/31/1960	10.59		4/29/1960	9.80
6/30/1960	11.45		11/30/1960	10.41
7/29/1960	12.57		5/31/1960	10.59
8/31/1960	13.26		6/30/1960	11.45
9/30/1960	11.63		9/30/1960	11.63
10/31/1960	11.67		10/31/1960	11.67
11/30/1960	10.41		7/29/1960	12.57
12/29/1960	8.44		8/31/1960	13.26
2/1/1961	10.21		3/1/1961	5.88
3/1/1961	5.88		3/31/1961	7.15
3/31/1961	7.15		11/30/1961	7.35
4/28/1961	7.92		9/29/1961	7.51
5/31/1961	8.77		4/28/1961	7.92
6/29/1961	11.54		5/31/1961	8.77
7/31/1961	12.58		12/29/1961	9.21
9/1/1961	12.65		10/30/1961	10.19
9/29/1961	7.51		2/1/1961	10.21
10/30/1961	10.19		6/29/1961	11.54
11/30/1961	7.35		7/31/1961	12.58
12/29/1961	9.21		9/1/1961	12.65
1/31/1962	9.05		11/28/1962	7.80
2/28/1962	10.93		3/30/1962	8.02
3/30/1962	8.02		10/26/1962	8.53
4/27/1962	9.02		4/27/1962	9.02
5/28/1962	10.68		1/31/1962	9.05
6/27/1962	11.49		12/26/1962	9.45
7/30/1962	12.82		5/28/1962	10.68
8/28/1962	13.67		2/28/1962	10.93
9/27/1962	13.93		6/27/1962	11.49
10/26/1962	8.53		7/30/1962	12.82
11/28/1962	7.80		8/28/1962	13.67
12/26/1962	9.45		9/27/1962	13.93
1/29/1963	10.14		3/27/1963	8.46
2/26/1963	11.02		11/27/1963	8.84
3/27/1963	8.46		12/27/1963	9.16
4/26/1963	9.97		4/26/1963	9.97
5/27/1963	10.11		5/27/1963	10.11
6/26/1963	11.46		1/29/1963	10.14
7/30/1963	12.70		2/26/1963	11.02

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
8/27/1963	13.62		6/26/1963	11.46
9/26/1963	14.22		7/30/1963	12.70
10/24/1963	14.22		8/27/1963	13.62
11/27/1963	8.84		9/26/1963	14.22
12/27/1963	9.16		10/24/1963	14.22
1/28/1964	5.88		1/28/1964	5.88
2/27/1964	9.29		4/24/1964	7.47
3/27/1964	7.54		3/27/1964	7.54
4/24/1964	7.47		2/27/1964	9.29
5/25/1964	10.90		5/25/1964	10.90
6/29/1964	12.48		12/24/1964	12.32
7/28/1964	13.06		6/29/1964	12.48
8/31/1964	13.96		7/28/1964	13.06
9/29/1964	14.51		8/31/1964	13.96
10/26/1964	14.74		9/29/1964	14.51
11/28/1964	14.74		10/26/1964	14.74
12/24/1964	12.32		11/28/1964	14.74
1/28/1965	9.94		4/23/1965	7.85
2/23/1965	8.88		3/31/1965	8.80
3/31/1965	8.80		2/23/1965	8.88
4/23/1965	7.85		1/28/1965	9.94
5/24/1965	10.42		5/24/1965	10.42
6/22/1965	11.06		6/22/1965	11.06
7/23/1965	12.75		7/23/1965	12.75
8/27/1965	13.86		8/27/1965	13.86
9/21/1965	14.40		12/27/1965	13.98
10/20/1965	14.65		9/21/1965	14.40
11/24/1965	14.96		10/20/1965	14.65
12/27/1965	13.98		11/24/1965	14.96
1/29/1966	12.22		2/26/1966	7.60
2/26/1966	7.60		3/28/1966	8.44
3/28/1966	8.44		5/20/1966	10.18
4/25/1966	10.45		12/27/1966	10.28
5/20/1966	10.18		4/25/1966	10.45
6/28/1966	11.50		11/23/1966	10.59
7/29/1966	13.03		6/28/1966	11.50
8/22/1966	13.76		1/29/1966	12.22
9/28/1966	14.13		7/29/1966	13.03
10/21/1966	14.00		8/22/1966	13.76
11/23/1966	10.59		10/21/1966	14.00

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
12/27/1966	10.28		9/28/1966	14.13
1/30/1967	7.98		4/27/1967	6.95
2/24/1967	8.83		3/29/1967	7.63
3/29/1967	7.63		5/26/1967	7.95
4/27/1967	6.95		1/30/1967	7.98
5/26/1967	7.95		12/26/1967	8.79
6/28/1967	10.43		2/24/1967	8.83
7/28/1967	11.84		6/28/1967	10.43
8/28/1967	12.60		11/27/1967	10.93
9/27/1967	13.40		7/28/1967	11.84
10/30/1967	12.99		8/28/1967	12.60
11/27/1967	10.93		10/30/1967	12.99
12/26/1967	8.79		9/27/1967	13.40
1/27/1968	7.91		3/26/1968	5.52
2/27/1968	10.03		12/26/1968	6.93
3/26/1968	5.52		1/27/1968	7.91
4/24/1968	9.76		5/24/1968	9.69
5/24/1968	9.69		4/24/1968	9.76
6/25/1968	9.80		6/25/1968	9.80
7/23/1968	11.68		2/27/1968	10.03
8/26/1968	13.11		11/25/1968	10.23
9/26/1968	13.95		7/23/1968	11.68
10/28/1968	14.38		8/26/1968	13.11
11/25/1968	10.23		9/26/1968	13.95
12/26/1968	6.93		10/28/1968	14.38
1/27/1969	9.30		3/26/1969	4.03
2/24/1969	9.62		12/30/1969	4.74
3/26/1969	4.03		4/25/1969	6.53
4/25/1969	6.53		11/25/1969	7.62
5/26/1969	10.19		1/27/1969	9.30
6/26/1969	11.89		2/24/1969	9.62
7/25/1969	12.97		5/26/1969	10.19
8/26/1969	13.11		6/26/1969	11.89
9/25/1969	13.40		7/25/1969	12.97
10/27/1969	13.36		8/26/1969	13.11
11/25/1969	7.62		10/27/1969	13.36
12/30/1969	4.74		9/25/1969	13.40
1/27/1970	10.09		3/27/1970	7.30
2/25/1970	8.20		12/24/1970	8.06

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
3/27/1970	7.30		2/25/1970	8.20
4/28/1970	9.00		5/26/1970	8.82
5/26/1970	8.82		4/28/1970	9.00
6/26/1970	11.08		1/27/1970	10.09
7/29/1970	12.47		11/25/1970	10.75
8/26/1970	13.21		6/26/1970	11.08
9/28/1970	13.50		7/29/1970	12.47
10/28/1970	13.64		8/26/1970	13.21
11/25/1970	10.75		9/28/1970	13.50
12/24/1970	8.06		10/28/1970	13.64
1/26/1971	9.93		3/23/1971	6.73
2/22/1971	6.97		2/22/1971	6.97
3/23/1971	6.73		5/24/1971	8.32
4/23/1971	9.06		12/22/1971	8.73
5/24/1971	8.32		4/23/1971	9.06
6/22/1971	11.14		1/26/1971	9.93
7/22/1971	12.84		6/22/1971	11.14
8/30/1971	13.63		7/22/1971	12.84
9/28/1971	14.02		8/30/1971	13.63
10/21/1971	14.11		11/23/1971	13.79
11/23/1971	13.79		9/28/1971	14.02
12/22/1971	8.73		10/21/1971	14.11
1/25/1972	8.74		3/24/1972	5.07
2/23/1972	9.30		4/24/1972	6.72
3/24/1972	5.07		11/22/1972	6.80
4/24/1972	6.72		5/22/1972	7.13
5/22/1972	7.13		12/21/1972	7.75
6/22/1972	8.68		6/22/1972	8.68
7/24/1972	11.54		1/25/1972	8.74
8/24/1972	12.53		2/23/1972	9.30
9/22/1972	12.73		7/24/1972	11.54
10/24/1972	12.53		8/24/1972	12.53
11/22/1972	6.80		10/24/1972	12.53
12/21/1972	7.75		9/22/1972	12.73
1/24/1973	9.69		12/20/1973	5.53
2/21/1973	9.26		5/23/1973	8.11
3/22/1973	8.71		3/22/1973	8.71
4/23/1973	9.27		2/21/1973	9.26
5/23/1973	8.11		4/23/1973	9.27
6/22/1973	11.35		1/24/1973	9.69

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
7/24/1973	11.10		7/24/1973	11.10
8/23/1973	11.17		8/23/1973	11.17
9/24/1973	12.82		6/22/1973	11.35
10/24/1973	13.50		11/23/1973	12.78
11/23/1973	12.78		9/24/1973	12.82
12/20/1973	5.53		10/24/1973	13.50
1/22/1974	8.82		3/25/1974	6.69
2/21/1974	8.02		12/23/1974	7.42
3/25/1974	6.69		2/21/1974	8.02
4/29/1974	9.02		1/22/1974	8.82
5/23/1974	9.18		4/29/1974	9.02
6/24/1974	11.46		5/23/1974	9.18
7/24/1974	12.57		10/24/1974	10.03
8/26/1974	13.69		11/21/1974	10.05
9/24/1974	13.53		6/24/1974	11.46
10/24/1974	10.03		7/24/1974	12.57
11/21/1974	10.05		9/24/1974	13.53
12/23/1974	7.42		8/26/1974	13.69
1/24/1975	7.10		11/24/1975	6.45
2/21/1975	9.56		3/24/1975	7.05
3/24/1975	7.05		1/24/1975	7.10
4/23/1975	9.59		10/24/1975	7.71
5/22/1975	10.37		12/23/1975	8.98
6/23/1975	11.15		2/21/1975	9.56
7/21/1975	12.76		4/23/1975	9.59
8/25/1975	13.40		5/22/1975	10.37
9/23/1975	13.44		6/23/1975	11.15
10/24/1975	7.71		7/21/1975	12.76
11/24/1975	6.45		8/25/1975	13.40
12/23/1975	8.98		9/23/1975	13.44
1/21/1976	8.12		1/30/1976	6.54
1/30/1976	6.54		3/26/1976	7.88
2/23/1976	8.55		1/21/1976	8.12
3/26/1976	7.88		2/23/1976	8.55
4/26/1976	10.74		5/25/1976	10.69
5/25/1976	10.69		8/25/1976	10.69
6/28/1976	12.58		4/26/1976	10.74
7/26/1976	13.52		12/28/1976	11.22
8/25/1976	10.69		9/23/1976	11.38
9/23/1976	11.38		10/27/1976	11.40

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
10/27/1976	11.40		11/29/1976	11.57
11/29/1976	11.57		6/28/1976	12.58
12/28/1976	11.22		7/26/1976	13.52
1/27/1977	9.82		12/28/1977	5.55
2/25/1977	9.16		3/30/1977	6.00
3/30/1977	6.00		4/28/1977	6.90
4/28/1977	6.90		11/28/1977	8.50
5/26/1977	9.32		2/25/1977	9.16
6/28/1977	11.78		5/26/1977	9.32
7/27/1977	12.86		10/27/1977	9.47
8/26/1977	13.30		1/27/1977	9.82
9/29/1977	13.70		6/28/1977	11.78
10/27/1977	9.47		7/27/1977	12.86
11/28/1977	8.50		8/26/1977	13.30
12/28/1977	5.55		9/29/1977	13.70
1/26/1978	7.42		3/22/1978	6.10
2/27/1978	10.40		1/26/1978	7.42
3/22/1978	6.10		4/27/1978	7.75
4/27/1978	7.75		5/25/1978	8.25
5/25/1978	8.25		2/27/1978	10.40
6/30/1978	11.61		12/26/1978	11.06
7/27/1978	12.81		6/30/1978	11.61
8/29/1978	13.45		7/27/1978	12.81
9/26/1978	14.10		8/29/1978	13.45
10/27/1978	13.53		10/27/1978	13.53
11/27/1978	14.70		9/26/1978	14.10
12/26/1978	11.06		11/27/1978	14.70
1/29/1979	5.43		1/29/1979	5.43
2/26/1979	9.59		5/30/1979	7.60
3/27/1979	7.64		3/27/1979	7.64
4/25/1979	8.87		4/25/1979	8.87
5/30/1979	7.60		11/26/1979	9.08
6/27/1979	11.17		2/26/1979	9.59
7/26/1979	12.63		10/23/1979	10.10
8/29/1979	11.93		12/26/1979	10.52
9/24/1979	11.93		6/27/1979	11.17
10/23/1979	10.10		8/29/1979	11.93
11/26/1979	9.08		9/24/1979	11.93
12/26/1979	10.52		7/26/1979	12.63

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
1/24/1980	10.70		3/24/1980	5.80
2/25/1980	11.73		4/23/1980	7.85
3/24/1980	5.80		5/21/1980	9.25
4/23/1980	7.85		12/22/1980	10.18
5/21/1980	9.25		1/24/1980	10.70
6/24/1980	11.25		6/24/1980	11.25
7/21/1980	11.98		8/25/1980	11.45
8/25/1980	11.45		2/25/1980	11.73
9/22/1980	13.47		7/21/1980	11.98
10/23/1980	14.18		11/21/1980	12.55
11/21/1980	12.55		9/22/1980	13.47
12/22/1980	10.18		10/23/1980	14.18
1/22/1981	11.44		11/22/1981	6.66
2/23/1981	9.86		12/22/1981	6.82
3/23/1981	8.66		3/23/1981	8.66
4/25/1981	9.56		4/25/1981	9.56
5/23/1981	10.25		2/23/1981	9.86
6/21/1981	11.93		5/23/1981	10.25
7/23/1981	12.74		1/22/1981	11.44
8/25/1981	12.68		6/21/1981	11.93
9/24/1981	13.70		8/25/1981	12.68
10/27/1981	13.06		7/23/1981	12.74
11/22/1981	6.66		10/27/1981	13.06
12/22/1981	6.82		9/24/1981	13.70
1/22/1982	8.79		6/25/1982	7.96
2/23/1982	9.46		1/22/1982	8.79
3/28/1982	9.00		4/25/1982	8.86
4/25/1982	8.86		3/28/1982	9.00
5/23/1982	10.60		2/23/1982	9.46
6/25/1982	7.96		11/21/1982	10.27
7/23/1982	11.12		5/23/1982	10.60
8/21/1982	11.89		12/21/1982	10.89
9/26/1982	13.10		7/23/1982	11.12
10/21/1982	12.62		8/21/1982	11.89
11/21/1982	10.27		10/21/1982	12.62
12/21/1982	10.89		9/26/1982	13.10
1/21/1983	9.47		3/23/1983	5.04
2/22/1983	6.27		2/22/1983	6.27
3/23/1983	5.04		12/21/1983	6.52
4/21/1983	6.82		4/21/1983	6.82

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Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
5/24/1983	10.10		11/21/1983	7.36
6/22/1983	11.14		1/21/1983	9.47
7/22/1983	12.90		5/24/1983	10.10
8/24/1983	13.97		6/22/1983	11.14
9/22/1983	13.66		7/22/1983	12.90
10/21/1983	14.13		9/22/1983	13.66
11/21/1983	7.36		8/24/1983	13.97
12/21/1983	6.52		10/21/1983	14.13
1/23/1984	10.22		2/22/1984	5.66
2/22/1984	5.66		3/20/1984	5.82
3/20/1984	5.82		4/21/1984	7.76
4/21/1984	7.76		12/26/1984	8.46
5/22/1984	9.65		5/22/1984	9.65
6/22/1984	10.25		1/23/1984	10.22
7/20/1984	11.34		6/22/1984	10.25
8/14/1984	12.21		7/20/1984	11.34
8/22/1984	12.26		8/14/1984	12.21
9/18/1984	13.66		8/22/1984	12.26
9/24/1984	13.80		11/21/1984	12.35
10/23/1984	14.07		9/18/1984	13.66
11/21/1984	12.35		9/24/1984	13.80
12/26/1984	8.46		10/23/1984	14.07
1/22/1985	9.90		11/21/1985	6.74
2/21/1985	9.59		3/25/1985	8.21
3/25/1985	8.21		12/24/1985	9.31
4/22/1985	9.52		4/22/1985	9.52
5/23/1985	10.53		2/21/1985	9.59
6/24/1985	11.15		1/22/1985	9.90
7/22/1985	11.86		5/23/1985	10.53
8/20/1985	11.41		9/23/1985	10.86
9/23/1985	10.86		6/24/1985	11.15
10/22/1985	11.39		10/22/1985	11.39
11/21/1985	6.74		8/20/1985	11.41
12/24/1985	9.31		7/22/1985	11.86
1/21/1986	11.10		12/22/1986	4.99
2/24/1986	8.80		3/24/1986	7.74
3/24/1986	7.74		2/24/1986	8.80
4/22/1986	10.63		6/26/1986	9.68
5/21/1986	11.50		11/24/1986	10.54
6/26/1986	9.68		4/22/1986	10.63

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Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
7/22/1986	11.12		1/21/1986	11.10
8/21/1986	12.75		7/22/1986	11.12
9/24/1986	13.75		5/21/1986	11.50
10/22/1986	14.17		8/21/1986	12.75
11/24/1986	10.54		9/24/1986	13.75
12/22/1986	4.99		10/22/1986	14.17
1/21/1987	7.36		1/21/1987	7.36
2/23/1987	9.96		4/23/1987	7.47
3/25/1987	8.12		12/22/1987	7.74
4/23/1987	7.47		3/25/1987	8.12
5/21/1987	10.19		11/24/1987	9.31
6/23/1987	12.26		2/23/1987	9.96
7/22/1987	13.25		5/21/1987	10.19
8/21/1987	14.04		10/22/1987	10.28
9/22/1987	11.89		9/22/1987	11.89
10/22/1987	10.28		6/23/1987	12.26
11/24/1987	9.31		7/22/1987	13.25
12/22/1987	7.74		8/21/1987	14.04
1/22/1988	10.44		2/24/1988	6.40
2/24/1988	6.40		5/26/1988	7.87
3/23/1988	9.23		11/24/1988	8.92
4/25/1988	10.20		3/23/1988	9.23
5/26/1988	7.87		4/25/1988	10.20
6/22/1988	12.00		12/22/1988	10.33
7/22/1988	13.11		1/22/1988	10.44
8/25/1988	12.80		6/22/1988	12.00
9/21/1988	13.39		8/25/1988	12.80
10/24/1988	13.90		7/22/1988	13.11
11/24/1988	8.92		9/21/1988	13.39
12/22/1988	10.33		10/24/1988	13.90
1/20/1989	11.04		4/24/1989	7.26
2/22/1989	11.34		10/24/1989	8.00
3/22/1989	9.64		11/21/1989	8.11
4/24/1989	7.26		5/24/1989	9.35
5/24/1989	9.35		3/22/1989	9.64
6/22/1989	9.79		6/22/1989	9.79
7/24/1989	12.27		12/21/1989	10.91
8/23/1989	11.52		1/20/1989	11.04
9/21/1989	12.97		2/22/1989	11.34
10/24/1989	8.00		8/23/1989	11.52

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
11/21/1989	8.11		7/24/1989	12.27
12/21/1989	10.91		9/21/1989	12.97
1/25/1990	11.18		10/26/1990	6.93
2/22/1990	7.98		5/21/1990	7.44
3/22/1990	9.15		2/22/1990	7.98
4/24/1990	8.36		4/24/1990	8.36
5/21/1990	7.44		3/22/1990	9.15
6/22/1990	12.33		12/26/1990	9.18
7/24/1990	13.54		11/26/1990	9.81
8/23/1990	11.12		8/23/1990	11.12
9/27/1990	12.45		1/25/1990	11.18
10/26/1990	6.93		6/22/1990	12.33
11/26/1990	9.81		9/27/1990	12.45
12/26/1990	9.18		7/24/1990	13.54
1/23/1991	8.13		11/25/1991	7.40
2/25/1991	8.92		4/25/1991	7.47
3/26/1991	8.68		1/23/1991	8.13
4/25/1991	7.47		3/26/1991	8.68
5/29/1991	12.04		2/25/1991	8.92
6/27/1991	12.99		12/23/1991	8.93
7/30/1991	13.85		10/29/1991	10.80
8/28/1991	13.53		5/29/1991	12.04
9/26/1991	13.05		6/27/1991	12.99
10/29/1991	10.80		9/26/1991	13.05
11/25/1991	7.40		8/28/1991	13.53
12/23/1991	8.93		7/30/1991	13.85
1/30/1992	9.00		12/22/1992	7.70
2/21/1992	10.48		1/30/1992	9.00
3/27/1992	9.44		4/24/1992	9.19
4/24/1992	9.19		3/27/1992	9.44
5/26/1992	11.02		10/29/1992	9.46
6/29/1992	11.62		2/21/1992	10.48
7/30/1992	13.32		11/24/1992	10.94
8/28/1992	13.35		5/26/1992	11.02
9/29/1992	12.81		6/29/1992	11.62
10/29/1992	9.46		9/29/1992	12.81
11/24/1992	10.94		7/30/1992	13.32
12/22/1992	7.70		8/28/1992	13.35
1/22/1993	9.78		4/1/1993	4.90

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
2/25/1993	9.22		12/28/1993	7.17
4/1/1993	4.90		4/28/1993	7.80
4/28/1993	7.80		2/25/1993	9.22
5/27/1993	11.52		1/22/1993	9.78
6/24/1993	13.45		5/27/1993	11.52
7/29/1993	13.75		11/29/1993	11.82
8/30/1993	14.59		6/24/1993	13.45
9/29/1993	14.90		7/29/1993	13.75
10/28/1993	14.86		8/30/1993	14.59
11/29/1993	11.82		10/28/1993	14.86
12/28/1993	7.17		9/29/1993	14.90
1/31/1994	7.55		3/30/1994	5.35
2/25/1994	7.61		1/31/1994	7.55
3/30/1994	5.35		2/25/1994	7.61
4/26/1994	8.86		12/21/1994	7.89
5/31/1994	8.90		4/26/1994	8.86
6/27/1994	12.11		5/31/1994	8.90
7/27/1994	13.69		11/25/1994	10.56
8/29/1994	14.33		10/27/1994	11.88
9/27/1994	12.70		6/27/1994	12.11
10/27/1994	11.88		9/27/1994	12.70
11/25/1994	10.56		7/27/1994	13.69
12/21/1994	7.89		8/29/1994	14.33
1/25/1995	7.07		1/25/1995	7.07
2/28/1995	10.19		11/27/1995	8.08
4/26/1995	9.48		4/26/1995	9.48
5/23/1995	10.60		2/28/1995	10.19
6/27/1995	11.97		5/23/1995	10.60
7/27/1995	13.72		6/27/1995	11.97
8/23/1995	14.40		10/30/1995	12.84
9/26/1995	15.08		7/27/1995	13.72
10/30/1995	12.84		8/23/1995	14.40
11/27/1995	8.08		9/26/1995	15.08
1/25/1996	4.87		1/25/1996	4.87
2/28/1996	7.17		10/30/1996	6.40
3/26/1996	7.26		4/23/1996	6.92
4/23/1996	6.92		2/28/1996	7.17
5/29/1996	10.33		3/26/1996	7.26
6/26/1996	12.30		12/30/1996	7.80
7/26/1996	12.09		11/26/1996	10.18

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Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
8/29/1996	13.49		5/29/1996	10.33
9/26/1996	13.05		7/26/1996	12.09
10/30/1996	6.40		6/26/1996	12.30
11/26/1996	10.18		9/26/1996	13.05
12/30/1996	7.80		8/29/1996	13.49
1/24/1997	10.11		4/29/1997	8.34
2/28/1997	10.10		3/25/1997	8.79
3/25/1997	8.79		12/22/1997	9.51
4/29/1997	8.34		11/26/1997	9.52
5/23/1997	9.68		5/23/1997	9.68
6/27/1997	12.18		2/28/1997	10.10
7/24/1997	13.69		1/24/1997	10.11
8/21/1997	14.34		6/27/1997	12.18
9/24/1997	14.80		7/24/1997	13.69
10/29/1997	15.32		8/21/1997	14.34
11/26/1997	9.52		9/24/1997	14.80
12/22/1997	9.51		10/29/1997	15.32
1/29/1998	6.75		2/26/1998	4.62
2/26/1998	4.62		1/29/1998	6.75
3/25/1998	9.26		6/26/1998	8.08
4/22/1998	9.17		4/22/1998	9.17
5/26/1998	9.56		3/25/1998	9.26
6/26/1998	8.08		5/26/1998	9.56
7/27/1998	11.61		10/30/1998	10.18
9/2/1998	12.55		7/27/1998	11.61
10/30/1998	10.18		11/30/1998	11.68
11/30/1998	11.68		12/22/1998	11.78
12/22/1998	11.78		9/2/1998	12.55
1/26/1999	8.19		10/29/1999	7.89
2/23/1999	8.60		1/26/1999	8.19
3/17/1999	8.40		3/17/1999	8.40
4/28/1999	11.23		2/23/1999	8.60
6/22/1999	12.38		12/21/1999	9.09
7/26/1999	13.41		9/21/1999	9.18
8/27/1999	14.16		11/24/1999	9.81
9/21/1999	9.18		4/28/1999	11.23
10/29/1999	7.89		6/22/1999	12.38
11/24/1999	9.81		7/26/1999	13.41
12/21/1999	9.09		8/27/1999	14.16

Appendix E
Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
2/2/2000	10.62		4/26/2000	5.76
2/28/2000	8.18		2/28/2000	8.18
3/29/2000	8.43		3/29/2000	8.43
4/26/2000	5.76		12/29/2000	8.79
4/30/2000	10.15		11/27/2000	9.22
5/31/2000	9.80		5/31/2000	9.80
6/27/2000	10.31		8/22/2000	10.13
7/25/2000	10.94		4/30/2000	10.15
8/22/2000	10.13		6/27/2000	10.31
9/27/2000	10.69		10/25/2000	10.46
10/25/2000	10.46		2/2/2000	10.62
11/27/2000	9.22		9/27/2000	10.69
12/29/2000	8.79		7/25/2000	10.94
1/23/2001	11.27		3/27/2001	5.58
2/21/2001	9.37		6/20/2001	8.17
3/27/2001	5.58		2/21/2001	9.37
4/30/2001	10.15		4/30/2001	10.15
5/30/2001	11.86		12/31/2001	10.20
6/20/2001	8.17		7/26/2001	11.18
7/26/2001	11.18		1/23/2001	11.27
8/28/2001	11.96		5/30/2001	11.86
9/25/2001	13.14		8/28/2001	11.96
10/24/2001	13.47		9/25/2001	13.14
11/28/2001	13.81		10/24/2001	13.47
12/31/2001	10.20		11/28/2001	13.81
2/25/2002	8.86		11/19/2002	5.77
3/27/2002	7.62		12/19/2002	6.77
4/26/2002	10.16		3/27/2002	7.62
5/29/2002	9.10		10/28/2002	8.40
7/29/2002	12.03		2/25/2002	8.86
8/27/2002	13.23		5/29/2002	9.10
10/28/2002	8.40		4/26/2002	10.16
11/19/2002	5.77		7/29/2002	12.03
12/19/2002	6.77		8/27/2002	13.23
1/31/2003	10.78		12/22/2003	6.67
2/25/2003	10.20		4/29/2003	7.87
3/25/2003	7.93		3/25/2003	7.93
4/29/2003	7.87		10/30/2003	8.29
6/27/2003	8.55		6/27/2003	8.55
7/23/2003	11.67		8/21/2003	9.60

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Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
8/21/2003	9.60		11/24/2003	10.00
9/22/2003	12.22		2/25/2003	10.20
10/30/2003	8.29		1/31/2003	10.78
11/24/2003	10.00		7/23/2003	11.67
12/22/2003	6.67		9/22/2003	12.22
1/20/2004	10.77		4/28/2004	7.43
2/24/2004	13.68		9/24/2004	8.47
3/30/2004	10.02		8/23/2004	8.48
4/28/2004	7.43		12/22/2004	8.59
6/30/2004	11.92		3/30/2004	10.02
7/27/2004	10.10		7/27/2004	10.10
8/23/2004	8.48		10/28/2004	10.63
9/24/2004	8.47		1/20/2004	10.77
10/28/2004	10.63		11/23/2004	11.24
11/23/2004	11.24		6/30/2004	11.92
12/22/2004	8.59		2/24/2004	13.68
2/28/2005	9.59		10/27/2005	5.25
3/25/2005	8.56		5/26/2005	8.07
4/22/2005	10.43		12/20/2005	8.12
5/26/2005	8.07		3/25/2005	8.56
6/22/2005	11.44		11/22/2005	9.21
7/21/2005	11.38		2/28/2005	9.59
8/30/2005	13.18		4/22/2005	10.43
9/22/2005	13.30		7/21/2005	11.38
10/27/2005	5.25		6/22/2005	11.44
11/22/2005	9.21		8/30/2005	13.18
12/20/2005	8.12		9/22/2005	13.30
1/25/2006	7.92		5/24/2006	7.00
2/24/2006	9.49		11/28/2006	7.66
3/28/2006	11.16		1/25/2006	7.92
4/27/2006	10.75		6/29/2006	9.33
5/24/2006	7.00		2/24/2006	9.49
6/29/2006	9.33		7/26/2006	10.06
7/26/2006	10.06		12/19/2006	10.67
8/24/2006	11.98		4/27/2006	10.75
9/26/2006	11.65		10/24/2006	11.06
10/24/2006	11.06		3/28/2006	11.16
11/28/2006	7.66		9/26/2006	11.65
12/19/2006	10.67		8/24/2006	11.98

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Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
1/30/2007	10.68		4/24/2007	7.03
2/21/2007	12.15		5/23/2007	7.09
3/27/2007	7.70		3/27/2007	7.70
4/24/2007	7.03		6/26/2007	9.50
5/23/2007	7.09		1/30/2007	10.68
6/26/2007	9.50		11/28/2007	10.68
7/24/2007	12.68		2/21/2007	12.15
8/28/2007	12.94		7/24/2007	12.68
9/25/2007	13.48		8/28/2007	12.94
10/23/2007	13.76		9/25/2007	13.48
11/28/2007	10.68		10/23/2007	13.76
1/30/2008	8.75		7/29/2008	7.21
2/25/2008	7.49		2/25/2008	7.49
3/24/2008	7.70		3/24/2008	7.70
4/23/2008	9.38		1/30/2008	8.75
5/20/2008	10.30		4/23/2008	9.38
6/24/2008	11.38		8/25/2008	9.69
7/29/2008	7.21		5/20/2008	10.30
8/25/2008	9.69		9/22/2008	10.59
9/22/2008	10.59		11/24/2008	11.17
10/29/2008	11.54		6/24/2008	11.38
11/24/2008	11.17		10/29/2008	11.54
2/24/2009	8.30		2/24/2009	8.30
3/25/2009	9.98		7/30/2009	8.47
4/27/2009	8.76		12/21/2009	8.70
5/26/2009	11.57		11/23/2009	8.72
6/25/2009	9.99		4/27/2009	8.76
7/30/2009	8.47		10/26/2009	9.47
8/24/2009	11.91		3/25/2009	9.98
9/28/2009	12.12		6/25/2009	9.99
10/26/2009	9.47		5/26/2009	11.57
11/23/2009	8.72		8/24/2009	11.91
12/21/2009	8.70		9/28/2009	12.12
1/25/2010	10.82		3/26/2010	6.20
2/22/2010	11.37		12/20/2010	8.06
3/26/2010	6.20		11/22/2010	8.08
4/26/2010	10.17		10/26/2010	9.05
5/25/2010	11.19		4/26/2010	10.17
6/28/2010	12.11		1/25/2010	10.82
7/26/2010	13.09		5/25/2010	11.19

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Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
8/23/2010	13.84		2/22/2010	11.37
9/27/2010	12.29		6/28/2010	12.11
10/26/2010	9.05		9/27/2010	12.29
11/22/2010	8.08		7/26/2010	13.09
12/20/2010	8.06		8/23/2010	13.84
3/28/2011	8.27		8/31/2011	6.96
4/25/2011	8.05		10/24/2011	7.66
5/23/2011	10.27		4/25/2011	8.05
6/27/2011	9.59		3/28/2011	8.27
7/27/2011	12.05		11/28/2011	8.48
8/31/2011	6.96		12/27/2011	9.05
9/26/2011	9.88		6/27/2011	9.59
10/24/2011	7.66		9/26/2011	9.88
11/28/2011	8.48		5/23/2011	10.27
12/27/2011	9.05		7/27/2011	12.05
1/23/2012	10.12		11/5/2012	8.35
3/8/2012	9.05		3/8/2012	9.05
3/26/2012	10.82		12/21/2012	9.12
4/30/2012	9.62		4/30/2012	9.62
5/23/2012	9.69		5/23/2012	9.69
6/25/2012	11.93		1/23/2012	10.12
7/23/2012	12.33		11/26/2012	10.59
8/27/2012	11.24		3/26/2012	10.82
9/17/2012	12.29		8/27/2012	11.24
11/5/2012	8.35		6/25/2012	11.93
11/26/2012	10.59		9/17/2012	12.29
12/21/2012	9.12		7/23/2012	12.33
1/30/2013	10.49		3/28/2013	8.22
3/28/2013	8.22		6/27/2013	9.24
4/29/2013	10.81		5/31/2013	10.02
5/31/2013	10.02		1/30/2013	10.49
6/27/2013	9.24		4/29/2013	10.81
7/31/2013	12.29		12/23/2013	11.62
8/26/2013	12.77		7/31/2013	12.29
9/24/2013	13.58		8/26/2013	12.77
10/28/2013	14.04		9/24/2013	13.58
11/29/2013	14.34		10/28/2013	14.04
12/23/2013	11.62		11/29/2013	14.34
1/27/2014	8.44		12/18/2014	6.77

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Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
2/24/2014	8.82		1/27/2014	8.44
3/24/2014	8.50		3/24/2014	8.50
4/28/2014	8.83		11/26/2014	8.80
5/27/2014	10.41		2/24/2014	8.82
6/23/2014	11.05		4/28/2014	8.83
7/29/2014	11.72		10/27/2014	10.08
8/25/2014	11.22		5/27/2014	10.41
9/23/2014	12.65		6/23/2014	11.05
10/27/2014	10.08		8/25/2014	11.22
11/26/2014	8.80		7/29/2014	11.72
12/18/2014	6.77		9/23/2014	12.65
1/30/2015	10.82		4/29/2015	7.78
3/25/2015	8.10		3/25/2015	8.10
4/29/2015	7.78		12/22/2015	10.58
5/28/2015	11.63		1/30/2015	10.82
6/22/2015	11.70		5/28/2015	11.63
7/30/2015	12.36		6/22/2015	11.70
8/26/2015	13.38		11/25/2015	12.21
10/1/2015	14.19		7/30/2015	12.36
10/27/2015	13.45		8/26/2015	13.38
11/25/2015	12.21		10/27/2015	13.45
12/22/2015	10.58		10/1/2015	14.19
1/27/2016	8.65		2/26/2016	8.05
2/26/2016	8.05		1/27/2016	8.65
3/30/2016	8.71		3/30/2016	8.71
4/27/2016	10.04		12/30/2016	9.49
5/27/2016	11.25		4/27/2016	10.04
6/29/2016	12.43		11/25/2016	10.38
7/27/2016	13.38		5/27/2016	11.25
8/24/2016	14.06		6/29/2016	12.43
9/30/2016	14.59		7/27/2016	13.38
10/28/2016	13.39		10/28/2016	13.39
11/25/2016	10.38		8/24/2016	14.06
12/30/2016	9.49		9/30/2016	14.59
1/30/2017	7.79		2/24/2017	7.01
2/24/2017	7.01		3/31/2017	7.34
3/31/2017	7.34		1/30/2017	7.79
4/27/2017	9.79		4/27/2017	9.79
5/26/2017	9.82		5/26/2017	9.82
6/30/2017	16.73		12/15/2017	10.02

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USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
7/26/2017	11.77		11/24/2017	10.86
8/24/2017	13.12		7/26/2017	11.77
9/22/2017	13.32		8/24/2017	13.12
10/24/2017	13.82		9/22/2017	13.32
11/24/2017	10.86		10/24/2017	13.82
12/15/2017	10.02		6/30/2017	16.73
1/23/2018	8.61		11/21/2018	5.83
2/27/2018	7.86		4/19/2018	6.44
3/27/2018	7.96		2/27/2018	7.86
4/19/2018	6.44		3/27/2018	7.96
5/24/2018	10.47		1/23/2018	8.61
6/27/2018	12.29		12/13/2018	9.11
7/24/2018	12.36		10/23/2018	10.41
8/23/2018	11.46		5/24/2018	10.47
9/20/2018	12.23		8/23/2018	11.46
9/20/2018	12.22		9/20/2018	12.22
10/23/2018	10.41		9/20/2018	12.23
11/21/2018	5.83		6/27/2018	12.29
12/13/2018	9.11		7/24/2018	12.36
1/17/2019	10.00		12/12/2019	6.27
2/21/2019	9.25		3/26/2019	8.88
3/26/2019	8.88		4/18/2019	9.02
4/18/2019	9.02		2/21/2019	9.25
5/23/2019	9.74		5/23/2019	9.74
6/18/2019	11.18		1/17/2019	10.00
6/25/2019	10.59		11/20/2019	10.01
7/18/2019	10.16		7/18/2019	10.16
8/22/2019	11.96		6/25/2019	10.59
9/11/2019	12.31		6/18/2019	11.18
9/19/2019	12.62		10/24/2019	11.52
10/24/2019	11.52		8/22/2019	11.96
11/20/2019	10.01		9/11/2019	12.31
12/12/2019	6.27		9/19/2019	12.62
1/23/2020	10.12		12/11/2020	6.73
2/20/2020	9.18		4/23/2020	8.80
3/19/2020	10.53		2/20/2020	9.18
4/23/2020	8.80		5/22/2020	10.11
5/22/2020	10.11		1/23/2020	10.12
6/18/2020	10.97		3/19/2020	10.53
7/15/2020	11.79		6/18/2020	10.97

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Historical Water Level Measurements
USGS Monitoring Well (MA-XOW-14) Winchester, MA

Date	Measured Monthly Water Levels (ft BLS)		Date	Sorted Monthly Water Levels (ft BLS)
7/28/2020	12.47		7/15/2020	11.79
8/20/2020	13.29		11/18/2020	12.24
9/18/2020	13.95		7/28/2020	12.47
10/16/2020	14.48		8/20/2020	13.29
10/28/2020	14.40		9/18/2020	13.95
11/18/2020	12.24		10/28/2020	14.40
12/11/2020	6.73		10/16/2020	14.48
1/21/2021	7.79		4/22/2021	7.70
2/24/2021	9.07		1/21/2021	7.79
3/18/2021	9.47		7/23/2021	8.32
4/22/2021	7.70		2/24/2021	9.07
5/20/2021	9.62		3/18/2021	9.47
6/22/2021	10.75		5/20/2021	9.62
7/23/2021	8.32		9/22/2021	9.62
8/19/2021	10.47		8/19/2021	10.47
9/22/2021	9.62		6/22/2021	10.75

ft bls = feet below land surface