PUMP TEST REPORT
PROPOSED TAUNTON PUMP STATION

Proposed Taunton Pump Station Project
690 West Water Street
Taunton, Massachusetts

Prepared for:

BETA Group, Inc.
6 Blackstone Valley Place
Lincoln, RI 02865

Prepared by:

Paul B. Aldinger & Associates, Inc.
860A Waterman Avenue, Suite 9
East Providence, Rhode Island 02914

PBA No. 17006
June 2018

PAUL B. ALDINGER & ASSOCIATES, INC.
Consulting in Geotechnical Engineering & Groundwater Hydrology
860 Waterman Avenue, Suite 9, East Providence, R.I. 02914 (401) 435-5570

June 1, 2018

Mr. Christopher Cronin, P.E.
Project Manager
BETA Group, Inc.
6 Blackstone Valley Place
Lincoln, RI 02865

Re: Pump Test Report
Proposed Taunton Pump Station
690 West Water Street
Taunton, Massachusetts
PBA Job No. 17006

Dear Mr. Cronin:

Paul B. Aldinger & Associates Inc. (PBA) is pleased to provide BETA Group Inc. (BETA) with this geotechnical engineering report for the above referenced project. This report is subject to the limitations that are outlined in Appendix A.

1.00 INTRODUCTION, PROJECT DESCRIPTION, AND PUMP TEST WORK SCOPE OBJECTIVES

The project consists of constructing a new Main Sewage Pump Station, and influent sewage pipeline with intermediate manhole structures located north and west of the proposed pump station, beneath West Water Street in Taunton, Massachusetts. Additionally, two "twin" 24 inch diameter sewer force mains are planned to extend south from the proposed pump station to the Taunton Waste Water Treatment Plant. The proposed pump station is planned to be located directly adjacent and east of the existing pump station, at 690 West Water Street, Taunton, Massachusetts. Refer to the attached Figure 1, Site Vicinity Plan.

For project background information refer to the following:

- Geotechnical Engineering Report for the Proposed Pump Station and Stream Crossing, Taunton, Massachusetts; Paul B. Aldinger and Associates; August 16, 2017.

- Main Lift Pump Station Drawings, City of Taunton, Massachusetts; BETA Group Inc., April 2018.

- Existing Pump Station, Test Pit Report ; Paul B. Aldinger and Associates; June 1, 2018

The proposed pump station will be located less than approximately 10 feet to the east of the existing pump station, and will be founded deeper than the existing pump station. The results of a recent test pit program undertaken adjacent to and along the east and west perimeter foundation walls of the existing pump station indicated no sheet piling exists around and below the existing pump station's foundation. This absence of sheeting potentially makes the existing pump station sensitive to the proposed adjacent deep construction.

Due to the proximity of the two pump station structures, the existing shallow groundwater depth, and the depth of proposed pump station construction, support-of-excavation and construction dewatering systems will be required for the new construction, particularly considering that the proposed pump station foundation will extend below the existing pump station foundation.

The site for the proposed pump station is presently asphalt paved and relatively flat with an existing ground surface elevation of approximately +11.5 feet. According to the project drawings, the existing station's mat foundation bottom is at elevation -19.7 feet, approximately 31 feet below ground surface. The proposed pump station will be founded with the top-of-mat foundation at elevation -21.5 feet. The structure's mat foundation is anticipated to be on-the-order of 3 to 5 feet in thickness, which would place a 5 foot thick mat bottom at the approximate elevation of -26.5 feet, 38 feet below the ground surface.

Other significant project facets include:

- To the east of the proposed pump station, the site slopes downward to the Taunton River. There is an existing sewer siphon extending from beneath the Taunton River into the existing pump station that currently bisects the proposed pump station foot print. The sewer siphon pipeline will need to be integrated into the proposed pump station.

- An extensive and deep system of influent sewer pipeline and manhole structures are planned to be constructed below West Water Street, leading to and supplying the proposed pump station.

- Two "twin" 24 inch diameter sewer force mains are planned to exit the proposed pump station on the south side, and extend south approximately one-quarter (¼) mile, with one stream crossing, to the Taunton Waste Water Treatment Plant located at 825 West Water Street.

This report focuses on the procedures, performance data and analysis results of a groundwater

Pump Test program undertaken to develop design-phase hydraulic data for the proposed pump station's support-of-excavation and construction dewatering designs, which are linked. The proposed pump station's excavation is estimated to extend approximately 40 feet below ground surface.

The Pump Test was performed from a pump well located within the footprint of the proposed pump station during March of 2018. The construction dewatering approach for the proposed pump station is recommended to consist of the dewatering of the varved SILT stratum (Glacial Outwash 1), which extends approximately to the bottom of the proposed pump station excavation, and the dewatering/depressurization of the coarse granular stratum described as fine to coarse SAND and to trace gravel (Glacial Outwash 2) located between approximately 40 and 68 feet below ground surface. The fine to coarse SAND and to trace Gravel stratum was the focus of the Pump Test program. The strata identification terms Glacial Outwash 1 and Glacial Outwash 2 are from the project's Geotechnical Report.

The project's elevation datum is the North American Vertical Datum of 1988 (NAVD 88), and the horizontal datum is North American Datum of 1983 (NAD 83).

Work scope objectives of the Pump Test are to:

- Provide data for the successful Contractor to develop an estimated range of permeability values (k value range) for the proposed pump station's construction dewatering design. The construction dewatering effort will focus on the dewatering of the varved SILT stratum (Glacial Outwash 1) and the depressurization/dewatering of the coarse granular stratum (Glacial Outwash 2) located approximately 40 to 68 feet below existing ground surface.

- Provide data for the successful Contractor to develop an estimated range of construction dewatering pump rate (steady-state) and an estimated areal extent of construction dewatering influence zone (groundwater level zone of depression), based upon the depth of proposed pump station support-of-excavation system, i.e. based upon the extent of coarse granular stratum groundwater cut-off by the proposed sheet pile system. The anticipated support-of-excavation system is a braced steel sheet pile system approach to support an excavation depth of approximately 40 feet below ground surface.

2.00 CHRONOLOGY OF SIGNIFICANT PROJECT EVENTS

- Project Boring Program Performance, PBA-1 through PBA-5: February 27 to March 3, 2017.

- Project Geotechnical Report submission: August 16, 2017.
- Existing Pump Station, Test Pit Program:, October 27, 2017.
- Pump Well and Pump Installation:, January 9 to January 11, 2018.
- Existing Pump Station, Vertical Movement Monitoring Point Installations: February 2 to February 28, 2018.
- Pump Test Monitor Well Installations, MW-1, 2 and 3: February 5 to February 22, 2018.
- Pump Well, Step Test Performance: Morning of March 19, 2018.
- Pump Test Performance: Afternoon of March 19 to March 22, 2018.
- Pump Test Equipment Demobilization: March 23, 2018.
- Existing Pump Station, Vertical Movement Monitoring Point Elevation Checks: March 23, 2018.
- Pump Test Data-Logger Demobilization: March 29, 2018.

3.00 PROPOSED PUMP STATION AREA, SUBSURFACE STRATIGRAPHY

For the following discussion refer to:

- Figure 2, Pump Station Area Locations: Borings, Pump and Monitor Wells.
- Figure 3A, Pump Station Area Locations: Subsurface Profile A-A and Schematic Profile B-B.
- Figure 3B, Pump Station Area: Subsurface Profile A-A.
- Appendix B: Boring Logs PBA-1 and PBA-2; and Grainsize Analysis Pump Well Screen Stratum: Soil sample from boring PBA-1, Glacial Outwash 2 stratum (F/C SAND and/trace Gravel stratum) sample depth 49 to 56 feet below ground surface.

A brief description of the subsurface stratigraphy encountered within and surrounding the proposed pump station foot print, utilizing project borings PBA-1 and PBA-2 and Geotechnical Report terminology, is described from top to bottom:

- Existing Ground Surface, elevation +11.5.

- Granular Non-Engineered Fill extending to between approximately 17 and 20 feet below ground surface (elev. -5.5 to -8.5). This stratum is generally described as: variably loose to dense; brown/gray; mixture of Sand, Gravel and Silt with wood encountered at bottom-of-stratum in boring PBA-1.

- Glacial Outwash 1 extending to between approximately 30 and 40 feet below ground surface (elev. -18.5 to -28.5). This granular stratum is generally described as: medium dense; gray; varved inorganic SILT (ML).

- Glacial Outwash 2 extending to approximately 68 feet below ground surface (elev. -56.5). This granular stratum is generally described as: medium dense to very dense; gray; fine to coarse SAND, and to trace Gravel, trace Silt (SP-SM). This stratum is the focus of the Pump Test and the location of the Pump Well screen. Note: the pump well installation log indicates the presence of cobble size rock components within this stratum.

- Glacial Till extending to approximately 72 feet below ground surface (elev. -60.5). This granular stratum is generally described as: very dense; gray; fine to coarse SAND AND GRAVEL, trace Silt (SP-SM).

- Bedrock (assumed, not core sampled) with approximate surface at 72 feet below ground surface (elev. -60.5). From the literature, area bedrock is the relatively soft Rhode Island Formation composed typically of interbedded Shale, Sandstone and/or Conglomerate rock types.

- Groundwater Level: From the groundwater monitoring well installed within borehole PBA-1: on March 3, 2017 groundwater level was approximately 7.2 feet below ground surface (elev. +4.3); and on March 19, 2018 groundwater level was approximately 5.0 feet below ground surface (elev. +6.5).

4.00 PUMP TEST PROGRAM COMPONENTS

For the following Report Section 4.00 discussion, refer to:

Appendix C: J. Russell Water Well Inc. Information Package:

- Step and Pump Tests, Pump Well Summary Data.

- Submersible Pump, Grundfos model 300S100-3A, Pump Performance Curves.

- Step Test Data, Pump Well: Pump Rate, Pump Well Groundwater Level, Time.

- Pump Test Data, Pump Well: Pump Rate, Pump Well and Boring PBA-1 Monitoring Well Groundwater Level, Time.

- Pump Well and Well Screen Installation Log.

Components of the Pump Test program include:

- Pump well and submersible pump installations.

- Monitor and pump wells, vibrating-wire piezometer installations.

- Existing pump station, vertical movement monitoring point installations.

- Pump well, Step Test performance.

- Pump well, Pump Test performance.

4.10 PUMP WELL AND SUBMERSIBLE PUMP INSTALLATIONS

Between Tuesday January 9 and Thursday January 11, 2018, the Viera Well Company of Georgetown, Massachusetts in coordination with J. Russell Water Well Inc. of Hope Valley, Rhode Island installed and logged the pump well casing/screen, and set the submersible pump. Well construction consisted of standard 8 inch I.D. steel casing extending to 50 feet below ground surface, with an 8 inch I.D. by 10 foot long, 50 slot, stainless steel well screen without filter pack set below the casing, between depths of 50 and 60 feet below ground surface. The well screen was set at the approximate middle of the coarser granular stratum (Glacial Outwash 2), herein after referred to as the "aquifer stratum". Well drilling procedures consisted of air-rotary drilling between 0 and 20 feet, mud-rotary drilling between 20 and 47 feet, and water-rotary drilling between 47 and 65 feet. Water-rotary drilling procedures were used within the aquifer stratum and well screen depth zone to limit stratum contamination by the mud-rotary drilling procedure.

The Pump Test's submersible pump was set within the well casing at an intake depth of 43 feet below ground surface. The pump was a 10 hp Grunfos model 300S100-3A submersible 3-stage turbine pump, capable of pumping a maximum of 400 gallons per minute (gpm) against a water head of 50 feet. Power for the pump testing was obtained from the existing pump station's electrical panel. Also installed within the pump well casing was facility for the well driller to monitor groundwater level before, during and after pump testing. In-well hand measurement of groundwater level was performed by the well driller periodically using a Solonist electronic water level meter, as a back-up to an in-well vented vibrating-wire piezometer installed by PBA.

Pump Test discharge was conveyed to the existing pump station's wet well through approximately 45 feet of 6 inch I.D. PVC pipe installed between the well head and wet well through an opening cut-into a (temporary) securely bolted plywood cover over an existing pump station exterior wet well access-way. Pump Test discharge flow volume was measured by an in-line PVC pipe digital flow meter installed approximately mid-way between the well head and wet well discharge point.

4.20 MONITOR AND PUMP WELLS, VIBRATING-WIRE PIEZOMETER PROGRAM

For the following discussion refer to Figure 2, Pump Station Area Locations: Borings, Pump and Monitor Wells; Figure 3A, Pump Station Area Locations: Subsurface Profile A-A and Schematic Profile B-B; and Figure 4, Pump Station Area, Schematic Subsurface Profile B-B: Borings, Pump and Monitor Wells.

Between Monday February 5 and Thursday February 22, 2018, New England Boring Contractors of Derry, New Hampshire installed three (3) groundwater monitoring wells at locations selected by PBA. Monitor well installations were observed and guided by a PBA geotechnical engineer and/or engineering technician. Monitor wells were located at specific distances from the pump well for analysis purposes: MW-1 at approximately 5 feet, MW-2 at approximately 50 feet, and MW-3 at approximately 100 feet. Each monitor well was constructed to contain three (3) vibrating-wire piezometers (Geokon 4500S-700KPA, unvented) located at borehole depths for stratum specific groundwater level information. Vibrating-wire piezometers were installed by first advancing and cleaning nominal 4 inch diameter steel casing (HW) by the drive and wash method to several feet below the deepest piezometer depth. At ground surface, the three (3) piezometers and their wiring were attached to a nominal 1 inch diameter PVC pipe at specific depth intervals, which was then lowered to bottom-of-casing at borehole center. The PVC pipe was now used as a tremie pipe to cement-bentonite grout the borehole orifice with piezometers in-place, from borehole bottom to ground surface while extracting the four (4) inch diameter casing.

Additionally, a "vented" barometric pressure compensating vibrating-wire piezometer (Geokon 4500SV-700KPA, vented) was installed within the pump well at a groundwater depth deep enough to not be impacted by Pump Test draw-down, at a depth below ground surface of approximately 46 feet.

Each monitor well piezometer was located at the approximate center of the three (3) principal saturated soil strata, from top to bottom: the granular non-engineered Fill, varved SILT (Glacial Outwash 1) and coarse granular stratum(Glacial Outwash 2) as seen in the pump station area boring logs PBA-1 and PBA-2. Vibrating-wire piezometers were set at the following approximate depths below ground surface in each of the three (3) monitor wells, from top to bottom: 9 feet, 28 feet and 55 feet. Within MW-1, located approximately 5 feet from the pump well, the bottom piezometer was set at the adjacent mid-pump well screen depth, coincidentally at 55 feet below ground surface, to record immediate well adjacent groundwater level during the Step and Pump testing.

All nine (9) monitor well and the one (1) pump well piezometers were wire connected to a 16 channel data logger (Geokon 8002-16-2; LC-2x16) for simultaneous groundwater data collection during the Step and Pump Testing. There are two types of vibrating-wire piezometers, those that are open to the atmosphere or "vented" and those that are not. Vented piezometers are designed to apply a barometric pressure compensation to readings, unvented (hermetically sealed) piezometers do not.

For piezometer applications within groundwater regimes not open to the atmosphere, e.g. most below ground surface applications and within grouted boreholes, the full effects of barometric pressure may be attenuated, delayed or otherwise minimized. In this case, the application of barometric pressure compensation to groundwater level readings may introduce significant errors. For example, a barometric pressure change from 29 to 31 inches of mercury would result in approximately one (1) psi of barometric pressure reading correction or up to 2.3 feet of groundwater level error. For this application, an unvented (or sealed) piezometer would be appropriate, e.g. the nine (9) unvented piezometers installed in the project's groundwater monitor wells MW-1, 2 and 3.

For piezometer applications where the water column is open to the atmosphere, e.g. within and open borehole or well, a vented or barometrically compensated piezometer will more accurately reflect groundwater pressure and thus groundwater level conditions. Piezometer venting is typically obtained through a dedicated vented signal cable, e.g. the vented piezometer installed in the project's pump well.

4.30 EXISTING PUMP STATION, VERTICAL MOVEMENT MONITORING POINT PROGRAM

For the following discussion refer to Figure 5, Existing Pump Station, Vertical Movement Monitoring Point Locations; and Appendix D: Surveyor's Sketch, Existing Pump Station Vertical Movement Monitoring Point Locations, and Monitoring Point Spreadsheet Data; and Main Lift Pumping Station, Taunton, MA, "Vertical Control (Locations)," Figure1, BETA Group Inc.

Vertical movement monitoring points were installed on the existing pump station structure to record and document any structure movement that could be associated with the Pump Test program.

Bench mark, vertical survey control points were obtained from locations outside of the immediate pump station area on West Water Street, and control point elevations were brought onto the pump station site to verify known bench mark elevations on and around the existing pump station structure. A total of twelve (12) existing pump station perimeter, interior and exterior, vertical movement monitoring points were installed, and elevations obtained and checked, prior to the Pump Test performance. Vertical movement monitoring point elevations

were determined to level survey accuracy, 1/100th of a foot, ±1/8th inch. Post Pump Test performance, all structure vertical movement monitoring points were checked for elevation variation. To level survey accuracy, no vertical movement was detected at any of the monitoring points.

4.40 STEP TEST PROCEDURE AND WELL DRILLER PUMP WELL DATA SUMMARY

On the morning of Monday, March 19, 2018 the pump well was Step Tested to develop a sustainable pumping rate for the immediately following three (3) day Pump Test. Step Testing involves the sequential pumping of a well over a relatively short time period, in increasing pump rate increments, to determine a maximum safe pumping rate for the subsequent extended period Pump Test. During Step Test pumping, pump and monitor well groundwater level measurements are made to determine a pumping rate that provides drawn-down groundwater levels within the pump well that do not jeopardize pump function, and provides a pumping rate sufficient to induce a suitable groundwater level (aquifer) reaction to ultimately estimate aquifer hydraulic properties from the Pump Test results.

Prior to Step Test start, static groundwater level within the pump well was measured to be approximately 5.3 feet below ground surface, elev. +6.1. The first step pumping rate was 100 gpm, which produced an in-well groundwater level of 21.1 feet below ground surface. The second step pumping rate was 150 gpm, which produced an in-well groundwater level of 25.2 feet below ground surface. The third step pumping rate was 200 gpm, which produced an in-well groundwater level of 32.1 feet below ground surface. The groundwater level, 32.1 feet below ground surface, leaves a safety factor of approximately 11 feet of water above the submersible pump's intake, which was set at 43 feet below ground surface. After review of monitor well piezometer data, it was decided that a Pump Test pumping rate of 200 gpm would be appropriate and adequate.

At Step Test completion, groundwater conditions at the pump well recovered to within 0.34 feet (4 inches) of initial static conditions within approximately one (1) hour. At that time, the three (3) day Pump Test was initiated.

4.50 PUMP TEST PROCEDURE AND WELL DRILLER PUMP WELL DATA SUMMARY

On the afternoon of Monday, March 19, 2018 the three (3) day Pump Test was initiated. A constant pumping rate of 200 gpm was maintained until test completion on the afternoon of Thursday March 22, 2018. The maximum depth of in-well groundwater level was recorded to be 35.7 feet below ground surface. The in-well groundwater level recovered to 1.8 feet below static level within 30 minutes after pumping termination.

At the end of the Pump Test program the submersible pump was removed and the pump well screen/casing was left-in-place and capped with a bolted steel plate. Top of pump well capped casing is approximately 1.9 feet above ground surface.

5.00 SUMMARY: MONITOR AND PUMP WELLS VIBRATING-WIRE PIEZOMETER DATA

Prior to initiating the pump test the vibrating wire piezometers were installed and connected to the data logger. The piezometers were preset to record pressure readings at predetermined intervals. The results of these pressure readings were later downloaded and these readings used to develop the drawdown at each location by subtracting from the initial readings. These drawdown readings were then used to develop several plots which present the reaction of the groundwater at the piezometer level to the stress caused by the pumping of the well. See Appendix C for a summary of the well and observation well data.

Figures 6 through 8 present the drawdown measured in each of the piezometers as a result of the pumping of the well measured at each level versus the time since the start of the pump test. We note that the "top" piezometer was set 9 feet below ground surface, the "Mid" piezometer was set 28 feet below ground surface and the "Btm" piezometer was set 55 feet below ground surface in each piezometer. It is noted that most locations do indicate a tidal effect, and as expected the most drawdown is observed in the lowest piezometer at each location (btm) which was set in the sand and gravel stratum which was being pumped. The other piezometers are set in the varved silt (mid) and the granular fill (top) which show a significant retarding of the drawdown effect. This indicates that there is not good communication between these upper strata and the sand and gravel stratum which is being pumped.

Figures 9 through 11 present the drawdown measured in each of the piezometers within the same stratum (at the same depth) as a result of the pumping of the well. Figure 9 presents the drawdown in the fill layer measured in each piezometer set in that layer (at the same depth). We note here that the piezometer in MW-2 appears to be affected by the tidal influence more than the others and this retards the drawdown observed. The retardation of drawdown with distance from the pumping well is not entirely evident since the piezometer in MW-2 (50 feet from the pumping well) appears to have less drawdown than the one in MW-3 (100 feet from the pumping well), presumably due to tidal impacts. Figure 10 presents the drawdown in the varved silt stratum (mid Piezometer) measured in each piezometer set in that stratum (at the same depth). We note here that all of the piezometers appear to be affected by the tidal influence but the one in MW-2 appears to be affected more than the others. The retardation of drawdown with distance from the pumping well is more evident in this stratum.

Figure 11 presents the drawdown in the coarser stratum ("btm" Piezometer) beneath the varved silt measured in each piezometer set in that stratum (at the same depth). We note that the piezometer in MW-2 does not react as quickly as the other two, presumably due to tidal effects.

We also note the effect of a reduction in drawdown with distance from the pumping well in the stratum.

For comparison, Figure 12 presents the results of all nine piezometers on the same plot. This clearly depicts the retardation of drawdown in the upper two strata, the fill (in blue) and the varved silt (in red). The fill layer sees very little effect and the varved silt is reduced by more than 50%. This demonstrates the lack of a good hydraulic communication among the strata. We can observe the retardation of drawdown with distance from the pumping well as well.

Figure 13 presents the drawdown in the three piezometers which are all in the coarser sand and gravel stratum beneath the varved silt versus the time since the initiation of the pump test. This figure presents the same information as in Figure 11 but adds the measurement of the drawdown in the pumping well. This clearly depicts the retardation of drawdown with distance from the pumping well.

Figure 14 presents the drawdown in the three piezometers ("btm" Piezometers)which were measured at the end of the pumping test. Also indicated are the hand measurements of drawdown in observation well PBA-1 which was screened in this stratum as well. Figure 15 presents the same information but adds the measurement of the drawdown in the pumping well. We believe that the break in the line from the piezometer at five feet to the pumping well is due to the inefficiency of this well.

6.00 ANALYSIS AND CONCLUSIONS

The excavation for the construction of the proposed new pump station will require the driving of sheeting to limit the extent of the excavation and protect nearby structures and ancillary development. This sheeting may also be utilized to limit the extent and type of dewatering required to stabilize the excavation. The soil at the bottom of the excavation (most likely the varved silt) must be dewatered, however due to the nature of the soil profile, the sand and gravel stratum beneath the excavation will also have to be depressurized. The results of this pumping test provides actual distance drawdown and hydraulic conductivity data for this underlying sand and gravel stratum as well as information on the hydraulic communication among the identified strata. We utilized this data along with our estimate of the thickness of this sand and gravel stratum in which the pump was set to estimate the hydraulic conductivity of this stratum at 5.4×10^{-2} cm/sec.

This data must be utilized by the successful contractor for the project to design the dewatering system to dewater the excavation for the pump station and to depressurize the underlying sand and gravel stratum. It will also be utilized to determine the depth which the sheeting will be driven to assist in the dewatering operation, perhaps driving the sheeting deeper than is required for structural stability, thus effecting a partial or full cutoff by driving the sheeting into the underlying glacial till deposit. This data will also be very helpful in designing the dewatering system required

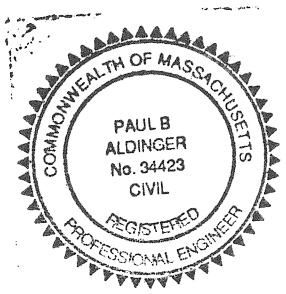
west of the proposed pump station, beneath West Water Street.

We appreciate to have been of service to you and we trust the information contained in this report is adequate for your needs at this time. Please contact the undersigned if there are questions on these recommendations or if you need additional information.

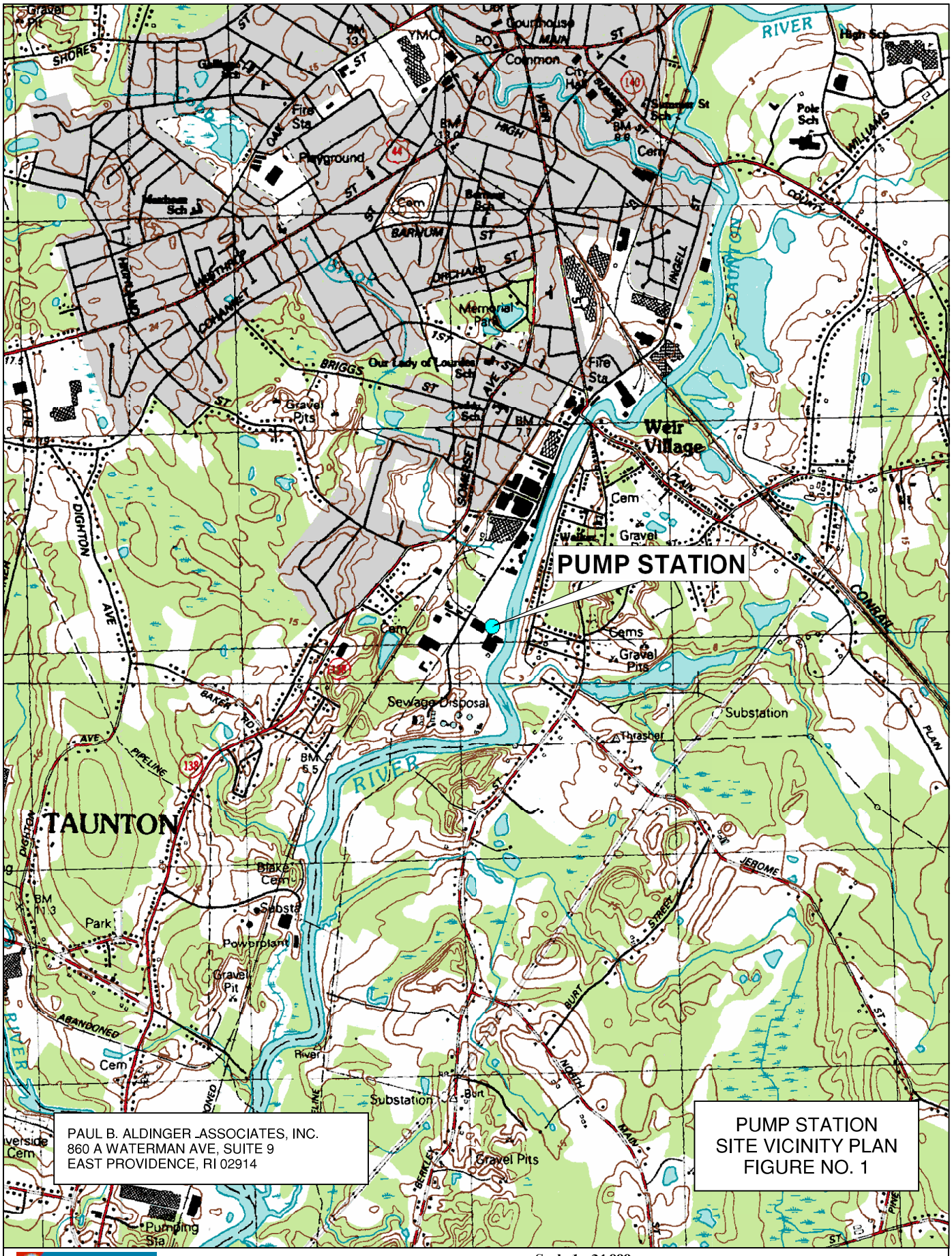
Very truly yours,

PAUL B. ALDINGER & ASSOCIATES, INC.

Paul B. Aldinger, Ph.D., P.E.
Chief Engineer



FIGURES



PAUL B. ALDINGER ASSOCIATES, INC.
860 A WATERMAN AVE, SUITE 9
EAST PROVIDENCE, RI 02914

PUMP STATION
SITE VICINITY PLAN
FIGURE NO. 1

EAST

WEST

N

PROPOSED
PUMP STATION

50'±

5'±

MW-2

PBA-2

MW-1

PUMP WELL

24" CI.

100'±

EXISTING
PUMP STATION

MW-3

PBA-1
(OBS.WELL)

VALVE
VAULT

WEST WATER
STREET

TAUNTON RIVER

6'H CLF

20" PVC

GATE

CPD

BIT.

CSP

STR

SIPHON

NOTE:

DEVELOPED FROM DRAWING TITLED "MAIN LIFT PUMP STATION - SITE GRADING PLAN, C-4" DATED JULY 2017 BY THE BETA GROUP OF LINCOLN RI.

0 10 20 30 40

SCALE: 1"= 20'

LEGEND:

PBA-1 — LOCATION OF TEST BORINGS COMPLETED BETWEEN FEBRUARY 27 AND MARCH 3, 2017 BY NEW ENGLAND BORING CONTRACTORS OF BROCTON, MA.

PUMP WELL

MW-3 — MONITOR WELLS

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PUMP STATION AREA LOCATIONS: BORINGS, PUMP AND MONITOR WELLS

PUMP TEST REPORT
PROPOSED PUMP STATION

690 WEST WATER STREET, TAUNTON, MA

PBA JOB NO.: 17006
DRAWN BY: DMS

DATE: MAY 2018
DESIGNED BY: PBA

SCALE: 1"=20'
CHECKED BY: PBA

Figure No: 2

EAST

WEST

N

PROPOSED
PUMP STATION

B

MW-2

PBA-2

MW-1

A

PUMP WELL

24" C.I.

A

VALVE
VAULT

B

EXISTING
PUMP STATION

PBA-1
(OBS.WELL)

MW-3

WEST WATER
STREET

TAUNTON RIVER

SIPHON

SIPHON

6"H CLF

GATE

6"H CLF

6"H CLF

20" PVC

CPD

BIT.

GATE

CS

NOTE:

DEVELOPED FROM DRAWING TITLED "MAIN LIFT PUMP STATION - SITE GRADING PLAN, C-4" DATED JULY 2017 BY THE BETA GROUP OF LINCOLN RI.

0 10 20 30 40

SCALE: 1"= 20'

LEGEND:

PBA-1 — LOCATION OF TEST BORINGS COMPLETED BETWEEN FEBRUARY 27 AND MARCH 3, 2017 BY NEW ENGLAND BORING CONTRACTORS OF BROCTON, MA.

PUMP WELL

MW-3 — MONITOR WELLS

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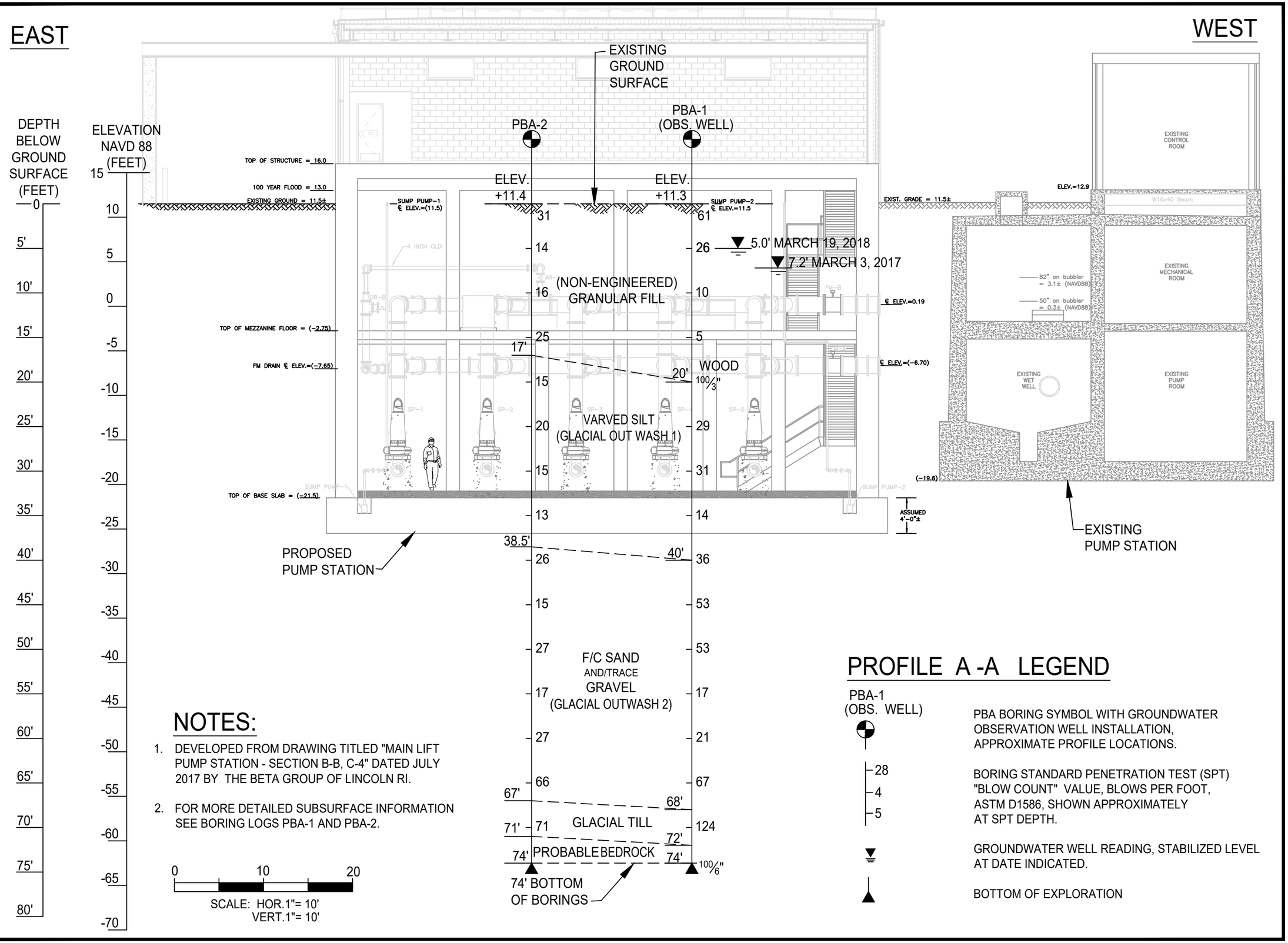
PUMP STATION AREA
LOCATIONS:
SUBSURFACE PROFILE A–A
AND
SCHEMATIC PROFILE B–B

PUMP TEST REPORT
PROPOSED PUMP STATION
690 WEST WATER STREET, TAUNTON, MA

PBA JOB NO.: 17006 | DRAWN BY: DMS
DATE: MAY 2018 | DESIGNED BY: PBA
SCALE: 1"=20' | CHECKED BY: PBA

Figure No: 3A



NOTES:

1. DEVELOPED FROM DRAWING TITLED "MAIN LIFT PUMP STATION - SECTION B-B, C-4" DATED JULY 2017 BY THE BETA GROUP OF LINCOLN RI.
2. FOR MORE DETAILED SUBSURFACE INFORMATION SEE BORING LOGS PBA-1 AND PBA-2.

PROFILE A -A LEGEND

PBA-1
(OBS. WELL)

PBA BORING SYMBOL WITH GROUNDWATER OBSERVATION WELL INSTALLATION, APPROXIMATE PROFILE LOCATIONS.

28
4
5

BORING STANDARD PENETRATION TEST (SPT) "BLOW COUNT" VALUE, BLOWS PER FOOT, ASTM D1586, SHOWN APPROXIMATELY AT SPT DEPTH.

GROUNDWATER WELL READING, STABILIZED LEVEL AT DATE INDICATED.

BOTTOM OF EXPLORATION

Paul B. Aldinger & Associates, Inc.
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Geotechnical Engineering
and Geohydrogeology
860A Waterman Avenue, Suite 9
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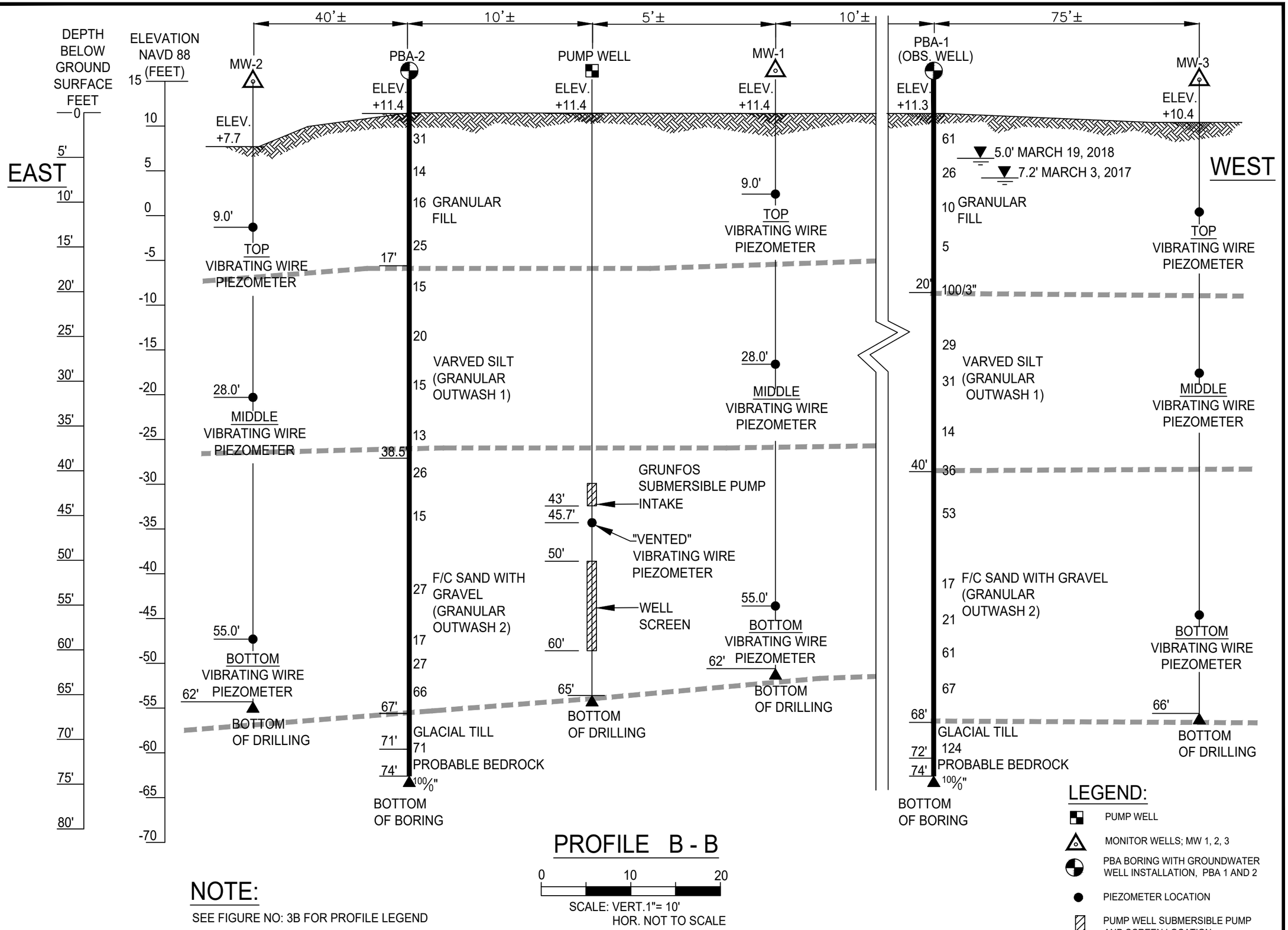
PUMP STATION AREA,
SUBSURFACE
PROFILE A-A

PUMP TEST REPORT
PROPOSED PUMP STATION
690 WEST WATER STREET, TAUNTON, MA

PBA JOB NO.: 17006	DRAWN BY: DMS
DATE: MAY 2018	DESIGNED BY: PBA
SCALE: 1"=10'	CHECKED BY: PBA

Figure No: 3B



PROFILE B - B

0 10 20

SCALE: VERT.1"= 10'
HOR. NOT TO SCALE

NOTE:

SEE FIGURE NO: 3B FOR PROFILE LEGEND

Paul B. Aldinger & Associates, Inc.
Consulting in
Geotechnical Engineering
and Geohydrogeology
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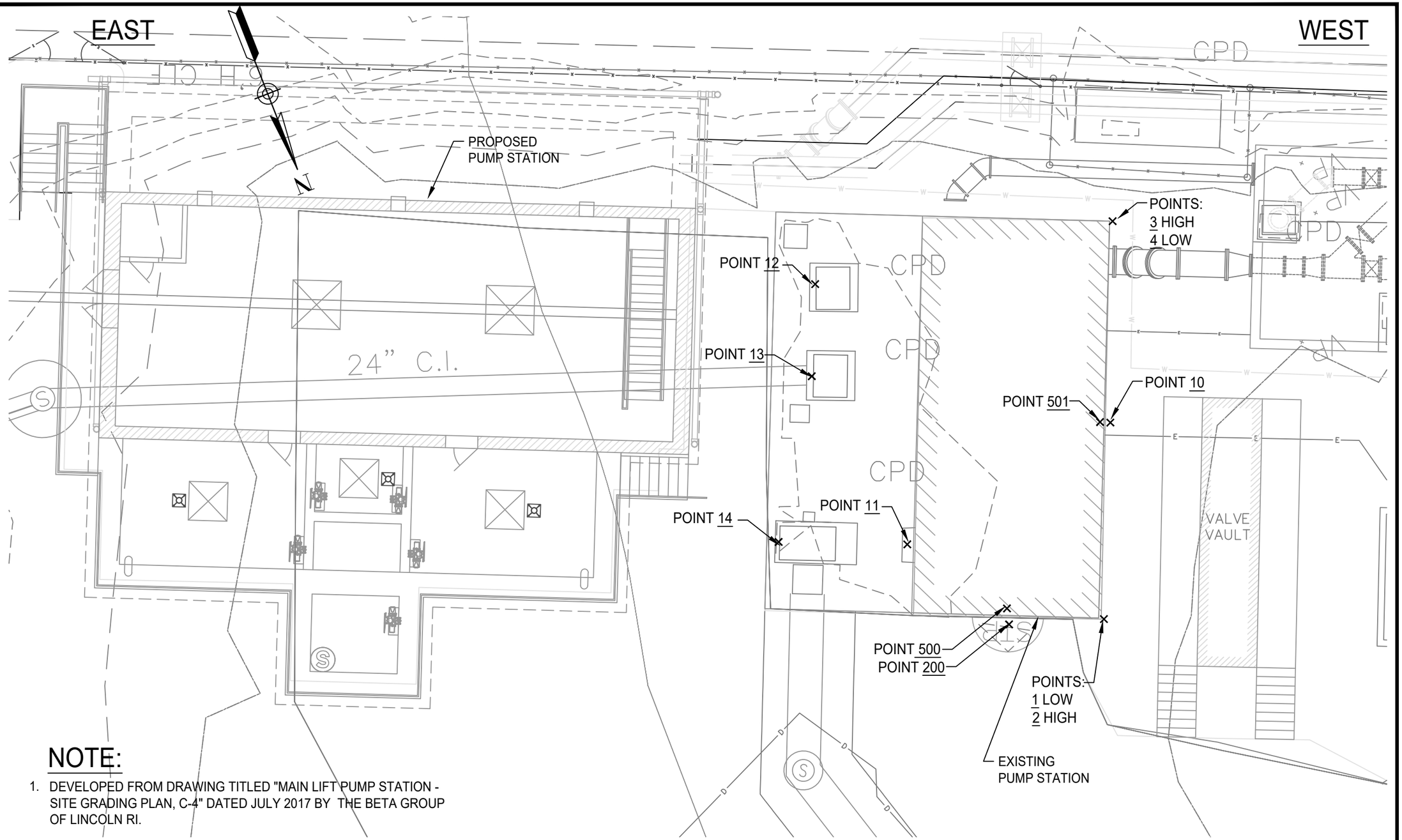
PUMP STATION AREA,
SCHEMATIC SUBSURFACE
PROFILE B–B:
BORINGS, PUMP
AND MONITOR WELLS

PUMP TEST REPORT
PROPOSED PUMP STATION
690 WEST WATER STREET, TAUNTON, MA

PBA JOB NO.: 17006	DRAWN BY: DMS
DATE: MAY 2018	DESIGNED BY: PBA
SCALE: 1"=10'	CHECKED BY: PBA

Figure No: 4



NOTE:

1. DEVELOPED FROM DRAWING TITLED "MAIN LIFT PUMP STATION - SITE GRADING PLAN, C-4" DATED JULY 2017 BY THE BETA GROUP OF LINCOLN RI.
2. REFER TO REPORT APPENDIX D:
   - SURVEYOR'S SKETCH, EXISTING PUMP STATION VERTICAL MOVEMENT MONITORING POINT LOCATIONS, AND MONITORING POINT SPREADSHEET DATA,
   - MAIN LIFT PUMPING STATION, TAUNTON, MA, "VERTICAL CONTROL," FIGURE 1, BETA GROUP INC.
3. THERE ARE TWELVE (12) EXISTING PUMP STATION VERTICAL MONITORING POINTS.

0 10 20
SCALE: 1"= 10'

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EXISTING PUMP STATION,
VERTICAL MOVEMENT
MONITORING POINT
LOCATIONS

PUMP TEST REPORT
PROPOSED PUMP STATION
690 WEST WATER STREET, TAUNTON, MA

PBA JOB NO.: 17006	DRAWN BY: DMS
DATE: MAY 2018	DESIGNED BY: PBA
SCALE: 1"=10'	CHECKED BY: PBA

Figure No: 5

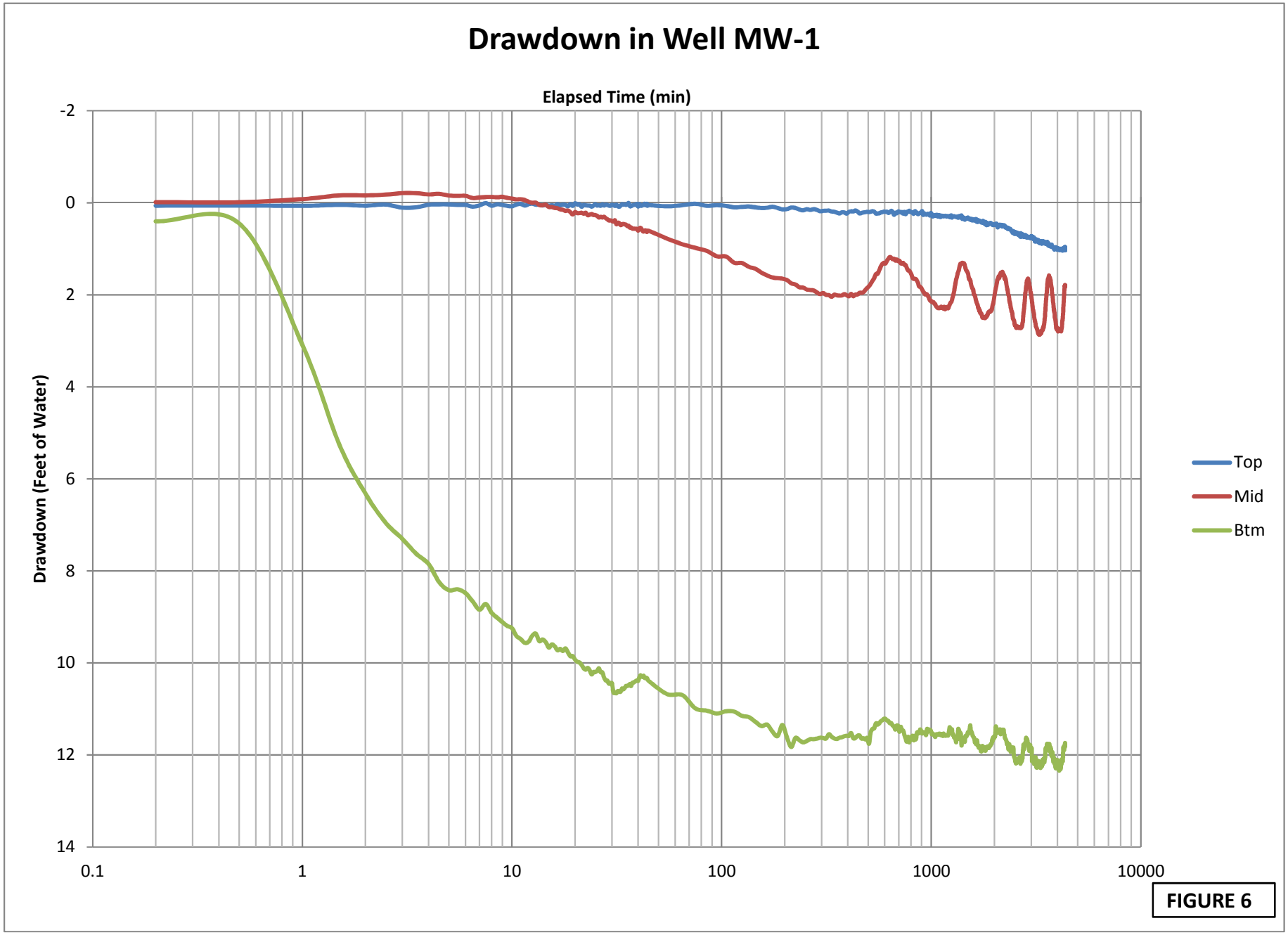

Drawdown in Well MW-1
Elapsed Time (min)
Drawdown (Feet of Water)
-2
0
2
4
6
8
10
12
14
0.1
1
10
100
1000
10000
Top
Mid
Btm

FIGURE 6

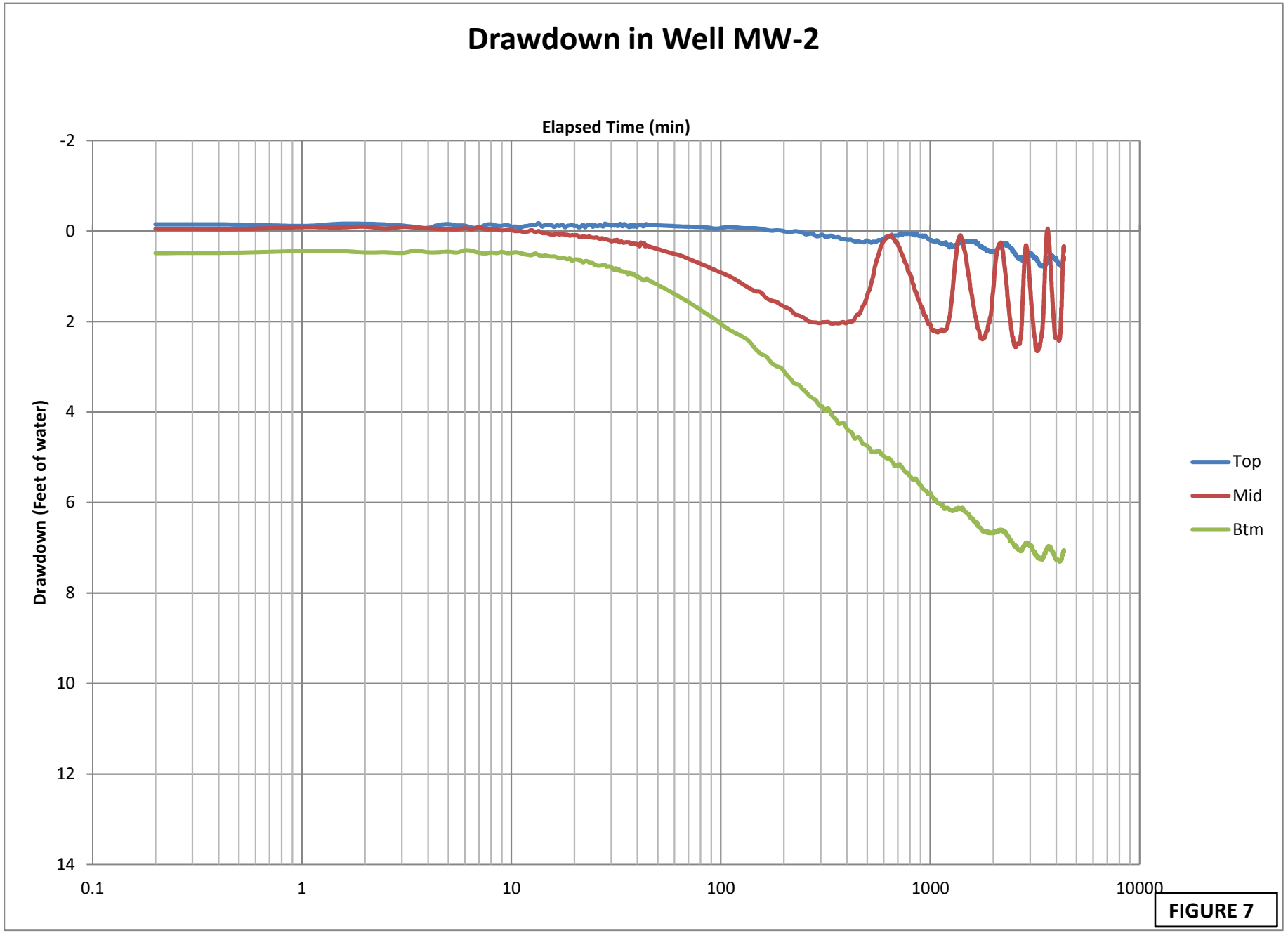

Drawdown in Well MW-2
Elapsed Time (min)
Drawdown (Feet of water)
-2
0
2
4
6
8
10
12
14
0.1
1
10
100
1000
10000
Top
Mid
Btm

FIGURE 7

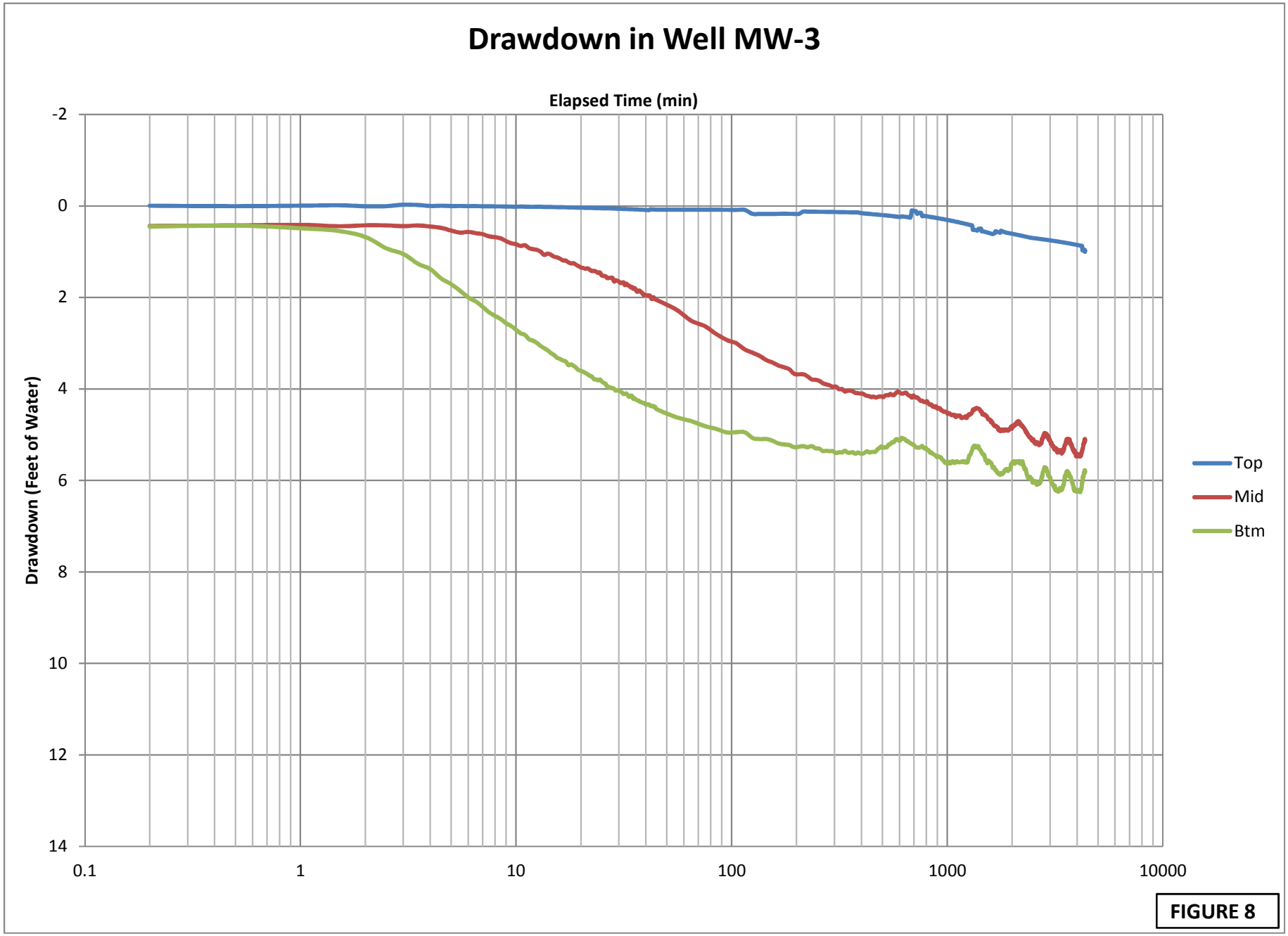

Drawdown in Well MW-3
Elapsed Time (min)
Drawdown (Feet of Water)
-2
0
2
4
6
8
10
12
14
0.1
1
10
100
1000
10000
Top
Mid
Btm

FIGURE 8

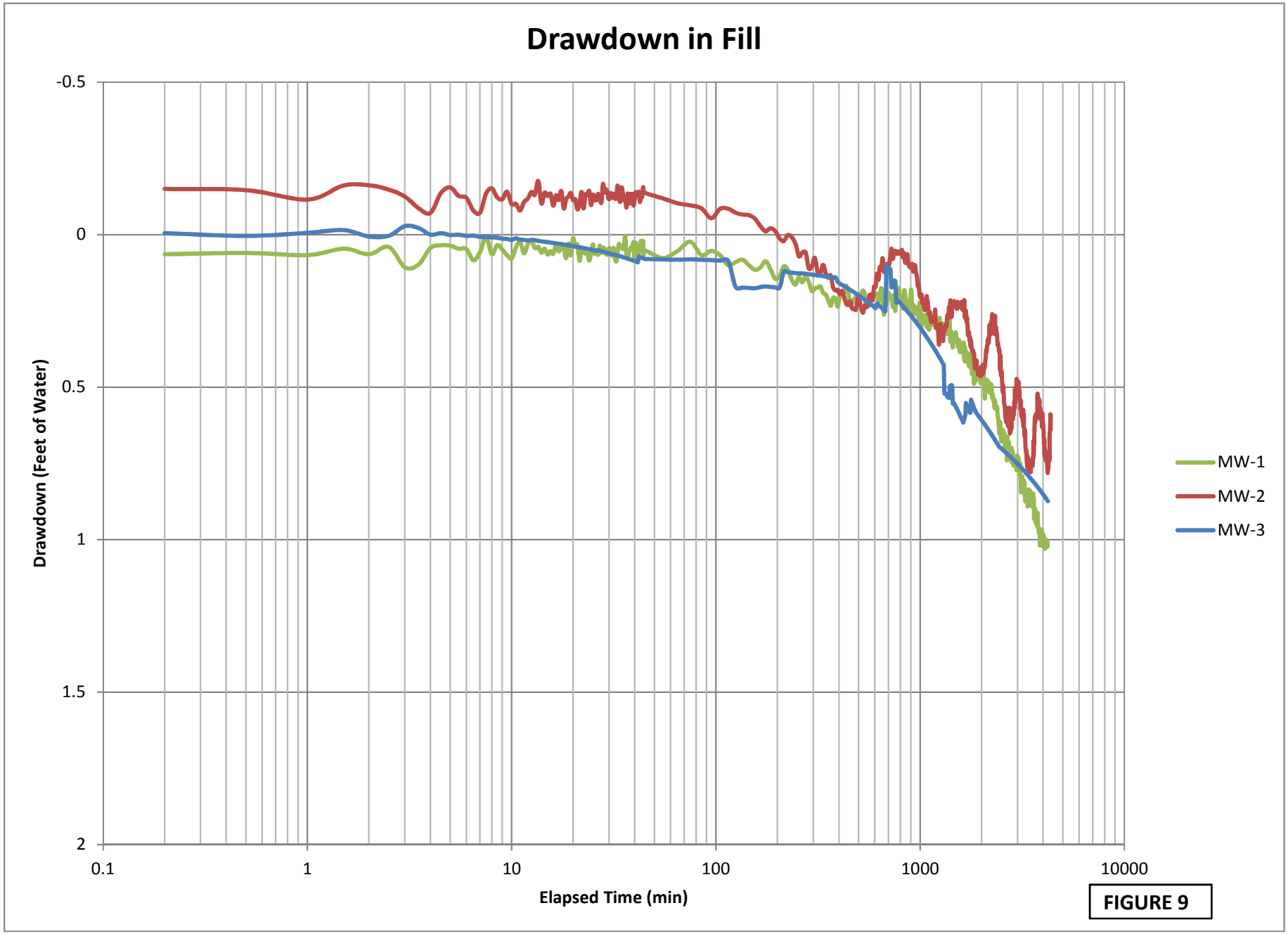

Drawdown in Fill
-0.5
0
0.5
1
1.5
2
Drawdown (Feet of Water)
0.1
1
10
100
1000
10000
Elapsed Time (min)
MW-1
MW-2
MW-3

FIGURE 9


Drawdown in Silt
-1
0
1
2
3
4
5
6
7
8
Drawdown (Feet of Water)
0.1
1
10
100
1000
10000
Elapsed Time (min)
MW-1
MW-2
MW-3

FIGURE 10

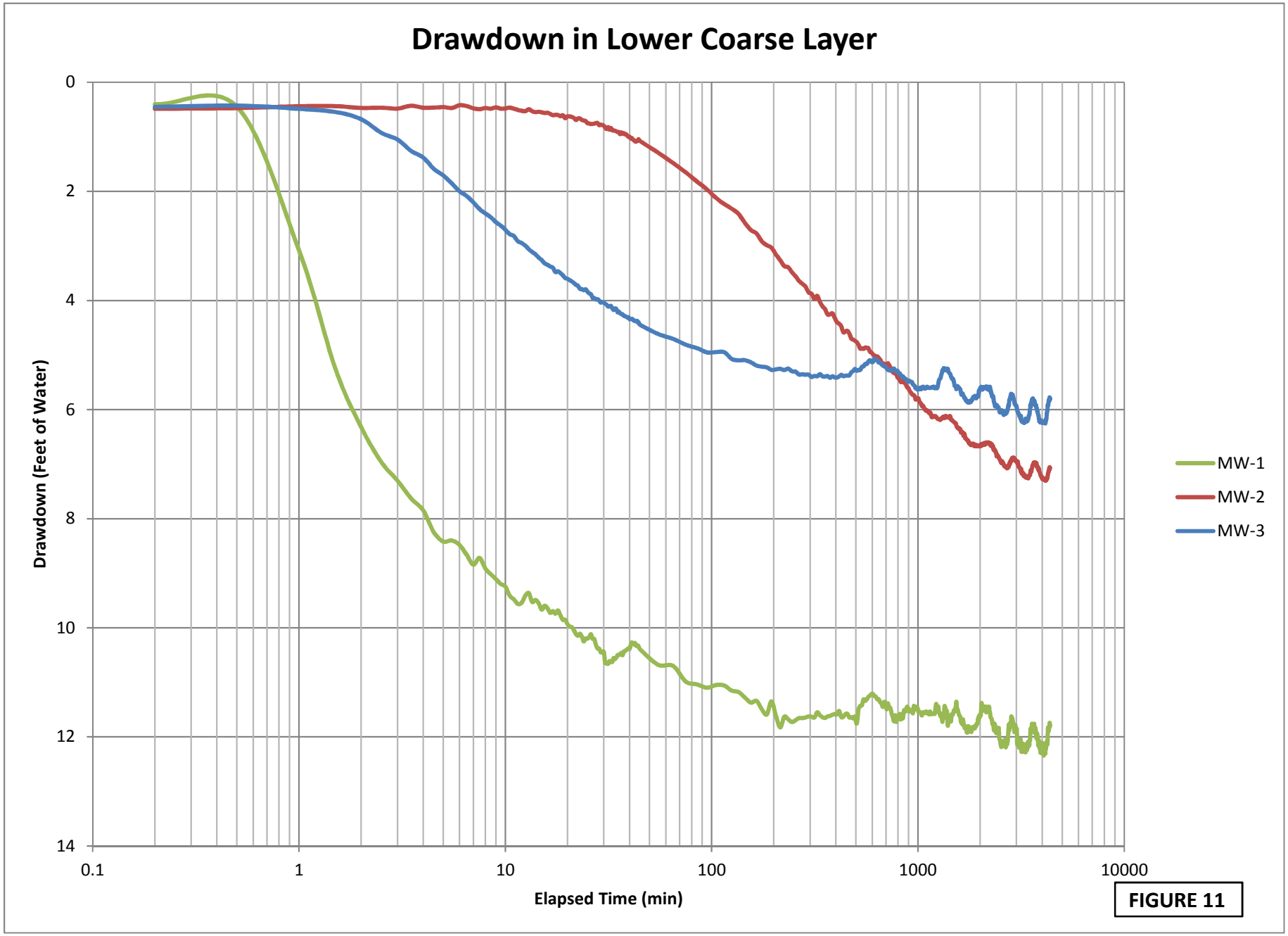

Drawdown in Lower Coarse Layer
Drawdown (Feet of Water)
0
2
4
6
8
10
12
14
0.1
1
10
100
1000
10000
Elapsed Time (min)
MW-1
MW-2
MW-3

FIGURE 11

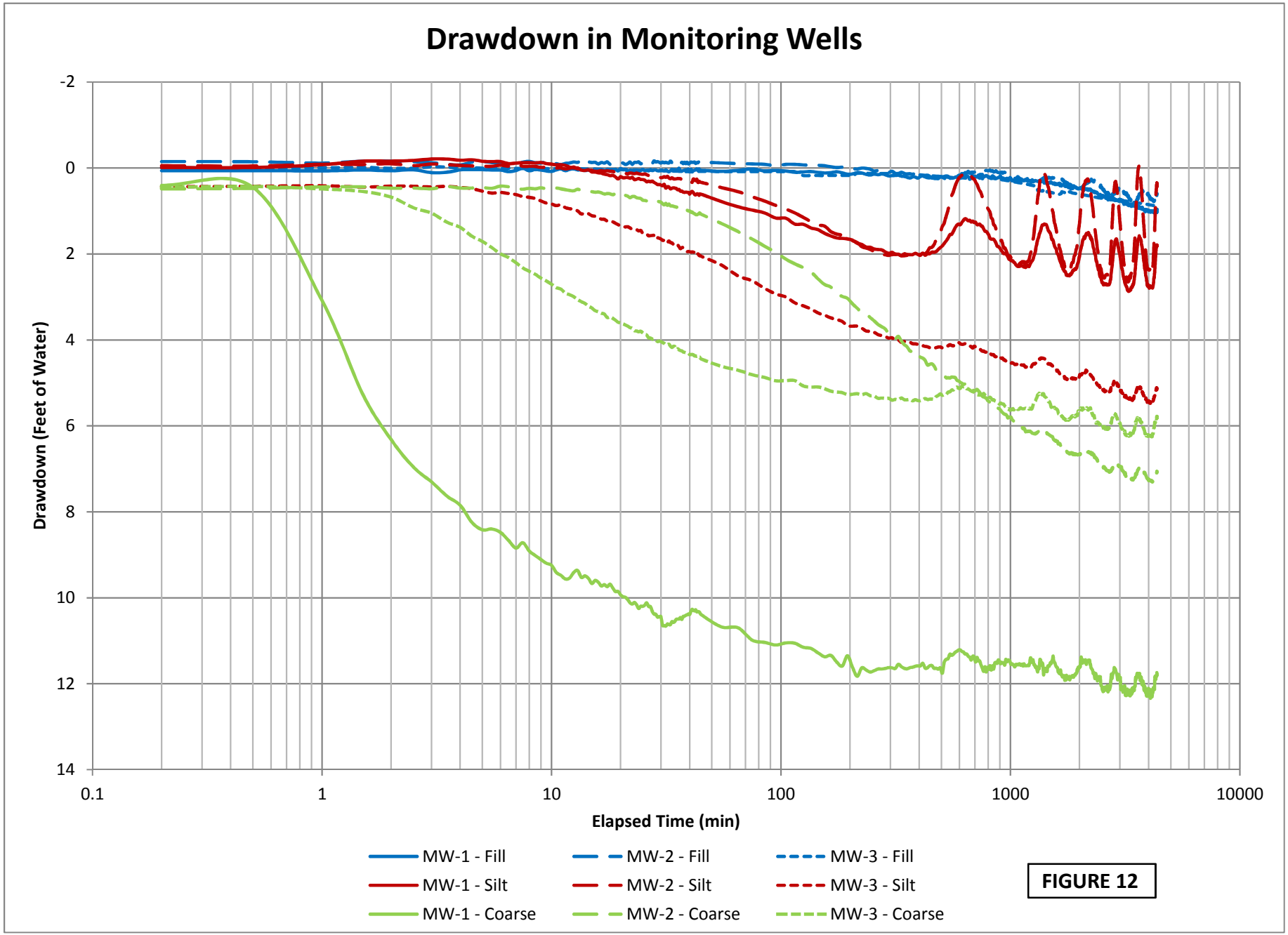

Drawdown in Monitoring Wells
-2
0
2
4
6
8
10
12
14
Drawdown (Feet of Water)
0.1
1
10
100
1000
10000
Elapsed Time (min)
MW-1 - Fill
MW-2 - Fill
MW-3 - Fill
MW-1 - Silt
MW-2 - Silt
MW-3 - Silt
MW-1 - Coarse
MW-2 - Coarse
MW-3 - Coarse

FIGURE 12

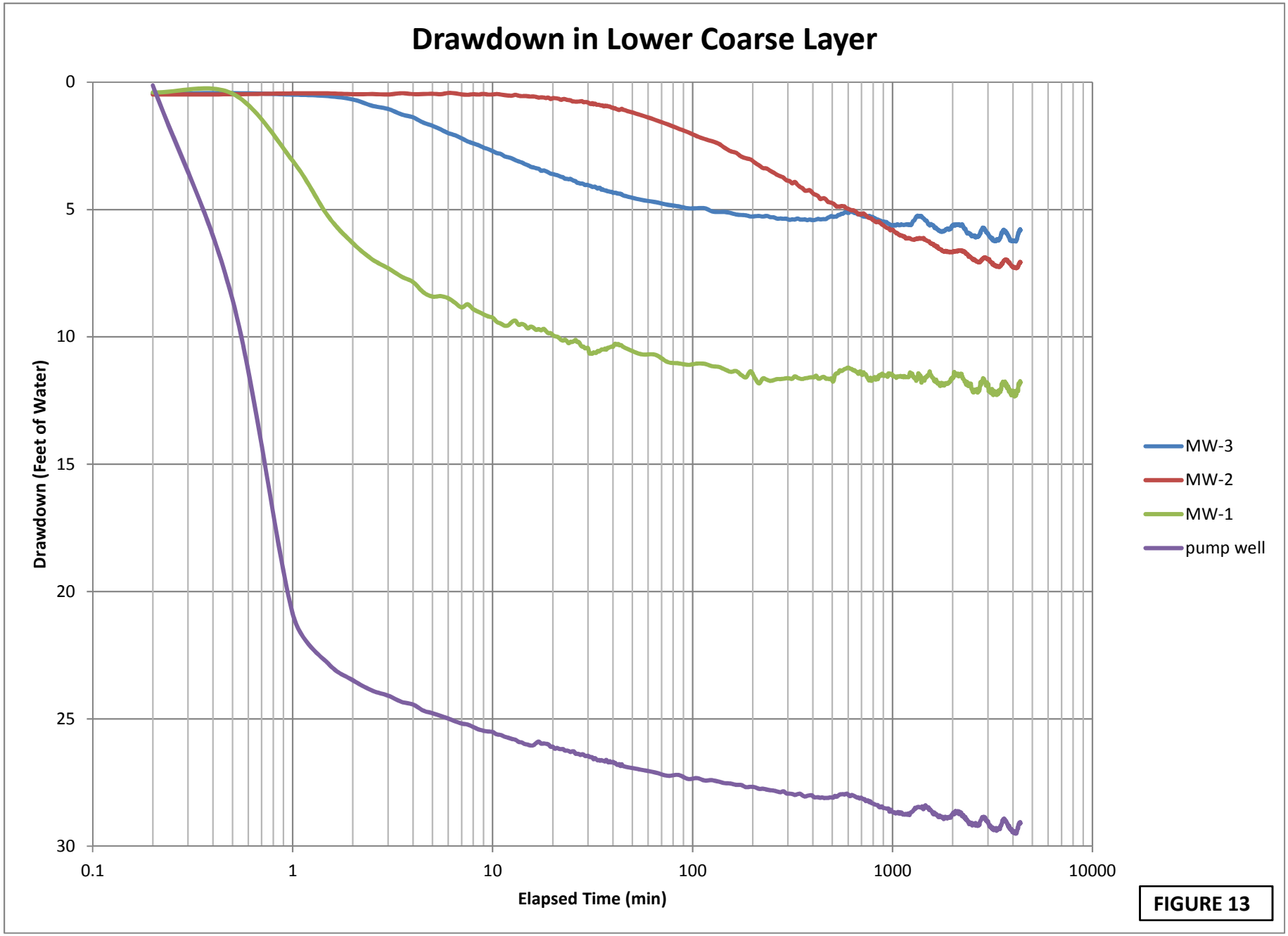

Drawdown in Lower Coarse Layer
Drawdown (Feet of Water)
0
5
10
15
20
25
30
0.1
1
10
100
1000
10000
Elapsed Time (min)
MW-3
MW-2
MW-1
pump well

FIGURE 13

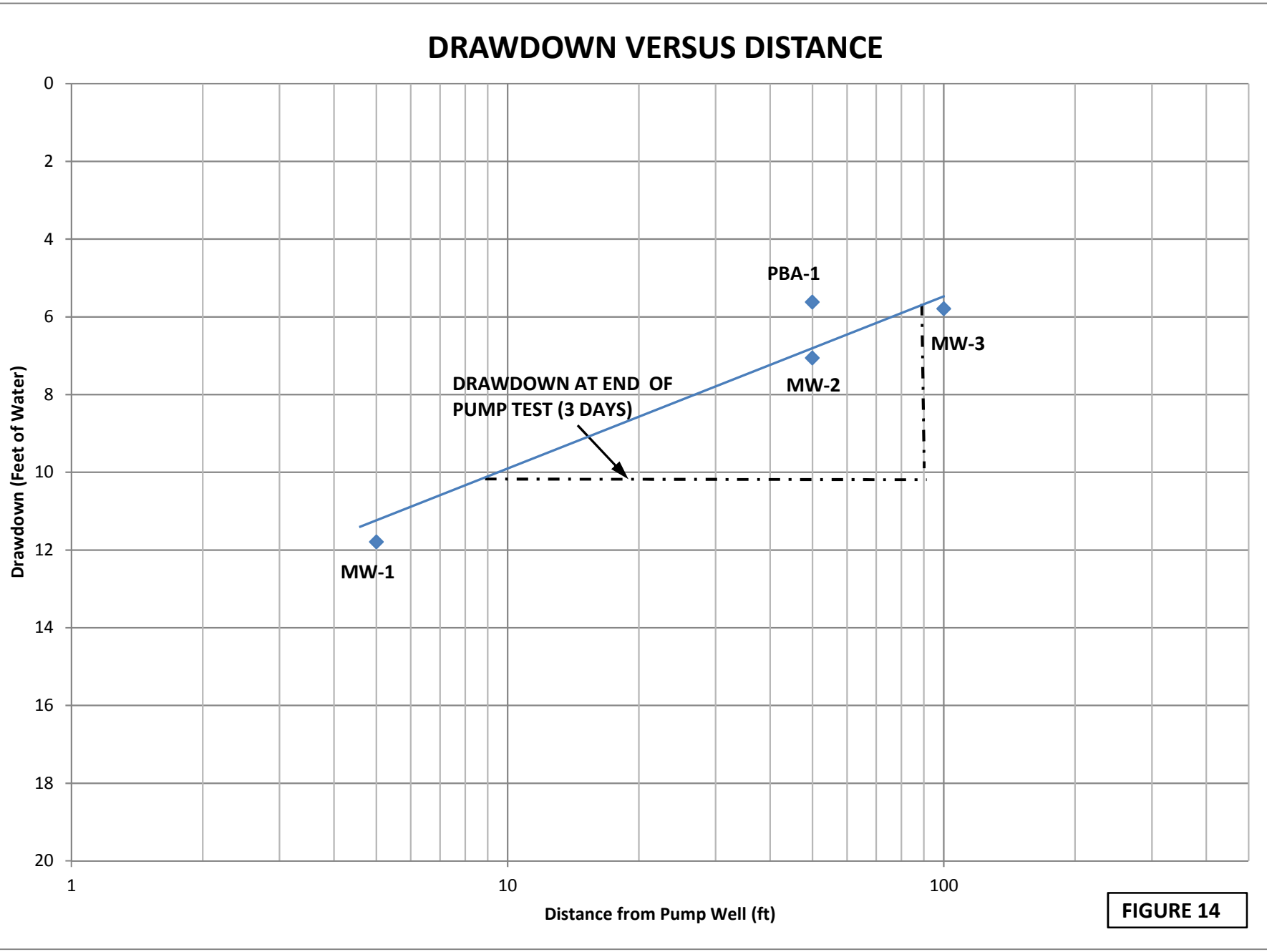

DRAWDOWN VERSUS DISTANCE
0
2
4
6
8
10
12
14
16
18
20
Drawdown (Feet of Water)
1
10
100
Distance from Pump Well (ft)
PBA-1
MW-3
MW-2
DRAWDOWN AT END OF
PUMP TEST (3 DAYS)
MW-1

FIGURE 14

DRAWDOWN VERSUS DISTANCE

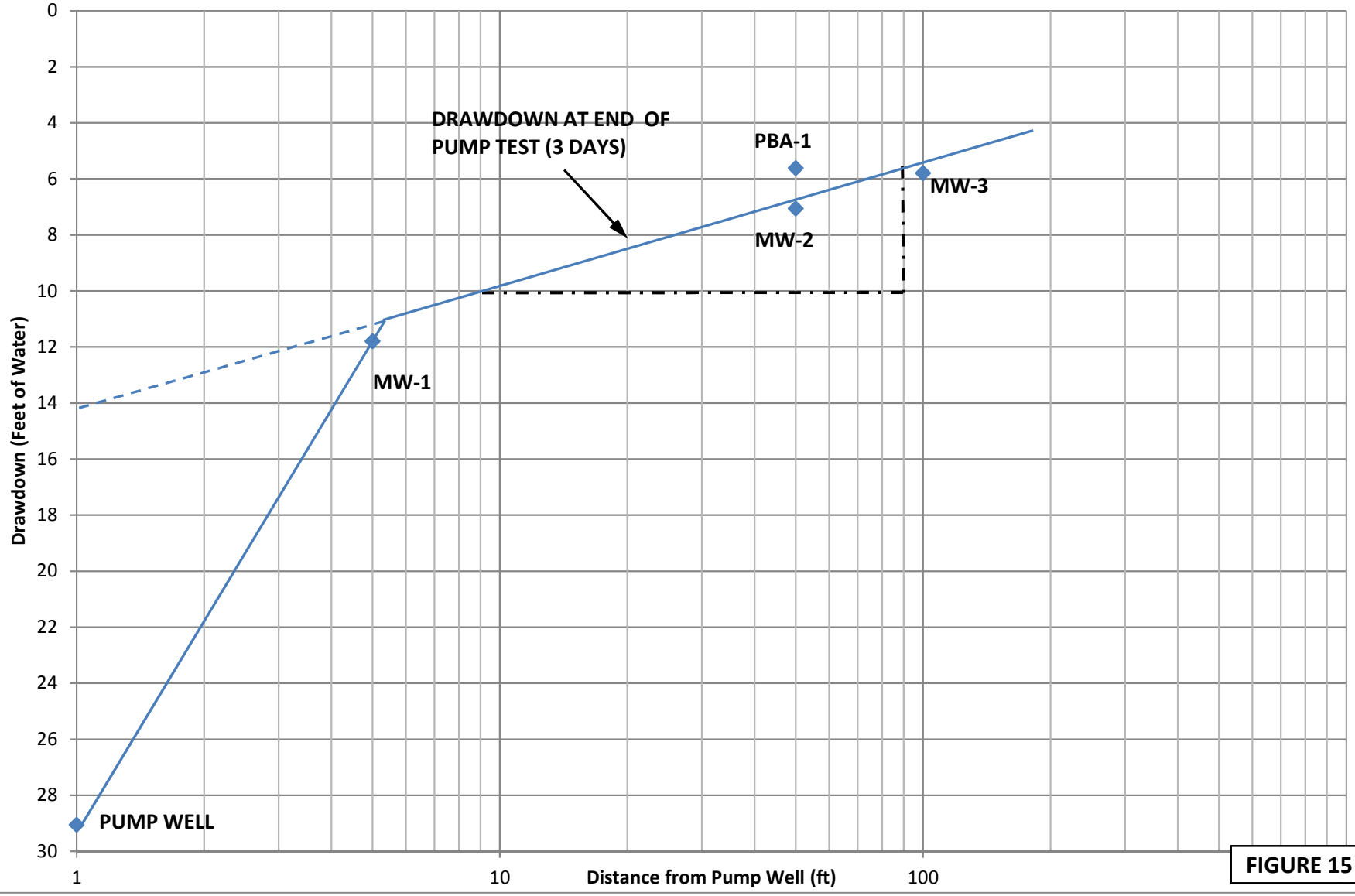


FIGURE 15

APPENDIX A

LIMITATIONS

LIMITATIONS

A. Explorations

1. The analyses, conclusions and recommendations submitted in this report are based in part upon the data obtained from subsurface explorations, groundwater monitoring wells, pump well and pump tests performance. The nature and extent of variations between and beyond these explorations and wells may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

2. The generalized soil profiles described in the text and shown on the figures are intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.

3. Groundwater level readings have been made in the borings, monitor wells and pump well at times and under conditions stated on the logs and data sheets. These data have been reviewed and interpretations have been made in the text of this report; however, it must be noted that fluctuations in the level of the groundwater may occur due to a variety of reasons including: variations in rainfall, temperature, tide, season and other factors occurring since the time measurements were made.

B. Review

1. In the event that any changes in the nature, design, or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report are modified or verified in writing by Paul B. Aldinger & Associates, Inc. It is recommended that this firm be provided the opportunity for a general review of final design and specifications, in order that groundwater and foundation recommendations may be properly interpreted and implemented in the design and specifications.

C. Construction

1. It is recommended that this firm be retained to provide soil engineering services during construction of the support of excavation, dewatering, excavation and foundation phases of the work. This is to observe compliance with the design concepts, specifications, report conclusions and recommendations, and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

D. Use of Report

1. This report has been prepared for the exclusive use of BETA Group, Inc. for specific application to the proposed Pump Station and Stream Crossing in Taunton, Massachusetts in accordance with generally accepted soil and foundation engineering practices. No warranty, express or implied, is made.

2. This report may contain comparative cost estimates for the purpose of evaluating alternative construction schemes. These estimates may also involve approximate quantity evaluations. It should be noted that quantity estimates may not be accurate enough for construction bids. Since Paul B. Aldinger & Associates, Inc. has no control over labor and materials cost and design, the estimates of construction costs have been made on the basis of experience. We cannot guarantee the accuracy of cost estimates as compared to contractors' bids for construction costs.

APPENDIX B

- **Boring Logs PBA-1 and PBA-2,**

- **Grainsize Analysis, Pump Test Screen Stratum:**
  Soil sample from boring PBA-1, Glacial Outwash 2 Stratum, Sample depth 49 to 56 feet below ground surface.

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 2	Boring No. PBA-1
P. B. Aldinger & Associates	1215 W. Chestnut Street Brockton, MA 02301	NEBC JOB No: 36951	PBA Job No. 17006
City/Town: Taunton, Ma.		PROJECT NAME: Pump Station & Water Crossing	

Location: Pump Station, North	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 8.0' E.O.B. 7.2' on 3/3/17	2/27/2017	2/28/2017	
DRILLER: Norman Studdard	HELPER:		
Ground Elevation: +11.5'	Inspector's Name: Bryan Deely	Inspector's Company: P.B. Aldinger	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
							ASPHALT	3"
S-1	6" - 2'6"	44	33	28	47	12"	Medium dense, brown FINE TO COARSE SAND, little gravel, little inorganic silt (Fill).	
S-2	4'- 6'	26	13	13	8	6"	Medium dense, brown INORGANIC SILT, little fine to coarse sand (Fill).	FILL
S-3	9' - 11'	18	7	3	3	5"	Loose, gray INORGANIC SILT, little fine to coarse sand (Fill).	
S-4	14' - 16'	7	3	2	4/5"	18"	Loose, gray INORGANIC SILT, little fine to coarse sand, WOOD at 16 (Fill)'.	16'
S-5	19' - 19'3"	100/3"				3"	WOOD.	20'
S-6	24' - 26'	26	13	16	26	19"	Medium dense, gray VARVED INORGANIC SILT.	
S-7	29' - 31'	11	13	18	26	14"	Medium dense, gray INORGANIC SILT. Medium dense, brown FINE TO MEDIUM SAND, trace inorganic silt.	
S-8	34' - 36'	8	7	7	6	24"	Medium dense, gray, VARVED INORGANIC SILT.	SILT
S-9	39' - 41'	10	19	17	13	11"	Medium dense, gray INORGANIC SILT.	40'
S-10	44' - 46'	29	27	26	18	12"	Wet, very dense, gray, FINE TO COARSE SAND, trace inorganic silt, trace gravel.	
S-11	49' - 51	27	9	8	7	12"	Medium dense, gray, FINE TO COARSE SAND, little gravel, trace inorganic silt.	FINE TO COARSE SAND

Remarks: E.O.B. = End of boring

Casing Used: HW and NW

Casing Size: 4" and 3"

Hammer Weight 300lbs.

Split Spoon Size: 1 3/8" ID X 24"

Hammer Weight 140lbs.

Drill Rig Type: CME 75 Truck Mount

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Second Entry of Descriptions: and = 35-50%, some = 20-35%, little 10-20%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 2 of 2	**Boring No. PBA-1**
P. B. Aldinger & Associates	**1215 W. Chestnut Street**		
	Brockton, MA 02301	NEBC JOB No: 36951 PBA Job No. 17006	
City/Town: Taunton, Ma.		PROJECT NAME: Pump Station & Water Crossing	
Location: Pump Station, North		Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 8.0' E.O.B. 7.2' on 3/3/17		2/27/2017	2/28/2017	
DRILLER: Norman Studdard		HELPER:		
Ground Elevation: +11.5'	Inspector's Name: Bryan Deely	Inspector's Company: P.B. Aldinger		

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches				Recovery (inches)	Field Description	Strata Changes
		0-6	6-12	12-18	18-24			
S-12	54' - 56	17	10	11	14	7"	Medium dense, gray FINE TO COARSE SAND, trace inorganic silt.	**FINE TO COARSE SAND**
S-13	59' - 61'	33	23	38	26	12"	Very dense, gray FINE TO COARSE SAND, some gravel, trace inorganic silt.	**63'**
S-14	64'- 66'	21	28	39	30	17"	Very dense, gray FINE SAND.	**F. SAND 68'**
S-15	69' - 71'	42	68	56	51	12"	Very dense, gray FINE TO COARSE SAND AND GRAVEL, trace inorganic silt (Glacial Till).	**TILL 72'**
S-16	74'	100/0"					Probable Bedrock	**BEDROCK 74'**
							Bottom of Exploration = 74'	
							Installed Groundwater Monitoring Well to 45 foot depth	
							Stabilized Groundwater reading 7.21 feet below pavement surface, March 3, 2017	

Remarks: E.O.B. = End of Boring

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

Casing Used: HW and NW

Casing Size: 4" and 3"

Hammer Weight 300lbs.

Split Spoon Size: 1 3/8" ID X 24"

Hammer Weight 140lbs.

Drill Rig Type: CME 75 Truck Mount

N = Sum of Second and Third 6" Blow Counts

Second Entry of Descriptions: and = 35-50%, some = 20-35%, little 10-20%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 2	**Boring No. PBA-2**
P. B. Aldinger & Associates	**1215 W. Chestnut Street**		
	Brockton, MA 02301	NEBC JOB No: 36951 PBA Job No. 17006	
City/Town: Taunton, Ma.		PROJECT NAME: Pump Station & Water Crossing	
Location: Pump Station, South		Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 8.0' E.O.B.		2/28/2017	3/1/2017	
DRILLER: Norman Studdard		HELPER:		
Ground Elevation: +11.5'	Inspector's Name: Bryan Deely	Inspector's Company: P.B. Aldinger		

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
							ASPHALT	**3"**
S-1	6" - 2'6"	8	14	17	12	15"	Dense, brown FINE TO COARSE SAND, little gravel, trace inorganic silt, (Fill.)	
S-2	4'- 6'	18	7	7	9	17"	Medium dense, gray FINE TO COARSE SAND, some inorganic silt, little gravel.	**FILL**
S-3	9' - 11'	8	8	8	11	15"	Medium dense, brown FINE TO MEDIUM SAND, trace inorganic silt, (Fill.)	
S-4	14' - 16'	18	12	13	11	20"	Medium dense, mottled, orange-gray SILT (Fill).	**15'**
							Medium dense, gray FINE TO COARSE SAND, little silt.	**17'**
S-5	19' - 21'	13	8	7	11	3"	Medium dense, gray INORGANIC SILT.	
S-6	24' - 26'	16	12	8	9	19"	Medium dense, gray, varved INORGANIC SILT.	**SILT**
S-7	29' - 31'	7	7	8	9	21"	Wet, medium dense, light brown, varved INORGANIC SILT.	
S-8	34' - 36'	9	8	5	7	23"	Wet, medium dense, light brown, varved INORGANIC SILT.	**38.5'**
S-9	39' - 41'	31	17	9	12	8	Wet, medium dense, gray FINE TO COARSE SAND AND GRAVEL, some inorganic silt.	
S-10	44' - 46'	15	7	8	9	2"	Wet, medium dense, gray FINE TO COARSE SAND trace inorganic silt.	**FINE TO COARSE SAND**
S-11	49' - 51'	12	12	15	15	18"	Wet, medium dense, gray FINE TO COARSE SAND, little gravel, trace inorganic silt.	

Remarks: E.O.B. = End of boring

Casing Used: HW and NW

Casing Size: 4" and 3"

Hammer Weight 300lbs.

Split Spoon Size: 1 3/8" ID X 24"

Hammer Weight 140lbs.

Drill Rig Type: CME 75 Truck Mount

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Second Entry of Descriptions: and = 35-50%, some = 20-35%, little 10-20%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 2 of 2	**Boring No. PBA-2**
P. B. Aldinger & Associates	**1215 W. Chestnut Street**		
	Brockton, MA 02301	NEBC JOB No: 36951 PBA Job No. 17006	
City/Town: Taunton, Ma.		PROJECT NAME: Pump Station & Water Crossing	
Location: Pump Station, South		Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 8.0' E.O.B.		2/28/2017	3/1/2017	
DRILLER: Norman Studdard		HELPER:		
Ground Elevation: +11.5'	Inspector's Name: Bryan Deely	Inspector's Company: P.B. Aldinger		

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-12	54' - 56	5	6	11	12	18"	Medium dense, gray FINE TO COARSE SAND, trace gravel, trace inorganic silt.	**FINE TO COARSE SAND**
S-13	59' - 61'	22	15	12	15	24"	Medium dense, gray FINE TO COARSE SAND, trace gravel, trace silt.	
S-14	64' - 65'5"	19	47	100/5"		14"	Very dense, gray FINE TO MEDIUM SAND, trace inorganic silt.	**67'**
S-15	69' - 71'	122	39	32	45	15"	Very dense, gray FINE TO COARSE SAND AND GRAVEL, little inorganic silt (Glacial Till).	**TILL 71'**
S-16	74'	100/0"					Probable BEDROCK	**BEDROCK 74'**
							Bottom of Exploration = 74'	

Remarks: E.O.B. = End of boring

Casing Used: HW and NW

Casing Size: 4" and 3"

Hammer Weight 300lbs.

Split Spoon Size: 1 3/8" ID X 24"

Hammer Weight 140lbs.

Drill Rig Type: CME 75 Truck Mount

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Second Entry of Descriptions: and = 35-50%, some = 20-35%, little 10-20%, trace = 10% or less

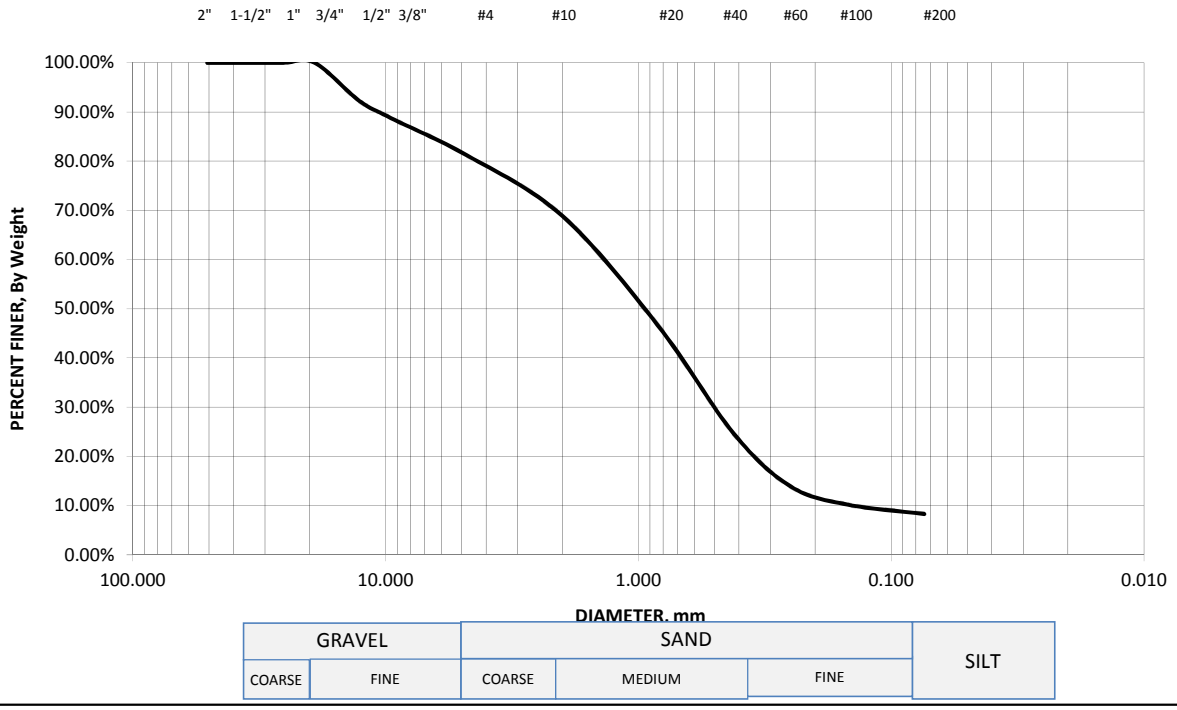
SIEVE ANALYSIS

DESCRIPTION:	Fine to coarse SAND, little Gravel, trace Silt	PROJ:	Pump Station & Water Crossing
		LOCATION:	Taunton, MA
		JOB #:	17006
Sample Location:	Taunton, MA	DATE:	6/9/2017
		CONTAINER #:	47
USCS:	SW-SM	CONT.+ WET SOIL:	636.44
TEST BORING NO.:	PBA-1	CONT.+ DRY SOIL:	585.97
DEPTH:	49'-56'	WGT WATER:	50.47
SAMPLE #:	S-11,S-12	CONT WGT:	177.51
WASH SIEVE	yes	DRY SOIL:	408.46
		% MOIST:	12.36%

SIEVE	OPENING (MM)	WEIGHT RETAINED	ACCUM. RETAINED	PERCENT RETAINED	TOTAL % FINER/WGT	PROJECT SPEC.
3"	76.2	0.00	0.00	0.00%	100.00%	
2"	50.800	0.00	0.00	0.00%	100.00%	
1 ½"	37.500	0.00	0.00	0.00%	100.00%	
1"	25.400	0.00	0.00	0.00%	100.00%	
3/4"	19.100	0.00	0.00	0.00%	100.00%	
1/2"	12.700	31.66	31.66	7.75%	92.25%	
3/8"	9.525	14.25	45.91	11.24%	88.76%	
4	4.750	31.14	77.05	18.86%	81.14%	
10	2.000	50.05	127.10	31.12%	68.88%	
20	0.840	90.57	217.67	53.29%	46.71%	
40	0.420	90.09	307.76	75.35%	24.65%	
60	0.250	43.99	351.75	86.12%	13.88%	
100	0.149	15.03	366.78	89.80%	10.20%	
200	0.074	7.83	374.61	91.71%	8.29%	
Pan	0.000	33.85	408.46	100.00%	0.00%	
TOTAL DRY WT.			408.46			

	% GRAVEL	% SAND	% SILT & CLAY
TOTAL	18.9%	72.8%	8.3%
COARSE	0.0%	12.3%	
MEDIUM		44.2%	
FINE	18.9%	16.4%	

SIEVE ANALYSIS



APPENDIX C

J. Russell Water Well Inc. Information Package:

- **Step and Pump Tests, Pump Well Summary Data,**
- **Pump Well Installation Log,**
- **Pump Well Submersible Pump Performance Curves,**
- **Step and Pump Tests, Pump Well: Pump Rate, Groundwater Level Monitoring Data, Time.**

J. RUSSELL WATER WELL INC.

P.O. Box 1025
Hope Valley, RI 02832
(401) 539-2739

Well Drilling
Complete Water Systems
Water Testing
Water Treatment

72 HOUR PUMP TEST

WEST WATER STREET TAUNTON PUMPING STATION

A 72-hour pump test was conducted on an 8-inch diameter screened gravel developed well at the West Water Street Pumping Station in Taunton Massachusetts. This well is 60 ft. deep with 10 ft. of 50 slot stainless steel well screen.

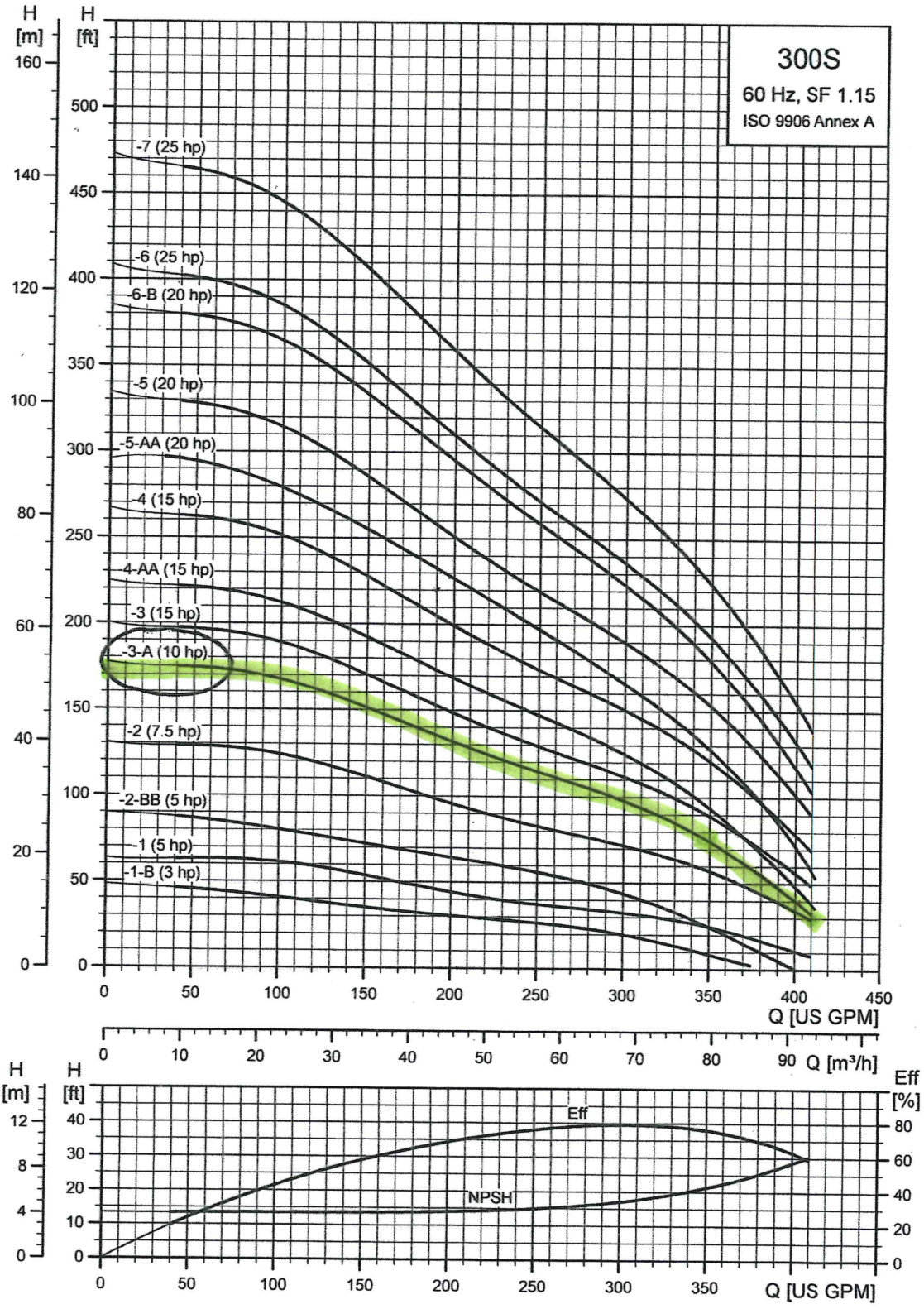
A Grundfos model 300S100-3A submersible turbine pump was installed for this test. This three-stage turbine can pump a maximum of 400 gpm against 50 ft. of head. The pump intake was set at 43 ft. below land surface. A stilling tube was also installed to allow unobstructed hand measurements with a Solonist electric tape measure. The water was discharged through approximately 45 ft. of PVC pipe to an underground chamber near the pumping station building. Discharge was measured with an in-line digital flow meter installed about 25 ft. from the well.

On 3/19/18 a step test was performed to determine a sustainable pumping rate for this three-day test. The static water level was 7.16 ft below the measuring point. (The M.P. was the top of the well, 1.90 ft above land surface).

The first step was at 100 gpm, which produced 15.79 ft. of drawdown. The second step was at 150 gpm, which produced 19.94 ft. of drawdown and the third step was at 200 gpm which produced 26.84 ft. of drawdown, (a pumping W.L. of 34.00 ft.). This left a safe reserve of 10.9 ft. of additional available drawdown above the pump intake. Aldinger and Associates determined that this was a safe rate that would sufficiently produce an aquifer response.

The well was allowed to recover to within 0.34 ft. of static before starting the 3-day test. At 12:45 on 3/19/18 the pump test began. A constant rate of 200 gpm was maintained until the end of the test at 13:05 on 3/22/18. A total of 30.39 ft. of drawdown was measured, (pumping W.L. of 37.55 ft.). The well recovered to within 1.8 ft. of static within 30 minutes after shutting the pump off. The following day all equipment was removed.

300S (300 gpm)



TM05 0247 1812

J. RUSSELL WATER WELL INC.
Well Drilling and Pump Installation
P.O. Box 1025
Hope Valley R.I. 02832

TAUNTON WEST WATER ST.
PUMPING STATION

PUMPING TEST DATA

Well No. 8" well

MP = T.O.C

Sheet 1 of 3

Observer	Date	Time	Time since pump on (min)	E-Tape or W.L. Rec. 1.90 Ft Above LS (ft)	Tape Measurement Held	Tape Measurement Wet	Tape Measurement Depth below MP		Well PBA-1	Q Rate GPM
JR	3/19/18	1053	STATIC	7.16					4.94	
				Step Test						
	3/19	1123		7.16						
		1126		22.25						100
		1128		22.65						100
		1130		22.95						100
		1133		26.44						150
		1135		26.70						150
		1137		26.99						150
		1139		27.10						150
		1140		32.88						200
		1145		33.40						200
		1147		33.58						200
		1149		33.75						200
		1153		34.00						200
		1154	**Pump OFF**		(Step Test Recovery)					
		1156		10.85						
		1158		9.67						
		1200		9.09						
		1221		7.76						
		1220		7.62						
JR	3/19/18	1244		7.50						

J. RUSSELL WATER WELL INC.
Well Drilling and Pump Installation
P.O. Box 1025
Hope Valley R.I. 02832

TAUNTON West WATER St
Pumping STATION

PUMPING TEST DATA

Well No. 8" well

MP=T.O.C.

Sheet 2 of 3

Observer	Date	Time	Time since pump on (min)	E-Tape or W.L. Rec. 1.90 FT Above LS (ft)	Tape Measurement: Held	Wet	Depth below MP		Well PBA-1	Q RATE GPM
				PUMP TEST						
JR	3/19/18	1244	0	7.50						0
		1246		30.30						200
		1247		31.45						
		1248		32.05						
		1249		32.42						
JR		1250		32.68						
FW		1255		33.39						
		1300		33.87						
		1305		34.15						
		1310		34.41						
		1315		34.55						
		1320		34.72						
		1325		34.83						
		1335		35.03					9.20	
		1345		35.16						
		1355		35.28						
		1405		35.32						
		1415		35.40						
		1425		35.47						
		1445		35.58						
FW		1505		35.69					9.89	200
JR		1525		35.75					10.00	200
FW	3/19/18	2323		36.24					10.16	200
FW	3/20	0844		36.97					10.78	200
FW	3/20	2024		37.30					10.83	200
JR	3/21	0900		37.63					10.95	200
FW	3/21	1034		37.46					10.75	200
FW	3/21	2042		37.75					10.99	200
FW	3/22	0956		37.90					10.98	200
FW	3/22	1206		37.55					10.55	200
ET	3/22	1258		37.55					10.56	200
JR	3/22	1305		37.55					10.56	200

TAUNTON WEST WATER ST.
PUMPING STATION

J. RUSSELL WATER WELL INC.
Well Drilling and Pump Installation
P.O. Box 1025
Hope Valley R.I. 02832

PUMPING TEST DATA

Well No. 8" well

MP=T.O.C.

Sheet 3 of 3

Observer	Date	Time	Time since pump on (min)	E-Tape or W.L. Rec. 1.90 ft Above LS (ft)	Tape Measurement: Held	Wet	Depth below MP		Well PBA-1	Q Rate GPM
				PUMP TEST - RECOVERY						
JR	3/20/18	1305		39.55			PUMP OFF		10.56	0
JR/ET		1306		13.36						
		1307		11.85						
		1308		11.26						
		1309		10.95						
		1310		10.68						
		1315		9.95						
		1320		9.55						
		1325		9.28						
		1330		9.10						
JR/ET	3/21/18	1335		8.96						
	3/23/18	0925		7.82					5.72	

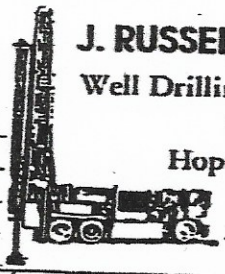
J. RUSSELL WATER WELL INC.
Well Drilling and Pump Installation
P.O. Box 1025
Hope Valley R.I. 02832

DATE STARTED 1/9/18
DATE COMPL. 1/11/18
BORING FOREMAN
INSPECTOR J. Russell
SOILS ENGR.
HOLE NO. 8"-1

PROJECT NAME TAUNTON
LOCATION PUMP STATION

Depth	Casing Blows Per Ft.	Sample Depths No.	Sample Depths From-To	Material Used	Strata Change	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Proportions used: Trace 0-10%; Little 10-20%; some 20-35% and 35-50%.	Drilling Time / Water Loss / Sample Type / Water Level
0				AIR LIFT DRILLING		ASPHALT Then fill - SAND, GRAVEL, BOULDERS, Pieces of WOOD	1-9-18
						BROWN 0-5	
					WATER TABLE ▽	Fill, Then FINE SAND WITH SILT	
0						BROWN 5-10	
						FINE SAND WITH SILT Chemical smell AT WATER TABLE	
						BROWN 10-15	
						FINE SILTY SAND TO 16 FT. Then 17-20 GRAY SILT/CLAY	
0						GRAY 15-20	
				MUD DRILLING SCREENED SAMPLES		MUD Drilling - SCREENED Samples With Loss of Fine PARTICLE SIZES 20-23 NO Recovery - Probable SILT 23-25 COARSE SAND W GRANUAL GRAVEL 20-25 DK BROWN	
						COARSE SAND, SOME VC SAND, LITTLE MED SAND	
0						LT. BROWN 25-30	
						SAME W/ Some GRANULAR GRAVEL	
						30-35	
						SAME ALSO WITH LARGE Cobbles - Rough Drilling	
0						35-40	
						VC SAND AND Pebble GRAVEL	
						GRAY W/ Black 40-47	1-9-18

PROJECT NAME TAUNTON
LOCATION PUMP STATION



J. RUSSELL WATER WELL INC.
Well Drilling and Pump Installation
P.O. Box 1025
Hope Valley R.I. 02832

DATE STARTED 1/9/18
DATE COMPL. 1/11/18
BORING FOREMAN
INSPECTOR J. Russell
SOILS ENGR.
HOLE NO. 8"-1

Depth	Casing Blows Per Ft.	Sample Depths No.	Sample Depths From-To	Material Used	Strata Change	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Proportions used: Trace 0–10%; Little 10–20%; some 20–35% and 35–50%.	Drilling Ti / Water Los / Sample Ty / Water Level
0						Set 8 INCH CASING TO 42 FT, THEN DROVE RE CASING TO 62 FT	1-10-18
						VC SAND + PEBBLE GRAVEL 47-50 BLACK	
				SAMPLES MUD		VC SAND + GRANULAR GRAVEL ANGULAR	
0						BLACK 50-55	
				WASHED NO		55-57 VC SAND + GRANULAR GRAVEL, HAD TO DRILL OUT SMALL COBBLES	
						57-62 COARSE SAND, SOME VC SAND ~~55-62~~	
						LITTLE MED SAND BLACK 55-62	
0						GRANULAR GRAVEL, SOME PEBBLE GRAVEL. LITTLE COARSE SAND 62-65 BLACK	
						* 0-20 FORMATION SAMPLES BY AIR LIFT	
						20-47 SAMPLES BY MUD DRILLING. SAMPLES WERE SCREENED AND WASHED WITH LOSS OF FINE PARTICLE SIZES	
0						47-65 SAMPLES WERE WASHED TO THE SURFACE WITH WATER	
						– WOOD FIBERS AND LEAF PARTICLES IN RE SAMPLES WERE RECIRCULATED FROM THE MUD PIT.	
0							1-10-18

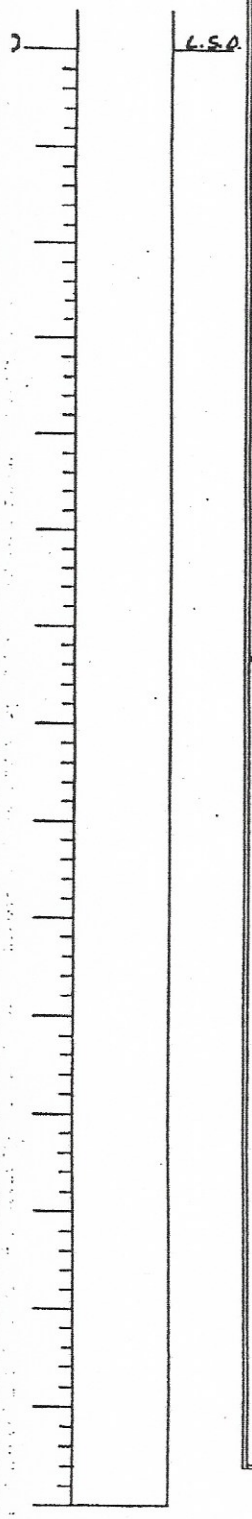
J. RUSSELL WATER WELL INC.

TEST HOLE SUMMARY

Hole No. 8"-1. TAUNTON MA

Property Owner _____
Owner's Address _____
Purpose of hole 8" TEST Hole
Altitude of land surface _____ (ft)

Date Started 1-9-18
Date Completed 1-11-18
Lat. _____ Long. _____
Log by _____



FINISH WELL

Diameter 8 in.
Screen Slot # 50 from 50 (ft) to 60 (ft)
___ from ___ (ft) to ___ (ft)
Water level below LSD 8.20 (ft)
at 1420 1-11-18 Hr/Date

From LSD (ft)

- 2.0 to top of casing
- 50 to bottom of casing
- 47 to top of riser
- 50 to top of screen
- 3 ft. length of riser
- 10 ft. length of screen
- 13 ft. riser + screen
- 60 to bottom of screen

DATE CASING PULLED _____

DEVELOPMENT/PUMPING DATA

Developed from 0700 to 1400 at 1-11-18 gp
Method 1/ _____
Pumped from _____ to _____ at _____ gp
in. vac. _____ Method 2/ _____

FIELD WATER QUALITY DATA

Sample taken _____ (Hr/Dat
after pumping _____ gpm for _____ H

Temp. _____ C° D.O _____ mg
S. Cond. _____ umho Alk. _____ mg
pH _____ _____

LABORATORY WATER QUALITY DATA (mg/l)

Fe _____ Cl _____ _____
Mn _____ NO_3 _____ _____

▼ Static Water Level

Topsoil, muck, peat

Clay

Silt

V.F. to F. Sand

M., C., & V.C. Sand

Gravel

Screened Interval

REMARKS
(Sketch map on reverse side)

SCREEN DEVELOPMENT WAS DONE USING COMPRESSED AIR

300 GPM ESTIMATED YIELD

DRILLER: JIM VERIA
INSPECTOR: J. RUSSELL

1/ D, diaphragm; S, surge block; T, turbine; A. compressed air; C, centrifugal

2/ C, centrifugal; D, diaphragm; T, turbine; R. rod pump

Sheet ___ of ___

APPENDIX D

- **Surveyor's Sketch, Existing Pump Station Vertical Movement Monitoring Point Locations, and Monitoring Point Spreadsheet Data,**

- **Main Lift Pumping Station, Taunton, MA, "Vertical Control (Locations)," Figure 1, BETA Group Inc.**

- Taunton Pump station
- Paul B. Aldinger & Assoc
- C. Holland
- Horizontal Pre/Post Survey
- Location Point Numbers
- Horizontal Survey Movement
- Conclusion

North

Pre-Post (Pumping)
Horizontal Survey Movement
CONCLUSION: NO MOVEMENT
DIFFERENCE = 0.00' FT.

"Warehouse"

Horizontal Distance Measured

HD = 258.12' * Pre/Post Survey

(100) Chisled "+" w/Punch Mark Plastic cap on ½" Rebar Driven 24" SET

EL. = 10.356 - Held 10.360 - Top Spike

(6) MAG SPIKE FOUND

H * = Horizontal Angle Turned

(25) P.K. Nail

HD *

Horizontal Distance Measured (10)

MW-3
303
303-A

Point (3) High — H = 183°-34'-38"
HD = 88.623'

(4) Low — H = 183°-34'-20"
HD = 88.630'

(501) X Front Door

"EXISTING"
"Pump station"

Door

(500)

Point "+" (1) Low — H = 158°-01'-12" * Pre/Post
HD = 92.757' Survey

Point "+" (2) High — H = 158°-01'-25" * Pre/Post
HD = 92.746' Survey

(200) Chisled "+"

(202) SMH

(201) SMH

(11) Point □

(12) Point "□"

(13) Point "□"

(14) Point "□"

PBA-1 O.W.
400
400-A

MW-1
301
301-A

TEST WELL
300
300-A
Top Block Metal Cap

MW-2
302
302-A

Taunton Main Lift Pumping Station and Stream Crossing

Taunton, MA

Pre - Post Pumping Flow Test Monitoring

Vertical Survey of Structure/Point Movement

◦ Paul B. Aldinger and Associates, Inc.

◦ Survey Dates: Fri. Feb 02; Mon. Feb 05; Wed. Feb 28; and Fri. Mar 23, 2018

◦ Survey Onsite By: Charles Holland, Bryan Deely, David Nacci or Mike

◦ Spreadsheet No. 1 of 1

Location	Pre-Survey (Pumping)	Pre-Survey (Pumping FT)	Pre-Survey (Pumping)		Pre-Survey (Pumping)		Post-Survey (Pumping)		Pre-Post (Pumping) Survey Measurement Variation ((+) = upward, (-) = downward)		**Pre-Post (Pumping) Survey Movement**	**Bench Marks on Site Plan Set**
Point	Fri. Feb 02 2018		Mon. Feb 05 2018		Wed. Feb 28 2018		Fri. Mar 23 2018		Elev. + (NAVD88)		**Determination**	Elev. + (NAVD88)
			Elev. + (NAVD88)		Elev. + (NAVD88)		Elev. + (NAVD88)					
No.	Found	Set	Found	Set	Found	Set	Found	Set	Difference (foot)	Difference (Inches)	**Conclusion**	Found
1		Paint "+" Cross		n/a		13.145		13.145	0	0	0"	
2		Paint "+" Cross		17.190		17.195		17.200	0.005' + to 0.010' +	1/16" + to 1/8" +	0"	
3		Paint "+" Cross		17.160		17.160		17.160	0	0	0"	
4		Paint "+" Cross		n/a		13.160		13.160	0	0	0"	
6	**Mag Spike/Punch Mark (Bench Mark Held)**		10.360		10.360		10.360		0	0	0"	10.356
10		Paint "[ ]" Sq.		12.965		12.965		12.970 - 12.965	0.005'+ to 0'	1/16" + to 0"	0"	
11		Paint "[ ]" Sq.		12.985		12.990		12.990	0.005' +	1/16" +	0"	
12		Paint "[ ]" Sq.		12.610		12.620		12.610	0.010' + to 0'	1/8" + to 0"	0"	
13		Paint "[ ]" Sq.		12.605		12.610		12.600	0.005' + to 0.010' -	1/16" + to 1/8" -	0"	
14		Paint "[ ]" Sq.		12.645		12.655		12.645	0.010' + to 0'	1/8" + to 0"	0"	
25	PK Nail in Bit Pavement		n/a		10.065		10.060		0.005' -	1/16" -	0"	10.030
200	Chisled "+" CL Step Metal Edge		12.960		12.960		12.960		0	0"	0"	13.000
201	SMH Rim		n/a		11.420		11.415		0.005' -	1/16" -	0"	11.40 +/-
202	SMH Rim		n/a		11.870		11.865		0.005' -	1/16" -	0"	11.97 - 12.18 +/-
300		Test Well w/ Blue Metal Cap Top @ Arrow Marker		n/a		n/a		13.385				
300-A		Test Well w/ Blue Cap @ Ground		n/a		n/a		11.385				
301		MW-1 Top 1" PVC		n/a		n/a		13.230				
301-A		MW-1 Ground		n/a		n/a		11.385				
302		MW-2 Top 1" PVC		n/a		n/a		10.855				
302-A		MW-2 Ground		n/a		n/a		7.720				
303		MW-3 Top 1" PVC		n/a		n/a		11.235				
303-A		MW-3 Ground		n/a		n/a		10.415				
400		PBA-1 Test Boring Top 1" PVC @ Arrow Marker		n/a		n/a		11.095				
400-A		PBA-1 Test Boring Casing/Grade		n/a		n/a		11.290				
500	1st Floor Conc., 6"-12" Inside SIDE Door		n/a		13.030		13.030		0'	0"	0"	13.070
501	1st Floor Conc., 3"-6" Inside FRONT Door		n/a		13.085		13.080		0.005' -	1/16" -	0"	12.970

Pump Testing: Mar 19 - 22, 2018

Prepared by:

BETA
www.BETA-Inc.com

Print Date: 1/29/2018 11:07 AM

N

S67°21'55"E

366.65'

322.58'

UP#NO

UP#46

UP#6

PROJECT BENCHMARK
XCUT STEP CENTER
ELEV=13.00' (NAVD88)

100
N: 2780652.189'(NAD83)
E: 766700.474'(NAD83)
EL: 11.384'(NAVD88)
MAG NL(SET)

SMH L-31.3
RIM = 11.40

S67°21'55"E

100.00'

N22°38'05"E

220'±

6
N: 2780658.142'(NAD83)
E: 766578.424'(NAD83)
EL: 10.356'(NAVD88)
MAG SPK(SET)

20" PVC
INV=3.65

WF #TOB7

WF #TOB6

WF #TOB5

WF #TOB4

WF #TOB3

WF #TOB2

WF #TOB1

15
N: 2780602.250'(NAD83)
E: 766771.970'(NAD83)
EL: 9.023'(NAVD88)
8IN SPK(SET)

25
N: 2780617.082'(NAD83)
E: 766566.823'(NAD83)
EL: 10.030'(NAVD88)
MAG NL(SET)

S67°21'55"E
15.42'

N67°21'55"W

519.54'

462.18'

240'±

24" TWIN

SMH N-1.1
RIM = 9.63

WF #A1

WF #A2

WF #A3

WF #A4

WF #A5

WF #A6

WF #A7

WF #A8

WF #A9

S26°37'05"W

S26°37'05"W

12" RD. 4 PVC

Main Lift
Pumping Station

Taunton, MA

Scale:

Figure No. 1

Vertical Control

J:\TAUNTON\MAIN LIFT PUMP STATION\AUTOCAD\DRAWINGFILES\XREFS\VERTICAL CONTROL PLAN.DWG