GeoHydroCycle, Inc.

Hazardous Waste
Water Supply

Assessment
Remediation
Analyses
Permitting
Modeling
Software

April 12, 2017

Ms. Susan Connors
MassDEP Drinking Water Program
Central Regional Office
8 New Bond Street
Worcester MA 01606

re: Addendum to
BRP WS-15 Report: Community Wells PW-1 and PW-2
Boxborough Town Center, LLC
Massachusetts Avenue
Boxborough, MA 01719
Transmittal #: X273115
GHC #15005

Dear Ms. Connors:

GeoHydroCycle, Inc. (GHC) is pleased to present this letter report summarizing a two-day pump test of two bedrock wells at the Boxborough Town Center (BTC) on Massachusetts Avenue in Boxborough, MA (the Site).

Introduction

The two-day was requested by Massachusetts DEP to supplement a 5-day pump test on the same BTC wells that was conducted by GHC in November of 2016. MassDEP established the following conditions for the 2-day test:

- monitoring groundwater levels and pumping rates in the two bedrock wells at a minimum of every two hours;
- monitoring antecedent water levels is not required;
- monitoring of abutter wells is not required;
- no shut downs will be allowed during the test;
- the two wells can have different pumping rates, and 12 gpm for PW-1 and 9 gpm for PW-2 are approved initial rates;
- approval to shut down the test will need to be provided by MassDEP;
- monitor groundwater levels until the wells achieve 95% recovery after the test; and
- water quality sampling is not required.

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The 2-Day Pump Test

Setup for the 2-day test occurred on March 27, 2017, and plans were to start the test the morning of March 28th. The test was started on March 28th, however, the rental generator failed after about 4 hours and had to be replaced.

Groundwater levels responded overnight, and, with MassDEP's approval, a second start for the test was made on Wednesday, March 29, 2017 at 10:30 AM. The test was run for two days, and after receiving approval from MassDEP, the test was stopped on March 31, 2017 at 10:50 AM.

The following paragraphs provide details of the test.

Pump Test Equipment

The same discharge equipment was used for the 2-day test as was used for the 5-day test. Each well discharged to a pressure regulator, a flow control valve, a totalizing discharge meter, a flow through discharge meter, and then into a 2-inch diameter fire hose. Flow control was achieved by adjusting the pressure regulators. The fire hose discharged to the same discharge area as was used for the 5-day test, and was located outside the Zone I of the two wells.

Transducers were used to measure and record groundwater levels in the two pumping wells. Transducer sampling interval was set at one minute for both the pumping and recovery portions of the test. Water levels and pumping rates were recorded in field books at one hour intervals.

A single rental generator was used to provide power to both wells.

The Test

Prior to starting the test, groundwater levels and discharge meter totalizer readings were recorded. Initial pumping rates were set at 12 gpm for well PW-1 and 9 gpm for well PW-2. Little change in the pumping rates occurred during the two days, and well PW-1 pumped a total of 34,404 gallons and well PW-2 pumped a total of 26,631 gallons. Using test duration of 2,900 minutes, well PW-1 averaged 17,083 gallons per day, and well PW-2 averaged 13,224 gallons per day.

Approximately one hour into the test a check reading of the transducer in well PW-1 indicated the transducer was no longer accurately reading water levels. That transducer was removed from the well, and water level recording by hand at 10 minute intervals began. A replacement transducer was installed in the well at about 2:20 PM that day, and hand water level readings returned to one hour intervals.

Figures 1 and 2 present groundwater levels and pumping rates for the two wells over the duration of the 2-day test. A schematic of the two bedrock wells with the recent groundwater levels is shown in Figure 7.

Test Analysis

Figures 3 and 4 present semi-logarithm plots of the groundwater levels recorded in wells PW-1 and PW-2. To demonstrate stabilization, the drawdown plots were

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extended 180 days for both wells. Based on these plots, at 180 days the groundwater level in well PW-1 would be at 63.0 feet, or 216 feet above the pump setting. The 180 day level in well PW-2 would be at 76.7, or 490 feet above the pump setting. Figures 5 and 6 present the 180 day drawdown plots showing a schematic of the well and pump at 180 days.

Approved Pumping Rate

Based on the drawdown plots from the 2 day pump test, the two Boxborough Town Center wells meet the stabilization criteria for bedrock community wells. The Boxborough Town Center wells have shown to be capable of pumping groundwater during the 2 day test. Applying a 0.75 safety factor, as required by the guidelines, the Approvable Yield is 12,812 gallons per day (0.75 x 17,083) for well PW-1, and 9,918 gallons per day (0.75 x 13,224) for well PW-2.

The two well total yield would be 22,730 gallons per day, which is capable of meeting the 20,660 gallon per day demand of the Boxborough Town Center, LLC project.

If you have any question, please call me.

Sincerely,
GeoHydroCycle, Inc.

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

Enclosures: 1 - Figures

cc: James Fenton, Fenton and Son, Inc.
Richard Harrington, Stamski & McNary, Inc.

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Enclosure 1 - Figures

Figue 1. Well PW-1, Pump Test Data.

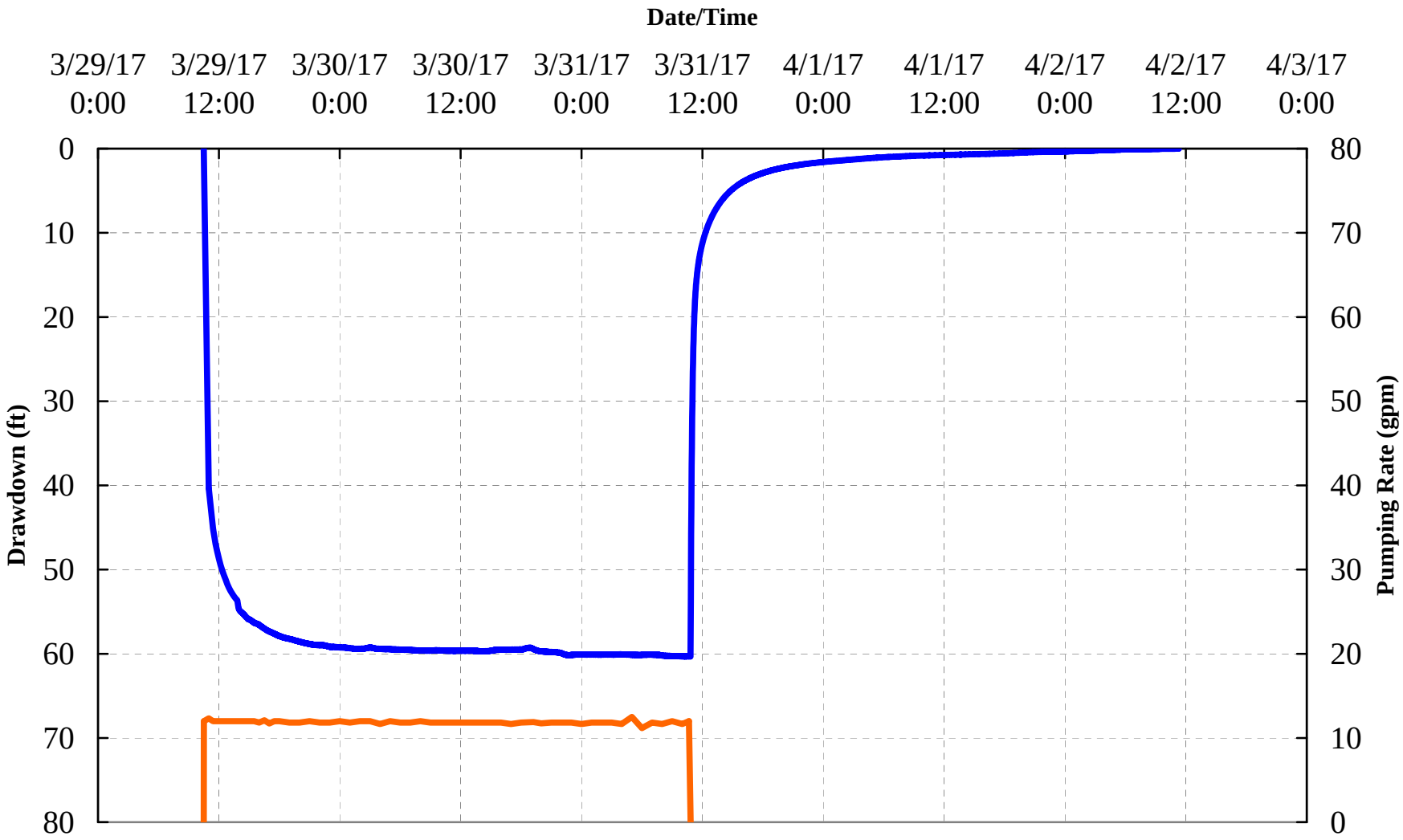


Figure 2. Well PW-2, Pump Test Data.

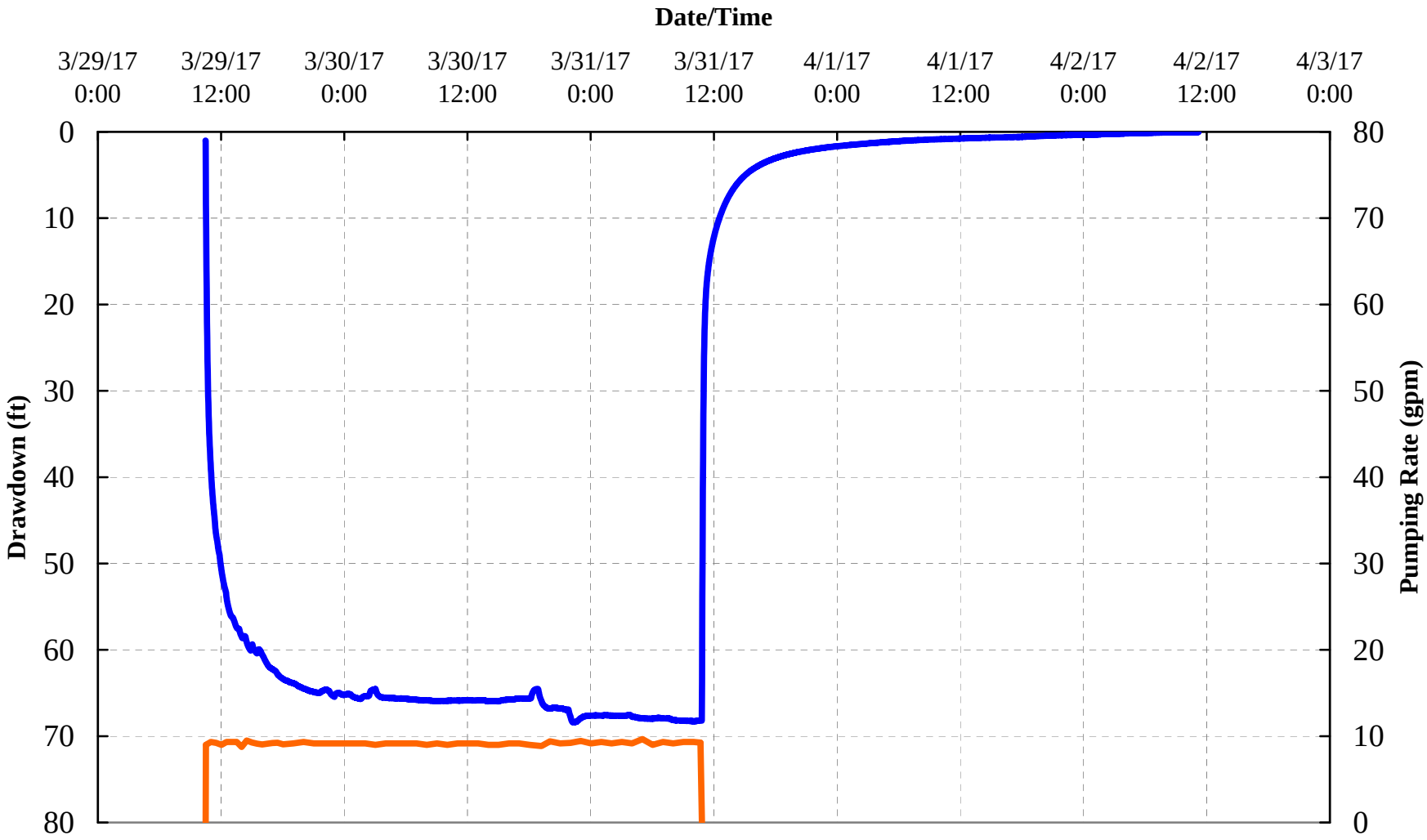


Figure 3. Well PW-1, 180 Day Extended Drawdown.

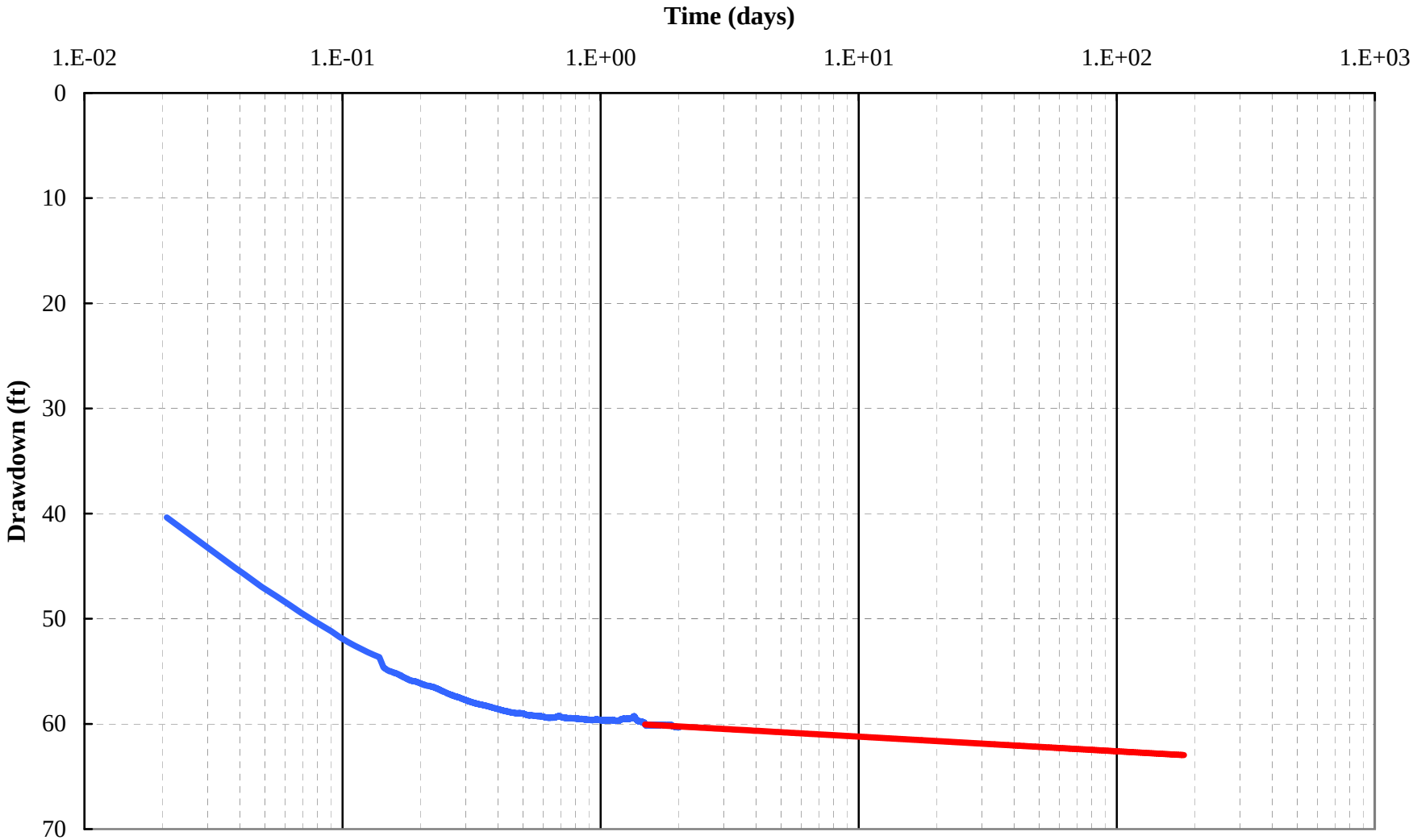


Figure 4. Well PW-2, 180 Day Extended Drawdown.

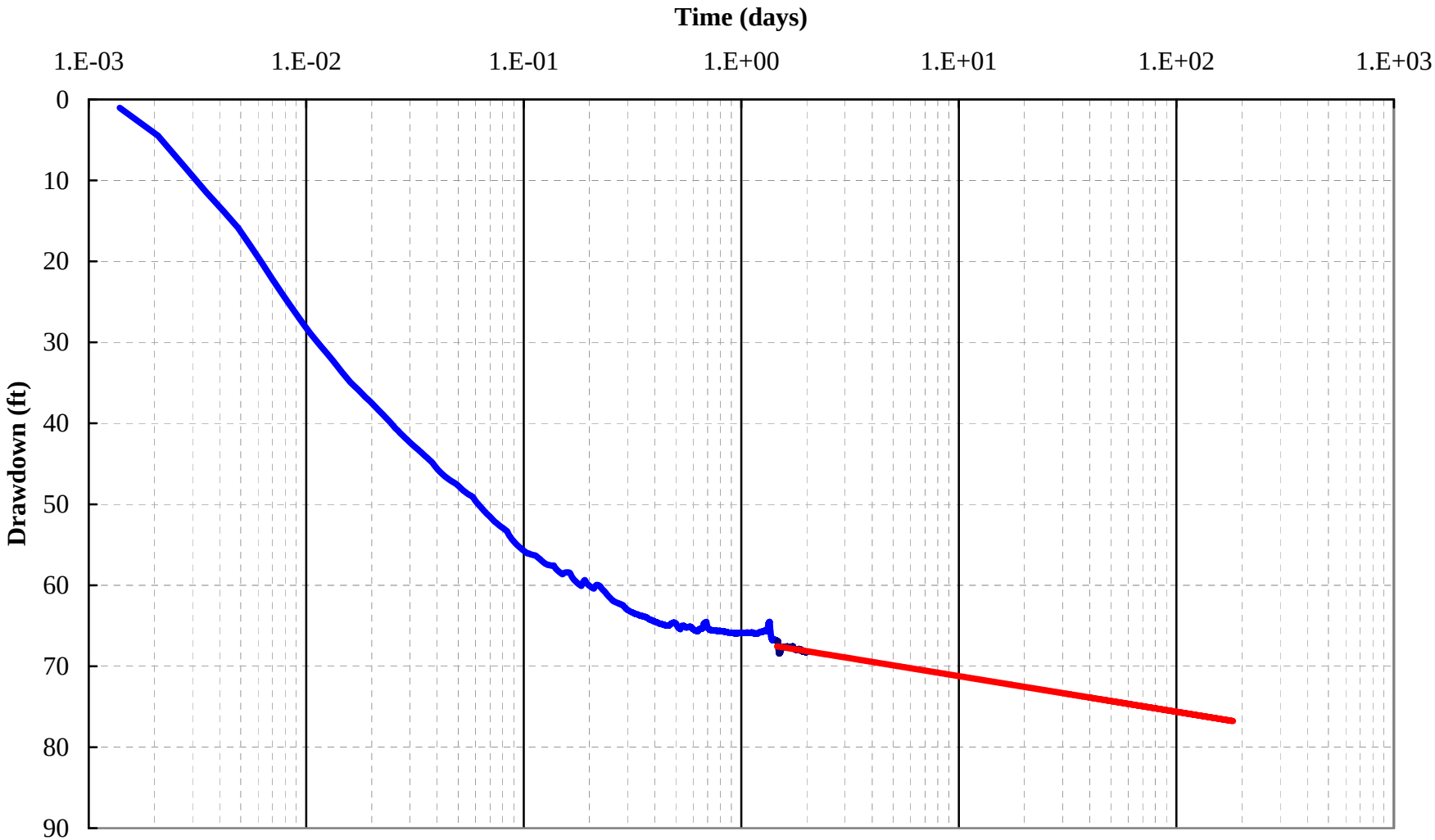


Figure 5. Well PW-1, 180 Day Extended Drawdown.

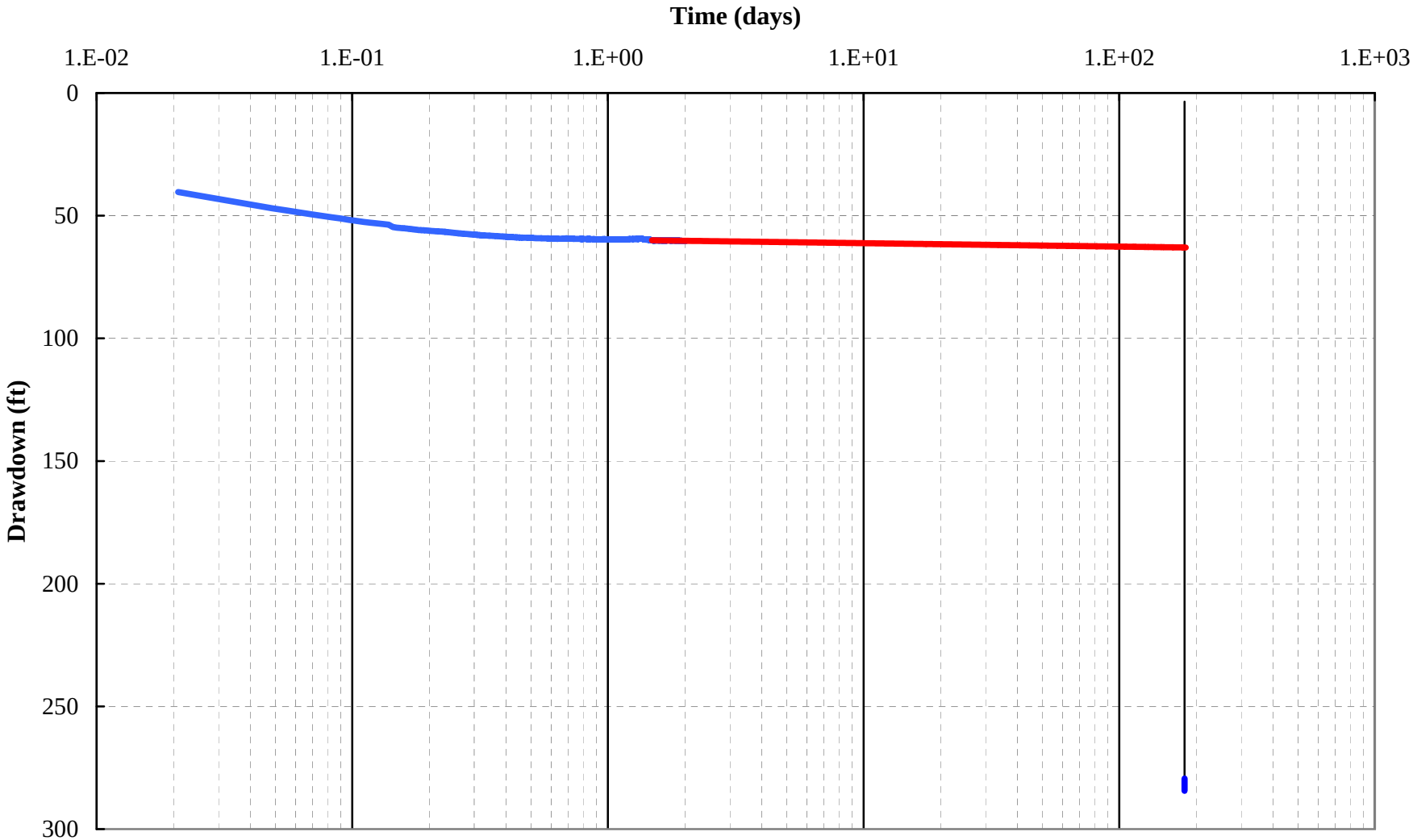
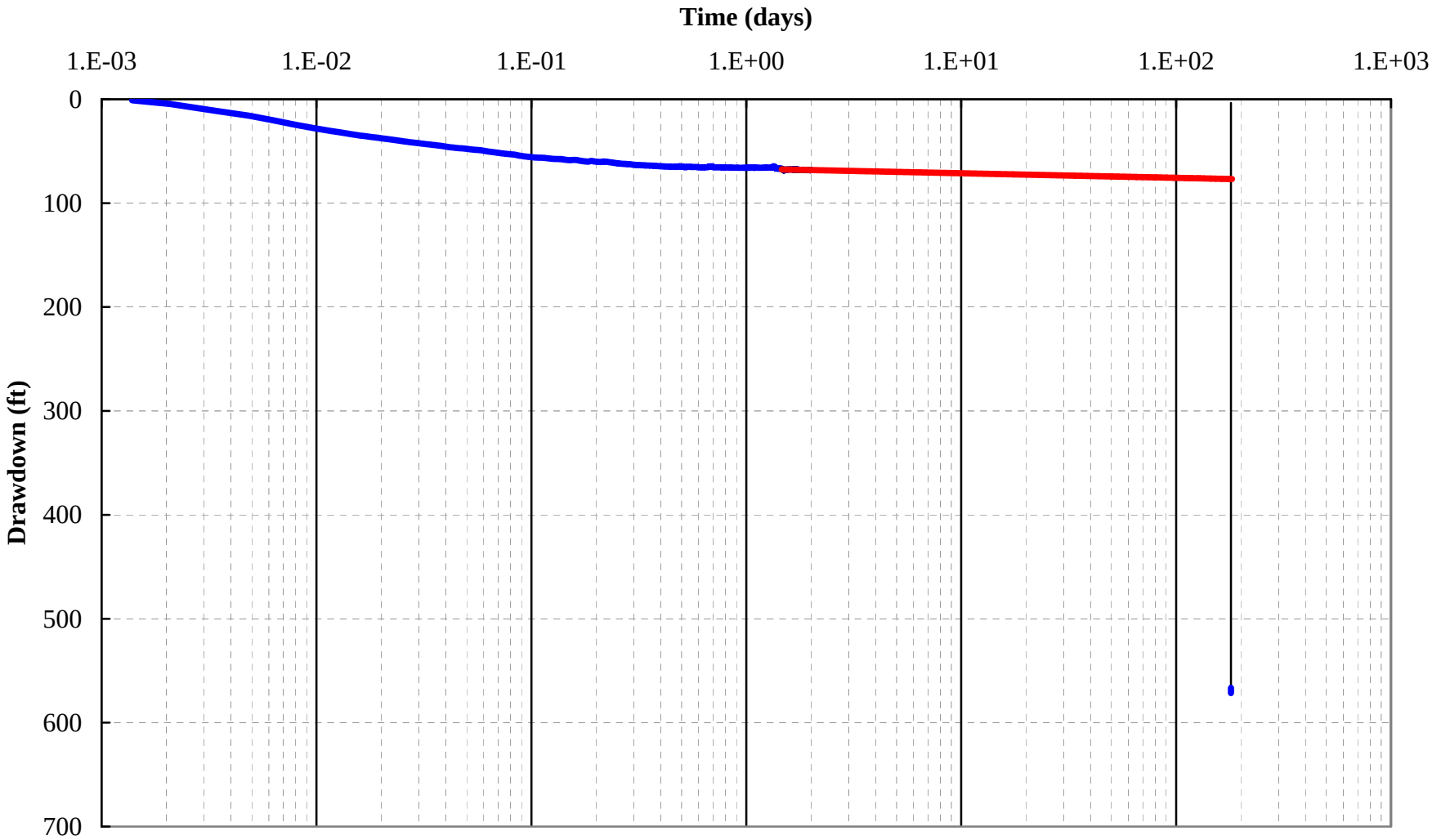
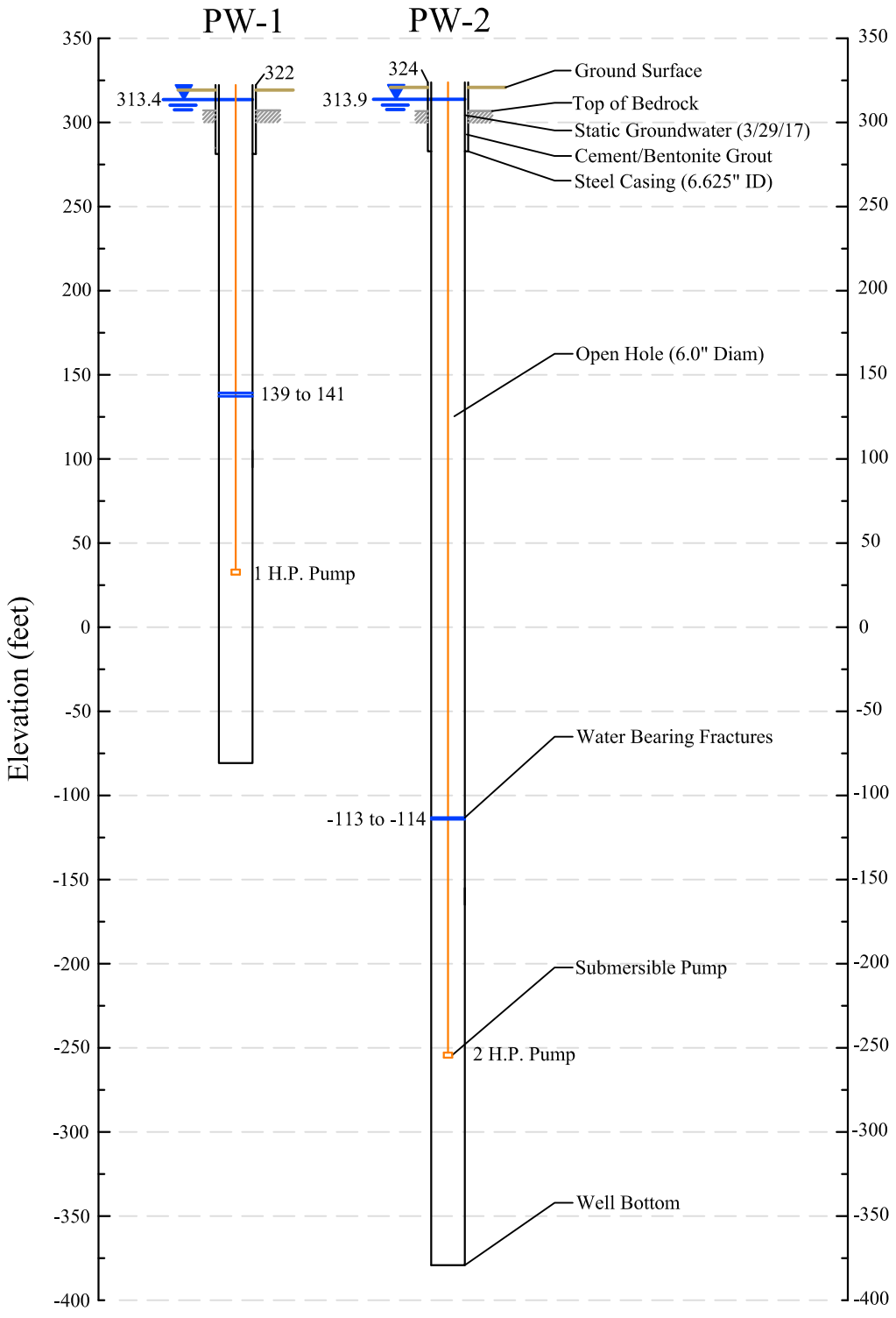


Figure 6. Well PW-2, 180 Day Extended Drawdown.





NOTES

1. Wells drilled by Gap Mountain Drilling, LLC on 8/17/16 (PW-1) and 8/23/16 (PW-2).
2. Upon completion of drilling, well yields were: PW-1 at 25 gpm by air blow-down for 4 hours; and PW-2 at 14 gpm by pump for 4 hours.
3. Pumps installed by Wilmington Pump on 9/28/16.
4. Depth to groundwater recorded on 3/29/17.

Well Location Sketch

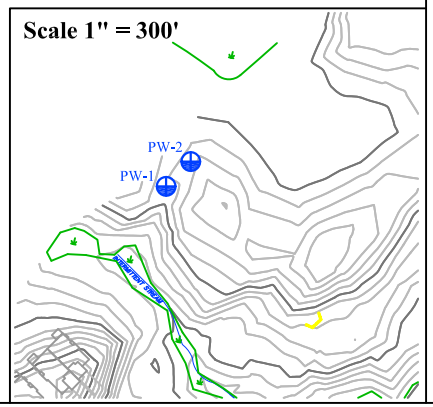


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Figure 7. Schematic Diagram of the BTC Wells.

Scales as shown.

Project No. GHC#15005
Drafted SWS Checked
Date 9/29/16 Rev 4/7/17
Base Map: CAD files and elevations obtained from Stamski & McNary.

GeoHydroCycle, Inc.