



A CMS Energy Company

Date: October 17, 2017

To: Operating Record

From: Harold D. Register, Jr., P.E. (HAR)

RE: Groundwater Monitoring System Certification, §257.91(f)
J.H. Campbell Generating Complex, JH Campbell Dry Ash Landfill

Introduction

According to Title 40 Code of Federal Regulations (40 CFR) Part 257, Subpart D, §257.91(f); the owner or operator of a Coal Combustion Residual (CCR) management unit must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system at the CCR management unit has been designed and constructed to meet the requirements of §257.91. Additionally, §257.91(a) details a performance standard requiring the system monitor the uppermost aquifer and include a minimum of at least one upgradient and three downgradient monitoring wells, and that if the uppermost aquifer monitoring system includes the minimum number of wells, the basis supporting use of only the minimum.

Groundwater Monitoring System

A groundwater monitoring system has been established for the JH Campbell Dry Ash Landfill, which established the following locations for determining background groundwater quality and detection monitoring.

Background:

| | | |
|--------------|--------------|--------------|
| JHC MW-15023 | JHC MW-15024 | JHC MW-15025 |
| JHC MW-15026 | JHC MW-15027 | JHC MW-15028 |

Downgradient:

| | | |
|--------------|--------------|--------------|
| JHC MW-15017 | JHC MW-15018 | JHC MW-15019 |
| JHC MW-15020 | JHC MW-15021 | JHC MW-15022 |
| JHC MW-15031 | JHC MW-15032 | JHC MW-15033 |
| JHC MW-15034 | JHC MW-15035 | JHC MW-15036 |
| JHC MW-15037 | | |

**“Groundwater Monitoring System Certification
JH Campbell Dry Ash Landfill”
October 17, 2017
Page 2**

Provided herein, as required by §257.91(f), is certification from a qualified professional engineer that the groundwater monitoring system at Consumers Energy JH Campbell Dry Ash Landfill meets the requirements of §257.91.

CERTIFICATION

Professional Engineer Certification Statement [40 CFR 257.91]

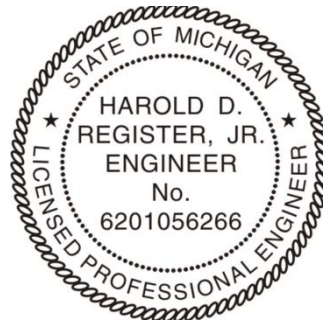
I hereby certify that, having reviewed the attached documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations §257.91 (40 CFR Part 257.91), I attest that this Groundwater Monitoring System has been designed and constructed to meet the requirements of 40 CFR 257.91. The report is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.91.

Harold D. Register, Jr.
Signature

October 17, 2017
Date of Certification

Harold D. Register, Jr., P.E.
Name

6201056266
Professional Engineer Certification Number



10/17/2017

ENCLOSURES

ARCADIS (2016). *“Summary of Monitoring Well Design, Installation, and Development – Existing CCR Landfill (Cells 1, 2, 3 and 4)”*

Consumers Energy Company

SUMMARY OF MONITORING WELL DESIGN, INSTALLATION, AND DEVELOPMENT – EXISTING CCR LANDFILL (CELLS 1, 2, 3 AND 4)

J.H. Campbell Electric Generation Facility –
West Olive, Michigan

May 13, 2016

Gregory E. Zellmer, P.G.
Certified Project Manager/Senior Geologist

Summary of Monitoring Well Design, Installation, and Development – Existing CCR Landfill

J.H. Campbell Electric Generation Facility
– West Olive, MI

Mark Robert Klemmer, PE

Printed Name of Registered Professional Engineer

Signature of Registered Professional Engineer
Registration Number: 62010-49167 State: MI

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May 13, 2016

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Appendix B – Photographic Log

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1 INTRODUCTION

ARCADIS has prepared this Summary of Monitoring Well Design, Installation, and Development (Report) to summarize monitoring well installation activities for Unit 1 at the J.H. Campbell electric generation facility (JHC), located in Muskegon, Michigan (Site). Monitoring wells were installed to achieve compliance under the recently published 40 CFR Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities (specifically Section 257.91(e)(1)). This Report summarizes the groundwater monitoring well installation activities, including drilling procedures, well locations, well construction details, development activities, and hydraulic testing results. The methodology used in the field activities conforms to federal and state guidance and industry standards.

2 OBJECTIVES

The objectives of this report are to document the work completed at the Site, including:

- Advancement of soil borings
- Monitoring well installation
- Monitoring well development
- Hydraulic testing

The following section describes each of these elements in more detail.

3 FIELD ACTIVITIES

3.1 Soil Borings

Thirteen (13) soil borings were completed using rotosonic-drilling methods operated by Mateco Drilling Company of Grand Rapids, Michigan with oversight provided by an ARCADIS geologist. Rotosonic drilling uses powered equipment to collect subsurface-soil samples. The rotosonic drill rig advances a length of pipe into the ground through a combination of hydraulic force and high-frequency vibration. The high-frequency vibrations allow the pipe to advance through various types of soil and bedrock producing a high-quality, continuous soil core within the pipe. Each length of pipe was extracted from the ground and emptied into a clear plastic liner for logging. This process was repeated until the total depth of the boring was reached.

Continuous soil cores were collected during drilling to provide detailed lithological and stratigraphic data. An on-site geologist inspected each core, classified the contents, and recorded the observations on an ARCADIS boring log field sheet (**Appendix A**). A photographic log showing the general soil types observed at the Site is included as **Appendix B**. All soil borings were completed as monitoring wells, and details of monitoring well installation are provided in the following section.

3.2 Monitoring Well Installation

Once the total depth of the soil boring was reached, a permanent monitoring well was installed in the uppermost aquifer unit for completion of monitoring wells. Monitoring wells were installed through the rotasonic drill rig piping allowing the driller to construct the monitoring well, while simultaneously removing the drill piping. Monitoring wells were constructed with 2-inch inside diameter Schedule 40, polyvinyl chloride (PVC) screens and PVC risers. The well screens have a slot size of 0.010 inch and are 10 feet in length. A medium-grained sand pack was placed around each well screen to a height 1 to 2 feet above the top of the well screen. A 2 to 4-foot thick bentonite grout seal was placed on top of the sand pack. The remainder of the annular space was sealed with a cement-bentonite grout to a depth approximately 1 to 6-foot below ground surface.

The wells were finished at the surface using a 3-foot long, locking, stickup well cover set in a 24 inch by 24 inch concrete pad. Well construction logs are included in **Appendix A**; well construction is summarized in **Table 1**; well locations are shown on **Drawing SG-22345**. Wells were labeled according to Consumers Energy’s site-specific nomenclature provided to ARCADIS. The CE construction manager supplied keyed-alike locks for each well that match the existing well keys.

3.3 Monitoring Well Development

Newly installed monitoring wells were allowed to set for a minimum of 48 hours, after which the wells were developed. Well development consisted of the gentle swabbing of the entire screened interval with a surge block. After surging the well screen, water was evacuated using a submersible pump. A “flow-thru cell” and a turbidity meter were utilized to monitor indicator parameters (turbidity, pH, temperature, oxidation-reduction potential (ORP), and conductivity) to determine if groundwater parameters had appropriately stabilized during the development activities at each monitoring well. The stabilization parameters are provided below in **Table 2**. Indicator parameters were recorded in field notes and the development process continued until development water was free of visible sediment, stabilization of the field parameters, and below 10 Nephelometric Turbidity Units (NTUs). The volume of groundwater removed during development and its appearance was recorded in the field logbook. If drilling fluids were utilized during well installation, the volume of fluids used was recorded in the field logbook. This volume was removed in addition to the volume required for standard development. Monitoring well development details are included in **Table 1**.

Table 2. Groundwater Parameter Stabilization Criteria

| Groundwater Parameter | Stabilization Criteria |
|-------------------------------------|---|
| pH | 3 readings within +/- 0.1 Standard Units |
| Specific Conductance (SpC) | 3 readings within +/- 3% mS/cms |
| Temperature | 3 readings within +/- 3% |
| Oxidation-Reduction Potential (ORP) | 3 readings within +/- 10 mV |
| Turbidity | 3 readings within +/- 10% or <1 when < 10 NTU |
| Dissolved Oxygen (DO) | 3 readings within +/- 0.3 mg/L |

3.4 Hydraulic Testing

On November 10, 2015, Arcadis conducted hydraulic tests (slug tests) at nine monitoring wells (JHC MW-15005, JHC MW-15007, JHC MW-15015, JHC MW-15018, JHC MW-15024, JHC MW-15028, JHC MW-15030, JHC MW-15033, and JHC MW-15036) at the Site. Well construction logs are included in **Appendix A**; well construction details are summarized in **Table 1**.

During the slug testing activities, three tests were completed at each of the monitoring wells. The slug tests at these wells were completed to estimate hydraulic conductivity (K) by introducing a water table displacement by removing a known volume of water or depressing the water level by compressed air and measuring the rate of recovery. With the exception of the tests completed at JHC MW-15015, the tests at all wells were completed using a disposable bailer to remove a known volume of water. The bailer used at all wells was 1.5-inches in diameter and 36-inches long. At all the wells where the bail-down slug was used, the first two tests were completed using half the bailer size and the last test was completed using the full size bailer. The tests at JHC MW-15015 were completed using the pneumatic slug test method where a manifold and pump was used to depress the water level. All wells have casing and screen diameters of 2-inches and filter pack diameter of 8-inches. All wells, with the exception of JHC MW-15015 were screened across the water table at the time of well development and hydraulic testing. JHC MW-15015 was screened 2.57 feet below the water table at the time of hydraulic testing. At all wells, a pressure transducer was set to record at 0.5 second intervals to measure static head, displacement and recovery data.

The slug tests at the nine monitoring wells reached full recovery within approximately 7 to 35 seconds. Recovery data collected from the wells were analyzed using the applicable analytical solution with AQTESOLV® for Windows®. Based on diagnostic analyses, the solution utilized at most of the recovery data was the unconfined KGS model (1994) that accounts for partial penetration effects. The unconfined Bouwer and Rice (1976 and 1989) solution was utilized for recovery data at JHC MW-15030. The results indicated an estimated hydraulic conductivity range from 21 to 139 feet per day (ft/d) with an average of 73 ft/d and a geometric mean of 62 ft/d. The results of this test seem to be a reasonable fit with the sandy formation of the unconfined aquifer where the wells are screened. The monitoring well locations where slug tests were conducted are shown on **Drawing SG-22345** and the results of the hydraulic conductivity tests are presented in **Table 3** and **Appendix C**.

TABLES



Table 1
Monitoring Well Construction and Development Summary
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

| MW ID | Former MW ID | Site Coordinates | | | | Date Installed | Geologic Unit of Screen Interval | Well Construction | Well Screen Length (ft) | Screen Interval (ft bgs) | Development Details | | | | | |
|-----------------------------|--------------|------------------|-------------|--------|------------------|----------------|----------------------------------|-------------------|-------------------------|--------------------------|---------------------------|-------------|----------------------------|-----------------|-----------------------|--|
| | | Northing | Easting | TOC | Ground Elevation | | | | | | Static DTW (ft below TOC) | Total Depth | Pumping DTW (ft below TOC) | Gallons Removed | Final Turbidity (NTU) | |
| Downgradient MW | | | | | | | | | | | | | | | | |
| JHC MW-15017 | --- | 521074.31 | 12635685.32 | 613.69 | 616.61 | 9/29/2015 | Sand | 2" PVC, 10 slot | 10 | 10 - 20 | 15.56 | 22.98 | NR | 80 | 5.28 | |
| JHC MW-15018 | --- | 521075.54 | 12635979.61 | 614.26 | 617.02 | 9/28/2015 | Sand | 2" PVC, 10 slot | 10 | 10 - 20 | 16.23 | 22.95 | NR | 80 | 3.99 | |
| JHC MW-15019 | --- | 521058.67 | 12636352.00 | 609.81 | 612.86 | 9/29/2015 | Sand | 2" PVC, 10 slot | 10 | 6 - 16 | 12.78 | 19.11 | NR | 80 | 3.65 | |
| JHC MW-15020 | --- | 521059.97 | 12636589.95 | 609.04 | 611.90 | 9/30/2015 | Sand | 2" PVC, 10 slot | 10 | 6 - 16 | 12.25 | 18.97 | NR | 80 | 5.33 | |
| JHC MW-15021 | --- | 521065.93 | 12636839.06 | 610.70 | 613.65 | 9/30/2015 | Sand | 2" PVC, 10 slot | 10 | 6 - 16 | 14.38 | 18.30 | NR | 80 | 7.41 | |
| JHC MW-15022 | --- | 520479.72 | 12638430.24 | 620.92 | 623.79 | 9/30/2015 | Sand | 2" PVC, 10 slot | 10 | 23 - 33 | 29.37 | 36.30 | NR | 105 | 3.41 | |
| JHC MW-15031 | --- | 520118.00 | 12637801.51 | 632.94 | 635.87 | 10/5/2015 | Sand | 2" PVC, 10 slot | 10 | 33 - 43 | 43.19 | 46.17 | NR | 105 | 1.63 | |
| JHC MW-15032 | --- | 520779.28 | 12638667.93 | 611.32 | 614.29 | 10/6/2015 | Sand | 2" PVC, 10 slot | 10 | 13 - 23 | 17.81 | 26.04 | NR | 80 | 8.78 | |
| JHC MW-15033 | --- | 521075.81 | 12638598.12 | 618.08 | 620.99 | 10/6/2015 | Sand | 2" PVC, 10 slot | 10 | 16 - 26 | 22.93 | 28.78 | 23.2 | 120 | 5.47 | |
| JHC MW-15034 | --- | 521335.83 | 12638568.90 | 612.90 | 615.97 | 10/6/2015 | Sand | 2" PVC, 10 slot | 10 | 11 - 21 | 16.81 | 23.98 | NR | 200 | 9.62 | |
| JHC MW-15035 | MW-B5 | 520112.93 | 12637510.26 | 632.53 | 634.28 | 3/14/2001 | Sand | 2" PVC, 10 slot | 10 | 33 - 43 | NA | NA | NA | NA | NA | |
| JHC MW-15036 | MW-B6 | 520099.80 | 12638094.34 | 617.94 | 618.34 | 3/13/2001 | Sand | 2" PVC, 10 slot | 10 | 20 - 30 | NA | NA | NA | NA | NA | |
| JHC MW-15037 | MW-B7 | 520083.04 | 12638436.69 | 614.28 | 616.06 | 8/29/2001 | Sand | 2" PVC, 10 slot | 10 | 23 - 28 | NA | NA | NA | NA | NA | |
| Background MW | | | | | | | | | | | | | | | | |
| JHC MW-15023 | --- | 521927.21 | 12638205.16 | 617.01 | 619.98 | 10/1/2015 | Sand | 2" PVC, 10 slot | 10 | 14 - 24 | 18.91 | 27.68 | NR | 130 | 7.94 | |
| JHC MW-15024 | --- | 522366.01 | 12637322.68 | 613.79 | 616.62 | 10/1/2015 | Sand | 2" PVC, 10 slot | 10 | 7 - 17 | 14.12 | 19.93 | 14.49 | 135 | 3.31 | |
| JHC MW-15025 | --- | 522702.98 | 12636668.15 | 614.14 | 617.17 | 10/1/2015 | Sand | 2" PVC, 10 slot | 10 | 7 - 17 | 13.50 | 19.94 | 14.42 | 90 | 2.32 | |
| JHC MW-15026 | --- | 522495.09 | 12635971.82 | 615.09 | 618.04 | 10/2/2015 | Sand | 2" PVC, 10 slot | 10 | 8 - 18 | 15.34 | 21.02 | 15.97 | 180 | 8.88 | |
| JHC MW-15027 | --- | 522394.86 | 12635097.51 | 614.77 | 617.30 | 10/2/2015 | Sand | 2" PVC, 10 slot | 10 | 10 - 20 | 15.85 | 22.99 | 16.36 | 90 | 4.31 | |
| JHC MW-15028 | --- | 521646.20 | 12634105.34 | 611.02 | 613.80 | 10/2/2015 | Sand | 2" PVC, 10 slot | 10 | 8 - 18 | 14.38 | 20.82 | 14.62 | 220 | 9.80 | |
| JHC MW-15029 | --- | 520503.52 | 12633774.30 | 608.08 | 610.95 | 10/5/2015 | Sand | 2" PVC, 10 slot | 10 | 8 - 18 | 10.03 | 20.96 | 10.26 | 105 | 4.21 | |
| JHC MW-15030 | --- | 519760.83 | 12633044.37 | 604.05 | 607.17 | 10/5/2015 | Sand | 2" PVC, 10 slot | 10 | 4 - 14 | 7.99 | 16.93 | 8.30 | NR | 8.81 | |
| Hydraulic Testing MW | | | | | | | | | | | | | | | | |
| JHC MW-15005 | --- | 517781.42 | 12633905.01 | 624.37 | 627.30 | 9/18/2015 | Sand | 2" PVC, 10 slot | 10 | 27 - 37 | 33.26 | 40.10 | 33.51 | 45 | 2.11 | |
| JHC MW-15007 | --- | 517540.50 | 12635742.72 | 624.82 | 627.70 | 9/21/2015 | Sand | 2" PVC, 10 slot | 10 | 22 - 32 | 29.28 | 34.75 | 29.36 | 55 | 2.64 | |
| JHC MW-15015 | --- | 519715.11 | 12634186.63 | 632.46 | 635.20 | 9/28/2015 | Sand | 2" PVC, 10 slot | 10 | 28 - 38 | 28.57 | 41.28 | 29.48 | 90 | 5.09 | |
| JHC MW-15018 | --- | 521075.54 | 12635979.61 | 614.26 | 617.02 | 9/28/2015 | Sand | 2" PVC, 10 slot | 10 | 10 - 20 | 16.23 | 22.95 | NR | 80 | 3.99 | |
| JHC MW-15024 | --- | 522366.01 | 12637322.68 | 613.79 | 616.62 | 10/1/2015 | Sand | 2" PVC, 10 slot | 10 | 7 - 17 | 14.12 | 19.93 | 14.49 | 135 | 3.31 | |
| JHC MW-15028 | --- | 521646.20 | 12634105.34 | 611.02 | 613.80 | 10/2/2015 | Sand | 2" PVC, 10 slot | 10 | 8 - 18 | 14.38 | 20.82 | 14.62 | 220 | 9.80 | |
| JHC MW-15030 | --- | 519760.83 | 12633044.37 | 604.05 | 607.17 | 10/5/2015 | Sand | 2" PVC, 10 slot | 10 | 4 - 14 | 7.99 | 16.93 | 8.30 | NR | 8.81 | |
| JHC MW-15033 | --- | 521075.81 | 12638598.12 | 618.08 | 620.99 | 10/6/2015 | Sand | 2" PVC, 10 slot | 10 | 16 - 26 | 22.93 | 28.78 | 23.2 | 120 | 5.47 | |
| JHC MW-15036 | MW-B6 | 520099.80 | 12638094.34 | 617.94 | 618.34 | 3/13/2001 | Sand | 2" PVC, 10 slot | 10 | 20 - 30 | NA | NA | NA | NA | NA | |

Notes:
ft = feet
bgs = below ground surface
TOC = top of casing
NR = Not recorded
NA = Not applicable

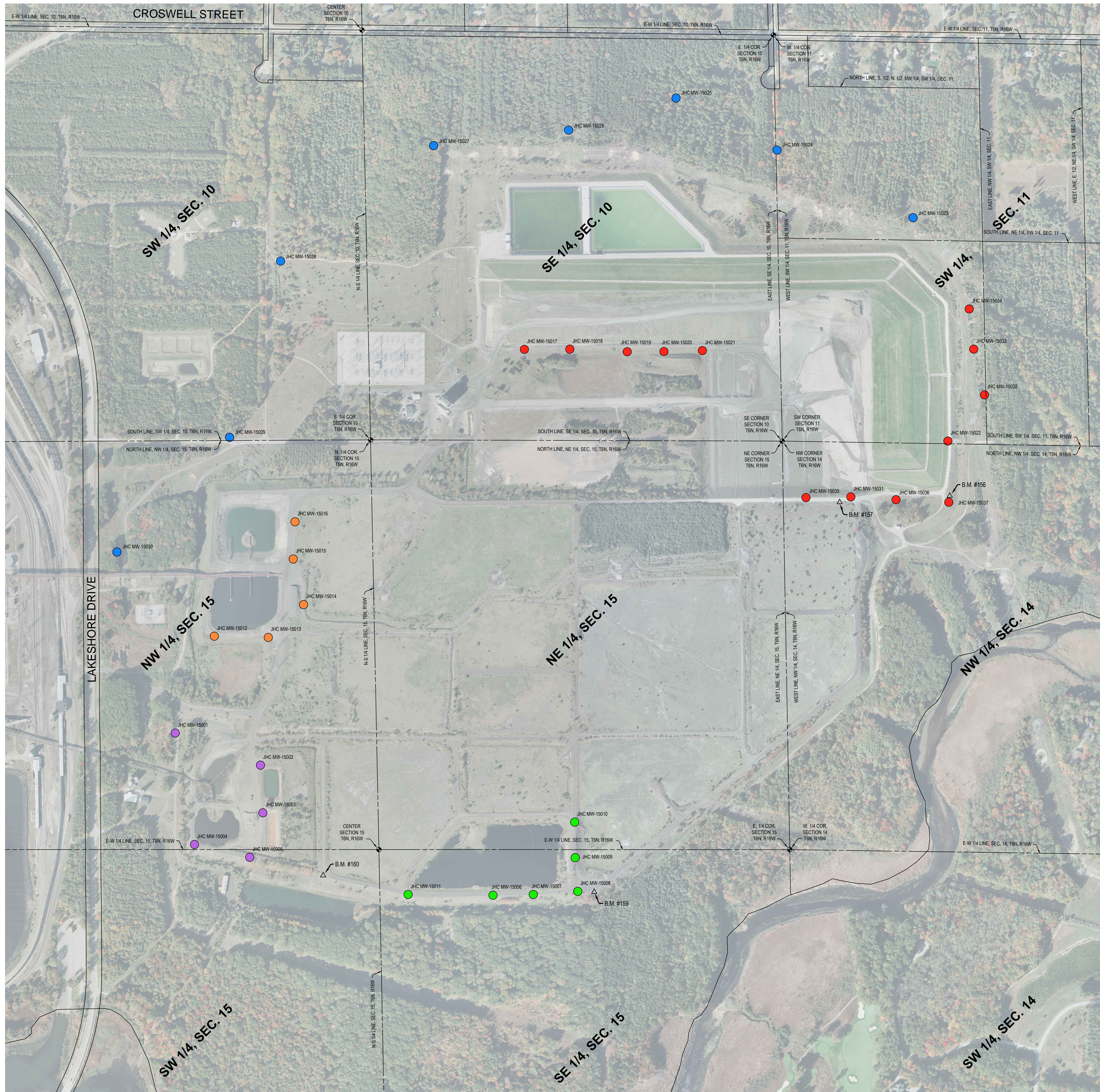
Table 3
Estimated Hydraulic Conductivity (K) Values
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

| Well ID | Test | H ⁰ (ft) | H ¹ (ft) | K (ft/d) | K (cm/sec) | Slug Test Solution |
|--------------------------------|---------|---------------------|---------------------|------------|-----------------|--------------------------------|
| JHC MW-15005 | 2 | 0.738 | 0.844 | 61 | 2.15E-02 | KGS Model (Hyder et. al, 1994) |
| | 3 | 1.422 | 1.69 | 58 | 2.05E-02 | KGS Model (Hyder et. al, 1994) |
| | Average | | | | 60 | 2.10E-02 |
| JHC MW-15036 | 2 | 0.777 | 0.844 | 118 | 4.16E-02 | KGS Model (Hyder et. al, 1994) |
| | 3 | 1.219 | 1.69 | 139 | 4.90E-02 | KGS Model (Hyder et. al, 1994) |
| | Average | | | | 129 | 4.53E-02 |
| JHC MW-15007 | 1 | 0.629 | 0.844 | 130 | 4.59E-02 | KGS Model (Hyder et. al, 1994) |
| JHC MW-15015 | 2 | 0.879 | 1.15 | 22 | 7.76E-03 | KGS Model (Hyder et. al, 1994) |
| | 3 | 1.98 | 2.31 | 21 | 7.41E-03 | KGS Model (Hyder et. al, 1994) |
| | Average | | | | 22 | 7.59E-03 |
| JHC MW-15024 | 2 | 0.801 | 0.844 | 49 | 1.73E-02 | KGS Model (Hyder et. al, 1994) |
| | 3 | 1.534 | 1.69 | 45 | 1.59E-02 | KGS Model (Hyder et. al, 1994) |
| | Average | | | | 47 | 1.66E-02 |
| JHC MW-15028 | 1 | 0.704 | 0.844 | 104 | 3.67E-02 | KGS Model (Hyder et. al, 1994) |
| | 3 | 1.515 | 1.69 | 86 | 3.03E-02 | KGS Model (Hyder et. al, 1994) |
| | Average | | | | 95 | 3.35E-02 |
| JHC MW-15033 | 2 | 0.669 | 0.844 | 74 | 2.61E-02 | KGS Model (Hyder et. al, 1994) |
| JHC MW-15030 | 2 | 0.701 | 0.844 | 100 | 3.53E-02 | Bouwer-Rice (1976) |
| | 3 | 1.194 | 1.69 | 87 | 3.07E-02 | Bouwer-Rice (1976) |
| | Average | | | | 94 | 3.30E-02 |
| JHC MW-15018 | 1 | 0.732 | 0.844 | 34 | 1.20E-02 | KGS Model (Hyder et. al, 1994) |
| | 3 | 1.486 | 1.69 | 33 | 1.16E-02 | KGS Model (Hyder et. al, 1994) |
| | Average | | | | 34 | 1.18E-02 |
| Over all Average | | | | 73 | 2.56E-02 | |
| Over all Geometric mean | | | | 62 | 2.19E-02 | |
| Minimum | | | | 21 | 7.41E-03 | |
| Maximum | | | | 139 | 4.90E-02 | |

Note:
H⁰ = initial displacement
H¹ = expected (calculated) displacement
cm/sec = centimeters per second
ft = feet
ft/d = feet per day

FIGURES

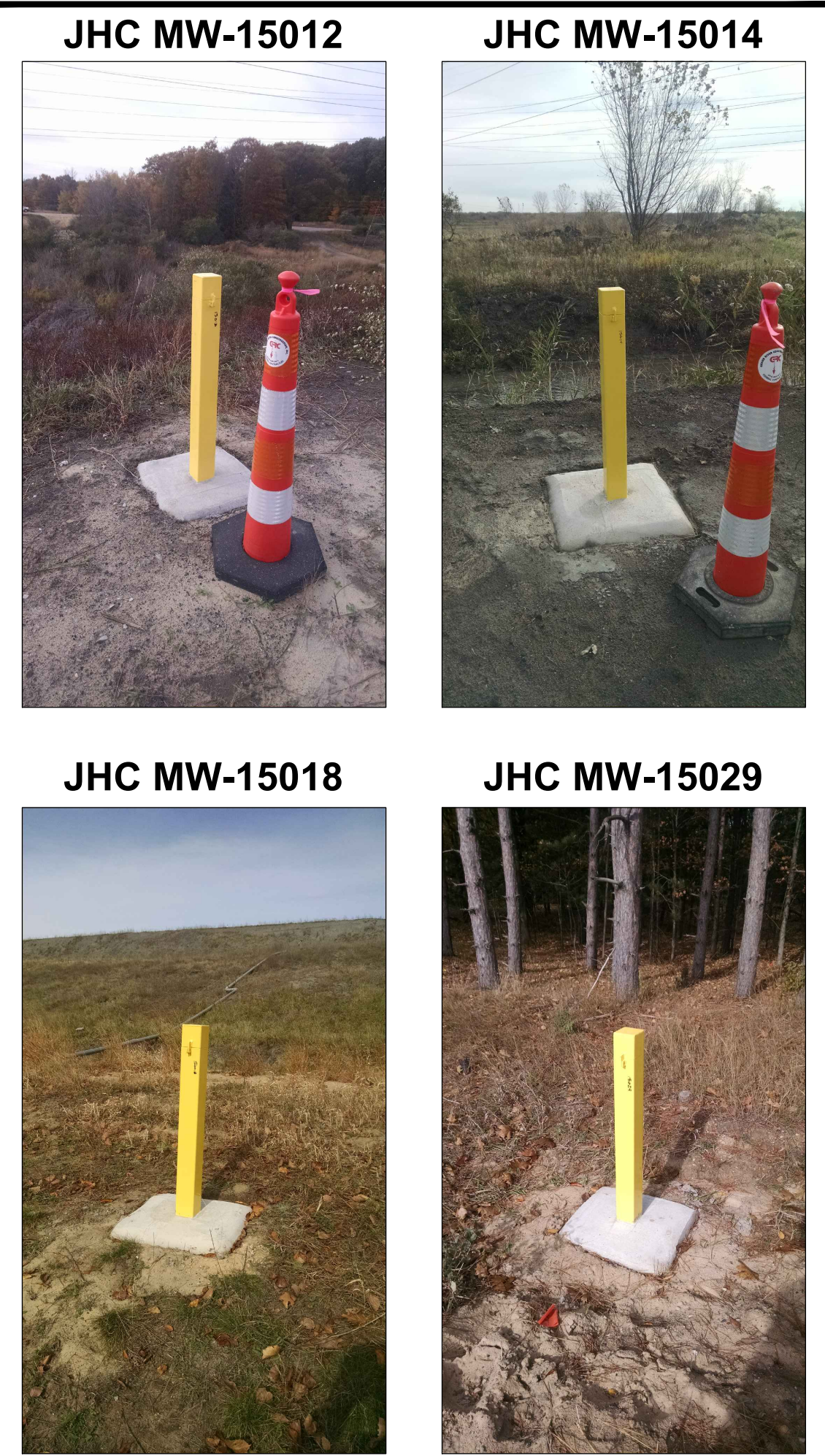




BENCHMARKS

- BENCHMARK #150** ELEV. = 611.72 (NAVD88)
Set railroad spike in West side of power pole 32± East of centerline of old Hiawatha Drive, 1000± North of Park Street.
- BENCHMARK #151** ELEV. = 612.77 (NAVD88)
Set on top of top bolt on West side of Northwest tower leg of middle tower of three running North-South.
- BENCHMARK #152** ELEV. = 620.75 (NAVD88)
Set on top of top bolt on Southwest side of South tower leg of North-most tower.
- BENCHMARK #153** ELEV. = 618.84 (NAVD88)
Set on top of top bolt on North side of Northwest tower leg.
- BENCHMARK #154** ELEV. = 614.44 (NAVD88)
Set on top of top bolt on North side of Northwest tower leg, 50± East of two-track to North extended.
- BENCHMARK #155** ELEV. = 619.32 (NAVD88)
JHC Control Point #33 monument, 100± South and 100± West of woods line in Northeast corner of site.
- BENCHMARK #156** ELEV. = 617.12 (NAVD88)
JHC Control Point #34 monument, approximately at top of bank, Southeast part of site, 60± Southeast of gravel drive, approximately at Southeast corner of grassy mound.
- BENCHMARK #157** ELEV. = 630.91 (NAVD88)
JHC Control Point #35 monument, 7± South of South edge of gravel drive, 120± West of centerline of gravel to South, approximately at Southwest corner of grassy mound.
- BENCHMARK #158** ELEV. = 631.45 (NAVD88)
Set on top of top bolt on top of bank approximately at point of intersection of gravel road to North and Southwest, 22± South of centerline of gravel road at Southeast corner of site.
- BENCHMARK #159** ELEV. = 632.77 (NAVD88)
JHC Control Point monument, no #, on top of bank approximately at point of intersection of centerline of gravel road to Northeast and West 30± South of centerline of gravel road on top of bank.
- BENCHMARK #160** ELEV. = 631.70 (NAVD88)
Set on top of top bolt on East side of East side of Southeast tower leg, North-most tower of three, North and East of Monitor Well 15013 (Tower #8810).
- BENCHMARK #161** ELEV. = 628.67 (NAVD88)
Set railroad spike in Northwest side of light pole, 5' West of fence, 100± South of Northwest corner of fence surrounding a pond and a metal building, approximate Southwest part of site.
- BENCHMARK #162** ELEV. = 633.61 (NAVD88)
Set on top of top bolt on East side of East side of Southeast tower leg, North-most tower of three, North and East of Monitor Well 15013 (Tower #8810).
- BENCHMARK #163** ELEV. = 635.03 (NAVD88)
Set on top of steel post holding bird house #150, across gravel road from Northeast corner of ash pond.

TYPICAL INSTRUMENTATION STRUCTURE



Randal J. Vugteveen
Professional Surveyor No. 28429
Nederveld, Inc.
rvugteveen@nederveld.com

| SURVEY POINT NUMBER | INSTRUMENTATION STRUCTURE | NORTHING NAD83 ADJ.2011 | EASTING INTERNATIONAL FT. | GROUND ELEVATION (TOP OF CONCRETE) (NAVD88) | TOP OF CASING ELEVATION (NAVD88) | LATITUDE (DECIMAL DEGREES) | LONGITUDE |
|---------------------|---------------------------|-------------------------|---------------------------|---|----------------------------------|----------------------------|------------|
| 70035 | JHC MW-15001 | 518586.883 | 12633422.010 | 607.02 | 609.53 | 42.908415 | -86.195653 |
| 70034 | JHC MW-15002 | 518378.917 | 12633974.821 | 625.97 | 628.87 | 42.907878 | -86.193573 |
| 70033 | JHC MW-15003 | 518069.863 | 12633990.368 | 628.31 | 630.63 | 42.907031 | -86.193490 |
| 70032 | JHC MW-15004 | 517864.558 | 12633547.120 | 624.92 | 628.44 | 42.906441 | -86.195127 |
| 70031 | JHC MW-15005 | 517781.423 | 12633905.007 | 624.37 | 627.30 | 42.906234 | -86.193785 |
| 70028 | JHC MW-15006 | 517535.735 | 12635481.661 | 624.74 | 627.58 | 42.905654 | -86.187881 |
| 70027 | JHC MW-15007 | 517540.502 | 12635742.724 | 624.82 | 627.70 | 42.905683 | -86.186908 |
| 70025 | JHC MW-15008 | 517560.390 | 12636631.246 | 632.43 | 635.30 | 42.905754 | -86.185833 |
| 70024 | JHC MW-15009 | 517779.126 | 12636014.809 | 632.33 | 635.32 | 42.906353 | -86.185912 |
| 70023 | JHC MW-15010 | 518009.361 | 12636011.459 | 632.55 | 635.57 | 42.906985 | -86.185943 |
| 70029 | JHC MW-15011 | 517540.496 | 12634931.588 | 627.71 | 630.83 | 42.905635 | -86.189935 |
| 70045 | JHC MW-15012 | 519214.841 | 12633675.278 | 632.59 | 635.66 | 42.910153 | -86.194759 |
| 70046 | JHC MW-15013 | 519207.188 | 12634025.153 | 632.40 | 635.25 | 42.910153 | -86.193452 |
| 70044 | JHC MW-15014 | 519419.850 | 12634254.118 | 635.13 | 638.18 | 42.910750 | -86.192615 |
| 70043 | JHC MW-15015 | 519715.111 | 12634186.634 | 632.46 | 635.20 | 42.911556 | -86.192891 |
| 70042 | JHC MW-15016 | 519556.792 | 12634198.522 | 631.81 | 634.64 | 42.912220 | -86.192866 |
| 70037 | JHC MW-15017 | 521074.309 | 12635685.320 | 613.69 | 616.61 | 42.915374 | -86.187407 |
| 70038 | JHC MW-15018 | 521075.536 | 12635979.612 | 614.26 | 617.02 | 42.915394 | -86.186309 |
| 70039 | JHC MW-15019 | 521058.673 | 12636351.996 | 609.81 | 612.86 | 42.915370 | -86.184918 |
| 70040 | JHC MW-15020 | 521059.974 | 12636589.953 | 609.04 | 611.90 | 42.915388 | -86.184030 |
| 70041 | JHC MW-15021 | 521063.933 | 12636639.055 | 610.70 | 613.65 | 42.915419 | -86.183100 |
| 70014 | JHC MW-15022 | 520478.119 | 12638430.236 | 620.92 | 623.79 | 42.913905 | -86.177114 |
| 70010 | JHC MW-15023 | 521927.205 | 12638205.162 | 617.01 | 619.98 | 42.917863 | -86.178071 |
| 70056 | JHC MW-15024 | 522366.013 | 12637322.677 | 613.79 | 616.62 | 42.919014 | -86.181400 |
| 70007 | JHC MW-15025 | 522702.978 | 12636668.146 | 614.14 | 617.17 | 42.919900 | -86.183870 |
| 70006 | JHC MW-15026 | 522495.091 | 12635971.882 | 615.09 | 618.04 | 42.919288 | -86.186452 |
| 70057 | JHC MW-15027 | 522394.860 | 12635997.509 | 614.77 | 617.30 | 42.918961 | -86.189708 |
| 70002 | JHC MW-15028 | 521646.198 | 12634105.336 | 611.03 | 613.80 | 42.916849 | -86.193350 |
| 70000 | JHC MW-15029 | 520503.524 | 12633774.259 | 608.08 | 610.95 | 42.913694 | -86.194493 |
| 70036 | JHC MW-15030 | 519760.827 | 12633044.373 | 604.05 | 607.17 | 42.911613 | -86.197157 |
| 70020 | JHC MW-15031 | 520118.003 | 12637801.509 | 632.94 | 635.87 | 42.912876 | -86.179432 |
| 70013 | JHC MW-15032 | 520779.281 | 12638667.931 | 611.32 | 614.29 | 42.914741 | -86.176251 |
| 70012 | JHC MW-15033 | 521075.809 | 12638598.117 | 618.08 | 620.99 | 42.915590 | -86.176536 |
| 70011 | JHC MW-15034 | 521335.834 | 12638668.896 | 615.90 | 618.97 | 42.916262 | -86.176666 |
| 70022 | JHC MW-15035 | 520112.933 | 12637310.259 | 632.53 | 635.28 | 42.912844 | -86.180518 |
| 70019 | JHC MW-15036 | 520099.800 | 12638094.344 | 617.94 | 618.34 | 42.912843 | -86.178337 |
| 70017 | JHC MW-15037 | 520083.044 | 12638436.693 | 614.28 | 616.06 | 42.912817 | -86.177058 |

| STATION | DESCRIPTION | WITNESSES | NORTHING (PLANT DATUM) | EASTING (PLANT DATUM) | NORTHING (UNIT 1 & 2) | EASTING (UNIT 1 & 2) | ELEVATION (PLANT DATUM) | ELEVATION (NAVD88 DATUM) |
|---------|--|--|------------------------|-----------------------|-----------------------|----------------------|-------------------------|--------------------------|
| NED 1 | SET 3-1/4" DOMED ALUMINUM CAP ON 3/4" ALUMINUM TOP SECURITY ROD MONUMENT DEPTH = 43 TO REFUSAL SET MAG IN EAST SIDE OF POWER POLE SET MAG IN NORTH SIDE OF POWER POLE SOUTH-WEST FACE OF S.B.C. RISER | N28°W 90.83' S63°W 185.96' N54°E 39.19' | 16259.8663 | 12360.7163 | --- | --- | 607.357 | 608.962 |
| NED 2 | SET 3-1/4" DOMED ALUMINUM CAP ON 3/4" ALUMINUM TOP SECURITY ROD MONUMENT DEPTH = 43 TO REFUSAL SET "X" ON SOUTH LEG OF TRANSMISSION LINE TOWER WEST FACE OF FENCE POST AT SOUTHWEST CORNER OF FENCE AROUND SUBSTATION SET MAG NAIL IN NORTH SIDE OF 10" PINE | N25°E 82.25' N90°E 89.54' S52°E 59.82' | 16584.3789 | 12791.7633 | --- | --- | 608.150 | 607.655 |
| NED 3 | SET 3-1/4" DOMED ALUMINUM CAP ON 3/4" ALUMINUM TOP SECURITY ROD MONUMENT DEPTH = 47 TO REFUSAL SOUTHEAST CORNER OF METAL GARAGE BUILDING NORTHEAST CORNER OF METAL GARAGE BUILDING MAG NAIL IN SOUTHWEST SIDE OF POWER POLE FACE OF FENCE POST AT SOUTHWEST CORNER OF FENCE AROUND SUBSTATION | S28°W 93.60' S41°W 89.22' N53°E 33.96' N49°W 11.34' | 16566.3834 | 13451.8335 | --- | --- | 609.457 | 608.962 |

SURVEY REPORT

Horizontal: State Plane Coordinates were obtained on the monitor wells using RTK GPS using the CORS network. The horizontal datum is Michigan State Plane Coordinates, Michigan South Zone, NAD83 (2011 Adjustment, Epoch 2010.00).
Vertical: Elevations are on NAVD 88 datum. All elevations were established on the monitor wells using closed and adjusted level loops from known JHC plant benchmarks.

SURVEYOR'S NOTES

- 1) Utility locations are derived from actual measurements or available records. They should not be interpreted to be exact locations nor should it be assumed that they are the only utilities in this area.
- 2) NOTE TO CONTRACTORS: 3 (THREE) WORKING DAYS BEFORE YOU DIG, CALL MISS DIG AT TOLL FREE 1-800-482-7171 FOR UTILITY LOCATIONS ON THE GROUND.
- 3) 2012 aerial imagery provided by Consumers Energy.

LEGEND

- ◆ = EXISTING MONITORING WELL
- = DOWNGRADIENT LANDFILL MONITORING WELL
- = DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- = DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- = POND A MONITORING WELL
- = BACKGROUND MONITORING WELL

BASIS OF BEARING

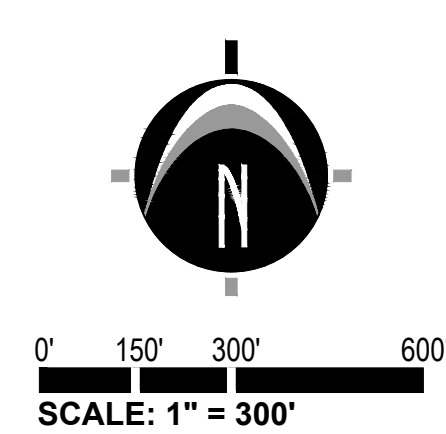
STATE PLANE COORDINATES

BASIS OF ELEVATION

NEDI BM (NAVD88)

DATUM CONVERSION

Plant Datum (NGVD29) to NAVD88 = -0.495'



811 Know what's below. CALL before you dig.

UTILITY LOCATIONS ARE DERIVED FROM ACTUAL MEASUREMENTS OR AVAILABLE RECORDS. THEY SHOULD NOT BE INTERPRETED TO BE EXACT LOCATIONS NOR SHOULD IT BE ASSUMED THAT THEY ARE THE ONLY UTILITIES IN THIS AREA.

NOTE: EXISTING UTILITIES AND SERVICE LINES IDENTIFIED AS "PLANT" WERE OBTAINED FROM ANA USE CITY AVAILABLE RECORD DRAWINGS. THE CONTRACTOR SHALL VERIFY THE LOCATION, DEPTH AND STATUS OF ALL UTILITIES AND SERVICE LINES PRIOR TO NEW CONNECTIONS.

| DRAWING NO. | REFERENCE DRAWINGS | REV | DATE | DESCRIPTION | BY | APP | REV | DATE | DESCRIPTION | BY | APP | REV | DATE | DESCRIPTION | BY | APP | DATE | DATE |
|-------------|--------------------|-----|------|-------------|----|-----|-----|------|-------------|----|-----|-----|------|-------------|----|-----|------|------|
| | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | |

DR. DATE

FLD. PV 10.27.15

CK. MN 11.25.15

A 11.25.15

REVISIONS PER CONSUMERS ENERGY REVIEW

MUL MN

APP.

Grand Rapids
217 Granite Ave., Suite 302
Grand Rapids, MI 49503

CAMPBELL PLANT MONITORING WELLS
CCR MONITORING

22345base.DWG

SCALE 1" = 300'

583-009-441

DRAWING NO. SG-22345

UNITS 1 & 2

SHEET 1

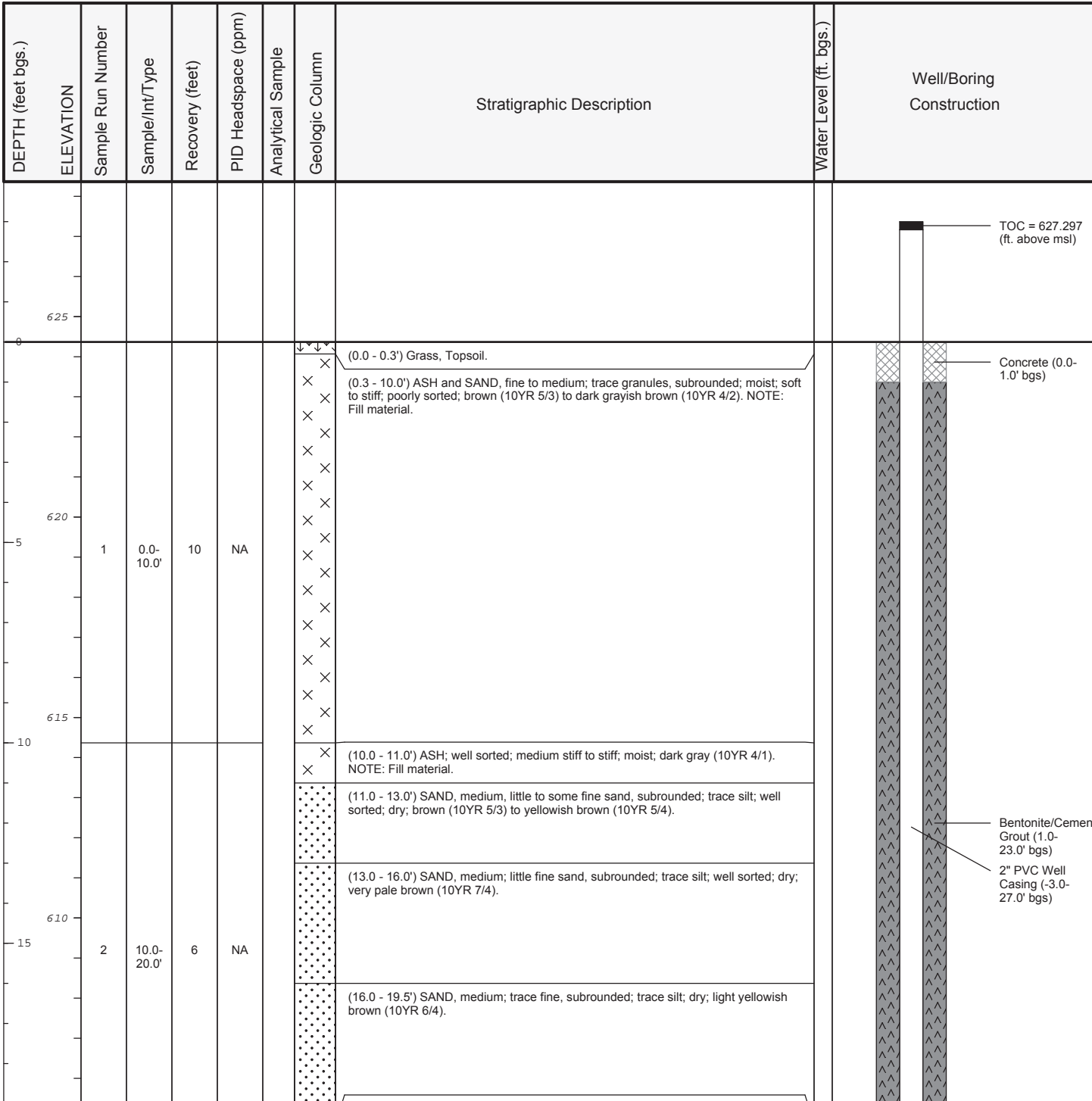
REV. A

APPENDIX A

Soil Boring and Monitoring Well Construction Logs



| | | |
|---|--|---|
| Date Start: 9/18/15 Date Finish: 9/18/15 Drilling Company: Mateco Drilling Driller's Name: John Pitsch Drilling Method: Air Knife/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 29.0 Water Level Finish (ft. btoc.): 33.26 | Northing: 517781.423 Easting: 12633905.01 Casing Elevation: 627.297 Borehole Depth (ft. bgs.): 40.0 Surface Elevation: 624.367 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15005 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: 70 F Cloudy |
|---|--|---|




Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 29.0' bgs during drilling.
Water level at development encountered at 33.26' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 595.77 feet

| | | |
|---|--|---|
| Date Start: 9/18/15 Date Finish: 9/18/15 Drilling Company: Mateco Drilling Driller's Name: John Pitsch Drilling Method: Air Knife/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 29.0 Water Level Finish (ft. btoc.): 33.26 | Northing: 517781.423 Easting: 12633905.01 Casing Elevation: 627.297 Borehole Depth (ft. bgs.): 40.0 Surface Elevation: 624.367 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15005 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: 70 F Cloudy |
|---|--|---|

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|--|---------------------------|------------------------|--|
| 20 | 605 | | | | | | (19.5 - 19.8') SAND, medium; trace fine, subrounded; little to some silt; moist, brown (10YR 4/3). | | | |
| | | | | | | | (19.8 - 29.0') SAND, medium, trace fine, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4). | | | |
| 25 | 600 | 3 | 20.0-30.0' | 6 | NA | | | | | Bentonite Pellets (23.0-25.0' bgs) |
| 30 | 595 | | | | | | (29.0 - 31.0') SAND, medium, little fine, trace coarse, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3). | | | |
| | | | | | | | (31.0 - 33.0') SAND, medium to coarse, little fine, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3). | | | Sand Pack K&E WP1 (25.0-40.0' bgs) 2" PVC 10 Slot Well Screen (27.0-37.0 bgs) |
| 35 | 590 | 4 | 30.0-40.0' | 9 | NA | | (33.0 - 40.0') SAND, fine, some medium, subrounded; well sorted; wet; pale brown (10YR 6/3). | | | |
| 40 | 585 | | | | | | End of boring at 40.0' bgs. | | | |

| | |
|--|---|
|  <small>Design & Consultancy for natural and built assets</small> | Remarks: bgs = below ground surface btoc = below top of casing Air knife to 10.0' bgs. Groundwater encountered at 29.0' bgs during drilling. Water level at development encountered at 33.26' btoc. No odor or staining observed. Groundwater elevation measured on December 2, 2015 was 595.77 feet |
|--|---|

Date Start: 9/21/15
Date Finish: 9/21/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 21.0
Water Level Finish (ft. btoc.): 29.28

Northing: 517540.502
Easting: 12635742.72
Casing Elevation: 627.697

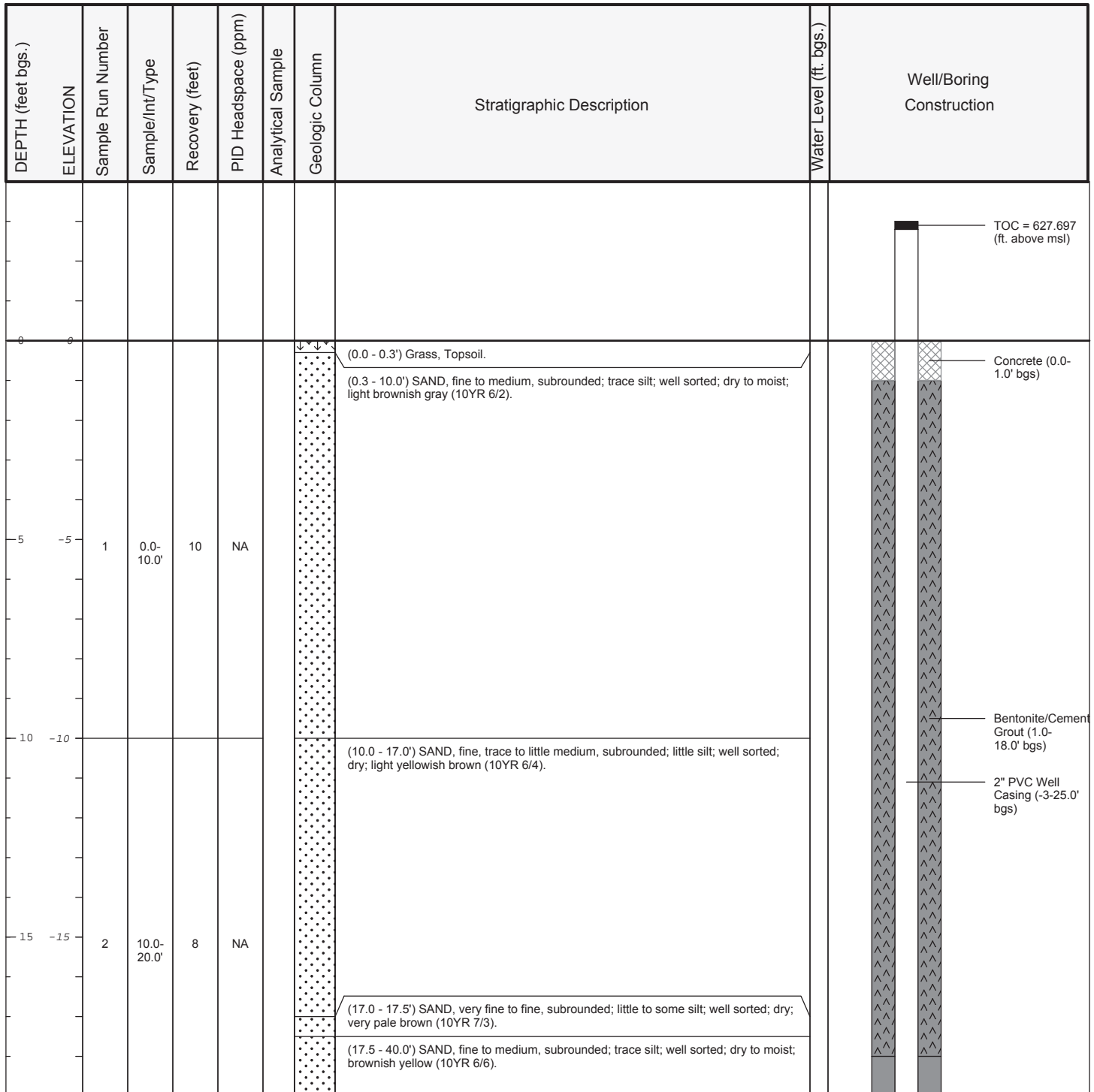
Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.817

Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15007
Client: Consumers Energy

Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460

Weather Conditions: 75 F Sunny



Remarks: bgs = below ground surface
 btoc = below top of casing

Air knife to 10.0' bgs.
 Groundwater encountered at 21.0' bgs during drilling.
 Water level at development was 29.28' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 599.22 feet

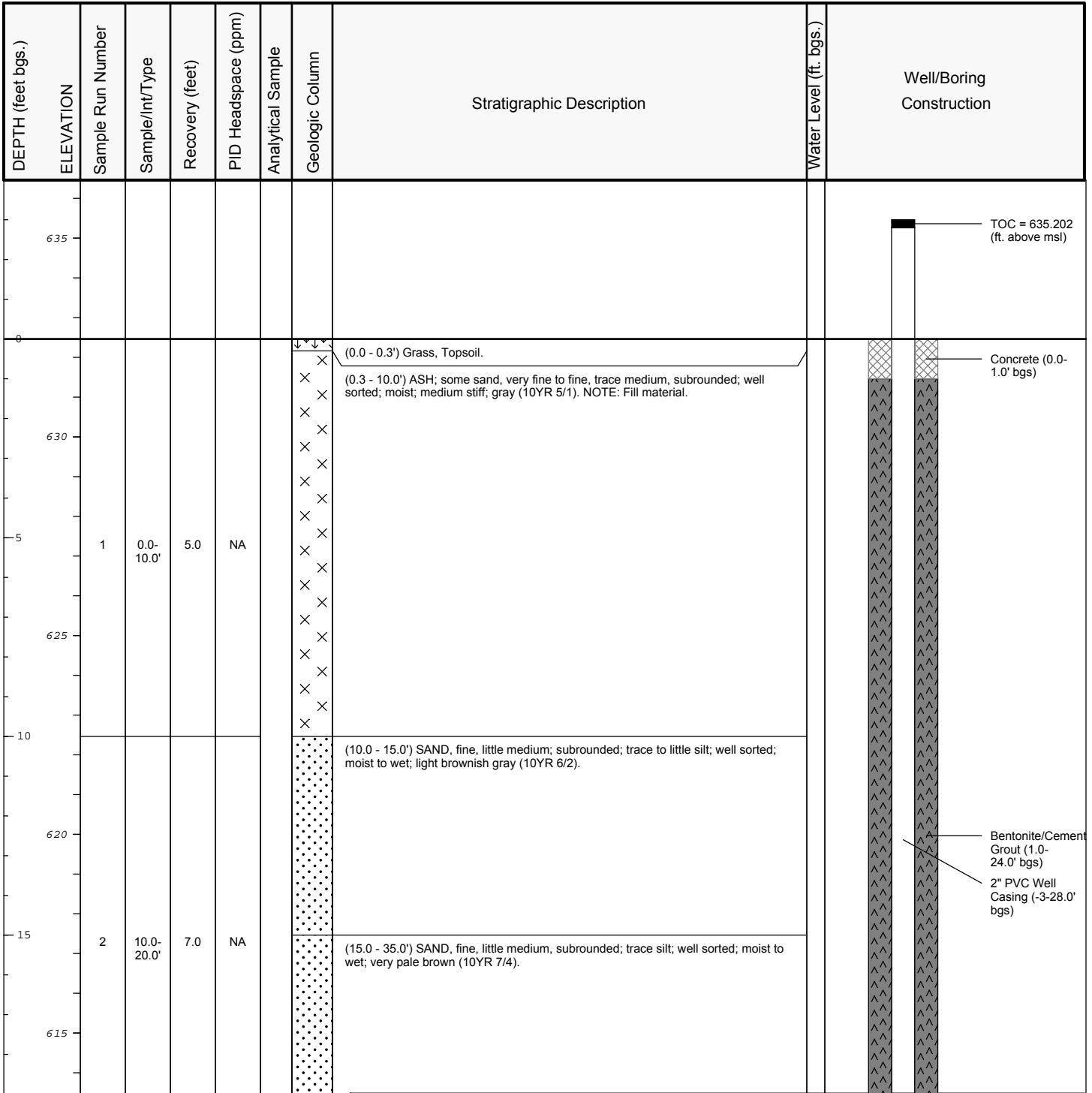


| | | |
|---|--|--|
| Date Start: 9/21/15 Date Finish: 9/21/15 Drilling Company: Mateco Drilling Driller's Name: John Pitsch Drilling Method: Air Knife/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 21.0 Water Level Finish (ft. btoc.): 29.28 | Northing: 517540.502 Easting: 12635742.72 Casing Elevation: 627.697 Borehole Depth (ft. bgs.): 40.0 Surface Elevation: 624.817 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15007 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: 75 F Sunny |
|---|--|--|

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|-----------------------------|------------------------|--------------------------|
| 20 | -20 | | | | | | | | | |
| 25 | -25 | 3 | 20.0-30.0' | 5 | NA | | | NOTE: Wet at 21.0' bgs. | | |
| 35 | -35 | 4 | 30.0-40.0' | 5 | NA | | | | | |
| 40 | -40 | | | | | | | End of boring at 40.0' bgs. | | |

| | |
|--|--|
| | Remarks: bgs = below ground surface btoc = below top of casing Air knife to 10.0' bgs. Groundwater encountered at 21.0' bgs during drilling. Water level at development was 29.28' btoc. No odor or staining observed. Groundwater elevation measured on December 2, 2015 was 599.22 feet |
|--|--|

| | | |
|--|---|--|
| Date Start: 9/25/15 Date Finish: 9/28/15 Drilling Company: Mateco Drilling Driller's Name: John Pitsch Drilling Method: Air Knife/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 23.92 Water Level Finish (ft. btoc.): 28.57 | Northing: 519715.111 Eastng: 12634186.63 Casing Elevation: 635.202 Borehole Depth (ft. bgs.): 40.0 Surface Elevation: 632.462 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15015 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: 75 F Sunny |
|--|---|--|



| | |
|--|--|
| | <p>Remarks: bgs = below ground surface btoc = below top of casing</p> <p>Air knife to 10.0' bgs. Groundwater encountered at 23.92' bgs. Water level at development was 28.57' btoc. No odor or staining observed. Groundwater elevation measured on December 3, 2015 was 607.68 feet</p> |
|--|--|

Date Start: 9/25/15
Date Finish: 9/28/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 23.92
Water Level Finish (ft. btoc.): 28.57

Northing: 519715.111
Easting: 12634186.63
Casing Elevation: 635.202
Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 632.462
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15015
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: 75 F Sunny

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|--|------------------------|--|
| 20 | | | | | | | | | | |
| 610 | | | | | | | | | | |
| 25 | | 3 | 20.0-30.0' | 8.0 | NA | | | NOTE: Wet at 23.92' bgs. | | Bentonite Pellets (24.0-26.0' bgs) |
| 605 | | | | | | | | | | |
| 30 | | | | | | | | | | |
| 600 | | | | | | | | | | |
| 35 | | 4 | 30.0-40.0' | 8.0 | NA | | | (35.0 - 40.0') SAND, very fine to fine, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3). | | Sand Pack K&E WP1 (26.0-40.0' bgs) 2" PVC 10 Slot Well Screen (28.0-38.0 bgs) |
| 595 | | | | | | | | | | |
| 40 | | | | | | | | End of boring at 40.0' bgs. | | |



Remarks: bgs = below ground surface
 btoc = below top of casing

 Air knife to 10.0' bgs.
 Groundwater encountered at 23.92' bgs.
 Water level at development was 28.57' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 3, 2015 was 607.68 feet

Date Start: 9/29/15
Date Finish: 9/29/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 12.0
Water Level Finish (ft. btoc.): 15.56

Northing: 521074.309
Easting: 12635685.32
Casing Elevation: 616.607
Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 613.691
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15017
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: 60 F Cloudy

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|--|------------------------------|------------------------|---|
| 615 | | | | | | | | | | |
| 0 | | | | | | | | (0.0 - 0.3') Grass, Topsoil. | | TOC = 616.607 (ft. above msl) |
| 5 | | 1 | 0.0-10.0' | 4.0 | NA | | (0.3 - 10.0') SAND, fine to medium, subrounded; trace silt; poorly sorted; dry; yellowish brown (10YR 4/3). | | | Concrete (0.0-1.0' bgs) Bentonite/Cement Grout (1.0-6.0' bgs) 2" PVC Well Casing (-3-10.0' bgs) Bentonite Pellets (6.0-8.0' bgs) |
| 10 | | | | | | | (10.0 - 18.0') SAND, fine, subrounded; trace silt; well sorted; moist to wet; pale brown (10YR 6/3). NOTE: Wet at 12.0'. | | | |
| 15 | | 2 | 10.0-20.0' | 7.0 | NA | | (18.0 - 20.0') SAND, medium, little fine, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3). NOTE: Little small pebbles, subrounded. | | | Sand Pack K&E WP1 (8.0-20.0' bgs) 2" PVC 10 Slot Well Screen (10.0-20.0 bgs) |
| 595 | | | | | | | | | 15.56 | |
| 20 | | | | | | | | End of boring at 20.0' bgs. | | |


Remarks: bgs = below ground surface
 btoc = below top of casing

 Air knife to 10.0' bgs.
 Groundwater encountered at 12.0' bgs.
 Water level at development was 15.56' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 596.00 feet




| | | |
|---|--|---|
| Date Start: 9/29/15 Date Finish: 9/29/15 Drilling Company: Mateco Drilling Driller's Name: John Pitsch Drilling Method: Air Knife/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 12.0 Water Level Finish (ft. btoc.): 16.29 | Northing: 521075.536 Easting: 12635979.61 Casing Elevation: 617.022 Borehole Depth (ft. bgs.): 20.0 Surface Elevation: 614.262 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15018 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: 60 F Cloudy |
|---|--|---|

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|---|------------------------|---|
| 615 | | | | | | | | | | TOC Elevation = 617.022 (ft. above msl) |
| 0 | | | | | | | | (0.0 - 0.3') Grass, Topsoil. | | Concrete (0.0-1.0' bgs) |
| 5 | | 1 | 0.0-10.0' | 3.0 | NA | | | (0.3 - 1.0') ASH and SAND, very fine to fine, well sorted; dry; light gray (10YR 7/2). NOTE: Fill material. (1.0 - 10.0') SAND, fine, subrounded; well sorted; dry; brownish yellow (10YR 6/6). | | Bentonite/Cement Grout (1.0-6.0' bgs) 2" PVC Well Casing (-3-10.0' bgs) |
| 10 | | | | | | | | (10.0 - 17.0') SAND, fine, subrounded; trace silt; well sorted; moist to wet; very pale brown (10YR 7/3). NOTE: Wet at 12.0' bgs. | | Bentonite Pellets (6.0-8.0' bgs) |
| 15 | | 2 | 10.0-20.0' | 7.0 | NA | | | (17.0 - 20.0') SAND, medium, little fine, subrounded; trace granules; subrounded; trace silt; well sorted; wet; very pale brown (10YR 7/4). | | Sand Pack K&E WP1 (8.0-20.0' bgs) 2" PVC 10 Slot Well Screen (10.0-20.0 bgs) |
| 20 | | | | | | | | End of boring at 20.0' bgs. | | |

| | |
|--|--|
|  | Remarks: bgs = below ground surface btoc = below top of casing Air knife to 10.0' bgs. Groundwater encountered at 12.0' bgs during drilling. Water level at development was 16.29' btoc. No odor or staining observed. Groundwater elevation measured on December 2, 2015 was 600.45 feet |
|--|--|

| | | |
|--|---|---|
| Date Start: 9/29/15 Date Finish: 9/29/15 Drilling Company: Mateco Drilling Driller's Name: John Pitsch Drilling Method: Air Knife/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 8.5 Water Level Finish (ft. btoc.): 12.78 | Northing: 521058.673 Easting: 12636352 Casing Elevation: 612.857 Borehole Depth (ft. bgs.): 16.0 Surface Elevation: 609.812 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15019 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: 60 F Cloudy, light rain |
|--|---|---|

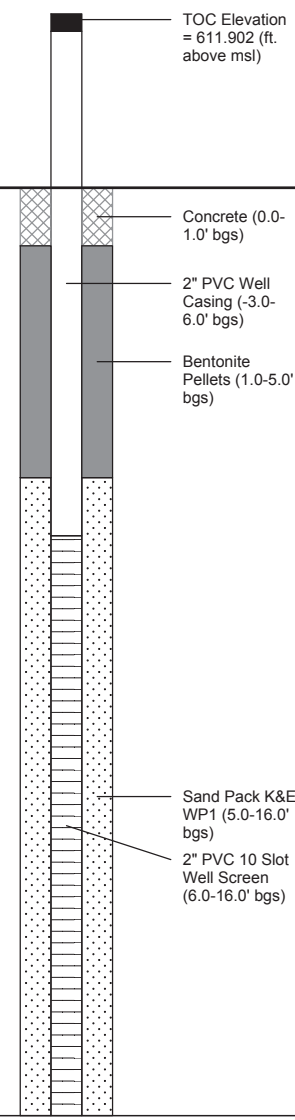
| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|--|------------------------|---|
| 0 | 610 | | | | | | | (0.0 - 0.3') Grass, Topsoil. | | TOC Elevation = 612.857 (ft. above msl) |
| 0.3 | | | | | | | | (0.3 - 10.0') SAND, fine, subrounded; trace silt; well sorted; dry; dark yellowish brown (10YR 4/4). | | Concrete (0.0-1.0' bgs) 2" PVC Well Casing (-3-6.0' bgs) Bentonite Pellets (1.0-5.0' bgs) |
| 5 | 605 | 1 | 0.0-10.0' | 4.0 | NA | | | NOTE: Wet at 8.5' bgs. | | |
| 10 | 600 | | | | | | | (10.0 - 12.0') SAND, fine, subrounded; little silt; well sorted; wet; brown (10YR 4/3). | | |
| 12 | | | | | | | | (12.0 - 16.0') SAND, fine, subrounded; trace silt; well sorted; wet; brownish yellow (10YR 6/6). | | Sand Pack K&E WP1 (5.0-16.0' bgs) 2" PVC 10 Slot Well Screen (6.0-16.0 bgs) |
| 15 | 595 | 2 | 10.0-16.0' | 7.0 | NA | | | | | |
| 16 | | | | | | | | End of boring at 16.0' bgs. | | |

| | |
|--|---|
|  <small>Design & Consultancy for natural and built assets</small> | <p>Remarks: bgs = below ground surface btoc = below top of casing</p> <p>Air knife to 10.0' bgs. Groundwater encountered at 8.5' bgs during drilling. Water level at development was 12.78' btoc. No odor or staining observed. Groundwater elevation measured on December 2, 2015 was 599.87 feet</p> |
|--|---|

Date Start: 9/30/15
Date Finish: 9/30/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.0
Water Level Finish (ft. btoc.): 12.25

Northing: 521059.974
Easting: 12636589.95
Casing Elevation: 611.902
Borehole Depth (ft. bgs.): 16.0
Surface Elevation: 609.042
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15020
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: Sunny, 60F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|--|---------------------------|------------------------|---|
| 0 | 610 | | | | | | | | |  <p> TOC Elevation = 611.902 (ft. above msl) Concrete (0.0-1.0' bgs) 2" PVC Well Casing (-3.0-6.0' bgs) Bentonite Pellets (1.0-5.0' bgs) Sand Pack K&E WP1 (5.0-16.0' bgs) 2" PVC 10 Slot Well Screen (6.0-16.0' bgs) </p> |
| 0.0 - 0.3' | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | | |
| 0.3 - 2.0' | | | | | | | (0.3 - 2.0') SAND, fine, subrounded; trace silt; well sorted; dry; brown (10 YR 4/3). | | | |
| 2.0 - 2.5' | | | | | | X | (2.0 - 2.5') ASH and SAND, fine, subrounded; trace silt; well sorted; dry; gray (10YR 5/1). NOTE: Fill material. Trace black coal fragments. | | | |
| 2.5 - 6.0' | | | | | | | (2.5 - 6.0') SAND, fine, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/4). | | | |
| 6.0 - 14.0' | | 1 | 0-10' | 10 | NA | | (6.0 - 14.0') SAND, fine, subrounded; trace silt; well sorted; pale brown (10 YR 6/3). NOTE: Wet at 8.0' bgs. | | | |
| 14.0 - 16.0' | | 2 | 10-16' | 4 | NA | | (14.0 - 16.0') SAND, fine to medium, trace coarse, subrounded; trace granules, subrounded; trace silt; well sorted; wet; pale brown (10 YR 4/3). | | | |
| 16.0' | | | | | | | End of boring at 16.0' bgs. | | | |

Remarks: bgs= below ground surface
 btoc = below top of casing

 Hand auger to 10.0' bgs.
 Groundwater encountered at 8.0' bgs during drilling.
 Water level at development was 12.25' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 599.45 feet



Date Start: 9/30/15
Date Finish: 9/30/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.5
Water Level Finish (ft. btoc.): 14.39

Northing: 521065.933
Easting: 12636839.06
Casing Elevation: 613.647
Borehole Depth (ft. bgs.): 16.0
Surface Elevation: 610.697
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15021
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: Sunny, 60F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|--|------------------------|--|
| 0 | 610 | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | TOC Elevation = 613.647 (ft. above msl) |
| 0.3 | | | | | | | | (0.3 - 1.5') SAND, fine, subrounded; trace granules, subrounded; trace silt; well sorted; dry; dark brown (10 YR 3/3). | | Concrete (0.0-1.0' bgs) |
| 1.5 | | | | | | | | (1.5 - 3.0') SAND, fine, subrounded; trace silt; well sorted; dry; yellowish brown (10 YR 5/6). | | 2" PVC Well Casing (-3.0-6.0' bgs) |
| 3.0 | | | | | | | | (3.0 - 3.5') SAND, fine, subrounded; trace silt; well sorted; dry; dark yellowish brown (10 YR 4/6). | | Bentonite Pellets (1.0-5.0' bgs) |
| 3.5 | | 1 | 0-10' | 10 | NA | | | (3.5 - 16.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/4). | | |
| 8.5 | | | | | | | | NOTE: Wet at 8.5' bgs. | | |
| 10 | 605 | | | | | | | | | Sand Pack K&E WP1 (5.0-16.0' bgs) |
| 10 | | 2 | 10-16' | 4 | NA | | | | | 2" PVC 10 Slot Well Screen (6.0-16.0' bgs) |
| 16.0 | 595 | | | | | | | End of boring at 16.0' bgs. | | |

Remarks: bgs= below ground surface
 btoc = below top of casing

 Hand auger to 10.0' bgs.
 Groundwater encountered at 8.5' bgs during drilling.
 Water level at development was 14.39' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 599.08 feet



Date Start: 9/30/15
Date Finish: 9/30/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 21.0
Water Level Finish (ft. btoc.): 29.39

Northing: 520479.719
Easting: 12638430.24
Casing Elevation: 623.792
Borehole Depth (ft. bgs.): 33.0
Surface Elevation: 620.917
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15022
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: Sunny, 65F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|---|------------------------------|------------------------|---|
| 0 | | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | TOC Elevation = 623.792 (ft. above msl) |
| 0.3 | 620 | 1 | 0-10' | 5 | NA | | (0.3 - 10.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry to moist; dark yellowish brown (10 YR 4/6). | | | Concrete (0.0-1.0' bgs) |
| 10.0 | 610 | | | | | | (10.0 - 21.0') SAND, fine, subrounded; little very fine sand; trace granules, subrounded; trace silt; well sorted; moist to wet; yellowish brown (10 YR 5/6). | | | Bentonite/Cement Grout (1.0-19.0' bgs) 2" PVC Well Casing (-3.0-23.0' bgs) |
| 15 | | 2 | 10-20' | 4 | NA | | | | | |
| 21.0 | 605 | | | | | | | | | |

Remarks: bgs= below ground surface
 btoc = below top of casing

 Air knife to 10.0' bgs.
 Groundwater not encountered during drilling.
 Water level at development was 29.39' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 594.34 feet



Date Start: 9/30/15
Date Finish: 9/30/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 21.0
Water Level Finish (ft. btoc.): 29.39

Northing: 520479.719
Easting: 12638430.24
Casing Elevation: 623.792

Borehole Depth (ft. bgs.): 33.0
Surface Elevation: 620.917

Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15022
Client: Consumers Energy

Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460

Weather Conditions: Sunny, 65F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|---|------------------------|--------------------------|
| 20 | 600 | | | | | | | | | |
| 25 | 595 | 3 | 20-30' | 5 | NA | | | (21.0 - 29.0') SAND, fine to medium, subrounded; trace granules, subrounded; well sorted; wet; yellowish brown (10 YR 5/4). | | |
| 30 | 590 | 4 | 30-33' | 3 | NA | | | (29.0 - 33.0') SAND, very fine to fine, subrounded; trace silt; well sorted; wet; yellowish brown (10 YR 5/4). | | |
| 35 | 585 | | | | | | | End of boring at 33.0' bgs. | | |

Remarks: bgs= below ground surface
 btoc = below top of casing

 Air knife to 10.0' bgs.
 Groundwater not encountered during drilling.
 Water level at development was 29.39' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 594.34 feet



Date Start: 10/1/15
Date Finish: 10/1/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 18.0
Water Level Finish (ft. btoc.): 18.91

Northing: 521927.205
Easting: 12638205.16
Casing Elevation: 619.977
Borehole Depth (ft. bgs.): 25.0
Surface Elevation: 617.012
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15023
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: Sunny, 60F.

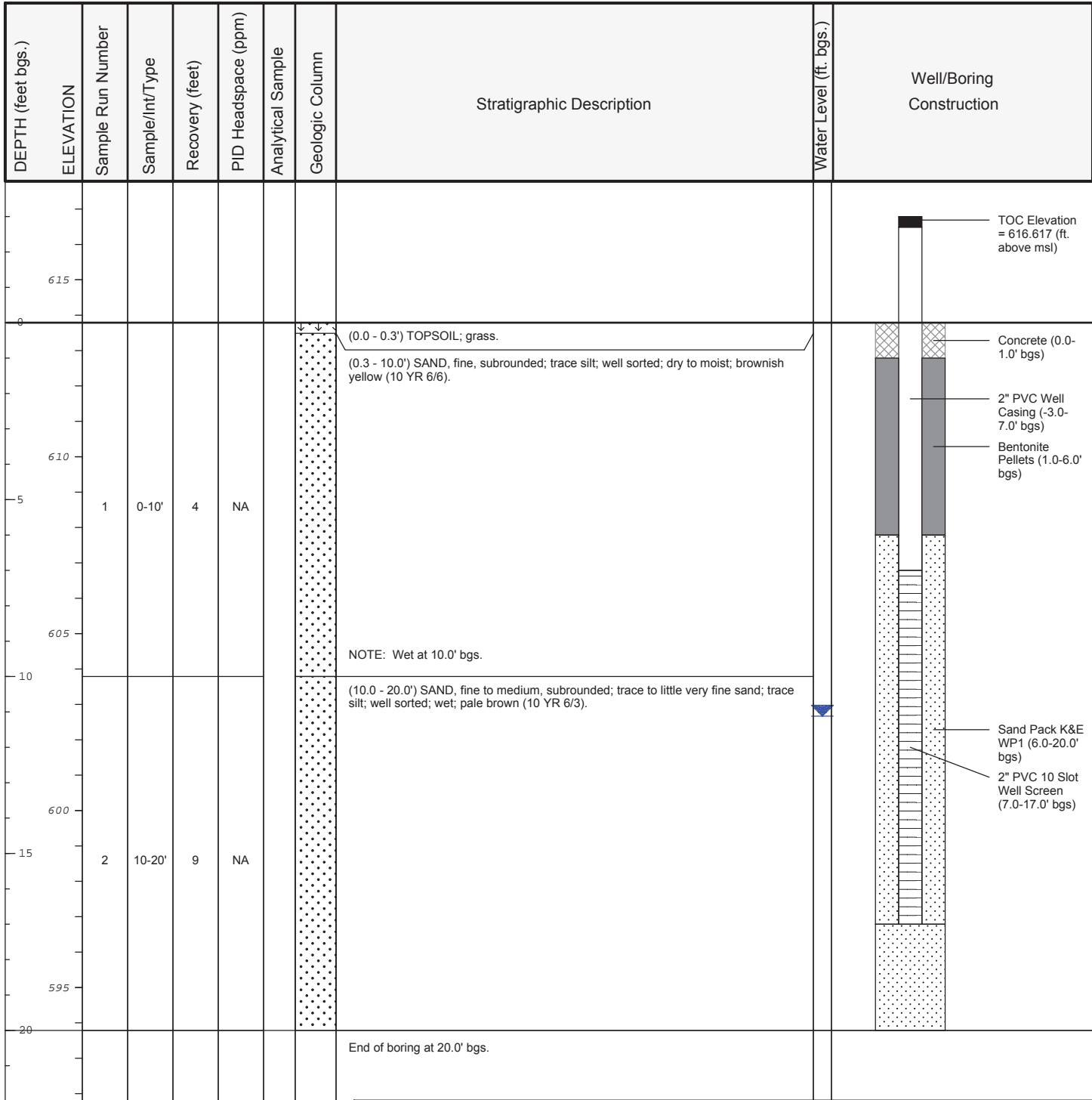
| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|--|------------------------|---|
| 620 | | | | | | | | | | TOC Elevation = 619.977 (ft. above msl) |
| 0 | | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | Concrete (0.0-1.0' bgs) |
| 615 | | 1 | 0-10' | 10 | NA | | | (0.3 - 10.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry; brown (10 YR 4/3). Note: Trace wood fragments from 7.0 to 10.0' bgs. | | Bentonite/Cement Grout (1.0-10.0' bgs) 2" PVC Well Casing (-3.0-14.0' bgs) |
| 610 | | | | | | | | (10.0 - 16.0') SAND, very fine to fine, subrounded; trace to little silt; well sorted; dry to moist; brownish yellow (10 YR 6/8). | | Bentonite Pellets (10.0-12.0' bgs) |
| 605 | | 2 | 10-20' | 8 | NA | | | (16.0 - 17.0') SAND, very fine to fine, subrounded; trace silt; well sorted; moist; yellow (10 YR 7/6). | 18.91 | |
| 600 | | | | | | | | (17.0 - 18.0') SAND, fine, subrounded; trace silt; well sorted; moist; brownish yellow (10 YR 6/6). | | |
| | | | | | | | | (18.0 - 21.0') SAND, very fine; little fine sand, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/3). | | Sand Pack K&E WP1 (12.0-25.0' bgs) 2" PVC 10 Slot Well Screen (14.0-24.0' bgs) |
| 595 | | 3 | 20-25' | 4 | NA | | | (21.0 - 25.0') SAND, medium; trace fine sand, subangular; trace granules, subangular; poorly sorted; wet; pale brown (10 YR 6/3). | | |
| 25 | | | | | | | | End of boring at 25.0' bgs. | | |
| 590 | | | | | | | | | | |

Remarks: bgs= below ground surface
 btoc = below top of casing

 Hand auger to 10.0' bgs.
 Groundwater encountered at 18.0' bgs during drilling.
 Water level at development was 18.91' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 592.53 feet



| | | |
|--|--|---|
| Date Start: 10/1/15 Date Finish: 10/1/15 Drilling Company: Mateco Drilling Driller's Name: Dan Mourer Drilling Method: Air Knife/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 10.0 Water Level Finish (ft. btoc.): 14.12 | Northing: 522366.013 Easting: 12637322.68 Casing Elevation: 616.617 Borehole Depth (ft. bgs.): 20.0 Surface Elevation: 613.787 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15024 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: Sunny, 60F. |
|--|--|---|



Remarks: bgs= below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 10.0' bgs during drilling.
Water level at development was 14.12' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 602.24 feet



Date Start: 10/1/15
Date Finish: 10/1/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 12.0
Water Level Finish (ft. btoc.): 13.50

Northing: 522702.978
Easting: 12636668.15
Casing Elevation: 617.167
Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 614.137
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15025
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: Sunny, 60F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|---|---------------------------|------------------------|--|
| 615 | | | | | | | | | | |
| 0 | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | | TOC Elevation = 617.167 (ft. above msl) |
| 5 | 610 | 1 | 0-10' | 10 | NA | | (0.3 - 5.0') SAND, fine, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/3). | | | Concrete (0.0-1.0' bgs) |
| 10 | 605 | | | | | | (5.0 - 12.0') SAND, fine, subrounded; trace silt; well sorted; dry; brownish yellow (10 YR 6/6). Note: Color change to brownish yellow (10YR 6/8) at 6.0' bgs. | | | 2" PVC Well Casing (-3.0-7.0' bgs) |
| 15 | 600 | 2 | 10-20' | 8 | NA | | (12.0 - 15.0') SAND, fine, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/3). | | | Bentonite Pellets (1.0-6.0' bgs) |
| 20 | 595 | | | | | | (15.0 - 16.0') SAND, fine to medium, subrounded; trace coarse sand, subrounded; trace granules, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/3). | | | Sand Pack K&E WP1 (6.0-20.0' bgs) |
| | | | | | | | (16.0 - 20.0') SAND, very fine to fine, subrounded; little silt; well sorted; wet; pale brown (10 YR 6/3). | | | 2" PVC 10 Slot Well Screen (7.0-17.0' bgs) |
| | | | | | | | End of boring at 20.0' bgs. | | | |

Remarks: bgs= below ground surface
 btoc = below top of casing

 Hand auger to 10.0' bgs.
 Groundwater encountered at 12.0' bgs during drilling.
 Water level at development was 13.50' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 603.36 feet



Date Start: 10/2/15
Date Finish: 10/2/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 12.0
Water Level Finish (ft. btoc.): 15.34

Northing: 522495.091
Easting: 12635971.82
Casing Elevation: 618.042
Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 615.087
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15026
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: Sunny, 45F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|--|------------------------|--|
| 0 | 615 | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | TOC Elevation = 618.042 (ft. above msl) |
| 5 | 610 | 1 | 0-10' | 10 | NA | | | (0.3 - 3.0') SAND, fine, subrounded; trace medium sand, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/3). | | Concrete (0.0-1.0' bgs) |
| | | | | | | | | (3.0 - 8.0') SAND, fine, subrounded; trace silt; well sorted; dry; brownish yellow (10 YR 6/6). | | 2" PVC Well Casing (-3.0-8.0' bgs) |
| | | | | | | | | (8.0 - 12.0') SAND, fine, subrounded; little very fine sand, subrounded; trace silt; well sorted; dry; pale brown (10 YR 6/3) to brownish yellow (10YR 6/6). | | Bentonite Pellets (1.0-7.0' bgs) |
| 15 | 600 | 2 | 10-20' | 6 | NA | | | (12.0 - 20.0') SAND, very fine to fine, subrounded; trace silt; well sorted; moist to wet; pale brown (10 YR 6/3). | 15.34 | Sand Pack K&E WP1 (7.0-20.0' bgs) |
| | | | | | | | | | | 2" PVC 10 Slot Well Screen (8.0-18.0' bgs) |
| 20 | 595 | | | | | | | End of boring at 20.0' bgs. | | |




Remarks: bgs= below ground surface
 btoc = below top of casing

 Hand auger to 10.0' bgs.
 Groundwater encountered at 12.0' bgs during drilling.
 Water level at development was 15.34' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 602.32 feet

| | | |
|---|--|---|
| Date Start: 10/2/15 Date Finish: 10/2/15 Drilling Company: Mateco Drilling Driller's Name: Dan Mourer Drilling Method: Hand Auger/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 13.0 Water Level Finish (ft. btoc.): 15.85 | Northing: 522394.86 Easting: 1235097.51 Casing Elevation: 617.302 Borehole Depth (ft. bgs.): 20.0 Surface Elevation: 614.767 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15027 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: Sunny, 50F. |
|---|--|---|

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|---|------------------------------|------------------------|--|
| 0 | 615 | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | TOC Elevation = 617.302 (ft. above msl) |
| 5 | 610 | 1 | 0-10' | 10 | NA | | (0.3 - 2.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry; dark yellowish brown (10 YR 4/6). (2.0 - 6.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/3). | | | Concrete (0.0-1.0' bgs) 2" PVC Well Casing (-3.0-10.0' bgs) Bentonite Pellets (1.0-8.0' bgs) |
| 10 | 605 | | | | | | (6.0 - 16.0') SAND, fine, subrounded; trace silt; well sorted; dry; yellow (10YR 7/6). | | | |
| 15 | 600 | 2 | 10-20' | 8 | NA | | Note: Wet at 13.0' bgs. | | | Sand Pack K&E WP1 (8.0-20.0' bgs) 2" PVC 10 Slot Well Screen (10.0-20.0' bgs) |
| 20 | 595 | | | | | | (16.0 - 20.0') SAND, fine; trace medium sand, subrounded; well sorted; wet; pale brown (10 YR 6/3). | | | |
| | | | | | | | End of boring at 20.0' bgs. | | | |

| | |
|--|--|
|  | Remarks: bgs= below ground surface btoc = below top of casing Hand auger to 10.0' bgs. Groundwater encountered at 13.0' bgs during drilling. Water level at development was 15.85' btoc. No odor or staining observed. Groundwater elevation measured on December 2, 2015 was 601.04 feet |
|--|--|

Date Start: 10/2/15
Date Finish: 10/2/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 9.0
Water Level Finish (ft. btoc.): 14.38

Northing: 521646.198
Easting: 12634105.34
Casing Elevation: 613.8

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 611.025

Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15028
Client: Consumers Energy

Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460

Weather Conditions: Sunny, 60F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|--|------------------------|---|
| 0 | 613.80 | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | TOC Elevation = 613.80 (ft. above msl) |
| 0.3 | 610.5 | | | | | | | (0.3 - 5.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry; yellowish (10 YR 7/8). | | Concrete (0.0-1.0' bgs) |
| 5 | 605.0 | 1 | 0-10' | 10 | NA | | | (5.0 - 9.0') SAND, fine, subrounded; trace silt; well sorted; dry to moist; pale brown (10 YR 6/3). | | Bentonite/Cement Grout (1.0-4.0' bgs) 2" PVC Well Casing (-3.0-8.0' bgs) |
| 9 | 600.0 | | | | | | | (9.0 - 20.0') SAND, medium; trace to little very fine to fine sand, subrounded; trace silt; poorly sorted; moist to wet; pale brown (10 YR 6/3). | 9.0 | Bentonite Pellets (4.0-6.0' bgs) |
| 15 | 595.0 | 2 | 10-20' | 9 | NA | | | | | Sand Pack K&E WP1 (6.0-20.0' bgs) 2" PVC 10 Slot Well Screen (8.0-18.0' bgs) |
| 20 | 590.0 | | | | | | | End of boring at 20.0' bgs. | | |


Remarks: bgs= below ground surface
 btoc = below top of casing

 Air knife to 10.0' bgs.
 Groundwater encountered at 9.0' bgs during drilling.
 Water level at development was 14.38' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 3, 2015 was 599.00 feet



| | | |
|--|---|--|
| Date Start: 10/5/15 Date Finish: 10/5/15 Drilling Company: Mateco Drilling Driller's Name: Dan Mourer Drilling Method: Air knife/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 12.0 Water Level Finish (ft. btoc.): 10.03 | Northing: 520503.524 Easting: 12633774.3 Casing Elevation: 610.952 Borehole Depth (ft. bgs.): 20.0 Surface Elevation: 608.082 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15029 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: Cloudy, Light Rain, 65F. |
|--|---|--|

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|--|-----------------------------|------------------------|---|
| 610 | | | | | | | | | | TOC Elevation = 610.952 (ft. above msl) |
| 0 | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | | Concrete (0.0-1.0' bgs) |
| 605 | | 1 | 0-10' | 3 | NA | | (0.3 - 10.0') SAND, fine, subrounded; trace silt; well sorted; dry; yellowish brown (10 YR 5/4). | | | 2" PVC Well Casing (-3.0-8.0' bgs) Bentonite Pellets (1.0-7.0' bgs) |
| 5 | | | | | | | (10.0 - 12.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry to moist; pale brown (10 YR 6/3). | | | |
| 600 | | | | | | | (12.0 - 15.0') SAND, medium; trace fine sand, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/3). | | | |
| 10 | | | | | | | (15.0 - 20.0') SAND, medium; little coarse sand; trace granules, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/4). | | | Sand Pack K&E WP1 (7.0-20.0' bgs) 2" PVC 10 Slot Well Screen (8.0-18.0' bgs) |
| 595 | | 2 | 10-20' | 6 | NA | | | | | |
| 15 | | | | | | | | | | |
| 590 | | | | | | | | | | |
| 20 | | | | | | | | End of boring at 20.0' bgs. | | |

| | |
|--|--|
|  | Remarks: bgs = below ground surface btoc = below top of casing Air knife to 10.0' bgs. Groundwater encountered at 12.0' bgs during drilling. Water level at development was 10.03' btoc. No odor or staining observed. Groundwater elevation measured on December 3, 2015 was 601.18 feet |
|--|--|

Date Start: 10/5/15
Date Finish: 10/5/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 5.0
Water Level Finish (ft. btoc.): 7.99

Northing: 519760.827
Easting: 12633044.37
Casing Elevation: 607.167
Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 604.047
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15030
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: Cloudy, Light Rain, 65F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|--|-----------------------------|------------------------|---|
| 605 | | | | | | | | | | |
| 0 | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | | TOC Elevation = 607.167 (ft. above msl) |
| 5 | | 1 | 0-10' | 3 | NA | | (0.3 - 10.0') SAND, fine, subrounded; trace silt; well sorted; dry to moist; dark brown (10 YR 3/3) to very pale brown (10YR 7/3). | | | Concrete (0.0-1.0' bgs) 2" PVC Well Casing (-3.0-4.0' bgs) Bentonite Pellets (1.0-3.0' bgs) |
| | | | | | | | NOTE: Wet at 5.0' bgs. | | | |
| 10 | | | | | | | (10.0 - 20.0') SAND, fine, subrounded; little medium sand, subrounded; trace silt; well sorted; wet; very pale brown (10 YR 7/3) to light gray (10YR 7/2). | | | Sand Pack K&E WP1 (3.0-20.0' bgs) 2" PVC 10 Slot Well Screen (4.0-14.0' bgs) |
| 15 | | 2 | 10-20' | 6 | NA | | | | | |
| 20 | | | | | | | | End of boring at 20.0' bgs. | | |

Remarks: bgs = below ground surface
 btoc = below top of casing

 Air knife to 10.0' bgs.
 Groundwater encountered at 5.0' bgs during drilling.
 Water level at development was 7.99' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 3, 2015 was 599.65 feet



Date Start: 10/5/15
Date Finish: 10/6/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 36.0
Water Level Finish (ft. btoc.): 43.20

Northing: 520118.003
Easting: 12637801.51
Casing Elevation: 635.872
Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 632.937
Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15031
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: Cloudy, 65F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|--|------------------------|---|
| 635 | | | | | | | | | | TOC Elevation = 635.872 (ft. above msl) |
| 0 | | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | Concrete (0.0-1.0' bgs) |
| 630 | | | | | | | | (0.3 - 2.0') SAND, fine, subrounded; trace silt; well sorted; dry; dark grayish brown (10 YR 4/2). | | |
| 5 | | 1 | 0-10' | 10 | NA | | | (2.0 - 5.0') SAND, fine, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/3). | | |
| 625 | | | | | | | | (5.0 - 10.0') SAND, fine, subrounded; trace silt; well sorted; dry; pale brown (10 YR 6/3). | | |
| 10 | | | | | | | | (10.0 - 19.0') SAND, fine, subrounded; trace silt; well sorted; moist; brown (10 YR 5/3). | | |
| 620 | | | | | | | | | | Bentonite/Cement Grout (1.0-29.0' bgs) |
| 15 | | 2 | 10-20' | 6 | NA | | | | | 2" PVC Well Casing (-3.0-33.0' bgs) |
| 615 | | | | | | | | | | |
| 20 | | | | | | | | (19.0 - 25.0') SAND, fine, subrounded; trace medium sand, subrounded; trace silt; well sorted; moist; yellowish brown (10 YR 5/4). | | |

Remarks: bgs = below ground surface
 btoc = below top of casing

 Hand auger to 10.0' bgs.
 Groundwater encountered at 36.0' bgs during drilling.
 Water level at development was 43.20' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 592.53 feet



Date Start: 10/5/15
Date Finish: 10/6/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 36.0
Water Level Finish (ft. btoc.): 43.20

Northing: 520118.003
Easting: 12637801.51
Casing Elevation: 635.872

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 632.937

Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15031
Client: Consumers Energy

Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460

Weather Conditions: Cloudy, 65F.

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|--|------------------------|---|
| 610 | | | | | | | | | | |
| 25 | | 3 | 20-30' | 8 | NA | | | (25.0 - 36.0') SAND, very fine to fine, subrounded; trace silt; well sorted; very pale brown (10 YR 7/3). | | |
| 605 | | | | | | | | | | |
| 30 | | | | | | | | | | Bentonite Pellets (29.0-31.0' bgs) |
| 600 | | | | | | | | | | |
| 35 | | 4 | 30-40' | 8 | NA | | | (36.0 - 45.0') SAND, fine; little medium sand, subrounded; trace silt; well sorted; pale brown (10 YR 6/3). NOTE: Wet at 36.0' bgs. | | |
| 595 | | | | | | | | | | |
| 40 | | | | | | | | | | Sand Pack K&E WP1 (31.0-45.0' bgs) 2" PVC 10 Slot Well Screen (33.0-43.0' bgs) |
| 590 | | 5 | 40-45' | 5 | NA | | | | | |
| 45 | | | | | | | | | | |
| 585 | | | | | | | | End of boring at 45.0' bgs. | | |


Remarks: bgs = below ground surface
 btoc = below top of casing

 Hand auger to 10.0' bgs.
 Groundwater encountered at 36.0' bgs during drilling.
 Water level at development was 43.20' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 592.53 feet



| | | |
|--|--|--|
| Date Start: 10/6/15 Date Finish: 10/6/15 Drilling Company: Mateco Drilling Driller's Name: John Pitsch Drilling Method: Hand Auger/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 16.0 Water Level Finish (ft. btoc.): 17.88 | Northing: 520779.281 Easting: 12638667.93 Casing Elevation: 614.287 Borehole Depth (ft. bgs.): 25.0 Surface Elevation: 611.322 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15032 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: Cloudy, 60F. |
|--|--|--|

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|--|------------------------|---|
| 615 | | | | | | | | | | |
| 0 | | | | | | | | (0.0 - 0.3') TOPSOIL; grass. | | TOC Elevation = 614.287 (ft. above msl) |
| 610 | | | | | | | | (0.3 - 2.5') SAND, fine, subrounded; trace silt; well sorted; dry; brown (10 YR 4/3). | | Concrete (0.0-1.0' bgs) |
| 5 | | 1 | 0-10' | 10 | NA | | | (2.5 - 11.0') SAND, fine, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/3). | | Bentonite/Cement Grout (1.0-9.0' bgs) |
| 605 | | | | | | | | | | 2" PVC Well Casing (-3.0-13.0' bgs) |
| 10 | | | | | | | | | | Bentonite Pellets (9.0-11.0' bgs) |
| 600 | | | | | | | | (11.0 - 21.0') SAND, fine, subrounded; trace silt; well sorted; moist to wet; pale brown (10 YR 6/3). | | |
| 15 | | 2 | 10-20' | 7 | NA | | | NOTE: Wet at 16.0' bgs. | | |
| 595 | | | | | | | | | | Sand Pack K&E WP1 (11.0-25.0' bgs) |
| 20 | | | | | | | | | | 2" PVC 10 Slot Well Screen (13.0-23.0' bgs) |
| 590 | | 3 | 20-25' | 5 | NA | | | (21.0 - 25.0') SAND, fine to medium, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/3). | | |
| 25 | | | | | | | | End of boring at 25.0' bgs. | | |
| 585 | | | | | | | | | | |

| | |
|--|---|
|  | Remarks: bgs = below ground surface btoc = below top of casing |
| | Hand auger to 10.0' bgs. Groundwater encountered at 16.0' bgs during drilling. Water level at development was 17.88' btoc. No odor or staining observed. Groundwater elevation measured on December 2, 2015 was 595.41 feet |

Date Start: 10/6/15
Date Finish: 10/6/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 19.0
Water Level Finish (ft. btoc.): 22.93

Northing: 521075.809
Easting: 12638598.12
Casing Elevation: 620.987

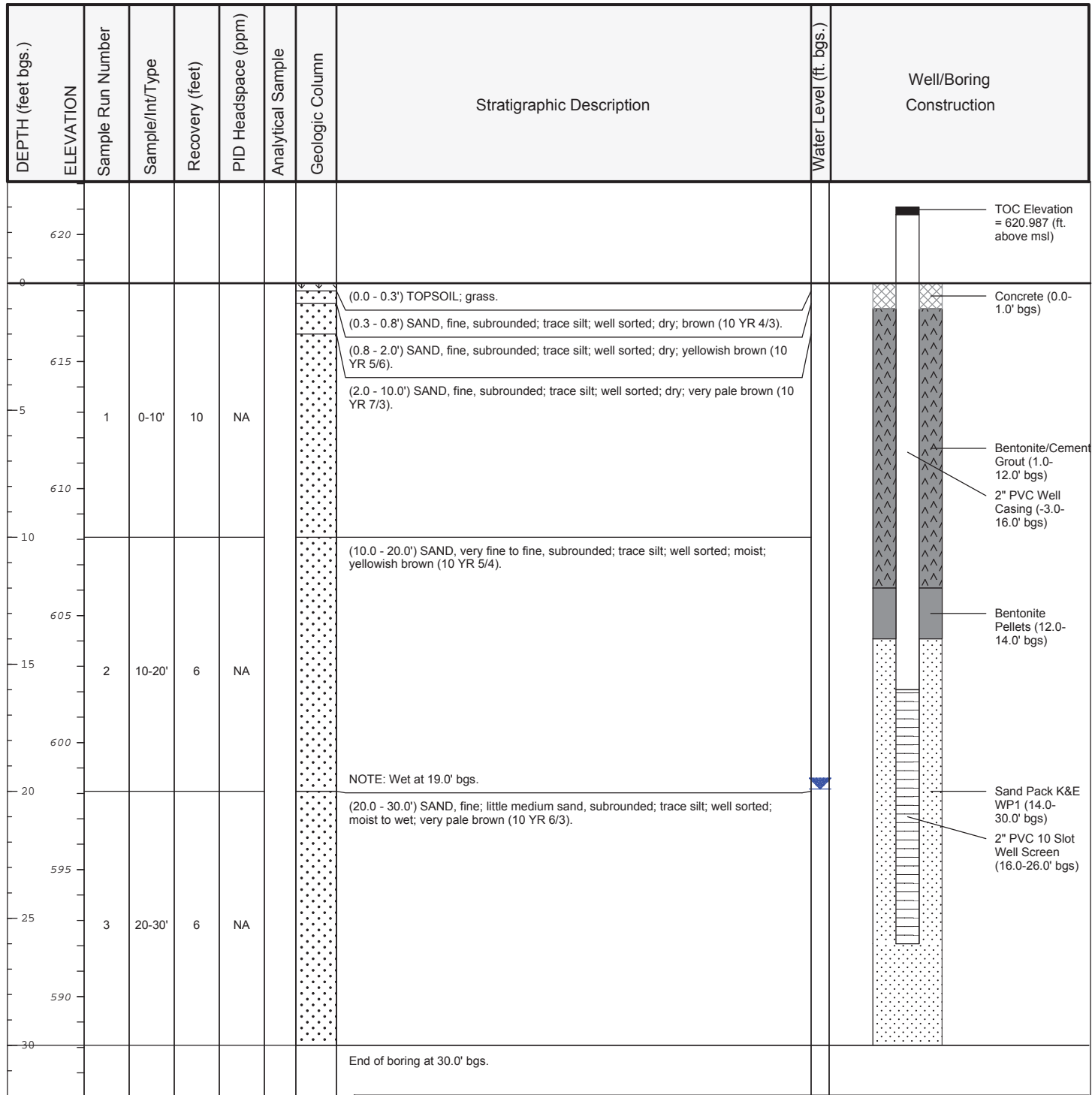
Borehole Depth (ft. bgs.): 30.0
Surface Elevation: 618.082

Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15033
Client: Consumers Energy

Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460

Weather Conditions: Cloudy, 60F.

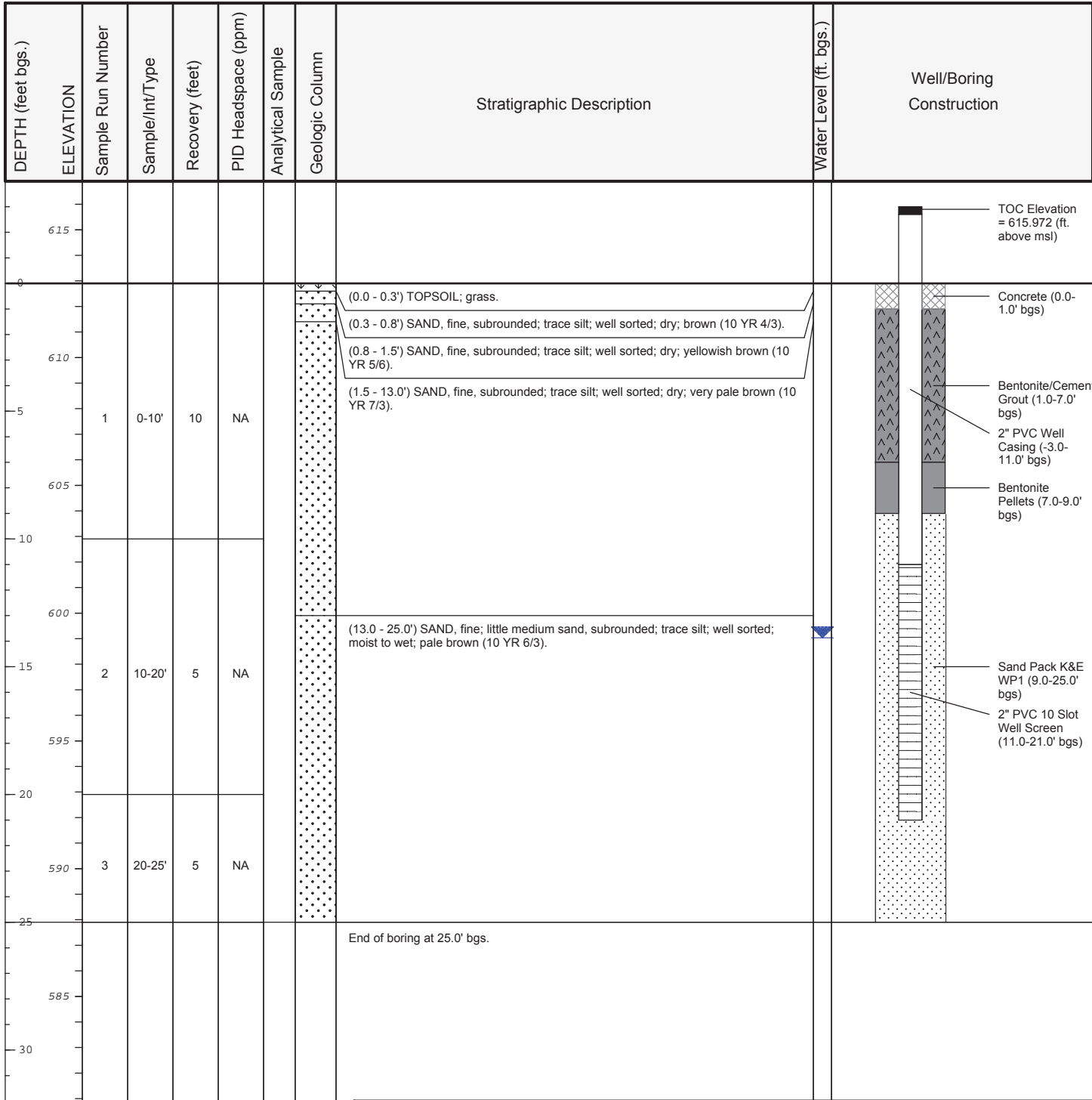



Remarks: bgs = below ground surface
 btoc = below top of casing

 Hand auger to 10.0' bgs.
 Groundwater encountered at 19.0' bgs during drilling.
 Water level at development was 22.93' btoc.
 No odor or staining observed.
 Groundwater elevation measured on December 2, 2015 was 598.05 feet

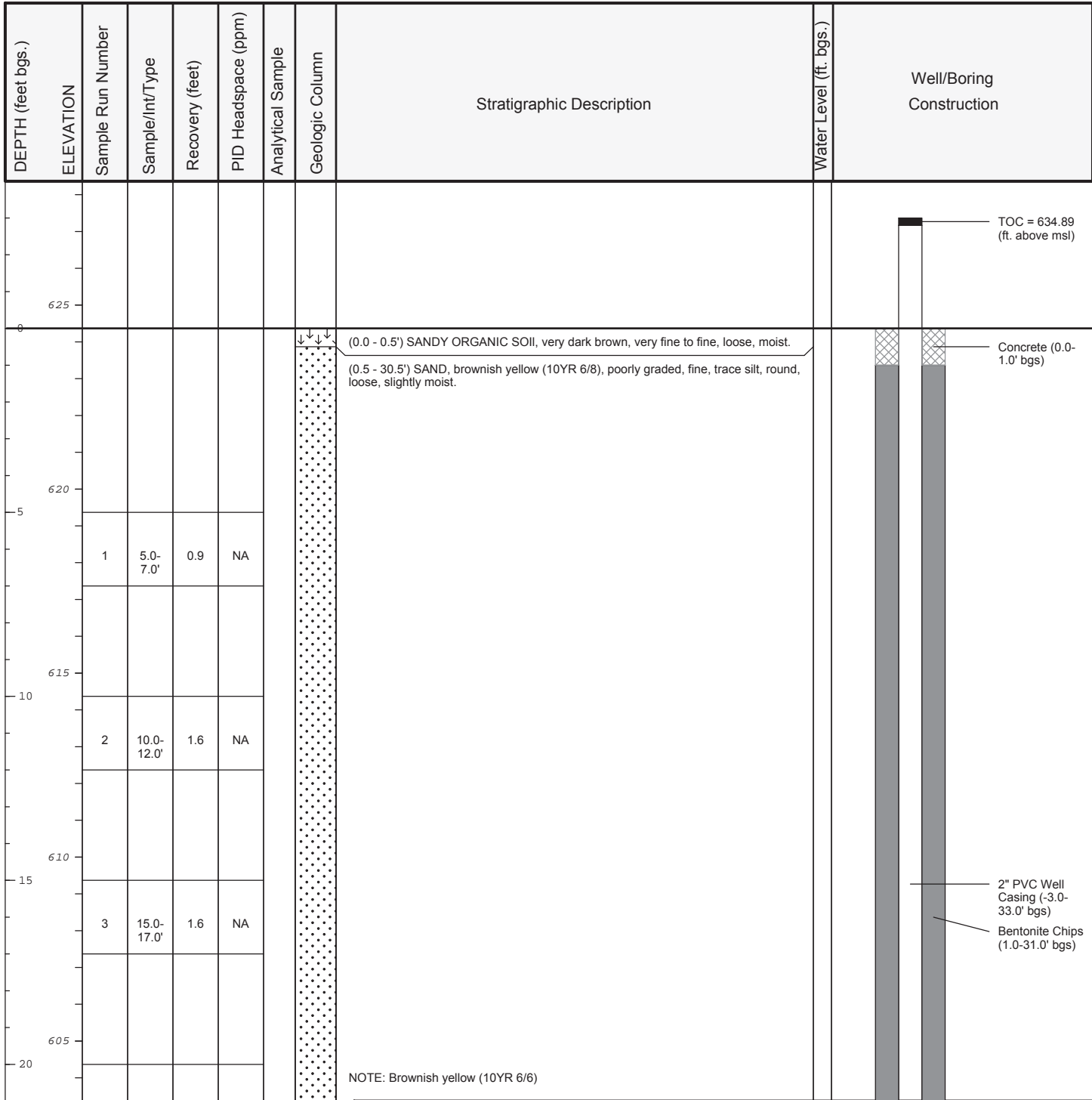


| | | |
|--|---|---|
| Date Start: 10/6/15 Date Finish: 10/6/15 Drilling Company: Mateco Drilling Driller's Name: John Pitsch Drilling Method: Hand Auger/Sonic Sampling Method: Continuous Rig Type: Sonic Water Level Start (ft. bgs.): 13.0 Water Level Finish (ft. btoc.): 16.87 | Northing: 521335.834 Easting: 12638568.9 Casing Elevation: 615.972 Borehole Depth (ft. bgs.): 25.0 Surface Elevation: 612.902 Descriptions By: A. Westhuis | Well/Boring ID: JHC MW-15034 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: Sunny, 60F. |
|--|---|---|



| | |
|--|--|
|  | Remarks: bgs = below ground surface btoc = below top of casing Hand auger to 10.0' bgs. Groundwater not encountered during drilling. Water level at development was 16.87' btoc. No odor or staining observed. Groundwater elevation measured on December 2, 2015 was 599.07 feet |
|--|--|

| | | |
|--|--|--|
| Date Start: 3/14/01 Date Finish: 3/14/01 Drilling Company: EDC, Inc. Driller's Name: Sean Smith Drilling Method: Hollow Stem Auger Sampling Method: Split Spoon Rig Type: Hollow Stem Auger Water Level Start (ft. bgs.): 36.0 Water Level Finish (ft. btoc.): NA | Northing: NA Eastings: NA Casing Elevation: 634.89 Borehole Depth (ft. bgs.): 43.5 Surface Elevation: NA Descriptions By: Rebecca J. Koepke | Well/Boring ID: JHC MW-15035 Client: Consumers Energy Location: JH Campbell Facility 1700 Crosswell Street Site A West Olive, MI 49460 Weather Conditions: NA |
|--|--|--|



Remarks: bgs = below ground surface
 btoc = below top of casing

Groundwater encountered at 36.0' bgs during drilling.
 No odor or staining observed.



Date Start: 3/14/01
Date Finish: 3/14/01
Drilling Company: EDC, Inc.
Driller's Name: Sean Smith
Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Rig Type: Hollow Stem Auger
Water Level Start (ft. bgs.): 36.0
Water Level Finish (ft. btoc.): NA

Northing: NA
Easting: NA
Casing Elevation: 634.89
Borehole Depth (ft. bgs.): 43.5
Surface Elevation: NA
Descriptions By: Rebecca J. Koepke

Well/Boring ID: JHC MW-15035
Client: Consumers Energy
Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460
Weather Conditions: NA

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|---|-----------------------------|------------------------|--------------------------|
| 600 | | 4 | 20.0-22.0' | 1.8 | NA | | | | | |
| 25 | | 5 | 25.0-27.0' | 1.8 | NA | | | | | |
| 595 | | 6 | 30.0-32.0' | 1.3 | NA | | NOTE: Yellow (10YR 7/6) NOTE: Very pale brown (10YR 7/4) | | | |
| 30 | | 7 | 35.0-37.0' | 1.8 | NA | | NOTE: Wet at 36.0' bgs | | | |
| 590 | | | | | | | | | | |
| 35 | | | | | | | | | | |
| 585 | | | | | | | | | | |
| 40 | | | | | | | | | | |
| 580 | | | | | | | | End of boring at 43.5' bgs. | | |
| 45 | | | | | | | | | | |

Remarks: bgs = below ground surface
 btoc = below top of casing

 Groundwater encountered at 36.0' bgs during drilling.
 No odor or staining observed.



Date Start: 3/13/01
Date Finish: 3/13/01
Drilling Company: EDC, Inc.
Driller's Name: Sean Smith
Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Rig Type: Hollow Stem Auger
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): NA

Northing: NA
Easting: NA
Casing Elevation: 615.90

Borehole Depth (ft. bgs.): 30.5
Surface Elevation: NA

Descriptions By: Rebecca J. Koepke

Well/Boring ID: JHC MW-15036
Client: Consumers Energy

Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460

Weather Conditions: NA

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|--|---|------------------------|--|
| 0 | 625 | | | | | | | | | TOC = 615.90 (ft. above msl) |
| 0 - 0.5' | | | | | | | (0.0 - 0.5') SANDY ORGANIC SOIL, very dark brown, very fine to fine, loose, moist. | | | Concrete (0.0-1.0' bgs) |
| 0.5 - 30.5' | | | | | | | (0.5 - 30.5') SAND, very pale brown (10YR 7/4), poorly graded, fine, trace silt, round, loose, slightly moist. | | | 2" PVC Well Casing (-3.0-20.0' bgs) Bentonite Chips (1.0-18.0' bgs) |
| 1 | 620 | 1 | 5.0-7.0' | 0.9 | NA | | | NOTE: Very fine. | | |
| 2 | 615 | 2 | 10.0-12.0' | 1.6 | NA | | | NOTE: Very pale brown (10YR 8/3), fine. | | |
| 3 | 610 | 3 | 15.0-17.0' | 1.6 | NA | | | NOTE: Fine to medium, moist. | | |
| 4 | 605 | 4 | 20.0-22.0' | 1.8 | NA | | | | | |
| 5 | 600 | 5 | 25.0-27.0' | 1.8 | NA | | | | | Sand Pack Flat Rock #30 (18.0-30.5' bgs) 2" PVC 10 Slot Well Screen (20.0-30.0 bgs) |
| 30 | 595 | | | | | | | End of boring at 30.5' bgs. | | |

Remarks: bgs = below ground surface
 btoc = below top of casing

 No odor or staining observed.



Date Start: 8/29/01
Date Finish: 8/29/01
Drilling Company: EDC, Inc.
Driller's Name: Sean Smith
Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Rig Type: Hollow Stem Auger
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): NA

Northing: NA
Easting: NA
Casing Elevation: 613.42


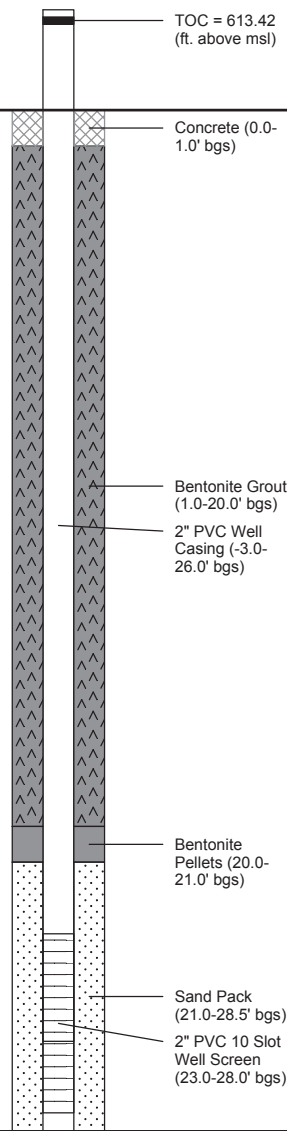


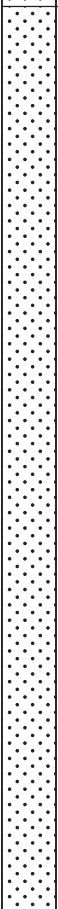
Borehole Depth (ft. bgs.): 28.5
Surface Elevation: NA

Descriptions By: Rebecca J. Koepke

Well/Boring ID: JHC MW-15037
Client: Consumers Energy

Location: JH Campbell Facility
 1700 Crosswell Street Site A
 West Olive, MI 49460

Weather Conditions: NA

| DEPTH (feet bgs.) | ELEVATION | Sample Run Number | Sample/Int/Type | Recovery (feet) | PID Headspace (ppm) | Analytical Sample | Geologic Column | Stratigraphic Description | Water Level (ft. bgs.) | Well/Boring Construction |
|-------------------|-----------|-------------------|-----------------|-----------------|---------------------|-------------------|---|--|------------------------|--|
| 625 | | | | | | | | | | |
| 0 | | 1 | 0.0-2.0' | 1.5 | NA | |  (0.0 - 1.0') SAND, semi compact, dark, organic, clayey, fine, moist. | | |  TOC = 613.42 (ft. above msl) Concrete (0.0-1.0' bgs) Bentonite Grout (1.0-20.0' bgs) 2" PVC Well Casing (-3.0-26.0' bgs) Bentonite Pellets (20.0-21.0' bgs) Sand Pack (21.0-28.5' bgs) 2" PVC 10 Slot Well Screen (23.0-28.0' bgs) |
| | | | | | | |  (1.0 - 2.0') SAND, loose, tan, fine, trace silt, moist. | | | |
| | | 2 | 2.0-4.0' | 1.96 | NA | |  (2.0 - 3.0') SAND, medium compact, light brown, fine, trace clay, moist. | | | |
| 5 | 620 | 3 | 4.0-6.0' | 1.5 | NA | |  (3.0 - 28.5') SAND, loose, tan, fine, trace silt, moist. | | | |
| | | 4 | 6.0-8.0' | 1.4 | NA | | | | | |
| | | 5 | 8.0-10.0' | 1.0 | NA | | | | | |
| | | 6 | 10.0-12.0' | 1.2 | NA | | | | | |
| | | 7 | 12.0-14.0' | 1.5 | NA | | | | | |
| | | 8 | 14.0-16.0' | 1.2 | NA | | | | | |
| | | 9 | 16.0-18.0' | NA | NA | | | | | |
| | | 10 | 18.0-20.0' | 1.0 | NA | | | | | |
| | | 11 | 20.0-22.0' | 1.6 | NA | | | | | |
| | | 12 | 22.0-24.0' | 1.5 | NA | | | NOTE: Wet at 22.0' bgs, grades to light brown. | | |
| | | 13 | 24.0-26.0' | 1.5 | NA | | | | | |
| | | 14 | 26.0-28.0' | 1.8 | NA | | | | | |
| 20 | 595 | | | | | | | End of boring at 28.5' bgs. | | |

Remarks: bgs = below ground surface
 btoc = below top of casing

 Groundwater encountered at 22.0' bgs during drilling.
 No odor or staining observed.



SOIL DESCRIPTION

| Udden-Wenworth Scale Modified ARCADIS, 2008 | | | |
|--|----------------|-----------------|--|
| Size Class | Millimeters | Inches | Standard Sieve # |
| Boulder | 256 – 4096 | 10.09+ | |
| Large cobble | 128 - 256 | 5.04 -10.08 | |
| Small cobble | 64 - 128 | 2.52 – 5.04 | |
| Very large pebble | 32 – 64 | 0.16 - 2.52 | |
| Large pebble | 16 – 32 | 0.63 – 1.26 | |
| Medium pebble | 8 – 16 | 0.31 – 0.63 | |
| Small pebble | 4 – 8 | 0.16 – 0.31 | No. 5 + |
| Granule | 2 – 4 | 0.08 – 0.16 | No.5 – No.10 |
| Very coarse sand | 1 -2 | 0.04 – 0.08 | No.10 – No.18 |
| Coarse sand | ½ - 1 | 0.02 – 0.04 | No.18 - No.35 |
| Medium sand | ¼ - ½ | 0.01 – 0.02 | No.35 - No.60 |
| Fine sand | 1/8 -¼ | 0.005 – 0.1 | No.60 - No.120 |
| Very fine sand | 1/16 – 1/8 | 0.002 – 0.005 | No. 120 – No. 230 |
| Silt (subgroups not included) | 1/256 – 1/16 | 0.0002 – 0.002 | Not applicable (analyze by pipette or hydrometer) |
| Clay (subgroups not included) | 1/2048 – 1/256 | .00002 – 0.0002 | |

| Modifier | Percent of Total Sample (by volume) |
|----------|-------------------------------------|
| and | 36 - 50 |
| some | 21 - 35 |
| little | 10 - 20 |
| trace | <10 |

| Description | Criteria |
|-------------|--|
| Nonplastic | A 1/8 inch (3 mm) thread cannot be rolled at any water content. |
| Low | The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit. |
| Medium | The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit. |
| High | It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit. |

| Description | Criteria |
|-----------------|--|
| Dry | Absence of moisture, dry to touch, dusty. |
| Moist | Damp but no visible water. |
| Wet (Saturated) | Visible free water, soil is usually below the water table. |

Fine-grained soil – Consistency

| Description | Criteria |
|--------------|---|
| Very soft | N-value < 2 or easily penetrated several inches by thumb. |
| Soft | N-value 2-4 or easily penetrated one inch by thumb. |
| Medium stiff | N-value 9-15 or indented about ¼ inch by thumb with great effort. |
| Very stiff | N-value 16-30 or readily indented by thumb nail. |
| Hard | N-value > than 30 or indented by thumbnail with difficulty |

| Description | Criteria |
|-------------|---|
| Angular | Particles have sharp edges and relatively plane sides with unpolished surfaces. |
| Subangular | Particles are similar to angular description but have rounded edges. |
| Subrounded | Particles have nearly plane sides but have well-rounded corners and edges. |
| Rounded | Particles have smoothly curved sides and no edges. |

Coarse-grained soil – Density

| Description | Criteria |
|--------------|----------------|
| Very loose | N-value 1- 4 |
| Loose | N-value 5-10 |
| Medium dense | N-value 11-30 |
| Dense | N-value 31- 50 |
| Very dense | N-value >50 |

APPENDIX B

Photographic Log





Photograph #1

Description of Photograph:
View of the various soil types encountered during the monitoring well installation activities at the Site.

Site Location:
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

Photograph Taken By:
Austin Westhuis

Date of Photograph:
September 17, 2015



Photograph #2

Description of Photograph:
View of the various soil types encountered during the monitoring well installation activities at the Site.

Site Location:
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

Photograph Taken By:
Austin Westhuis

Date of Photograph:
September 23, 2015



Photograph #3

Description of Photograph:
View of the various soil types encountered during the monitoring well installation activities at the Site.

Site Location:
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

Photograph Taken By:
Austin Westhuis

Date of Photograph:
September 25, 2015



Photograph #4

Description of Photograph:
View of the typical sand layer encountered at the Site where monitoring well screens were installed.

Site Location:
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

Photograph Taken By:
Austin Westhuis

Date of Photograph:
September 18, 2015

APPENDIX C

Hydraulic Test Logs



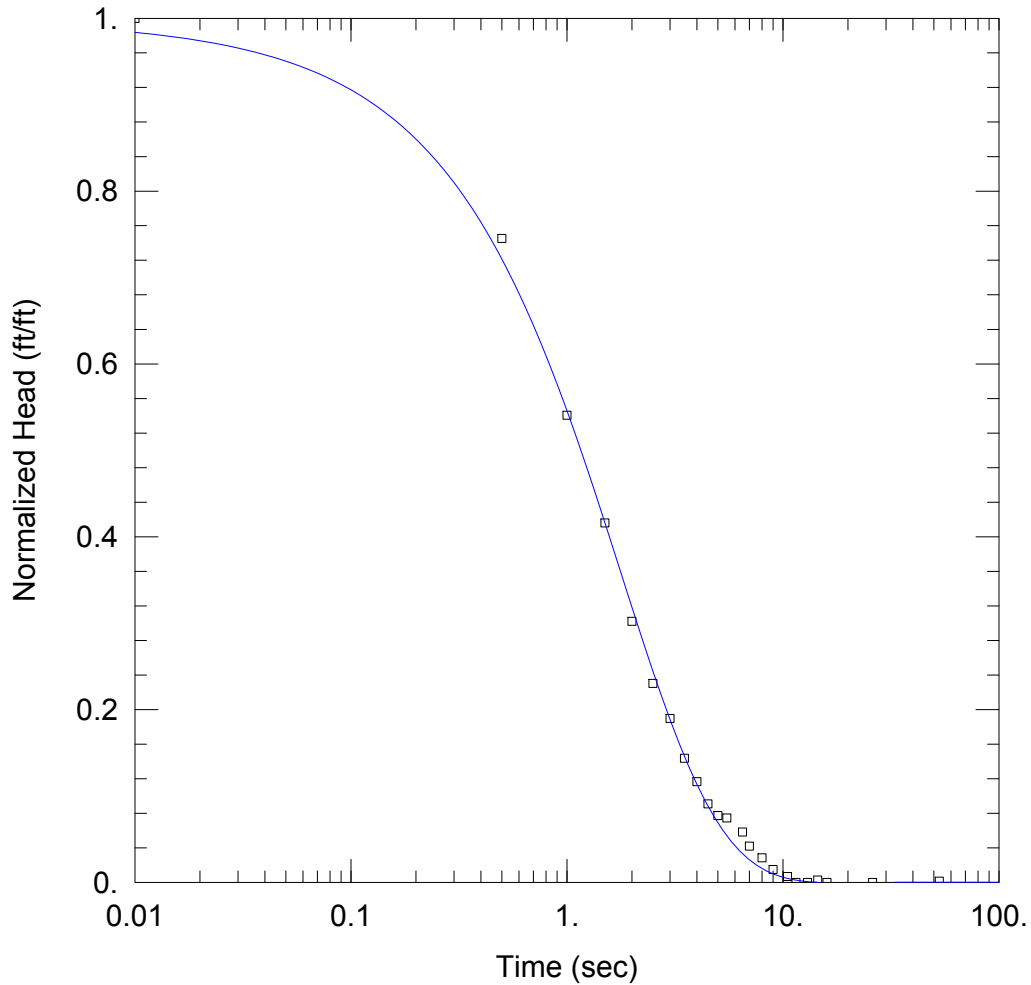
Slug Test Analysis Result for JHC MW-15005 - Test 2

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 61. ft/day Ss = 3.7E-5 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 19.82 ft

WELL DATA (JHC MW-15005)

Initial Displacement: 0.738 ft
Static Water Column Height: 6.82 ft
Total Well Penetration Depth: 6.82 ft
Screen Length: 6.82 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

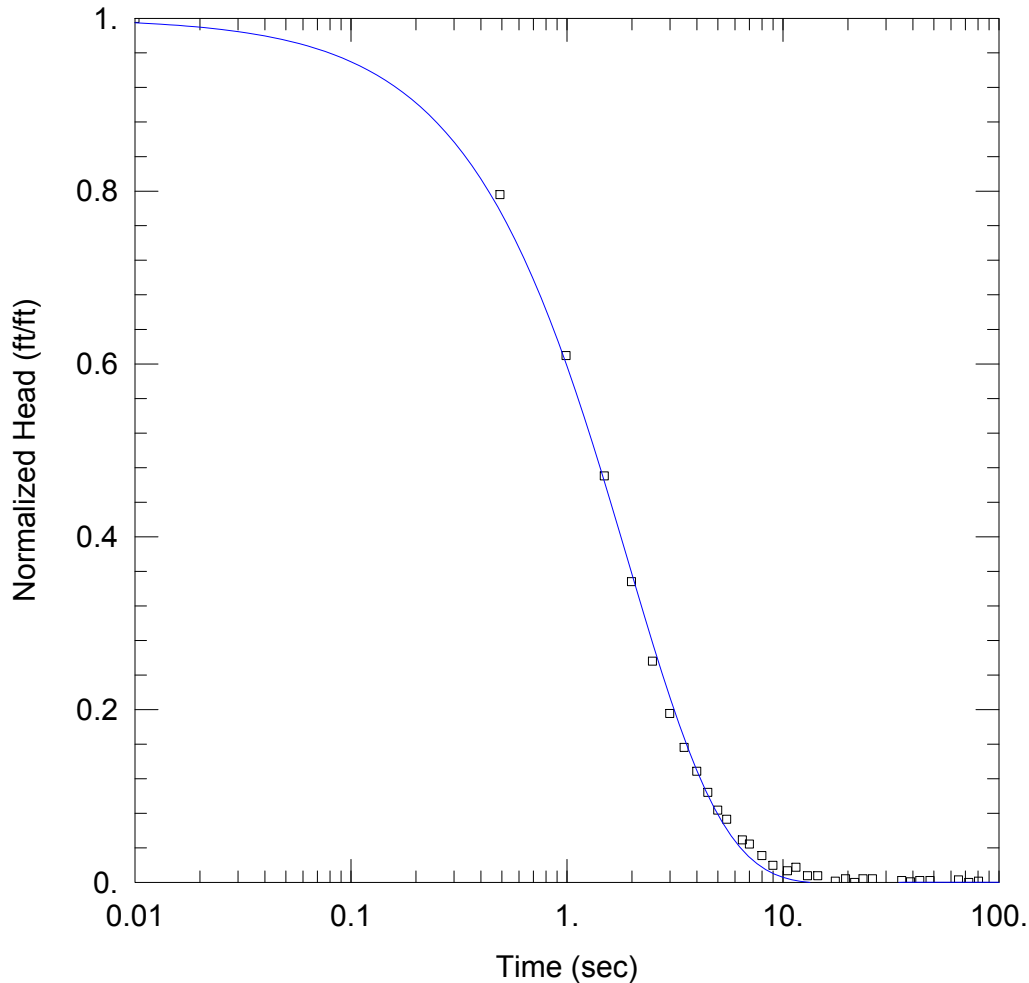
Slug Test Analysis Result for JHC MW-15005 - Test 3

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 58. ft/day Ss = 5.05E-12 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 19.82 ft

WELL DATA (JHC MW-15005)

Initial Displacement: 1.422 ft
Static Water Column Height: 6.82 ft
Total Well Penetration Depth: 6.82 ft
Screen Length: 6.82 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

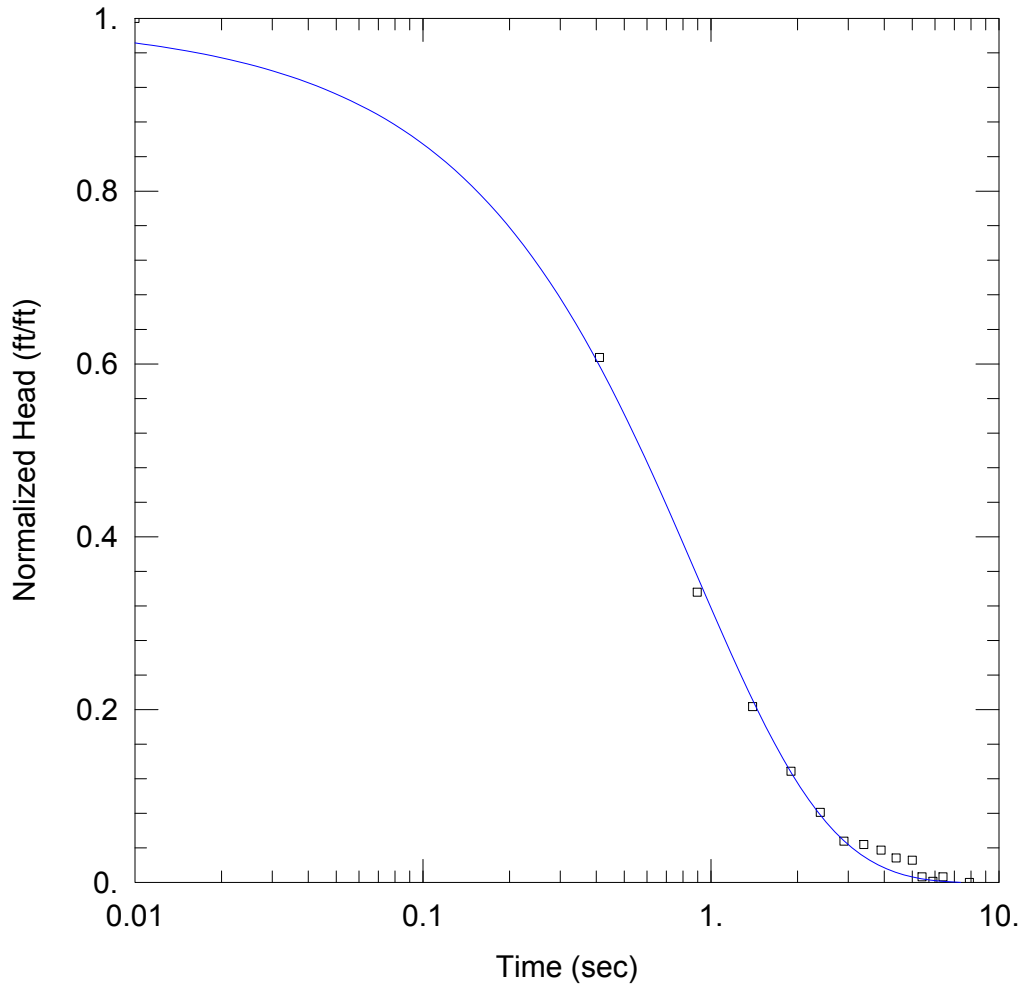
Slug Test Analysis Result for JHC MW-B6 - Test 2

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 118. ft/day Ss = 6.03E-5 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 25.71 ft

WELL DATA (JHC MW-B6)

Initial Displacement: 0.777 ft
Static Water Column Height: 5.71 ft
Total Well Penetration Depth: 5.71 ft
Screen Length: 5.71 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

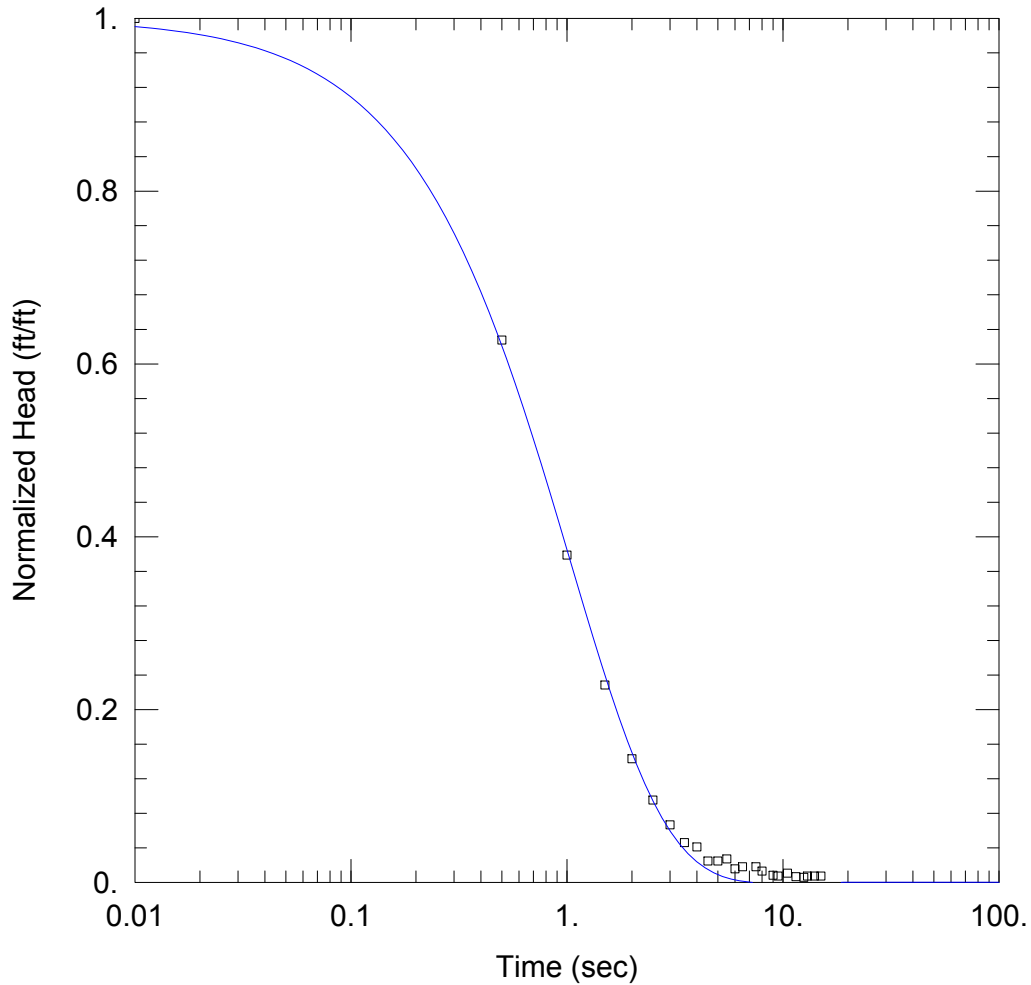
Slug Test Analysis Result for JHC MW-B6 - Test 3

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
 Solution Method: KGS Model
 Kr = 139. ft/day Ss = 5.05E-12 ft⁻¹
 Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 25.71 ft

WELL DATA (JHC MW-B6)

Initial Displacement: 1.217 ft
 Static Water Column Height: 5.71 ft
 Total Well Penetration Depth: 5.71 ft
 Screen Length: 5.71 ft
 Casing Radius: 0.083 ft
 Well Radius: 0.33 ft



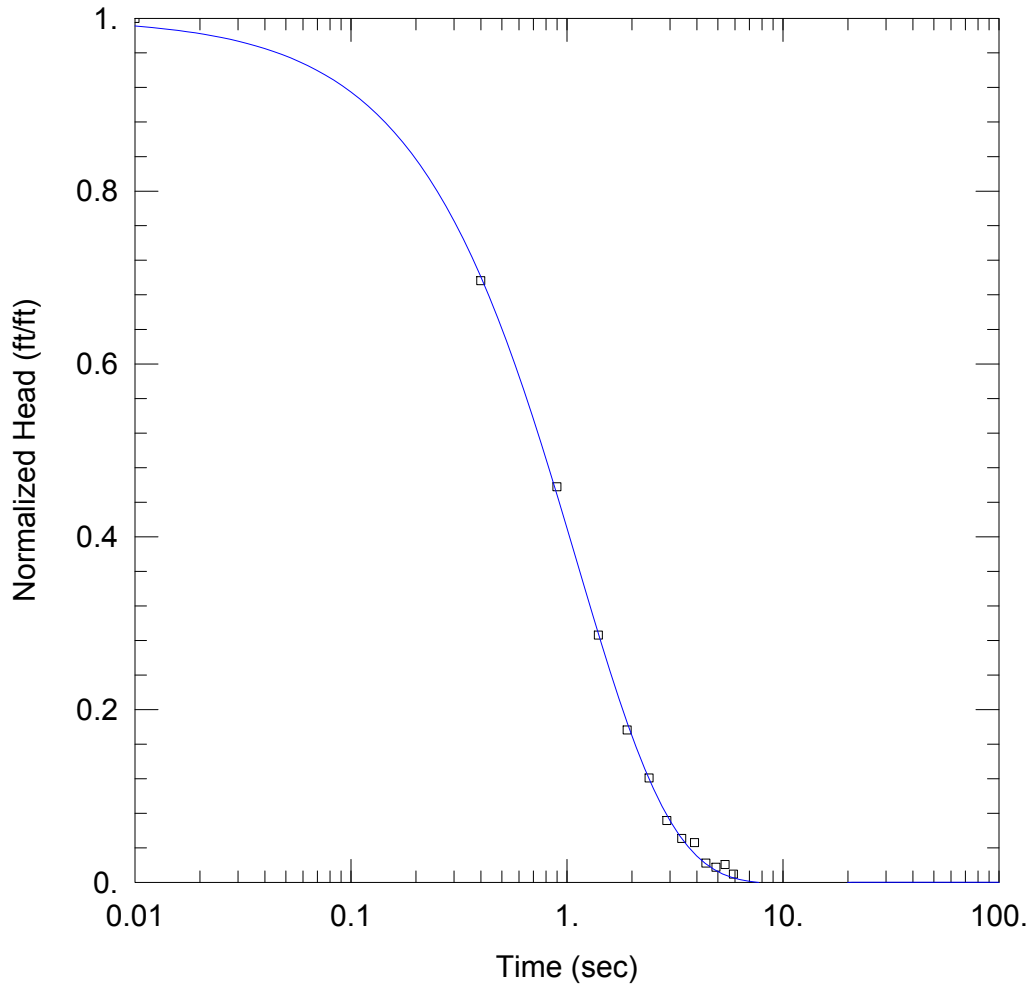
Slug Test Analysis Result for JHC MW-15007 - Test 1

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 130. ft/day Ss = 5.05E-12 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 23.37 ft

WELL DATA (JHC MW-15007)

Initial Displacement: 0.629 ft
Static Water Column Height: 5.37 ft
Total Well Penetration Depth: 5.37 ft
Screen Length: 5.37 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

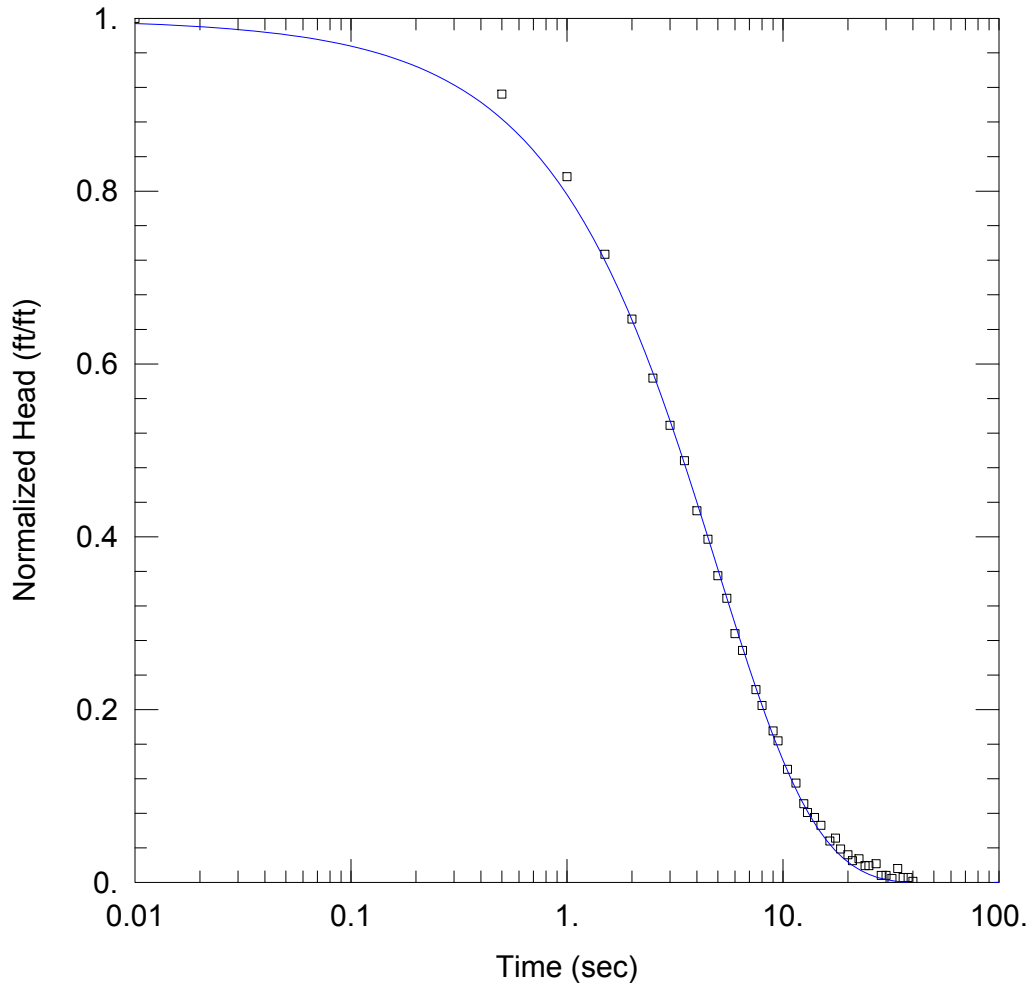
Slug Test Analysis Result for JHC MW-15015 - Test 2

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 22. ft/day Ss = 7.0E-6 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 24.57 ft

WELL DATA (JHC MW-15015)

Initial Displacement: 0.879 ft
Static Water Column Height: 12.57 ft
Total Well Penetration Depth: 12.57 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

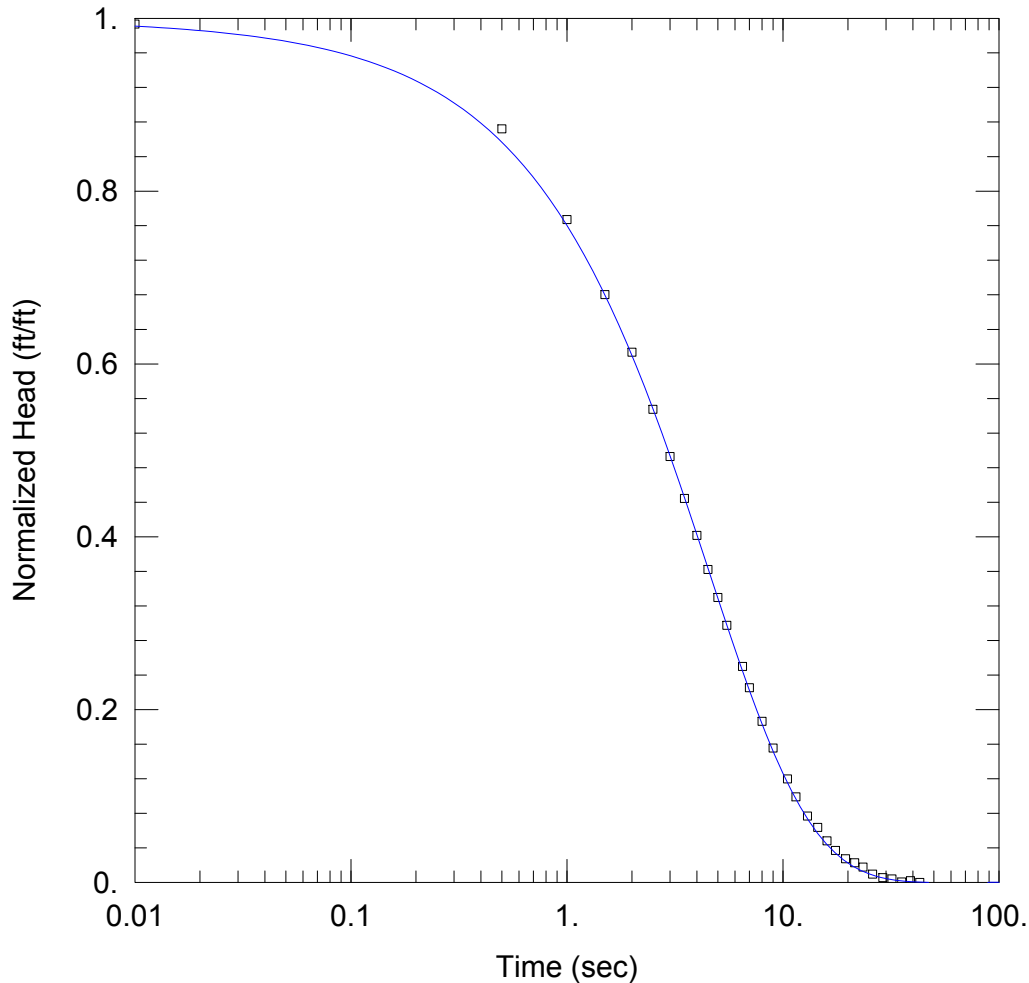
Slug Test Analysis Result for JHC MW-15015 - Test 3

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 21. ft/day Ss = 1.9E-5 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 24.57 ft

WELL DATA (JHC MW-15015)

Initial Displacement: 1.98 ft
Static Water Column Height: 12.57 ft
Total Well Penetration Depth: 12.57 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

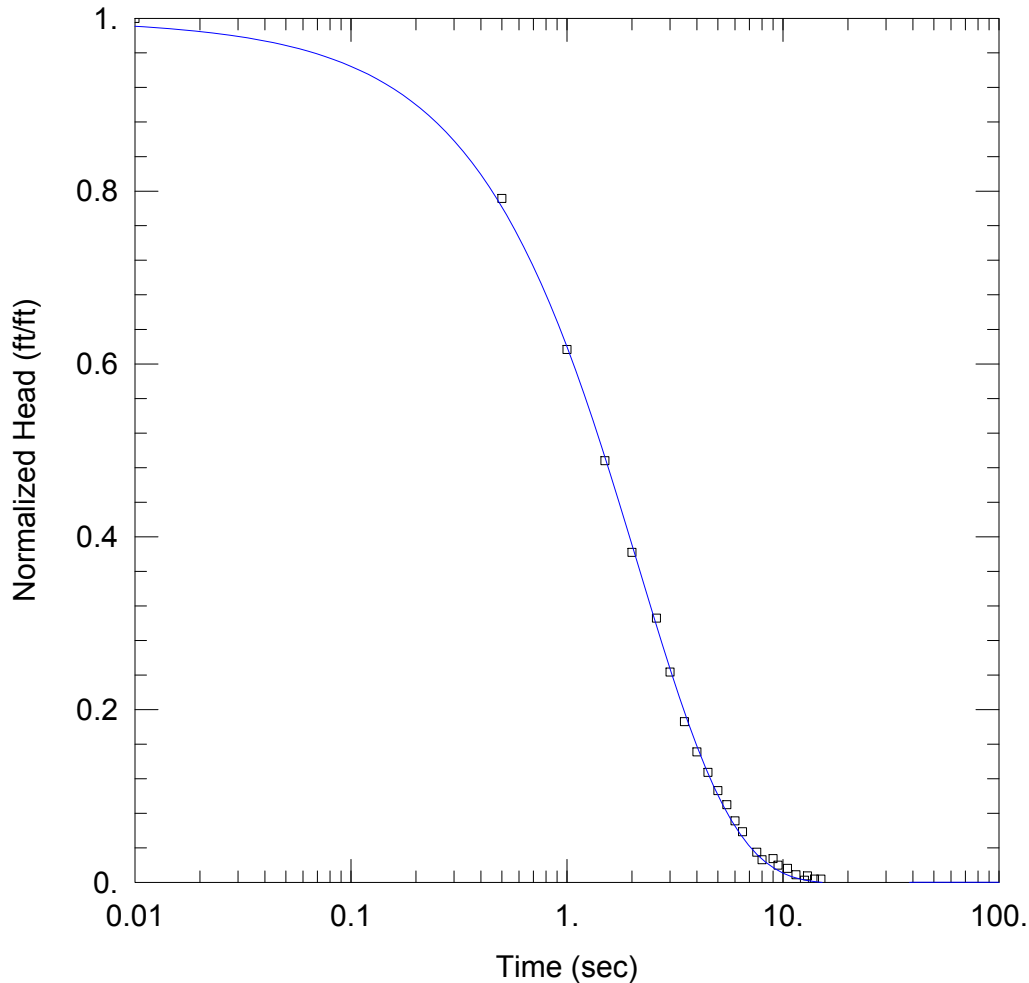
Slug Test Analysis Result for JHC MW-15024 - Test 2

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 49. ft/day Ss = 9.8E-6 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 38.71 ft

WELL DATA (JHC MW-15024)

Initial Displacement: 0.801 ft
Static Water Column Height: 5.71 ft
Total Well Penetration Depth: 5.71 ft
Screen Length: 5.71 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft



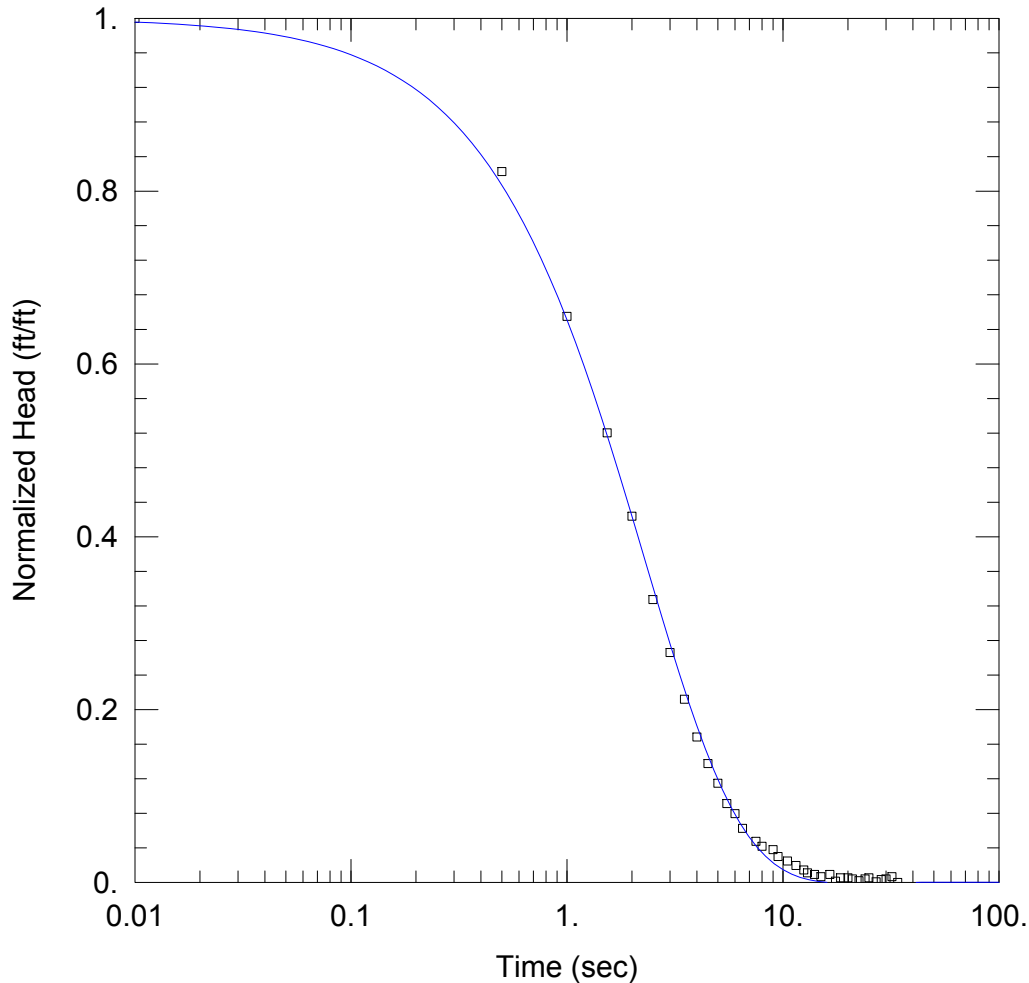
Slug Test Analysis Result for JHC MW-15024 - Test 3

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 45. ft/day Ss = 5.05E-12 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 38.71 ft

WELL DATA (JHC MW-15024)

Initial Displacement: 1.534 ft
Static Water Column Height: 5.71 ft
Total Well Penetration Depth: 5.71 ft
Screen Length: 5.71 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

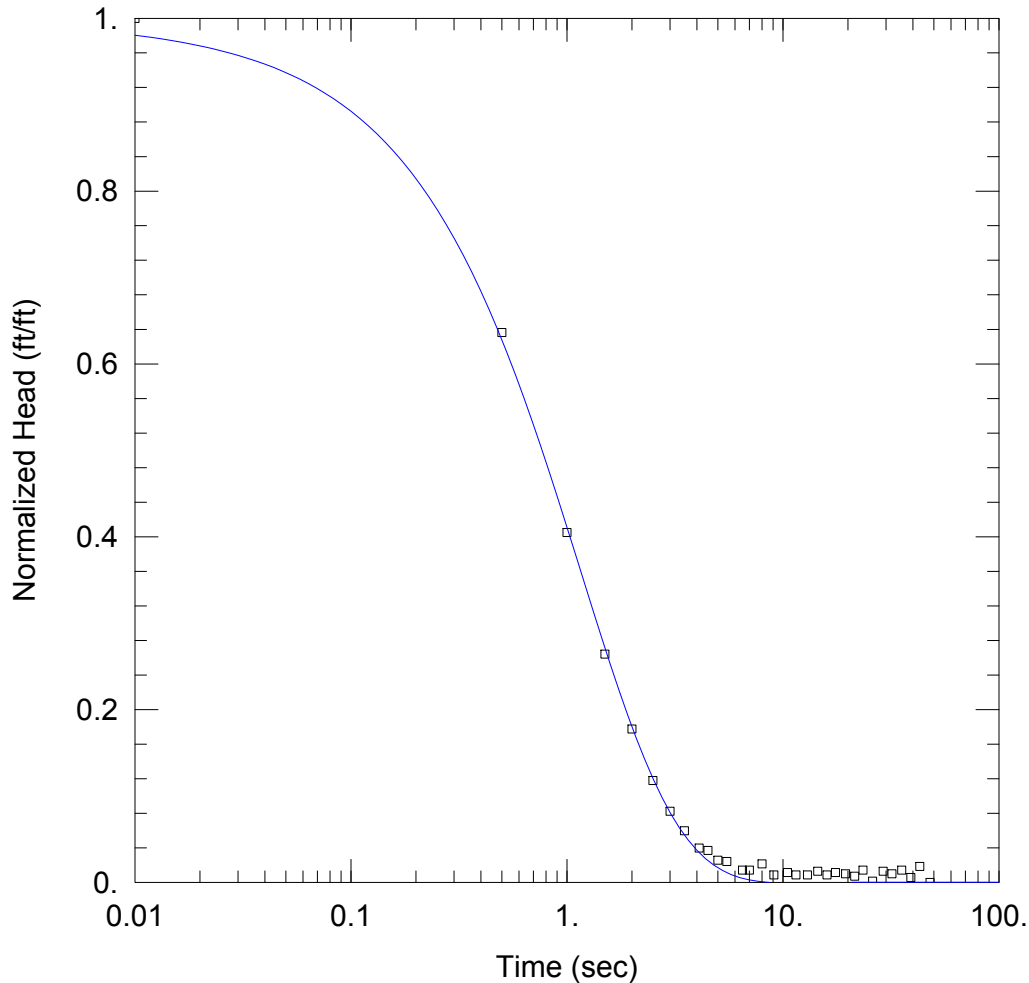
Slug Test Analysis Result for JHC MW-15028 - Test 1

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 104. ft/day Ss = 3.1E-5 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 38.22 ft

WELL DATA (JHC MW-15028)

Initial Displacement: 0.704 ft
Static Water Column Height: 6.22 ft
Total Well Penetration Depth: 6.22 ft
Screen Length: 6.22 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

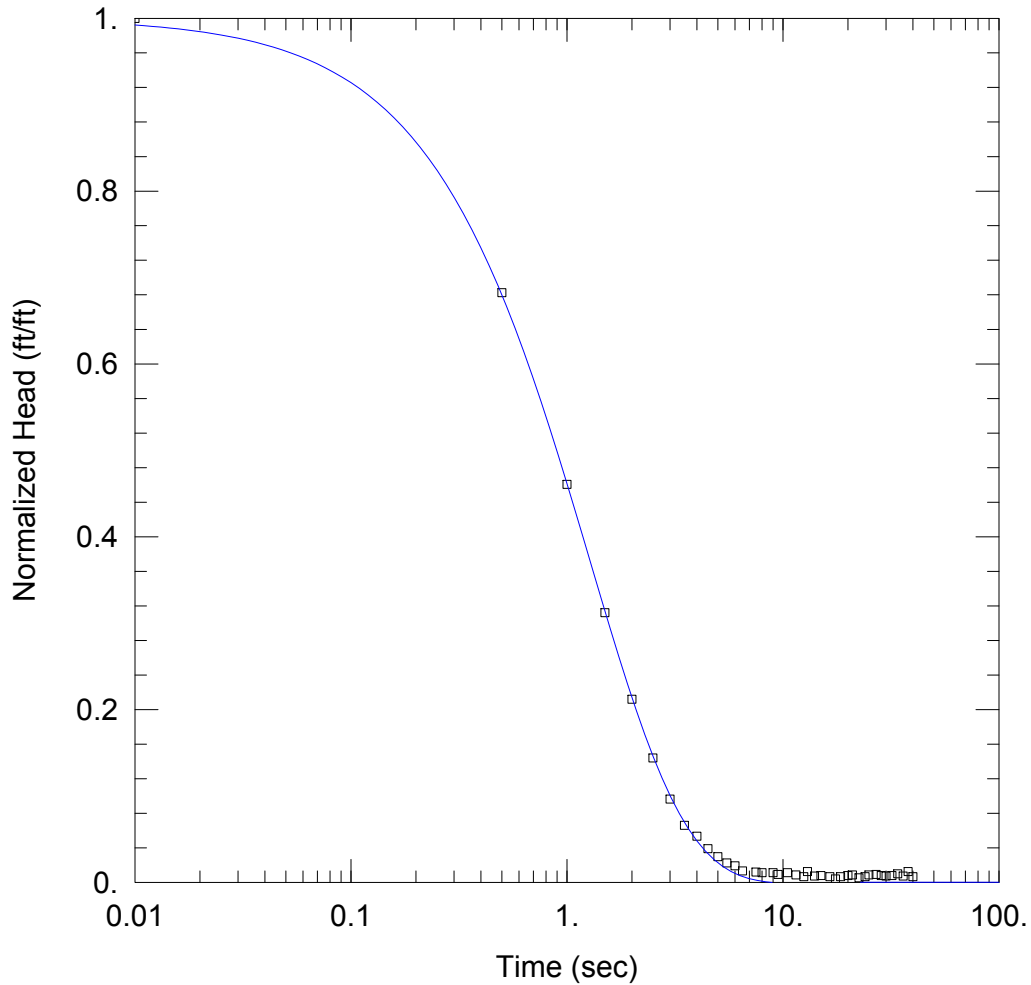
Slug Test Analysis Result for JHC MW-15028 - Test 3

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 86. ft/day Ss = 5.05E-12 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 38.22 ft

WELL DATA (JHC MW-15028)

Initial Displacement: 1.515 ft
Static Water Column Height: 6.22 ft
Total Well Penetration Depth: 6.22 ft
Screen Length: 6.22 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft



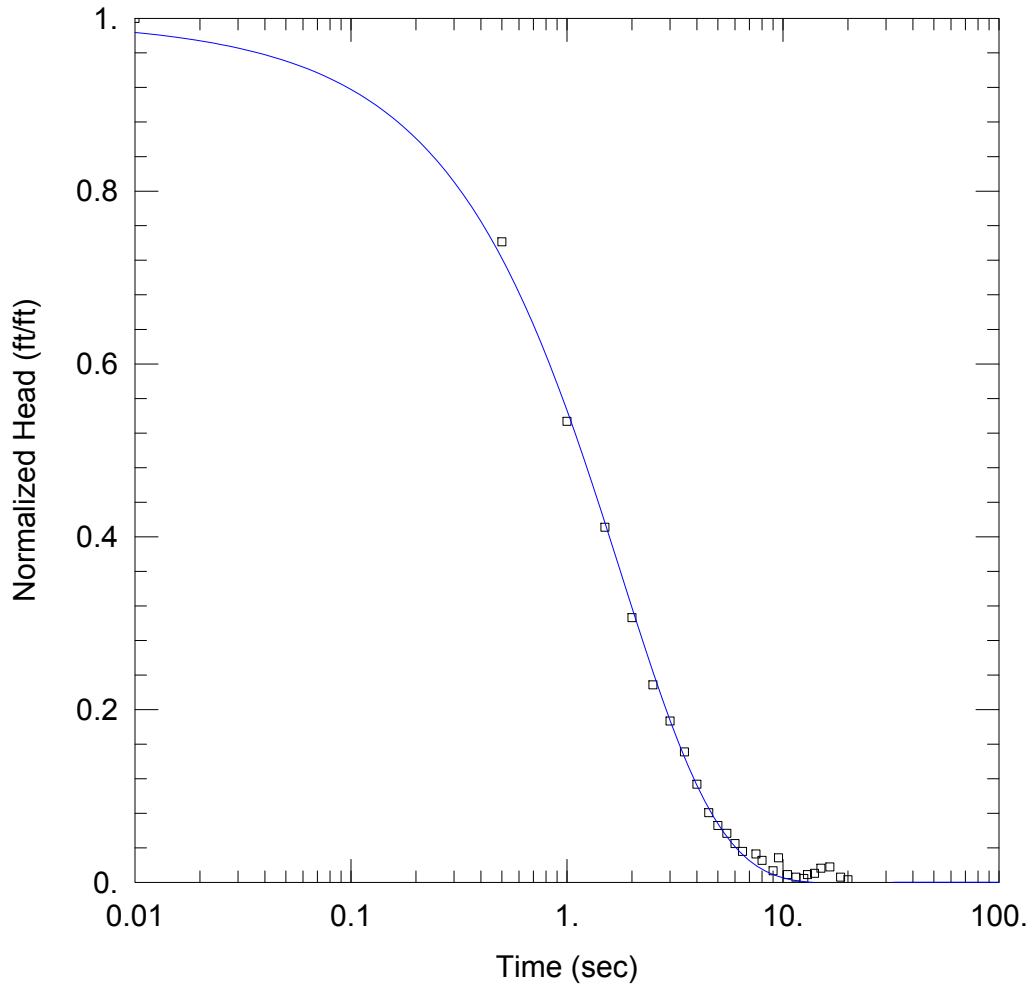
Slug Test Analysis Result for JHC MW-15033 - Test 2

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 74. ft/day Ss = 5.3E-5 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 29.83 ft

WELL DATA (JHC MW-15033)

Initial Displacement: 0.669 ft
Static Water Column Height: 5.83 ft
Total Well Penetration Depth: 5.83 ft
Screen Length: 5.83 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft



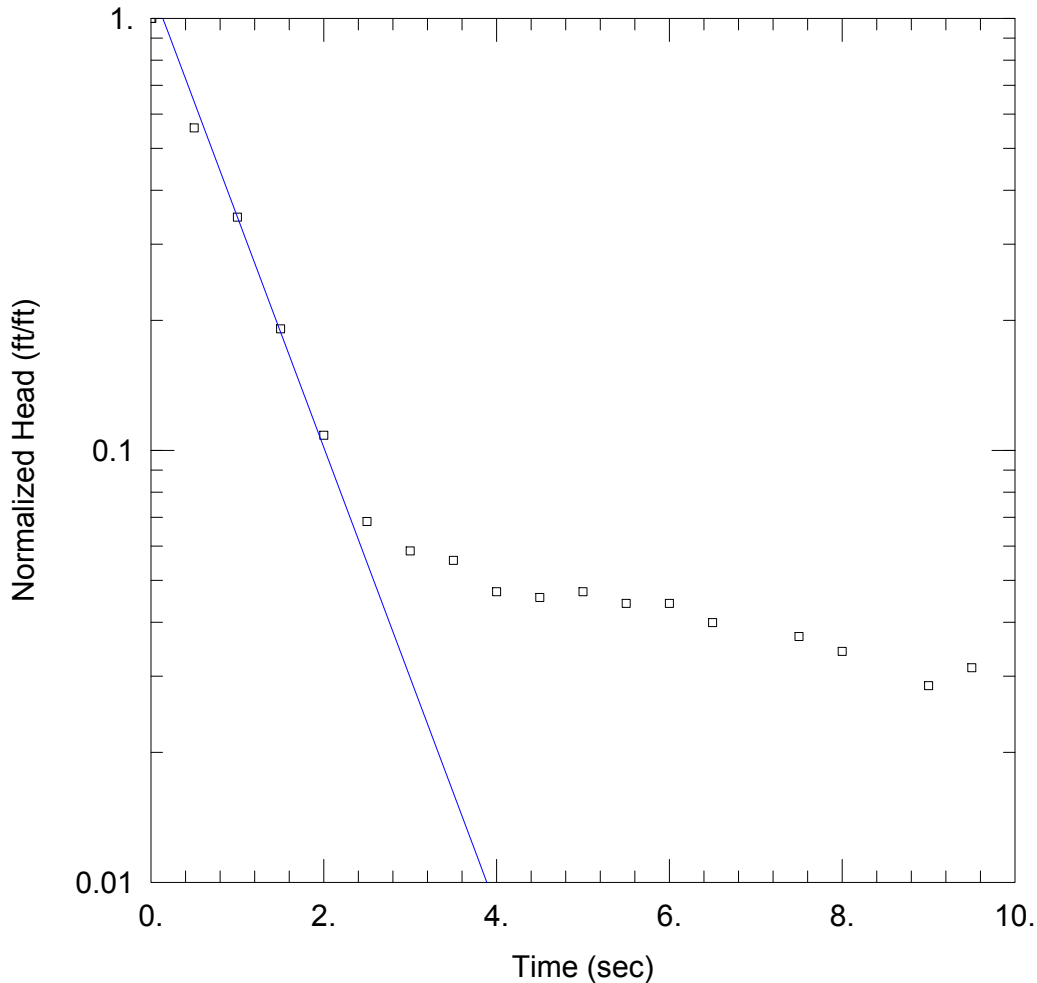
Slug Test Analysis Result for JHC MW-15030 - Test 2

Prepared By:
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Prepared For:
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Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Confined
 Solution Method: Bouwer-Rice
 K = 100 ft/day y0 = 0.83 ft

AQUIFER DATA

Saturated Thickness: 45.12 ft

WELL DATA (JHC MW-15030)

Initial Displacement: 0.701 ft
 Static Water Column Height: 9.12 ft
 Total Well Penetration Depth: 9.12 ft
 Screen Length: 9.12 ft
 Casing Radius: 0.083 ft
 Well Radius: 0.33 ft



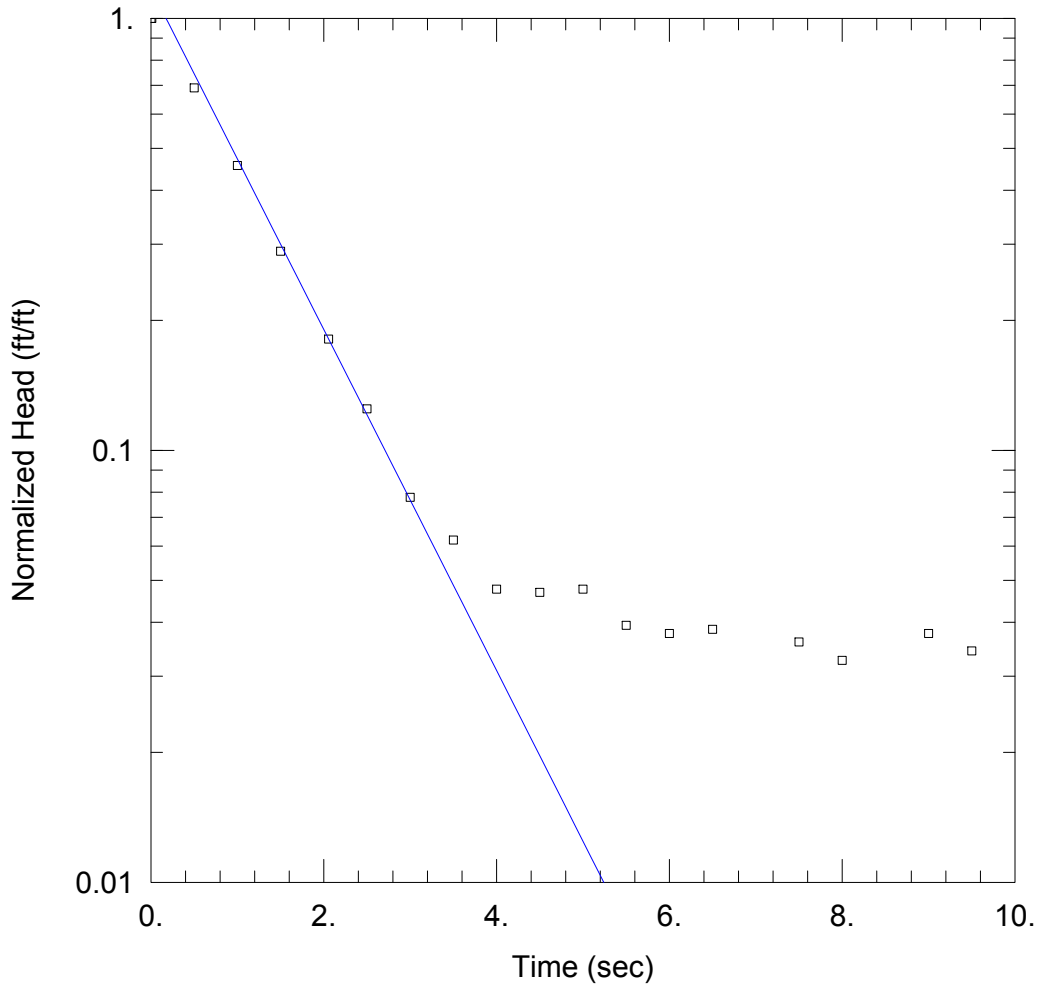
Slug Test Analysis Result for JHC MW-15030 - Test 3

Prepared By:
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Prepared For:
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Location:
West Olive, MI



SOLUTION

Aquifer Model: Confined
 Solution Method: Bouwer-Rice
 K = 87 ft/day y0 = 1.4 ft

AQUIFER DATA

Saturated Thickness: 45.12 ft

WELL DATA (JHC MW-15030)

Initial Displacement: 1.194 ft
 Static Water Column Height: 9.12 ft
 Total Well Penetration Depth: 9.12 ft
 Screen Length: 9.12 ft
 Casing Radius: 0.083 ft
 Well Radius: 0.33 ft



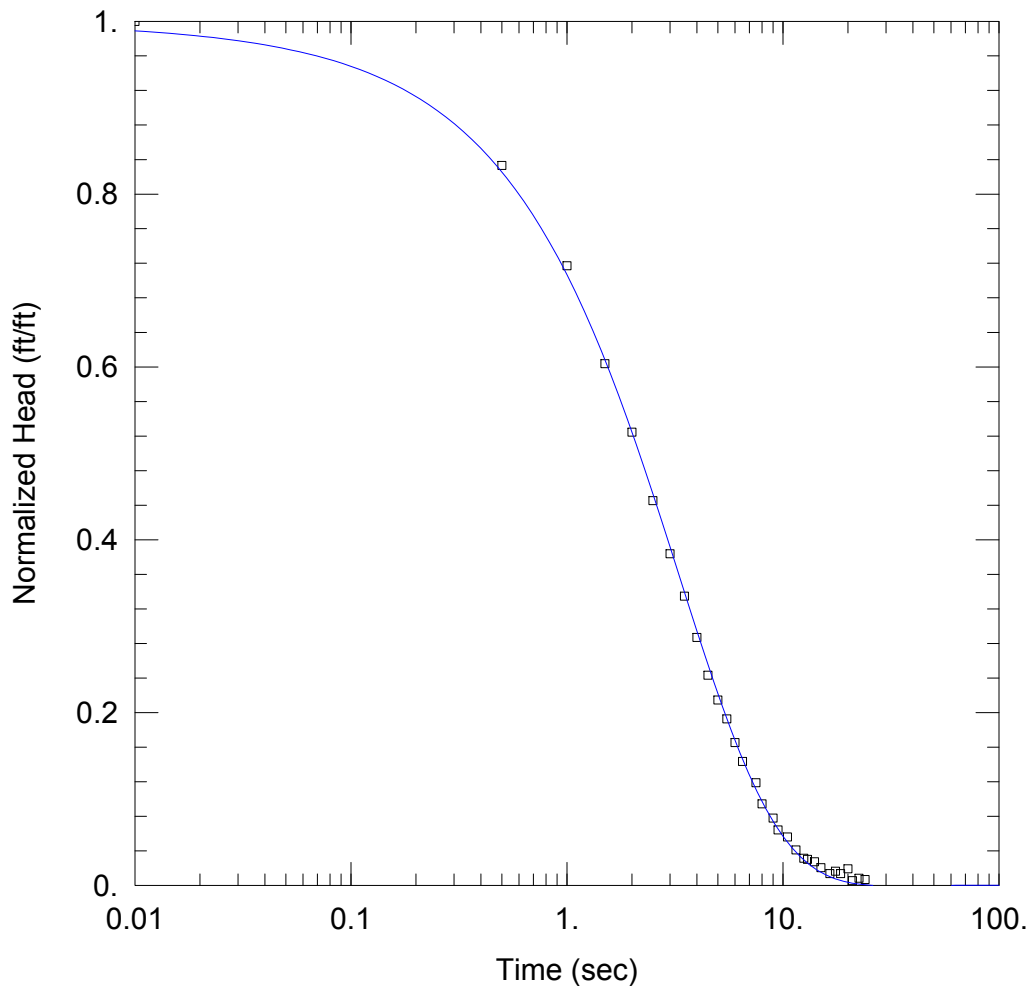
Slug Test Analysis Result for JHC MW-15018 - Test 1

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 34. ft/day Ss = 4.0E-5 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 36.5 ft

WELL DATA (JHC MW-15018)

Initial Displacement: 0.732 ft
Static Water Column Height: 6.5 ft
Total Well Penetration Depth: 6.5 ft
Screen Length: 6.5 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

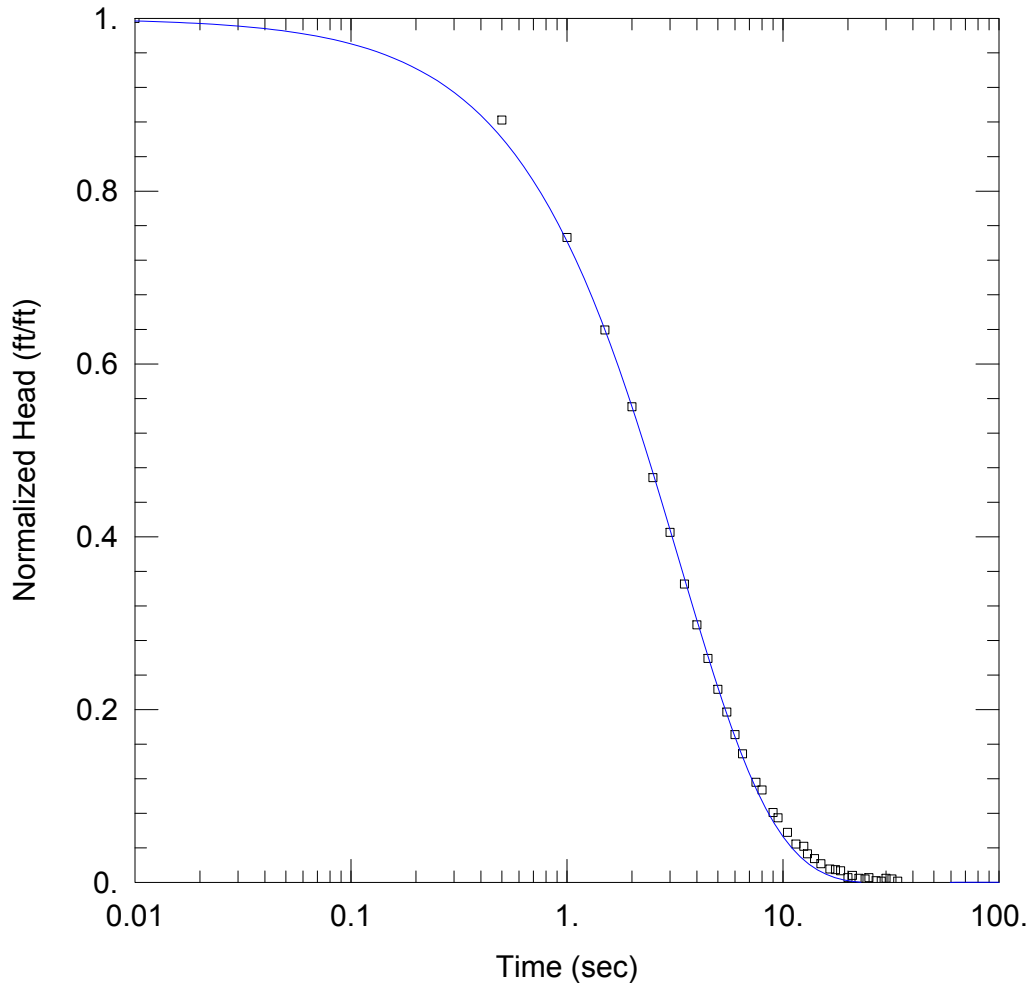
Slug Test Analysis Result for JHC MW-15018 - Test 3

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 33. ft/day Ss = 6.2E-12 ft⁻¹
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 36.5 ft

WELL DATA (JHC MW-15018)

Initial Displacement: 1.486 ft
Static Water Column Height: 6.5 ft
Total Well Penetration Depth: 6.5 ft
Screen Length: 6.5 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft



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A decorative graphic consisting of three thin orange lines. One line is horizontal, extending across the width of the page. Two other lines are diagonal, starting from the bottom left and extending towards the top right, crossing the horizontal line.