SOUTHERN PROPERTY BOUNDARY AREA VAPOR INTRUSION INVESTIGATION

Former York Naval Ordnance Plant
1425 Eden Road, Springettsbury Township
York, Pennsylvania

Prepared for:

Harley-Davidson Motor Company Operations, Inc.

1425 Eden Road

York, Pennsylvania

July 2015

Prepared by:

Groundwater Sciences Corporation

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/l	micrograms per liter
bgs	below ground surface
CCV	continuing calibration verification
CLP	Contract Laboratory Program (USEPA)
COC	constituents of concern
CR	cancer risk
DQO	data quality objective
FSP	field sampling plan
fYNOP	former York Naval Ordnance Plant
GSC	Groundwater Sciences Corporation
Harley-Davidson	Harley-Davidson Motor Company Operations, Inc.
HHRA	Human Health Risk Assessment
I.D.	inner diameter
IDW	investigation-derived waste
IS	internal standard
HI	hazard index
HQ	hazard quotient
LCL	lower control limit
LCS/LCSD	laboratory control sample / laboratory control sample duplicate
LOD	limit of detection
Langan	Langan Engineering and Environmental Services, Inc.
MEK	methyl ethyl ketone
mL	milliliter
MS/MSD	matrix spike / matrix spike duplicate
MSL	mean sea level

NSSG	near-source soil gas
O.D.	outside diameter
PADEP	Pennsylvania Department of Environmental Protection
PCE	tetrachloroethene
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance / quality control
RPD	relative percent difference
SPBA	Southern Property Boundary Area
TCE	trichloroethene
TCR	target cancer risk
UCL	upper control limit
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
VI	vapor intrusion
VISL	Vapor Intrusive Screening Level
VOCs	volatile organic compounds

1 INTRODUCTION

This report presents the results of an investigation to assess the potential for vapor intrusion (VI) in an off-Site Area to the south of the Southern Property Boundary Area (SPBA) at the former York Naval Ordnance Plant (fYNOP) located in York, Pennsylvania (defined as the Site) (see **Figure 1**). This off-Site area extends from the SPBA to U.S. Route 30 / Arsenal Road (hereinafter referred to in this report as the Study Area as shown on **Figure 1**). The investigation was performed by Groundwater Sciences Corporation (GSC) between October 2014 and April 2015. Elements of the VI investigation are described in Addendum #15 of the Field Sampling Plan (FSP) for Part 2 of the Supplemental Groundwater Remedial Investigation (GSC, April 2012).

Historical accounts indicate that liquid waste containing volatile organic compounds (VOCs) was used to control weeds and reduce dust along the SPBA perimeter road. Results of previous investigations in the SPBA indicate the primary VOCs present in soil and groundwater in this portion of the Site consist of trichloroethene (TCE) and tetrachloroethene (PCE) (Langan Engineering and Environmental Services, Inc. [Langan], 2005 and GSC, 2011). Previous monitoring in the off-Site portion of the Study Area near U.S. Route 30 indicated the presence of PCE and TCE in bedrock groundwater at concentrations significantly lower than those detected in the SPBA (GSC, 2011).

In 2005, results of a VI assessment of the Study Area concluded that the VI pathway due to volatilization of constituents of concern (COCs) from shallow groundwater is not complete (Langan, 2005). Thereafter, United States Environmental Protection Agency (USEPA) issued its Documentation of Environmental Indicator Determination finding that the VI pathway in the residential area off-Site in the vicinity of the SPBA was not significant (USEPA, 2005). The USEPA recently reviewed the 2005 VI assessment as part of their review of the proposed approach to the Human Health Risk Assessment (HHRA) for the Site (email from Griff Miller, USEPA to Stephen Snyder, GSC dated August 14, 2014). USEPA concluded that the methodology and modeling approach that it previously approved for the 2005 VI assessment are no longer considered by USEPA to be reliable methods to estimate the potential for VI into residences located in the off-Site portion of the Study Area. USEPA has requested more information to determine whether VI is a potential pathway for COCs from the Site into these neighboring residences.

Addendum #15 of the FSP provides a systematic program to assess the potential for VI that includes investigations of groundwater in the saturated materials just below the water table and, if necessary based on groundwater analytical results, soil gas in the vadose zone just above the capillary zone. The scope of work described includes the drilling of soil borings and installation of monitoring wells targeting shallow groundwater at ten locations in the off-Site neighborhood and five locations in the apparent SPBA source area on the fYNOP property.

The original version of Addendum #15 was submitted to USEPA and PADEP for review on October 2, 2014. Comments were received from USEPA on the original submittal, resulting in modifications to the work scope to accommodate the comments. The modified work scope was approved by USEPA by letter of October 31, 2014 from Griff Miller of USEPA to Steve Snyder of GSC.

In accordance with the modified work scope, the shallow groundwater portion of the VI investigation was proposed to include the installation of a stratigraphic boring, continuous soil sampling and geologic logging, grain size and moisture content analyses, monitoring well installation and development, potentiometric groundwater elevation monitoring, and groundwater sampling and analysis for Site-related VOCs. The vadose zone soil gas portion of the VI investigation was proposed to include installation of a second soil boring, proximate to each newly installed shallow groundwater monitoring well, for the collection of undisturbed soil samples and the installation of soil vapor probes, if called for by the results of the groundwater sampling. Physical testing of undisturbed soil samples along with sampling and analysis of the soil vapor probes were proposed only under the condition that VOC concentrations in groundwater sampled from the nearby monitoring well yielded one or more exceedances of target cancer risk or hazard indices calculated using the USEPA's Vapor Intrusive Screening Level (VISL) Calculator. Additional details about the application of the VISL Calculator are identified in Addendum #15 of the FSP.

The execution of this program of groundwater and soil gas investigations and the results generated by its execution are described herein.

2 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

The fYNOP is located in Springettsbury Township in York County, Pennsylvania. The Site setting and history is described in detail in the Supplemental RI Groundwater Report (GSC, 2011). The SPBA is located along the eastern portion of the southern property line of the Harley-Davidson Motor Company Operations, Inc.'s (Harley-Davidson) property. The adjacent off-Site residential area is located south of the SPBA, north of Arsenal Road and west of North Sherman Street (**Figure 1**).

The SPBA, located on Harley-Davidson property, is undeveloped woodland. The off-Site portion of the Study Area to the south is primarily comprised of residential properties with single-family homes, lawns and driveways. Commercial properties are located in the Study Area near the intersection of U.S. Route 30 / Arsenal Road and North Sherman Street. The topography of the Study Area slopes downhill from the SPBA to the off-Site residential area to the south.

2.1 Geology

Subsurface geologic conditions in the Study Area consist of either fill (associated with residential and roadway construction) or residual soil overlying bedrock. The residual soil consists primarily of silt and clay produced from the weathering of the underlying bedrock. As described in the Supplemental RI Groundwater Report (GSC, 2011), regional geologic mapping indicates bedrock formations beneath the Study Area include solution-prone (karst) gray carbonate bedrock (limestone and dolostone) and quartzitic sandstone. The quartzitic sandstone is encountered beneath the upland area in the southeastern portion of the Site, including a portion of the SPBA in the area north of Canterbury Lane (see **Figure 1**). The limestone and dolostone is located beneath the majority of the Study Area, including a portion of the SPBA.

2.2 Hydrogeology

The focus of this investigation is on groundwater quality at the water table, from which VOCs may potentially volatilize to create a soil vapor source for potential vapor intrusion into overlying structures. Within the study area, the water table sometimes occurs in the residual soil and sometimes occurs in the bedrock. The saturated thickness of the residual soil is variable, from 0 to greater than 30 feet. The limestone and dolostone is a karstic carbonate aquifer with groundwater

migrating through solution-enhanced discontinuities. The hydraulic conductivity of the quartzitic sandstone is a much lower than that of the carbonate rock. Groundwater in the quartzitic sandstone flows through discrete bedding plane partings, joints, and fractures, while the discontinuities in the carbonate aquifer have been enlarged by dissolution.

The lateral component of shallow groundwater flow in the Study Area is generally from north to south. However, where carbonate bedrock is present, the predominant direction of groundwater flow is vertical in response to a strong vertical gradient from the saturated residual soil downward into the underlying carbonate bedrock. Therefore, localized lateral flow within the shallow groundwater at and just below the water table is anticipated to be limited by the presence of this vertical downward gradient, as well as the lateral extent and thickness of fine-grained residual soils, the location of the contact between the quartzitic sandstone and the carbonate bedrock, the presence of shallow solution-enhanced karst features in the limestone and dolostone, and the occurrence of enhanced localized recharge due to the presence of surface water drainage features, such as storm sewers, that may concentrate surface water runoff.

3 DATA QUALITY ASSESSMENT

A comprehensive quality assurance/quality control (QA/QC) program was followed during the VI investigation in the off-Site area south of the SPBA at fYNOP. Groundwater samples and associated QA samples (e.g., field duplicates, equipment rinse blanks, field blanks, trip blanks, matrix spikes, and matrix spike duplicates) were analyzed for VOCs using approved methods specified in the QAPP (GSC, 2014) and in Addendum #15 of the FSP for Part 2 of the Supplemental Groundwater Remedial Investigation (GSC, 2012).

GSC conducted a systematic review of 10 percent of the data for compliance with QC criteria in accordance with SAIC Technical Procedure TP-DM-300-7 for data validation (300-7, Rev. 3, June 2009) and based on the following categories:

1. Holding times,
2. Blanks,
3. Laboratory control samples and laboratory control sample duplicates (LCS/LCSDs),
4. Surrogate recoveries (organic methods),
5. Internal standard (IS) recoveries (organic methods),
6. Calibrations (initial and continuing),
7. Sample reanalysis,
8. Secondary dilutions, and
9. Laboratory case narrative review and verification.

Data evaluation was accomplished by comparing the contents of the data packages and QA/QC results to requirements contained in the requested analytical methods. GSC evaluated QC data reported by the laboratory against required precision and accuracy limits established in Tables A-2 and A-4 of the QAPP (GSC, 2014).

Consistent with the data quality requirements as defined in the data quality objectives (DQOs), all project data and associated QC data were evaluated on these categories and qualified according to the outcome of the review. During the review, laboratory-applied data qualifiers were evaluated, defined, and explained. During verification, individual sample results were qualified, as necessary,

to designate usability of the data toward meeting project objectives. The qualifiers used are defined as follows:

U – The analyte was analyzed for, but was not detected above the reported sample quantitation limit. These results are qualitatively acceptable.

J – The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. Although estimated, these results are qualitatively acceptable.

UJ – The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. Although estimated, these results are qualitatively acceptable.

R – The analyte result was rejected due to serious deficiencies in the ability to analyze the sample and/or meet QC criteria. The presence or absence of the analyte cannot be verified.

Data qualifications were applied based on deviations from the measurement performance criteria identified in TP-DM-300-7.

A secondary stage of validation occurred once the initial validation for a discrete sampling event had been completed. Individual equipment rinse blanks, trip blanks, and field blanks were associated with the corresponding environmental samples. These field QC blanks were evaluated following the same criteria as method blanks, and the associated environmental samples were qualified accordingly.

The following sections summarize the laboratory chemical analysis program implemented as part of the groundwater sampling conducted in the SPBA. The project DQOs are summarized in the following sections and include a discussion on precision, accuracy, bias, representativeness, comparability, and completeness, and sensitivity. All data qualified due to the data validation process are presented in **Table 4**.

3.1 Precision

Precision was evaluated using the analysis of three types of QC samples: matrix spike / matrix spike duplicates (MS/MSDs), LCS/LCSDs, and field duplicate sample analyses.

The first type of QC sample used to assess the data precision was MS/MSD samples. All MS/MSD relative percent differences (RPDs) for project-sourced samples were acceptable. The second type of QC sample used to assess the data precision was LCS/LCSD samples. With the exception of three samples (see below), all LCS/LCSD RPD values were within acceptance criteria.

The third type of QC sample used to evaluate precision was field duplicates. Duplicate sample pairs were collected to ascertain the contribution of variability (i.e., precision) associated with environmental media and sampling precision technique. Field duplicate RPDs were calculated for analytes above the limit of detection (LOD) and all RPDs were below the lower control limit (LCL). Data have not been qualified based on the results of field duplicates, since the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review (EPA 540R/R-99/008) does not include control limits for field duplicate RPD values.

Overall, one result in each of three samples (see below) was rejected due to unacceptable precision. Based on an evaluation of MS/MSD, LCS/LCSD, and field duplicate RPDs, the overall precision is acceptable. As a result, the laboratory DQO for precision was met.

3.2 Accuracy

Analytical accuracy was measured through the use of LCSs, ISs, surrogates, MS/MSDs, instrument performance checks, initial and continuing instrument calibration, serial dilutions, second column confirmation analysis, method and calibration blanks, and field QC blanks (i.e., trip blanks, field blanks, and equipment rinse blanks).

The first type of QC sample used to assess the data accuracy was LCS and/or LCSD samples. The LCS and/or LCSD percent recoveries were acceptable with the exception of slightly low or high recoveries for carbon disulfide and 1,1,2,2-tetrachloroethane. As a result, six reported analytes were qualified as estimated (UJ) and three reported analytes were rejected (R).

The second QC measure used to assess the accuracy of the data was the surrogate percent recoveries for VOCs. Sample results were qualified as estimated (J/UJ) if the associated surrogates were below the LCL. Detected organic sample results were qualified as estimated (J) if the associated surrogate recovery was greater than the upper control limit (UCL). Non-detected organic sample results were qualified as rejected (R) if the associated surrogate recovery was less than 10 percent. All surrogate recoveries were within control limits.

ISs were added in calibration standards, environmental samples, and QC blanks in accordance with SW846 Methods 8260B for VOCs. All ISs for VOCs were within control limits in the two data packages that received full validation.

MS/MSD analyses were another QC method used to assess data accuracy. The native sample was qualified if MS or MSD recoveries were outside the applicable recovery QC limits. This was the case with several results for 1,1,2-trichloroethane and 1,1,2,2-tetrachloroethane.

Initial calibration of each instrument was completed in accordance with SW-846 method requirements for all analyses. All initial calibration criteria were met. No data were qualified due to unacceptable initial calibrations.

Continuing calibration verification (CCV) of each instrument was completed in accordance with SW-846 method requirements. Organic sample results were qualified as estimated (J/UJ) if the associated CCV was less than the LCL. Detected organic sample results were qualified as estimated (J) and non-detected sample results were qualified UJ if the associated CCV was above the UCL. No results were rejected (R) due to CCV results.

Method blanks were analyzed with each batch of samples in accordance with the analytical methods listed in the QAPP (GSC, 2014). Methylene chloride was detected in one or more method blanks at concentrations that might bias analytical results. Methylene chloride results in five samples were qualified as non-detect (U) due to method blank contamination. Methylene chloride detection in four other samples were qualified based on professional judgement and the fact that methylene chloride is a common laboratory contaminant.

During activities conducted as part of the groundwater monitoring program at fYNOP, field QC blanks were collected to gauge the impacts from various components of field activities. Field QC

samples were obtained to determine the degree of cross-contamination, verify successful decontamination procedures, or determine the effects of media heterogeneity on results. Equipment rinse blanks and field blanks provide a measure of various cross-contamination, decontamination efficiency, and other potential error that can be introduced from sources other than the sample. Field sample results associated with contaminants found in field QC blanks are considered non-detect (U) if they are at concentrations less than 10 times for common laboratory contaminants and less than 5 times for remaining contaminants, the level found in the associated blank.

Several VOCs were detected in equipment rinse blanks but the concentrations were not high enough to bias the analytical results. The associated sample detections less than 5 times the blank results would otherwise be qualified as non-detect (U) for rinse blank contaminants.

Several VOCs were detected in field blanks sourced from organic-free water at concentrations that were not high enough to bias analytical results. For the associated samples that had detections less than 10 times the field blank (for common laboratory contaminants) and less than 5 times the field blank (for the remaining contaminants), the field blank results would otherwise be qualified as non-detect (U) for field blank contamination.

Overall analytical accuracy was measured through the use of calibration standards (initial and continuing), surrogates, instrument performance checks, MS/MSDs, LCSs, serial dilutions, and method and calibration blanks. Supporting QC information cited above was qualitatively evaluated with respect to the analytical accuracy DQO. Only three data points for carbon disulfide were rejected due to unacceptable accuracy. Based on the evaluation of the initial and continuing calibration, surrogate, MS/MSD, LCS, serial dilution, and method blank results, the laboratory accuracy has been determined to be acceptable for all other analyses. The analytical DQO for accuracy has been met except as noted.

Based on an evaluation of the compounds and elements detected in the field QC blanks, overall field accuracy is acceptable, except where noted. As a result, the field DQO for accuracy has been fulfilled.

3.3 Bias

Bias is the systematic or persistent distortion of a measurement process causing errors in one direction. Analytical bias was evaluated by analysis of LCS/LCSD and MS/MSD samples. The laboratory performed a LCS/LCSD or MS/MSD for each analytical batch, as appropriate.

Acceptance criteria for LCS/LCSD and MS/MSD measurements will be expressed as a percent recovery and are specified in the analytical method and in the EPA Region 2 Standard Operating Procedures for the Validation of Organic Data (HW-24, Rev. 1, June 1999). Various blank samples (such as laboratory method blanks and field equipment rinse blanks) will also be used to assess contamination of samples that may bias results high.

3.4 Representativeness

Representativeness was satisfied by verifying that the QAPP (GSC, 2014) was properly followed, that proper sampling techniques were used, that proper analytical procedures were followed, and that analytical holding times of the samples were not exceeded. No samples were analyzed outside the VOC method required holding time and no results were qualified as estimated (J/UJ) due to missed holding times. Holding times exceeding more than two times the method required holding time are rejected (R) for non-detects and estimated (J) for detects. No sample results were rejected due to missed holding times. Based on an evaluation of sample precision and accuracy, the samples collected during groundwater sampling in the SPBA are considered to be representative of the environmental conditions.

3.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. Comparability is achieved through the use of established and approved sample collection techniques and analytical methods, consistency in the basis of analysis (wet weight vs. dry weight, volume vs. mass, etc.), consistency in reporting units, and analysis of standard reference materials.

Data comparability is achieved by using standard units of measure. The use of EPA-approved methods to collect and analyze samples, along with instruments calibrated against Standard

Analytical Reference Materials, which are National Institute for Standards and Technology-traceable standards, also aids comparability.

Based on the precision and accuracy assessment presented above and the use of EPA-approved methods, the data collected during groundwater sampling in the SPBA are considered to be comparable to data collected using similar EPA-approved methods.

3.6 Completeness

Completeness measures the quantity of valid data generated from the laboratory analysis and sampling processes. For data to be valid, all acceptance criteria must be fulfilled, including accuracy and precision, as well as other criteria specified by the analytical methods used for analytical data to be usable, each data point must be validated satisfactorily. Results of the groundwater sampling in the SPBA that have been qualified for completeness reasons have limited impact on the data quality. The DQOs were set at 90 percent for the field sampling and laboratory completeness. Based on the evaluation of the field and laboratory QC results, the data exceeded 90 percent completeness and were used in assessing results and providing recommendations.

Results that have been flagged or qualified U, UJ, or J for various reasons encountered minor analytical problems, with limited impact on the data quality.

3.7 Sensitivity

Sensitivity requirements were provided as minimum required reporting limits in the QAPP (GSC, 2014). All reporting limit criteria were specified with the exception of those samples that required dilution due to matrix interferences or elevated target compounds. Reporting limits have been determined to be acceptable for all analyses. The analytical DQO for sensitivity has been met.

4 FIELD INVESTIGATION ACTIVITIES

The work scope for field investigation activities undertaken as part of the VI investigation of the Study Area includes: stratigraphic boring advancement with continuous soil sampling and geologic logging; monitoring well construction, development, and sampling; survey of the newly installed monitoring wells and collection of depth to groundwater measurements; collection of undisturbed soil samples, and installation and sampling of soil vapor probes, the latter to be sampled only if required based on the results of the groundwater investigation. These field investigation activities are described in detail in the following sections.

4.1 Installation of Monitoring Wells and Soil Vapor Probes

Fifteen stratigraphic borings were completed in the Study Area and a monitoring well was installed in each of the stratigraphic borings as shown on **Figure 2**. Five of the monitoring wells were installed along the southeastern boundary of the fYNOP property (MW-161 through MW-165) and ten monitoring wells were installed in the off-Site portion of the property (MW-166 through MW-175). The second boring for each of the ten boring pairs in the off-Site portion of the Study Area was to be completed prior to sampling the groundwater, in order to avoid remobilizing the drilling rig to the Canterbury Lane neighborhood. However, due to delays in the field investigation program, groundwater chemistry data became available prior to the completion of the undisturbed samples and installation of soil vapor probes. After the completion of the second soil borings at SV-167, SV-168 and SV-171, analytical results were received for the first round of groundwater samples collected from the newly installed monitoring wells. The analytical results were evaluated using the VISL Calculator and the VOC concentrations detected in samples collected in the off-Site portion of the Study Area were found not to exceed the target cancer risk or hazard index. For that reason, pursuant to FSP Addendum #15, drilling of the remaining second borings and installation of additional vapor probes was not completed.

The stratigraphic borings, monitoring well installations, and soil vapor probe installations were performed by Eichelbergers, Inc. of Mechanicsburg, PA, with oversight by GSC.

4.1.1 Utility Pre-Clearance

Utility notification was provided by Eichelbergers, Inc. through the Pennsylvania One Call System on October 23, 2014. The proposed boring locations were marked on the ground with marking paint by GSC on October 27, 2014. Marked boring locations were reviewed and approved by Harley-Davidson, in accordance with the Harley-Davidson "Subsurface Protocol and Utility Clearance, Work Instruction (WI) YS2.03.300". The Harley-Davidson "Checklist for Off-Site Well Siting" was completed for each proposed boring location prior to the commencement of drilling activities.

Beginning on November 4, 2014, each proposed boring location was hand-cleared to a depth of five feet using hand tools and an air knife/vacuum excavation unit in order to identify and avoid subsurface utilities not previously marked and identified. During the process of hand clearing, an unmarked municipal water line was identified at the proposed location for MW-170. The proposed MW-170 boring location was moved 25 feet to the west and the utility pre-clearance process described above was repeated.

4.1.2 Soil and Bedrock Characterization

One stratigraphic boring at each of the 15 boring locations, designated MW-161 through 175 was completed to characterize the soil and/or bedrock that comprise the vadose zone and shallow portion of the saturated zone in the Study Area. The 15 stratigraphic borings were advanced to a depth that allowed the characterization of the shallow portion of the saturated zone just below the apparent encounter of the water table. Eleven stratigraphic borings were terminated in overburden soils and four borings were terminated in shallow bedrock.

The soil borings were advanced using 4 ¼-inch inner diameter (I.D.) hollow-stem auger drilling techniques. Continuous soil sampling was performed in the stratigraphic borings by hydraulically-driven direct-push drilling techniques using a 2-inch or 3-inch I.D. dual-tube macrocore sampler. The soil samples were logged in the field by a GSC geologist for texture, color, moisture, sample depth interval and recovery. The texture of the soil samples was described in accordance with the Modified Burmeister classification system. Soil samples were collected in glass jars and transported to the GSC Harrisburg office.

The four stratigraphic borings where bedrock was encountered prior to reaching an apparent zone of saturation are designated MW-163, MW-164, MW-165 and MW-171. To advance these borings beyond the point of auger refusal, a 5-inch diameter hammer bit was used to drill into bedrock using air rotary techniques. The rock chips produced by air rotary drilling were logged in the field by a GSC geologist for lithology, hardness, weathering, color and texture.

4.1.3 Monitoring Well Installation and Development

After drilling into the shallow portion of the saturated zone, a 1-inch I.D. polyvinyl chloride (PVC) temporary monitoring well was placed into the boreholes. The water level in the 1-inch temporary well was monitored until the water level stabilized in order to determine an appropriate depth at which to construct a permanent monitoring well.

After apparent stabilization of the water level, the 1-inch I.D. temporary well was removed and a 2-inch I.D. permanent monitoring well was constructed in the borehole. The 2-inch I.D. monitoring well was constructed using schedule 40 PVC riser pipe, PVC well screen with 0.01-inch slots, and a size #1 sand filter pack. Well construction and development was completed in accordance with the specifications and procedures identified in subsection 4.2.4.4 of the FSP (pp. 35-37). Care was taken to attempt to place the well screen of the newly constructed wells within the top five feet of the water table. In 11 wells, that goal was met. In the remaining four wells, the goal was exceeded by less than ten feet.

During the time of this investigation (fall 2014 and winter 2015), weather conditions were sufficiently dry that, MW-64S was dry. This is a somewhat rare condition in that this was only the fourth time in the 19 years of observing the MW-64 couplet that MW-64S was recorded as dry. When well MW-161 was drilled 39 feet from MW-64S, care was taken to observe the shallow water table conditions. During advancement of the MW-161 boring, two thin saturated zones were noted at depths of 35.4 to 35.8 feet below ground surface (bgs) and 36.8 to 37.0 feet bgs. Drilling was halted to observe water levels overnight, but water did not collect in the boring. In the absence of sufficient water to sample, the boring was deepened and constructed with a screen opening from 56 to 66 feet bgs, where saturated conditions were detected. The thin saturated zones in MW-161 occurred at the approximate elevation of 378 feet msl, compared to the lowest water level measured in MW-64S, which is 375 feet msl. These zones may represent the water table conditions normally

detected at MW-64S. The water level measured in MW-161 is nearly the same elevation as MW-64D.

The locations of the SPBA monitoring wells are shown on **Figure 2**. Physical well data, including depths of screened intervals, surface completions, and survey data are identified in **Table 1**. Monitoring well drilling and construction logs are provided in **Appendix A**.

The newly installed monitoring wells were developed by Eichelbergers, Inc. and GSC personnel between January 7, 2015 and March 3, 2015. The wells were developed to remove fine-grained formation particles from the well sand pack and promote the exchange of groundwater between the formation and the well. The wells were developed following procedures in the FSP subsection 4.2.4.4. **Appendix D** contains monitoring well development records.

4.1.4 Collection of Undisturbed Soil Samples and Soil Vapor Probe Installation

A second soil boring, designated SV-167, SV-168 and SV-171, was completed proximate to each of newly installed groundwater monitoring wells MW-167, MW-168 and MW-171 (**Figure 2**). These soil borings were advanced using hollow-stem auger drilling techniques to the top of the intervals designated for the collection of undisturbed soil samples. Undisturbed soil samples were collected in 30-inch long, 3-inch outside diameter (O.D.) steel Shelby tubes using hydraulically-driven direct-push drilling techniques. The top and bottom of the Shelby tubes were sealed with paraffin wax, capped, labeled, and stored at the Site in an upright position.

After the collection of an undisturbed soil sample, the soil boring was advanced using hollow-stem auger drilling techniques to the top of the interval of the next deepest undisturbed soil sample. Two or three undisturbed soil samples were collected in each boring at the depths in feet bgs indicated on **Table 2**.

TABLE 2
UNDISTURBED SOIL SAMPLE DEPTHS

SV-167 feet bgs	**SV-168** feet bgs	**SV-171** feet bgs
8 to 10	8 to 8.8	8.5 to 11
21 to 23	11 to 13.2	13 to 15.5
25 to 27		20 to 22.5

When all undisturbed soil samples in a soil boring were collected, the boring was advanced using hollow-stem auger drilling techniques to a depth of six-inches lower than the base of the deeper of the two nested soil vapor probes to be constructed.

Soil vapor probes SV-167, SV-168 and SV-171 were constructed according to the specifications identified in the Technical Memorandum "Near Source Soil Gas Vapor Point Installation" and the associated figure and table in **Appendix B**. The first vapor probe was installed with the goal of screening the vadose zone as close to the top of the capillary zone as possible. There was concern, however, that groundwater levels would rise prior to sampling, and render the vapor probe useless. As a precaution, a second vapor probe was installed five feet above the first vapor probe installation.

4.1.5 Decontamination Procedures

Down-hole tools used for drilling were decontaminated according to the procedures identified in subsection B.1.4 of the Quality Assurance Project Plan (QAPP).

4.2 Survey

Horizontal coordinates and vertical elevations of the monitoring wells were surveyed on March 11, 2015 by a Pennsylvania-licensed surveyor from Nutec Group of York, PA as described in subsection 4.2.4.4 of the FSP. Monitoring well survey data are tabulated in the Physical Well Data Table (**Table 1**).

4.3 Groundwater Elevation Measurements

Depth to water was measured by GSC personnel using an electronic water level meter to record depth below the PVC reference point for each monitoring well to the nearest 0.01 feet. Water levels for each well were measured several times throughout the monitoring well installation, development, and sampling activities. Comprehensive water level measurement rounds were performed in the Study Area on February 20, 2015 and April 14, 2015. Depth to water measurements recorded on these two dates and the corresponding groundwater elevation data are tabulated in **Table 3**.

4.4 Monitoring Well Sampling

The 15 newly installed monitoring wells were sampled twice by GSC personnel during the period from March 3, 2015 to April 10, 2015. In accordance with Pennsylvania Department of Environmental Protection (PADEP) guidance, the monitoring wells were sampled at least 14 days after they were developed, and were resampled at least three weeks after they were initially sampled. In addition to sampling the 15 newly installed monitoring wells, GSC personnel sampled three existing nearby monitoring wells: MW-64S, MW-64D and MW-141A, between April 14, 2015 and April 16, 2015. Sampling was performed in accordance with subsection 4.2.4.7 of the FSP. Purge data for monitoring well sampling were recorded on electronic tablets and are included in **Appendix E**.

The groundwater samples were collected in 40 milliliter (mL) glass vials for VOC analysis by SW-846 Method 8260C, stored in coolers with wet ice, and sent by courier to TestAmerica Laboratories, Inc. of Pittsburgh, PA via Federal Express overnight delivery.

4.5 Investigation-Derived Waste Handling and Disposal

Investigation-derived waste (IDW) produced by drilling and sampling activities was containerized, labeled, handled, and disposed in accordance with subsection 4.2.5 of the FSP and Harley-Davidson's Waste Disposal Work Instructions (YS2.03.637).

5 RESULTS

Information learned about the physical characteristics of soil and bedrock, through field investigation and laboratory analyses, is described in the following sections. Groundwater potentiometric elevations, apparent lateral and vertical flow directions, and VOC groundwater chemistry data are also presented below.

5.1 Field Descriptions of Soil and Bedrock

Study Area soils tend to be fine-grained, primarily composed of silt and clay. Sand and gravel-size particles of weathered quartzite tend either to be absent, or where they occur, comprise a minor component of the soil. Soils that are predominantly sand and/or gravel are uncommon, and where they occur, they tend to be in thin layers.

The thickness of soil encountered is relatively thin in the northwest portion of the SPBA (as thin as 4 feet), and thickens to the east and to the south, as shown on **Figure 3**, Section A-A'. In MW-165, the western-most Study Area boring within the Site southern property boundary, bedrock was encountered at 4.5 feet bgs. To the east at MW-164, competent bedrock was encountered at 10.5 feet bgs. Both of these borings are underlain by fine-grained sandstone that has been recrystallized to pale brown quartzite. Farther to the east at MW-163 the bedrock surface is at a depth of 32.5 feet bgs, where gray limestone was encountered. Bedrock was not encountered farther east in the stratigraphic borings for wells MW-162 and MW-161, with drilling advancing to depths of 57 feet and 66 feet bgs, respectively. Existing wells MW-64D and MW-141A are located 40 and 31 feet northeast of MW-161, respectively. These wells encountered limestone bedrock at 63 and 60 feet bgs, respectively.

Bedrock was not encountered elsewhere during the drilling activities of this investigation except at soil vapor probe/well location SV/MW-171. The depth to bedrock is 34.8 feet bgs at SV-171, while ten feet to the southwest at MW-171 bedrock is 40 feet bgs, indicating the pinnacled nature of the carbonate bedrock surface. Existing borings MW-108D, east of MW-161, MW-109D, on Old Arsenal Road, west of the intersection with North Sherman Street, and MW-110, to the west on Old Arsenal Road, all encountered carbonate bedrock. **Figure 4** shows the approximated location of the contact between the quartzite (denoted by the symbol Cah) and the carbonate rock (denoted by the

symbol Cv). Below 29 feet bgs at MW-165 the sandstone is interbedded with a sugary-textured hard gray dolostone. Dolomitic limestone is present to the east at well location MW-163 and to the south, underlying the entire Canterbury Lane residential area. Structurally, this area occurs in a tight synclinal fold, with the older quartzite rocks wrapping around the west, north and east sides of the younger carbonates. The synclinal fold plunges to the south.

5.2 Particle Size Distribution Results and USDA Soil Texture Classifications in the Vadose Zone

For each soil boring location, four or five soil samples were selected to be analyzed for particle size distribution and soil moisture content, except MW-164 and MW-165, where shallow soils occur. Analyses of particle size and soil moisture content were performed by F.T. Kitlinski & Associates, Inc. of Harrisburg, PA. Each soil sample consisted of either a 2-inch or 3-inch diameter cylinder measuring 0.4 to 0.5 feet long, stored in a screw-top glass jar. All samples were selected from the vadose zone above the water table. An effort was made to select the finest textured layer in each boring, as well as the most commonly encountered and thickest soil strata samples for particle size and moisture content analysis based on soil texture field descriptions.

Soil moisture content was determined by oven drying. Particle size distribution was determined by performing a standard sieve test with sieve sizes varying from 1-inch to #200 (0.074-inch). Fines passing the #200 sieve were analyzed by a hydrometer test to determine percent silt and clay.

Particle size distribution reports are presented in **Appendix C**. The particle size distribution data were compared to retained samples of the tested material, and were used to augment/check the soil descriptions on the well logs. The percent sand, silt, and clay for each soil sample, as determined by the laboratory analyses, was plotted on a United States Department of Agriculture (USDA) soil texture trilinear diagram to determine the USDA soil texture classification. A trilinear diagram was constructed for each boring. The plots are located in **Appendix F**. The results generally plot in the loam, silt loam, silty clay loam and clay loam portions of the (USDA) trilinear diagram, with a very few samples classified as sandy loam and sandy clay loam. Forty-nine of the sixty-four samples tested exhibited more than 50% silt and clay by weight and are, therefore, considered fine-grained soils. This indicates that the soils in the vadose zone are predominantly fine-grained and they are widely present within the study area.

5.3 Groundwater Level Elevations and Apparent Flow Directions

Shallow groundwater level contours inferred from water level data recorded on April 14, 2015 are shown on **Figure 4** and in profile view on **Figure 3**. The groundwater elevation data suggests complex groundwater flow conditions within the Study Area.

5.3.1 Water Table Elevation Contours

The April water levels were selected for contouring because the February round was less complete. Water table elevation contours using these data are shown on **Figure 4**. While these contours suggest an apparent lateral groundwater gradient that slopes generally southward from the SPBA towards the off-Site residential area, there are significant anomalies in the pattern of these contours. For example, in the middle of the Canterbury Lane circle, apparent horizontal groundwater gradients diverge to the southwest and to the southeast. There is also an anomalously high water level in MW-173 at the intersection of Canterbury Lane and Old Arsenal Road. Likewise, the water level in MW-170, directly north of MW-173, is elevated compared to laterally adjacent wells MW-171 and MW-169.

In general, these apparent anomalous conditions are believed to reflect the effects of a strong vertical gradient downward from the saturated zone in the residual soil to the underlying carbonate bedrock described in the next subsection. As such, anomalies in the water table elevation are principally associated with variations in the balance between direct recharge to the saturated soils at the water table and the rate at which water is drained from this saturated soil to the underlying bedrock. The apparent north to south overall slope of the water table would thus mostly reflect the north-south slope of the piezometric surface in the underlying bedrock, rather than indicate north to south flow within the saturated soils.

Some evidence also suggests that the concentration of recharge may be responsible for the anomalously high water table elevations at MW-170 and MW-173. There is a storm sewer with a drop culvert at MW-170, which collects water from the eastern and western laterals of Canterbury Lane, and then conveys the storm water southward toward MW-173. It is suspected that the high water level in MW-173, and to a lesser extent in MW-170, result from storm drain leakage. The concentration of recharge to the groundwater from the storm drainage system may result in the

saddle formed beneath this section of Canterbury Lane, as shown on **Figure 4**. This saddle appears to split the groundwater flow beneath the neighborhood to the southeast and southwest. In addition to the two complete rounds of water levels, numerous partial rounds of water levels in these wells during construction, purging and sampling support this configuration, suggesting it is rather persistent between precipitation events.

5.3.2 Vertical Downward Gradients

As a result of observations from monitoring wells MW-64 S&D, in the southeast corner of the SPBA, a strong vertical downward gradient is known to exist, with water levels in MW-64S at a median elevation of 385 feet mean sea level (msl), which is generally 25 feet higher than MW-64D. The water level in MW-64S represents a water table condition, while the water level in MW-64D represents the piezometric water level in the deeper limestone aquifer, which that well penetrates. This condition essentially creates an underdrain system below the residuum, causing the downward vertical gradient to exceed the horizontal gradient.

To illustrate the strong downward vertical gradient that occurs in the residuum underlain by the limestone in the eastern corner of the SPBA and in the residential area to the south, cross sections A-A' and B-B' (**Figure 3**) were drawn with potentiometric contours and flow direction arrows honoring the water level data collected in the wells. These contours and flow arrows show a downward flow path of groundwater from the on-Site source area in the SPBA through the residuum into the underlying carbonate aquifer, with limited lateral migration southward. Although much of the vertical head differential dissipates as groundwater migrates southward, there is still 0.65 feet of vertical downward head between the residuum water level in MW-174 and adjacent bedrock well MW-110, illustrated on the southwestern end of cross section B-B'. The downward vertical gradient between the residuum and the bedrock persists throughout the residential neighborhood to the southern limits of the Study Area at Old Arsenal Road.

5.4 Groundwater Chemistry

Results of the two rounds of sampling and VOC analysis of groundwater samples collected from new and existing groundwater monitoring wells in the Study Area is presented on **Table 4**. Existing wells not sampled during this investigation were sampled in October of 2014, and these results are

also included on **Table 4**. **Figure 5** posts the spatial distribution in plan view of VOC groundwater chemistry results above the method detection limit for each monitoring well in the SPBA and the off-Site residential area to the south.

As expected from previous investigations, relatively elevated concentrations of TCE and PCE were detected in groundwater samples collected in wells MW-161 to MW-163, within the boundary of the Harley-Davidson property. The highest concentrations occur in MW-162, with concentrations of 190 micrograms per liter (µg/l) of TCE and 700 µg/l of PCE. Concentrations detected in groundwater samples collected in the western portion of the SPBA are lower, but remain somewhat elevated. Concentrations to the east, in groundwater samples collected from well MW-161 are also elevated, with concentrations of 100 µg/l of TCE and 270 µg/l of PCE.

Groundwater concentrations in the first east-west line of shallow wells south of the SPBA along the northern east-west segment of Canterbury Lane (MW-166, MW-167 and MW-168, **Figure 5**) show substantially lower TCE and PCE concentrations than the wells in the SPBA. The highest concentrations of these compounds on this line of wells occur in MW-167, the center well, with concentrations of 2.6 µg/l of TCE and 8.6 µg/l of PCE. To the east of this well, groundwater from MW-166 detected 1 µg/l of TCE and 0.8 µg/l of PCE. To the west, groundwater samples from MW-168 detected no VOCs. Low detections of trihalomethane compounds, bromodichloromethane and chloroform, were also detected in wells MW-166, MW-167 and MW-170. These compounds are commonly present in chlorinated municipal water supplies, suggesting the potential localized presence of leaking municipal water supply lines. The water used during drilling of these investigation borings was not chlorinated; therefore, the presence of these substances is not an artifact of the drilling. These substances were not detected in the line of wells to the north in the SPBA, except in trace amounts, and therefore are not considered related to the Site.

For the three wells along the southern east-west segment of Canterbury Lane, analysis of groundwater from two wells, MW-169 and MW-170, detected no TCE or PCE. Analysis of groundwater from MW-171, the western-most well on this leg of Canterbury Lane, detected 0.36J µg/l of TCE and 2.4 µg/l of PCE. Groundwater from this particular well also contained 2-butanone (methyl ethyl ketone [MEK]) at 57 µg/l and trace concentrations of other compounds not considered to be COCs for the SPBA. It is noted, however, that there is a large differential between the first

and second round 2-butanone results for SPBA well MW-164. Because screening values for this compound are high (PADEP's MSC for used aquifers is 4000 µg/l, and EPA's target groundwater concentration corresponding to target indoor air is 44,000 µg/l), concentrations at the detected levels are not considered to be of concern.

Four shallow wells were constructed along Old Arsenal Road, which is the southern boundary of the residential area south of the SPBA. Groundwater samples analyzed from three of these wells had no detections of TCE or PCE. Groundwater from MW-174 detected 0.9 µg/l of TCE and 5.6 µg/l of PCE. There were also trace concentrations of trihalomethanes in three of the four wells.

Groundwater chemistry data collected in October 2014 from existing wells MW-109S and MW-110, located along Old Arsenal Road, and MW-108S, located east of the SPBA, were added to **Figure 5**. These wells were sampled in October 2014.

- Results of groundwater samples from MW-108S and MW109S detected no PCE or TCE indicating the eastern edge of the plume has been defined by this investigation.

- The sample collected from MW-110, screened in the shallow carbonate bedrock, showed concentrations of PCE (55 µg/l) and TCE (1.3 µg/l), somewhat higher than the shallow groundwater sample at adjacent well MW-174. The comparison shows a vertical chemical differential, and illustrates the importance of using the shallow component of groundwater for this vapor intrusion evaluation.

5.4.1 Screening Groundwater Concentrations

Following the process described in FSP Addendum #15, the results of groundwater sampling were evaluated using the USEPA's VISL Calculator (June 2015) to calculate the cumulative Cancer Risk (CR) and Hazard Index (HI) associated with maximum concentrations of all COCs constituting a VI concern detected at each monitoring well location.

The maximum concentration of each COC detected at each well was entered into this spreadsheet along with the temperature of groundwater derived from the average annual ambient air temperature in York, PA as an indicator of average groundwater temperature to calculate the VI CR and the VI Hazard Quotient (HQ). A groundwater-to-indoor air attenuation factor of 0.001 was used for these

calculations. The individual CR levels were summed for all COCs and compared to a Target Cancer Risk (TCR) of 10^{-4} and the individual HQs were summed to give the overall HI.

The work plan specified that the groundwater temperature used for the screening calculations was to be taken from the sampling records. A review of that temperature data, shown on **Table 5**, indicated a wide range of values, many of which are unrealistic for groundwater temperatures in York, PA. Our field measurements appeared to be variable, and probably were the result of the very low flows being produced from these low yielding wells, either caused by heating from the submersible pump or from the effects of air temperature and/or sunlight on the flow through cell.

For that reason, the average annual ambient air temperature (shown in **Appendix G**) was used in the VISL calculator. The average annual temperature is generally accepted as a good approximation of the groundwater temperature in Pennsylvania.

TABLE 5
STABILIZED TEMPERATURES OF GROUNDWATER SAMPLES USING LOW FLOW TECHNIQUES

	Sampling Event 1		Sampling Event 2	
Well ID	**Temp(°C)**	**Date**	**Temp(°C)**	**Date**
MW-161	11.77	03/17/15	13.76	04/09/15
MW-162	12.19	03/17/15	13.50	04/09/15
MW-163	11.12	03/17/15	12.81	04/08/15
MW-167	14.6	03/02/15	12.76	03/25/15
MW-171	14.0	03/03/15	11.73	03/25/15

VISL calculations were performed on groundwater sampling results of all newly installed shallow groundwater wells in the suspected source area on the fYNOP property. VISL calculations were also performed on groundwater sampling results from all newly installed shallow groundwater wells located off-Site, outside of the source area. **Appendix G** includes printed VISL spread sheet results and **Table 6** summarizes the screening results.

As expected, measured concentrations of TCE and PCE in samples from MW-161 and MW-162, the eastern-most wells on the Site property and in the suspected source area exceeded VISL screening criteria. MW-163, also on the Site property, with a maximum PCE concentration of 48 µg/l and TCE concentration of 2.7 µg/l, did not exceed VISL screening criteria. MW-165, with a maximum PCE concentration of 7.6 µg/l and TCE concentration of 17 µg/l, exceeded the screening criteria.

As summarized on **Table 6**, MW-167, the well with highest concentrations of TCE and PCE in the Canterbury Lane neighborhood, did not exceed the screening criteria as calculated by the VISL calculator, with a cumulative CR of 5 X 10^{-6} and an HQ of 0.3. Likewise, MW-171 fell below VISL's screening criteria with a cumulative CR of 9 X 10^{-7} and an HQ of 0.06. All other wells had lower concentrations, and the results included on **Table 6**, fell well below applicable screening criteria.

The sensitivity of the assumption to use the average annual ambient temperature was evaluated. The temperature for the off-site well with the highest concentrations of COCs (MW-167) was run through the VISL Calculator at 14.6°C, the highest sample temperature recorded in the field. The results were that the CR went from 4.95E-6 to 5.74E-6 and the HI went from 0.329 to 0.385. These results indicate that the decision to use the average annual ambient air temperature as the assumed groundwater temperature, which GSC feels is the more appropriate procedure, given the field results, does not significantly change the results of the screening process. Future work of this nature should make use of a calibrated in-well thermistor to avoid the potential of temperature changes resulting from the effects of sampling.

The FSP stated that for any monitoring location(s) within the residential area at which VOC concentrations observed in shallow groundwater exceeded a cumulative CR of 10^{-4} or a HI of 1, vadose zone investigations, including testing of undisturbed soil samples for physical characteristics and sampling of near-source soil gas (NSSG) at vapor probes, would be performed. Because the results indicate that neither the TCR nor the target HI was exceeded at any of the well locations in the Canterbury Lane/Old Arsenal Road residential area, vadose zone investigation was not necessary.

6 SUMMARY AND CONCLUSIONS

Historical accounts indicate that liquid waste containing VOCs was used to control weeds and reduce dust along the SPBA perimeter road. Previous investigations identify TCE and PCE as COCs in the SPBA. In 2005, results of a VI assessment of the SPBA, and the off-Site area to the south, concluded that the VI pathway due to volatilization from shallow groundwater is not complete (Langan, 2005). Thereafter, USEPA issued its Documentation of Environmental Indicator Determination finding that the VI pathway in the residential area off-Site in the vicinity of the SPBA was not significant (USEPA, 2005). The USEPA recently reviewed the 2005 VI assessment and concluded that the methodology and modeling approach that it previously approved for the 2005 VI assessment are no longer considered by USEPA to be reliable methods to estimate the potential for VI into neighboring residences. In August 2014, USEPA therefore requested more information to determine whether VI is a potentially complete pathway for COCs from the Site to enter neighboring residences.

A work plan, identified as Addendum #15, was sent to PADEP and USEPA. The plan was reviewed by USEPA, and after addressing comments, approved. The plan specified the use of USEPA's VISL calculator (Version 3.3.1, May 2014) pursuant to USEPA's current VI screening policy, to screen VOC concentrations in shallow groundwater in the wells and NSSG sample results. However, prior to completion of this report, a new version of the VISL calculator was released (June 2015), and the new version was used.

Fifteen stratigraphic borings were performed and a monitoring well was installed in each of the stratigraphic borings. Five of the monitoring wells were installed in the SPBA (see **Figures 1 through 3**). Ten monitoring wells were installed in the residential area south of the SPBA. Soils were sampled, and textures analyzed by a soils laboratory. Water levels in wells were measured, and two rounds of groundwater samples were collected and analyzed for VOCs.

Underlying soils in the vadose zone are classified by laboratory gradation analysis as loam, silt loam, silty clay loam and clay loam portions of the USDA trilinear diagram, and a few samples classified as sandy loam and sandy clay loam.

The lateral groundwater gradient slopes generally southward from the SPBA towards the off-Site residential area (**Figure 3**). Cross sections A-A' and B-B' (**Figure 4**) illustrate the strong downward vertical gradient of the groundwater that occurs in the residuum underlain by the limestone in the eastern corner of the SPBA and in the residential area to the south, and a corresponding downward flow path of groundwater from the on-Site source area in the SPBA through the residuum into the underlying carbonate aquifer, with limited lateral migration southward. The downward vertical head between the residuum and the bedrock persists throughout residential neighborhood to the southern limits of the Study Area, marked by Old Arsenal Road.

Two rounds of groundwater sampling in new and adjacent existing wells were analyzed for VOCs. As expected from investigations conducted by Langan, (Langan, 2005) and from the results of groundwater chemistry from preexisting wells MW-64 S&D, concentrations of TCE and PCE in the SPBA (i.e., within the boundary of the Harley-Davidson property) are elevated. Groundwater concentrations in the newly installed shallow wells in the Canterbury Lane neighborhood show substantially lower TCE and PCE concentrations, and no other significant concentrations of other VOCs with respect to vapor intrusion potential. The highest concentrations of these compounds in shallow off-Site groundwater occur in MW-167, with concentrations of 2.6 µg/l of TCE and 8.6 µg/l of PCE.

The results of groundwater sampling were evaluated using the USEPA's VISL Calculator (June 2015) to calculate the cumulative CR and HI associated with maximum concentrations of all COCs constituting a VI concern. As expected, MW-161 and MW-162, the eastern-most wells on the Site property, and MW-165, further to the west, in the suspected on-Site source area exceed screening criteria. No groundwater chemistry results in off-Site wells exceed the screening criteria as calculated by the VISL calculator. The comparisons of the VISL results indicate that neither the TCR nor the target HI have been exceeded in groundwater sampled in the Canterbury Lane neighborhood. As a result of the shallow groundwater chemistry results the proposed vadose zone investigation was not conducted.

The results of this investigation will be incorporated into the groundwater remedial investigation (part 2) report and further evaluated in the groundwater risk assessment. The completion of these documents is scheduled for the first quarter of 2016.

7 REFERENCES

GSC, 2011. Supplemental Remedial Investigation Groundwater Report (Part 1). September.

GSC, 2012. Field Sampling Plan (FSP) for Part 2 of the Supplemental Groundwater Remedial Investigation. April.

GSC, 2014. Quality Assurance Project Plan (QAPP) Former York Naval Ordnance Plant. June 2012, Revised August 2014.

Langan, 2005. Indoor Vapor Pathway Screening Assessment (Draft), Supplemental RI Report, Harley-Davidson Motor Company Operations, Inc., York, Pennsylvania, March.

USEPA, 2005. Documentation of Environmnetal Indicator Determination, RCRA Corrective Action, signed September 15.

USEPA, 2014. Letter from Griff Miller of USEPA to Steve Snyder of GSC. October 31.

Email from Griff Miller to Stephen Snyder, August 14, 2014.

Tables

TABLE 1
PHYSICAL WELL DATA TABLE
SPBA Report
former York Naval Ordnance Plant, York, PA

Well ID	Northing (Y) grid feet	Easting (X) grid feet	Ground Surface Elevation ft. amsl	Reference Point Elevation ft. amsl	Stickup ft.	Surface Completion	Installation Date	Total Drilled Depth ft. bgs	Top of Well Screen Depth ft. bgs	Bottom of Well Screen Depth ft. bgs	Top of Well Screen ft. amsl	Bottom of Well Screen ft. amsl	Screen Length ft.	Screen Diameter in.	Slot Size in.	Screen Material	Casing Diameter in.	Casing Material
MW-161	238989.580	2260208.866	413.78	415.92	2.14	Standpipe	2/10/2015	66.0	55.7	65.7	358.1	348.1	10	2	0.010	PVC	2	PVC
MW-162	238996.758	2260012.338	413.37	415.78	2.41	Standpipe	2/6/2015	57.0	43.0	53.0	370.4	360.4	10	2	0.010	PVC	2	PVC
MW-163	238999.212	2259838.321	416.97	419.41	2.44	Standpipe	2/4/2015	57.0	35.0	55.0	382.0	362.0	20	2	0.010	PVC	2	PVC
MW-164	238954.175	2259623.933	422.48	424.50	2.02	Standpipe	1/29/2015	53.0	43.0	53.0	379.5	369.5	10	2	0.010	PVC	2	PVC
MW-165	238842.029	2259411.882	418.74	419.41	0.67	Standpipe	1/2/2015	72.5	50.5	70.5	368.2	348.2	20	2	0.010	PVC	2	PVC
MW-166	238860.837	2260239.616	402.79	402.03	-0.76	Manhole	11/17/2014	60.0	41.0	51.0	361.8	351.8	10	2	0.010	PVC	2	PVC
MW-167	238861.218	2260043.563	399.55	399.07	-0.48	Manhole	12/4/2014	60.0	41.0	51.0	358.6	348.6	10	2	0.010	PVC	2	PVC
MW-168	238861.827	2259872.680	396.05	395.19	-0.86	Manhole	12/12/2014	57.0	31.0	41.0	365.1	355.1	10	2	0.010	PVC	2	PVC
MW-169	238579.721	2260197.951	389.87	389.43	-0.44	Manhole	2/5/2015	47.0	37.0	47.0	352.9	342.9	10	2	0.010	PVC	2	PVC
MW-170	238575.643	2259962.593	385.96	385.60	-0.36	Manhole	12/19/2014	40.0	21.3	31.3	364.7	354.7	10	2	0.010	PVC	2	PVC
MW-171	238616.679	2259762.499	387.01	386.75	-0.26	Manhole	1/21/2015	45.5	32.8	42.8	354.2	344.2	10	2	0.010	PVC	2	PVC
MW-172	238253.888	2260196.735	385.48	385.03	-0.45	Manhole	12/18/2014	40.0	27.5	37.5	358.0	348.0	10	2	0.010	PVC	2	PVC
MW-173	238249.237	2259945.012	382.07	381.57	-0.50	Manhole	12/10/2014	40.0	21.6	31.6	360.5	350.5	10	2	0.010	PVC	2	PVC
MW-174	238247.838	2259640.885	379.01	378.31	-0.70	Manhole	12/15/2014	35.0	21.0	31.0	358.0	348.0	10	2	0.010	PVC	2	PVC
MW-175	238248.740	2259407.100	376.49	376.18	-0.31	Manhole	1/7/2015	37.0	18.8	28.8	357.7	347.7	10	2	0.010	PVC	2	PVC

TABLE 3
POTENTIOMETRIC ELEVATION DATA
SPBA Report
former York Naval Ordnance Plant, York, PA

Well ID	Reference Point Elevation (ft. amsl)	Depth to Water (ft. below RP)	Ground-water Elevation (ft. amsl)	Depth to Water (ft. below RP)	Ground-water Elevation (ft. amsl)
		2/20/2015		4/14/2015	
MW-64D	416.43	53.93	362.50	61.02	355.41
MW-64S	416.34	NM	NM	35.2	381.14
MW-108S	425.46	36.92	388.54	26.07	399.39
MW-109S	388.39	37.80	350.59	35.72	352.67
MW-110	378.36	27.96	350.40	25.85	352.51
MW-141A	416.96	NM	NM	47.94	369.02
MW-161	415.92	63.52	352.40	60.72	355.20
MW-162	415.78	46.20	369.58	40.93	374.85
MW-163	419.41	35.07	384.34	32.18	387.23
MW-164	424.50	38.00	386.50	37.67	386.83
MW-165	419.41	43.50	375.91	40.27	379.14
MW-166	402.03	45.39	356.64	38.99	363.04
MW-167	399.07	37.05	362.02	29.47	369.60
MW-168	395.19	21.92	373.27	18.46	376.73
MW-169	389.43	NM	NM	29.99	359.44
MW-170	385.60	29.22	356.38	23.75	361.85
MW-171	386.75	36.10	350.65	33.98	352.77
MW-172	385.03	32.70	352.33	29.75	355.28
MW-173	381.57	19.84	361.73	14.44	367.13
MW-174	378.31	27.50	350.81	25.15	353.16
MW-175	376.18	26.85	349.33	24.65	351.53

Table 4
Groundwater Chemistry Data Summary – Southern Property Boundary Area Vapor Intrusion Investigation
Former York Naval Ordnance Plant - York, PA

	HD On-Site															
Location/ID	**MW-64S**	**MW-64S**	**MW-64D**	**MW-64D**	**MW-141A**	**MW-141A**	**MW-161**	**MW-161**	**MW-162**	**MW-162**	**MW-163**	**MW-163**	**MW-164**	**MW-164**	**MW-165**	**MW-165**
Parameter Sample Date	**9/12/13**	**4/16/15**	**10/22/14**	**4/14/15**	**10/21/14**	**4/15/15**	**3/17/15**	**4/9/15**	**3/18/15**	**4/10/15**	**3/17/15**	**4/8/15**	**3/16/15**	**4/8/15**	**3/17/15**	**4/10/15**
TOTAL VOC																
Total VOC	173	115	26.4	770	11.6	16.2	360.37	350.3	700	891.2	42.99	50.92	2.38	98.27	24.94	23.4
Volatile Organic Compound																
1,1,1,2-Tetrachloroethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	1.2 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloropropane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	2000 U	200 U	200 U	500 U	200 U	200 U	200 U	200 U	800 U	800 U	200 U	200 U	200 U	200 U	200 U	200 U
2-Butanone	50 U	5 U	5.0 U	13 U	5 U	5.0 U	5.0 U	5.0 U	20 U	20 U	5.0 U	5.0 U	0.95 J	97	5.0 U	5.0 U
2-Hexanone	50 U	5 U	5.0 U	13 U	5 U	5.0 U	5.0 U	5.0 U	20 U	20 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methyl-2-Pentanone	50 U	5 U	5.0 U	13 U	5 U	5.0 U	5.0 U	5.0 U	20 U	20 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Acetone	50 U	5 U	5.0 U	13 U	5 U	5.3	5.0 U	5.0 U	20 U	20 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Acrylonitrile	200 U	20 U	20 U	50 U	20 U	20 U	20 U	20 U	80 U	80 U	20 U	20 U	20 U	20 U	20 U	20 U
Benzene	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromochloromethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Disulfide	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	R	1.0 U	R	1.0 U	1.0 U	1.0 U	R
Carbon Tetrachloride	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorodibromomethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	0.37 J	0.30 J	4.0 U	4.0 U	0.29 J	0.32 J	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	10 U	1 U	1.0 U	2.5 U	1.4	1.4	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl tert-butyl ether	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	63	70	19	520	6.8	6.9	270	250	540	700	40	48	0.47 J	0.51 J	7.6	7.4 J
Toluene	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	10 U	1 U*	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	110	45	7.4	250	3.4	2.6	90	100	160	190	2.7	2.6	0.65 J	0.76 J	17	16 J
Vinyl Chloride	10 U	1 U	1.0 U	2.5 U	1 U	1.0 U	1.0 U	1.0 U	4.0 U	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes (Total)	30 U	3 U	3.0 U	7.5 U	3 U	3.0 U	3.0 U	3.0 U	12 U	12 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U

U = Not detected. J = Organics; estimated. R = Restult has been rejected.

Table 4
Groundwater Chemistry Data Summary – Southern Property Boundary Area Vapor Intrusion Investigation
Former York Naval Ordnance Plant - York, PA

	Off-Site																						
Location/ID	**MW-108S**	**MW-108D**	**MW-109S**	**MW-109D**	**MW-166**	**MW-166**	**MW-167**	**MW-167**	**MW-168**	**MW-168**	**MW-169**	**MW-169**	**MW-170**	**MW-170**	**MW-171**	**MW-171**	**MW-172**	**MW-172**	**MW-173**	**MW-173**	**MW-174**	**MW-174**	**MW-175**	**MW-175**
Parameter / Sample Date	**10/22/14**	**10/21/14**	**10/24/14**	**10/24/14**	**3/3/15**	**3/25/15**	**3/3/15**	**3/26/15**	**3/4/15**	**3/25/15**	**3/18/15**	**4/10/15**	**3/4/15**	**3/25/15**	**3/3/15**	**3/25/15**	**3/2/15**	**3/25/15**	**3/3/15**	**3/25/15**	**3/3/15**	**3/25/15**	**3/2/15**	**3/25/15**
TOTAL VOC																								
Total VOC	1	1.32	8.6	6.77	4.7	4.19	15.04	11.81	0	0	0.22	0.14	0.79	0.27	77.928	45.53	0.73	0	0	0	7.08	6.99	2.47	0.9
Volatile Organic Compound																								
1,1,1,2-Tetrachloroethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromoethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloropropane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U
2-Butanone	5.0 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	57	32	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Hexanone	5.0 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	0.58 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methyl-2-Pentanone	5.0 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1.6 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Acetone	5.0 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	14	10	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Acrylonitrile	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	0.72 J	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Benzene	1.0 U	1 U	4	0.87 J	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.4	0.17 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromochloromethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	1.0 U	1 U	1.0 U	1.0 U	0.50 J	0.38 J	0.84 J	0.31 J	1.0 U	1.0 U	1.0 U	1.0 U	0.17 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.31 J	1.0 U	0.42 J	0.16 J
Bromoform	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Disulfide	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.29 J	0.31 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Tetrachloride	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorodibromomethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.15 J	1.0 U
Chloroethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform	1	0.37 J	1.0 U	1.0 U	2.4	2	3	1.5	1.0 U	1.0 U	1.0 U	1.0 U	0.62 J	0.27 J	1.0 U	1.0 U	0.73 J	1.0 U	1.0 U	1.0 U	1.7	0.50 J	1.9	0.74 J
Chloromethane	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl tert-butyl ether	1.0 U	1 U	4.6	5.9	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.098 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	1.0 U	0.43 J	1.0 U	1.0 U	0.80 J	0.85 J	8.6	7.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1	2.4	1.0 U	1.0 U	1.0 U	1.0 U	4.7	5.6	1.0 U	1.0 U
Toluene	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.1	0.29 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	1.0 U	0.52 J	1.0 U	1.0 U	1	0.96 J	2.6	2.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.14 J	0.36 J	1.0 U	1.0 U	1.0 U	1.0 U	0.37 J	0.89 J	1.0 U	1.0 U
Vinyl Chloride	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes (Total)	3.0 U	3 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U

U = Not detected. J = Organics; estimated. R = Restult has been rejected.

Table 6
VISL Screening Results

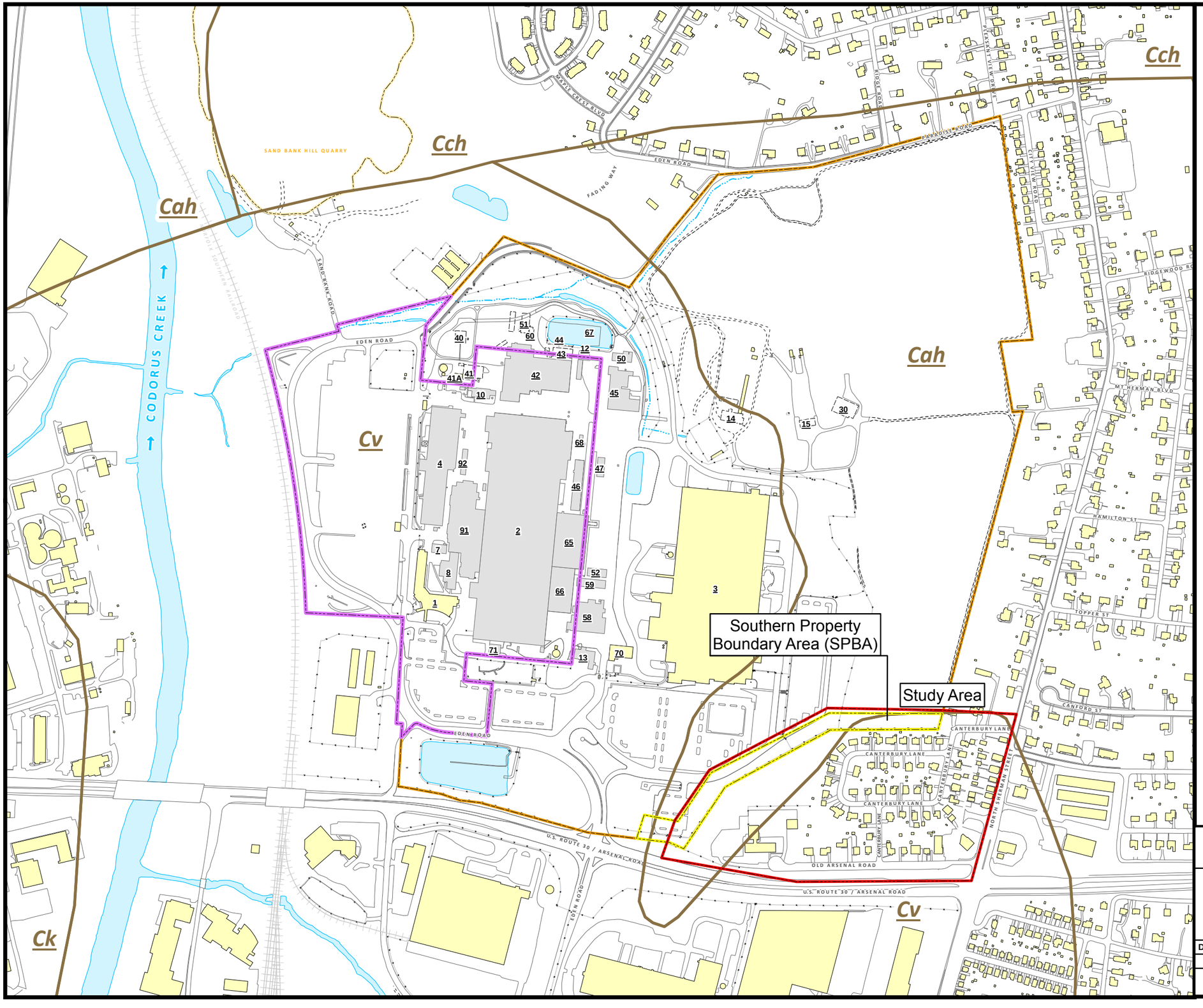
	SOURCE AREA (ON-SITE) WELLS									
	VISL Calculated Risk From Maximum Reported Groundwater Concentration									
	MW-161		MW-162		MW-163		MW-164		MW-165	
Chemical Name	**CR**	**HQ**	**CR**	**HQ**	**CR**	**HQ**	**CR**	**HQ**	**CR**	**HQ**
1,1-Dichloroethene			No IUR	3.71E-03						
2-Butanone							No IUR	2.23E-05		
Chloroform	2.51E-07	3.00E-04			2.17E-07	2.59E-04				
Methylene chloride			1.05E-09	1.71E-04	1.73E-10	2.81E-05	2.33E-10	3.78E-05	2.56E-10	4.15E-05
Tetrachloroethene	8.53E-06	2.21E+00	2.21E-05	5.72E+00	1.52E-06	3.92E-01	1.61E-08	4.17E-03	2.40E-07	6.21E-02
Trichloroethene	8.30E-05	9.85E+00	1.58E-04	1.87E+01	2.24E-06	2.66E-01	6.31E-07	7.48E-02	1.41E-05	1.67E+00
CUMULATIVE (SUM)	**9.E-05**	**1.E+01**	**2.E-04**	**2.E+01**	**4.E-06**	**7.E-01**	**6.E-07**	**8.E-02**	**1.E-05**	**2.E+00**

	NEIGHBORHOOD (OFF-SITE) WELLS															
	VISL Calculated Risk From Maximum Reported Groundwater Concentration															
	MW-166		MW-167		MW-169		MW-170		MW-171		MW-172		MW-174		MW-175	
Chemical Name	**CR**	**HQ**	**CR**	**HQ**	**CR**	**HQ**	**CR**	**HQ**	**CR**	**HQ**	**CR**	**HQ**	**CR**	**HQ**	**CR**	**HQ**
2-Butanone									No IUR	1.31E-05						
2-Hexanone									No IUR	3.15E-05						
4-Methyl-2-Pentanone									No IUR	1.33E-06						
Acetone									No IUR	3.42E-07						
Acrylonitrile									4.90E-08	9.70E-04						
Benzene									4.66E-07	5.36E-03						
Bromodichloromethane	2.89E-07	No RfC	4.85E-07	No RfC			9.81E-08	No RfC							2.42E-07	No RfC
Carbon Disulfide									No IUR	1.48E-04						
Chlorodibromomethane															2.76E-08	No RfC
Chloroform	1.63E-06	1.94E-03	2.03E-06	2.43E-03			4.20E-07	5.02E-04			4.95E-07	5.91E-04			1.29E-06	1.54E-03
Methylene chloride					1.66E-10	2.69E-05										
Styrene									No IUR	4.64E-06						
Tetrachloroethene	2.68E-08	6.95E-03	2.72E-07	7.03E-02					7.58E-08	1.96E-02			1.77E-07	4.58E-02		
Toluene									No IUR	2.79E-05						
Trichloroethene	8.30E-07	9.85E-02	2.16E-06	2.56E-01					2.99E-07	3.54E-02			7.39E-07	8.76E-02		
CUMULATIVE (SUM)	**3.E-06**	**1.E-01**	**5.E-06**	**3.E-01**	**2.E-10**	**3.E-05**	**5.E-07**	**5.E-04**	**9.E-07**	**6.E-02**	**5.E-07**	**6.E-04**	**9.E-07**	**1.E-01**	**2.E-06**	**2.E-03**

Key:
CR - VI Carcenogenic Risk from VISL Calculated Indoor Air Concentration
HQ - VI Hazard from VISL Calculated Indoor Air Concentration.
IUR - The inhalation unit risk factor for the chemical. This is the potential carcinogenic risk per unit concentration exposure associated with inhalation of the chemical.
RfC - The reference concentration for the chemical from the EPA RSL worksheet. This is the potential noncancer hazard per unit concentration exposure associated with inhalation of the chemical.

Notes:
Modeled Exposure Scenario was Residential for All Wells
Target Risk for Carcinogens is 1.00E-04
Target Hazard Quotient for Non-Carcinogens is 1.0
Average Groundwater Temperature used for VISL was 11.7 degrees celcius which is the average annual air temperature for York, PA
No reported concentratons in well MW-168 or MW-173
Blanks indicate no concentration above the laboratory reporting limit.

Figures



LEGEND

- Study Area
- Southeastern Property Boundary Area (SPBA)
- Cah — Antietam & Harpers Formation, undiv.
- Cv — Vintage Formation
- Ck — Kinzers Formation
- Cl — Ledger Formation
- West Campus Property Line
- Harley-Davidson Property Boundary
- Railroad
- Road (Paved)
- Road Curb
- Road (Unpaved)
- Walkway
- Fenceline
- Existing Water Feature
- Existing Building
- Demolished
- Demolished/Slab Removed

N
W E
S

Scale (feet)
0 125 250 500

Figure 1

Former York Naval Ordnance Plant
1425 Eden Road, York, PA 17402

Southern Property Boundary Area
Vapor Intrusion Investigation
Study Area Location Map

DRAWN BY: AGM	CHECKED AND APPROVED BY:SMS	DATE: 6/25/15

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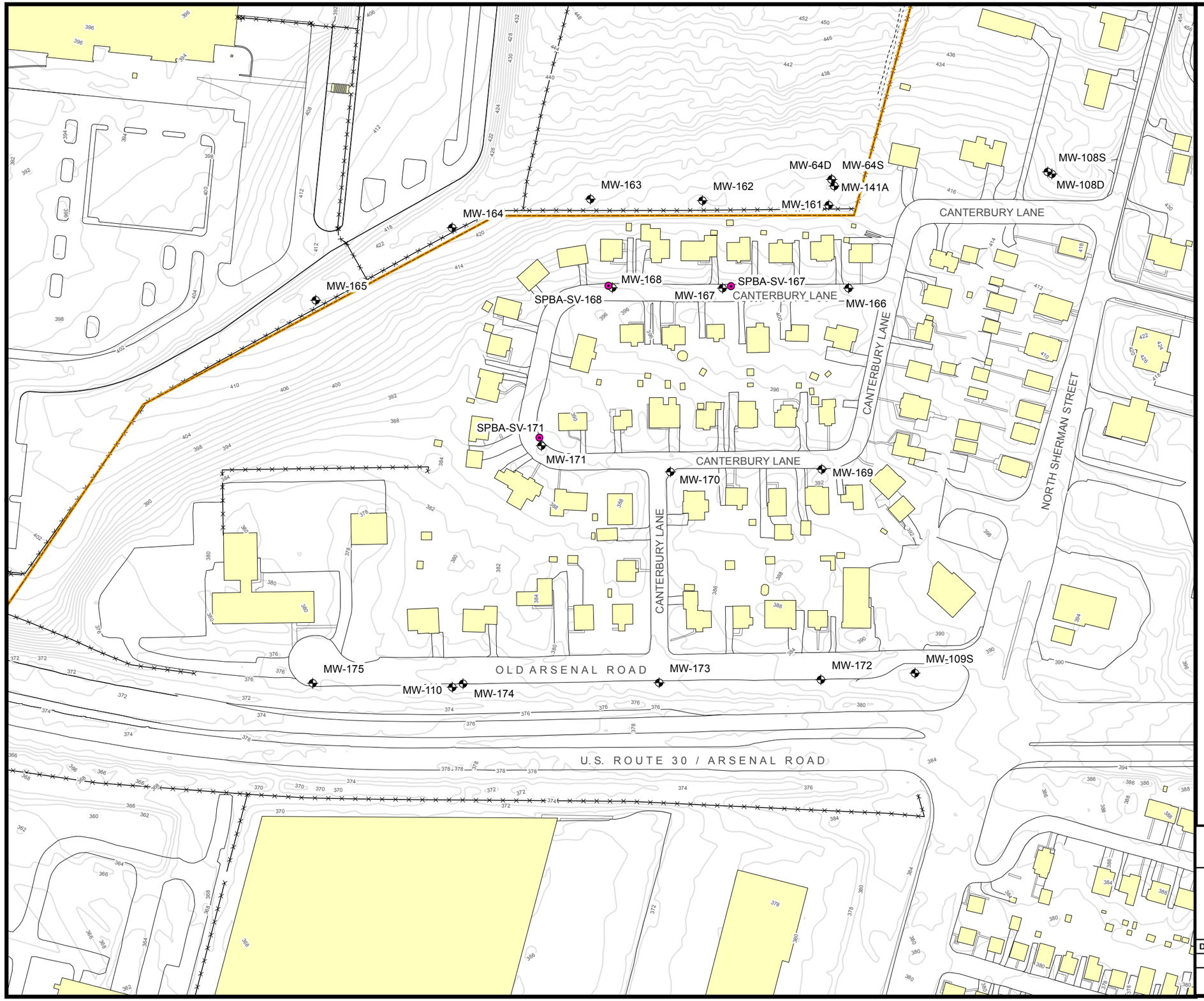

LEGEND

- Soil Vapor Point
- Monitoring Well
- Harley-Davidson Property Boundary
- Road (Paved)
- Road Curb
- Road (Unpaved)
- Walkway
- Fenceline
- Existing Building
- Surface Contour (2' Intervals)

N
W E
S

Scale (feet)
0 37.5 75 150

Figure 2

Former York Naval Ordnance Plant
1425 Eden Road, York, PA 17402

Southern Property Boundary Area
Vapor Intrusion Investigation
Well and Soil Vapor Probe Locations

DRAWN BY: AGM	CHECKED AND APPROVED BY:SMS	DATE: 6/25/15

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A **West** — **A'** **East**

MW-165 | MW-164 | MW-163 | MW-162 | MW-161 | MW-64D | MW-64S | MW-141A | MW-108D | MW-108S

Sandstone | Residuum | Limestone | Sandstone

MW-165 TCE | PCE RND 1: 17 | 7.6 RND 2: 16 | 7.4
MW-165 379.14
MW-164 TCE | PCE RND 1: 0.65 J | 0.47 J RND 2: 0.76 J | 0.51 J
MW-164 386.83
MW-163 TCE | PCE RND 1: 2.7 | 40 RND 2: 2.6 | 48
MW-163 387.23
MW-162 TCE | PCE RND 1: 160 | 540 RND 2: 190 | 700
MW-162 374.85
MW-161 TCE | PCE RND 1: 90 | 270 RND 2: 100 | 250
MW-161 355.20
MW-64D TCE | PCE RND 1: NM | NM RND 2: 250 | 520
MW-64D 355.41
MW-64S TCE | PCE RND 1: NM | NM RND 2: 45 | 70
MW-64S 381.14
MW-141A TCE | PCE RND 1: NM | NM RND 2: 2.6 | 6.9
MW-141A* 369.02
MW-108S 399.39

Open Interval for MW-141A at elevation 114-214 MSL

Elevation in Feet Relative to Mean Sea Level

Scale: 1-Inch =12.5 feet (Vertical) and 1-inch=50 feet (Horizontal) and Vertical Exaggeration 4x

B **Southwest** — **B'** **Northeast**

MW-110 | MW-174 | MW-170 | MW-167 | MW-161 | MW-141A | MW-64D | MW-64S

Residuum | Limestone

MW-174 TCE | PCE RND 1: 0.37 J | 4.7 RND 2: 0.89 J | 5.6
MW-174 353.16
MW-110 352.51
MW-170 TCE | PCE RND 1: 1 U | 1 U RND 2: 1 U | 1 U
MW-170 381.85
MW-167 TCE | PCE RND 1: 2.6 | 8.6 RND 2: 2.4 | 7.6
MW-167 369.60
MW-161 TCE | PCE RND 1: 90 | 270 RND 2: 100 | 250
MW-161 355.20
MW-64D 355.41
MW-64D TCE | PCE RND 1: NM | NM RND 2: 250 | 520
MW-64S TCE | PCE RND 1: NM | NM RND 2: 45 | 70
MW-64S 381.14
MW-141A TCE | PCE RND 1: NM | NM RND 2: 2.6 | 6.9
MW-141A* 369.02

Open Interval for MW-141A at elevation 114-214 MSL

Elevation in Feet Relative to Mean Sea Level

Scale: 1-Inch =12.5 feet (Vertical) and 1-inch=50 feet (Horizontal) and Vertical Exaggeration 4x

Legend

- Screen/Open Interval
- Void
- Flow Direction
- Contour
- Contour (Inferred)
- Water Table
- Residuum
- Limestone
- Sandstone
- Piezometric Level

343.61 Groundwater Elevation Measured on April 14, 2015

Location ID
Trichloroethene and Tetrachloroethylene
Round 1 2015 SPBA Sampling
Round 2 2015 SPBA Sampling

NOTE:
Chemistry results in ug/L.
NM = not measured.
J = Estimated concentration.
U = not detected above reported value.

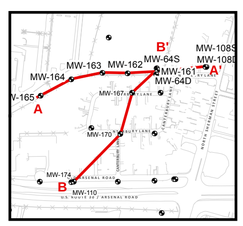

Figure 3

Former York Naval Ordnance Plant
1425 Eden Road, York, PA 17402

Southern Property Boundary Area
Vapor Intrusion Investigation
Cross Section
SPA A-A' and B-B'

DRAWN BY: AGM	CHECKED AND APPROVED BY: SMS	DATE: 6/25/15

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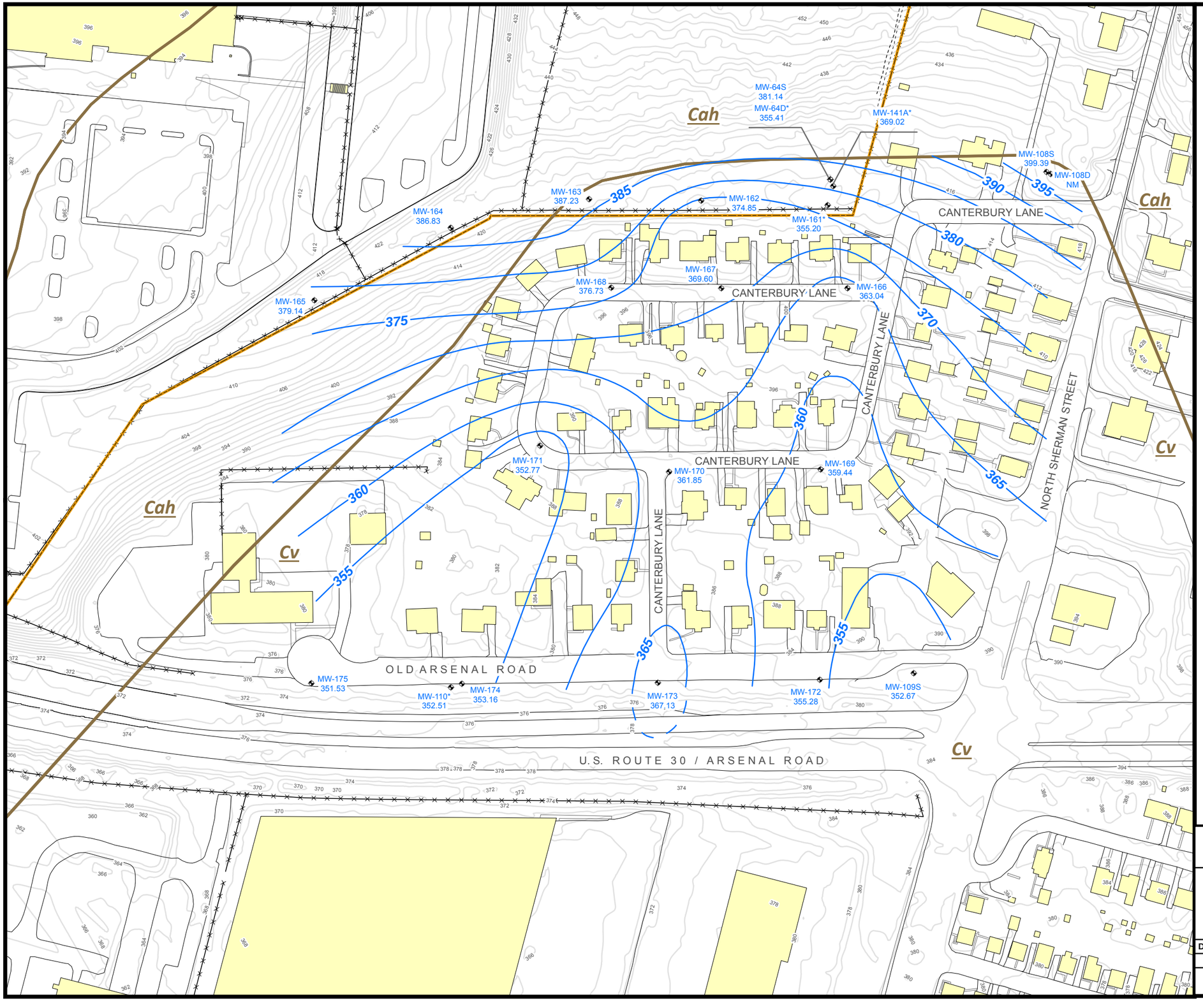

LEGEND

- Monitoring Well
- Groundwater Contour
- Groundwater Contour (Inferred)
- Cah — Antietam & Harpers Formation, undiv.
- Cv — Vintage Formation
- Harley-Davidson Property Boundary
- Road (Paved)
- Road Curb
- Road (Unpaved)
- Walkway
- Fenceline
- Existing Building
- Surface Contour (2' Intervals)

Note:
1) Water levles measured 4/14/2015.
2) Contours are in Feet Above Mean Sea Level.
3) Water levels for deeper wells marked with * not used in contouring.
4) NM= not measured.

N
W E
S

Scale (feet)
0 37.5 75 150

Figure 4

Former York Naval Ordnance Plant
1425 Eden Road, York, PA 17402

Southern Property Boundary Area
Vapor Intrusion Investigation
Water Table Contour Map

DRAWN BY: AGM	CHECKED AND APPROVED BY:SMS	DATE: 6/25/15

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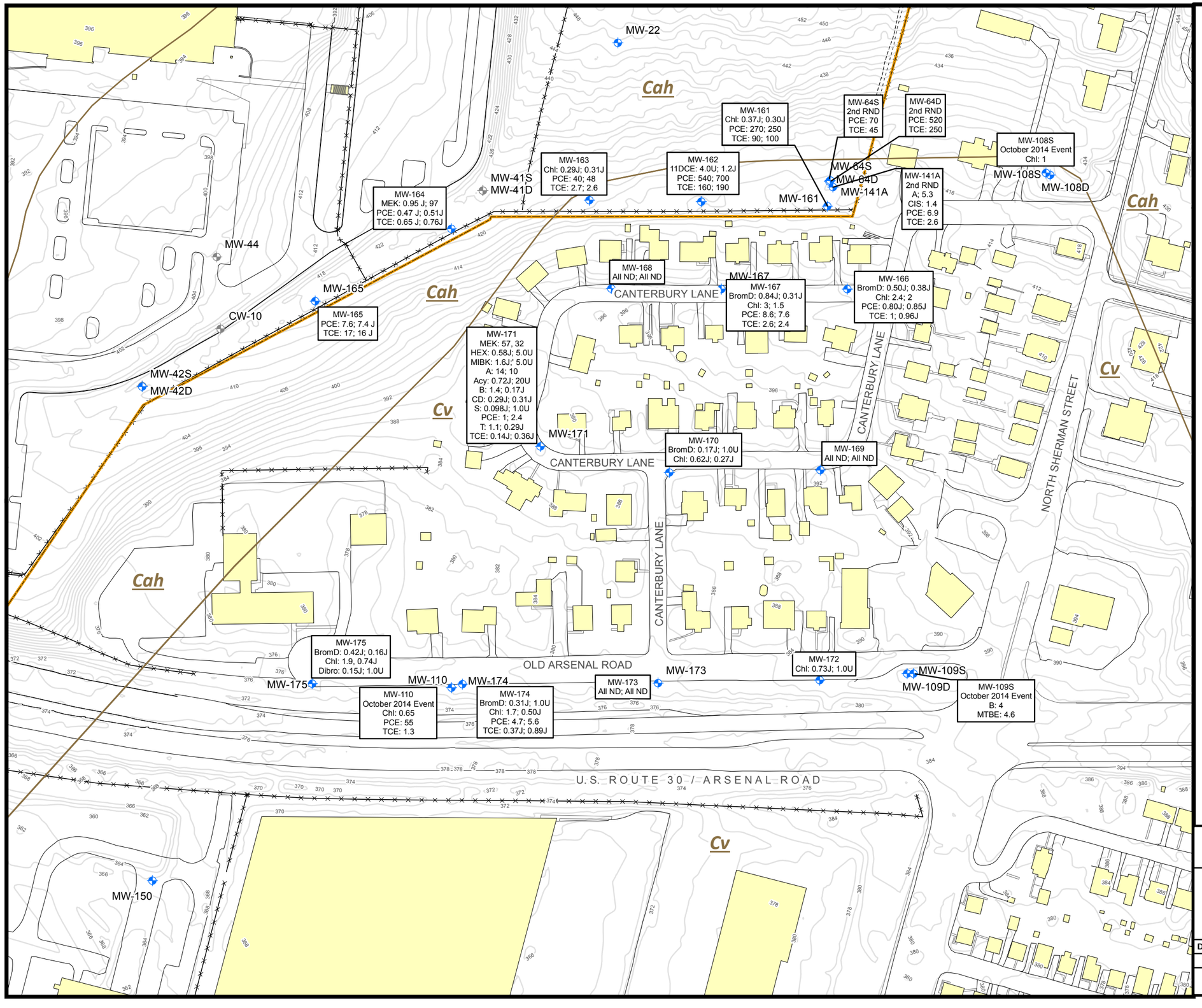

LEGEND

- Abandoned Well
- Monitoring Well
- Cah — Antietam & Harpers Formation, undiv.
- Cv — Vintage Formation
- Harley-Davidson Property Boundary
- Road (Paved)
- Road Curb
- Road (Unpaved)
- Walkway
- Fenceline
- Existing Building
- Surface Contour (2' Intervals)

Well ID
1st Result Rnd 1: 2nd Result Rnd 2
11DCE; 1,1-Dichloroethene
MEK: 2-Butanone
HEX: 2-Hexanone
MIBK: 4-Methyl-2-pentanone
MTBE: Methyl tert-butyl ether
A: Acetone
Acy: Acrylonitrile
B: Benzene
Bromch: Bromochloromethane
BromD: Bromodichloromethane
CD: Carbon disulfide
Chl: Chloroform
CIS: cis-1,2-Dichloroethene
Dibro: Dibromochloromethane
S: Styrene
PCE: Tetrachloroethene
T: Toluene
TCE: Trichloroethene

NOTE:
Chemistry results in ug/L.
NM = Not measured.
ND = Not detected.
J = Estimated concentration.
U = Not detected above reported value.

N
W E
S

Scale (feet)
0 37.5 75 150

Figure 5

Former York Naval Ordnance Plant
1425 Eden Road, York, PA 17402

Southern Property Boundary Area
Shallow Groundwater Investigation
Chemistry Results

DRAWN BY: AGM	CHECKED AND APPROVED BY: SMS	DATE: 6/25/15

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GROUNDWATER SCIENCES CORPORATION

Appendices

Appendix A

Monitoring Well Logs

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-161

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***12/2914-12/30/14, 2/915-2/10/15***

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***HSA, Geoprobe Dual-Tube Sampling***
DEVELOPMENT DATE:	***2/12/15-2/13/15, 2/20/15***
LOCATION:	***South Property Boundary Area***

NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to refusal at 50'. 4 1/4 ID HSA advanced to 66'. 2" PVC monitoring well installed 2/11/15.

SURFACE ELEVATION	413.78' AMSL
EASTING	2260208.866
NORTHING	238989.580

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
-4					-4		
-2					-2		6" Standpipe with locking cap
							Locking compression cap
0			Very dark brown 10YR 2/2, Topsoil. Moist		0		Concrete surface pad
			Limestone GRAVEL fill. Moist.				
2			10YR 5/4 yellowish brown, fine to coarse SAND, some Clayey Silt, trace fine Gravel. Moist.		2		#1 Sand pack (1.0'-2.0')
			5YR 4/4 reddish brown, Clayey SILT, some fine to coarse Sand, trace fine Gravel. Moist.				
4					4		8" HSA borehole (0-66')
			Reddish yellow 7.5YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.				
6					6		
			Light gray 5Y 7/2, coarse GRAVEL, trace fine to coarse Sand, trace Clayey Silt. Moist.				2" PVC riser, (0'-55.7')
	4.6/5.0	S1/1 to S11/1	Yellowish brown 10YR 5/4, fine to coarse SAND, some Clayey Silt, little fine Gravel. Moist.				
8			Yellowish brown 10YR 5/4, Clayey SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist.		8		
			Yellowish brown 10YR 5/4, fine to coarse GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.				
10					10		Portland/benseal grout (2.0'-49.8')
			Yellowish red 5YR 5/6, Clayey SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist. Grayish brown organic material at 10.3'.				
12			Yellowish red 5YR 5/6, fine to coarse GRAVEL, some Clayey Silt, little fine to coarse Sand. Moist.		12		
	5.0/5.0	S1/2 to S12/2	Reddish yellow 7.5YR 6/6, CLAY & SILT, some fine to coarse Gravel, some fine to coarse Sand, trace fine Gravel. Moist.				
14					14		
			Brownish yellow 10YR 6/6, SILT, little fine Sand. Moist.				
			Brownish yellow 10YR 6/6, SILT, some fine Gravel, little				

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
16			fine to coarse Sand. Moist.		16		
			Brownish yellow 10YR 6/6, fine to coarse subangular quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.				
18	5.0/5.0	S1/3 to S12/3	Brownish yellow 10YR 6/6, SILT & CLAY and fine to coarse Sand, trace fine to coarse subangular quartzite Gravel. Moist.		18		
20			Brownish yellow 10YR 6/6, SILT & CLAY, trace fine Sand. Moist.		20		8" HSA borehole (0-66')
			Brownish yellow 10YR 6/6, SILT & CLAY, trace fine to coarse Sand, trace fine Gravel. Moist.				
22			Brownish yellow 10YR 6/6, CLAY & SILT, some fine to coarse Sand, trace fine Gravel. Moist.		22		
	5.0/5.0	S1/4 to S12/4	Brownish yellow 10YR 6/6, SILT & CLAY, some fine to coarse Gravel, little fine to coarse Sand. Moist.				
24			Brownish yellow 10YR 6/6, SILT & CLAY, trace fine to coarse Sand, trace fine Gravel. Moist.		24		
			Light red 2.5YR 6/6, fine to coarse subangular to subrounded quartzite GRAVEL, some Silt & Clay, little fine to coarse Sand. Moist.				2" PVC riser, (0'-55.7')
26			Red 10R 5/6, CLAY & SILT, some fine to coarse Sand, little fine subangular to subrounded quartzite GRAVEL. Moist.		26		
	5.0/5.0	S1/5 to S12/5					
28			Brownish yellow 10YR 6/8, Clayey SILT, some fine to coarse Sand, trace fine Gravel. Moist.		28		
			Brownish yellow 10YR 6/8, fine to coarse subangular to subrounded quartzite GRAVEL, some Silt & Clay, little fine to coarse Sand. Moist.				
30			Reddish yellow 7.5YR 6/8, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist. Mottled reddish brown.		30		Portland/benseal grout (2.0'-49.8')
	3.4/2.5	S1/6 to S6/6					
32			Reddish yellow 7.5YR 6/8, CLAY & SILT, little fine to coarse Sand, trace fine Gravel. Moist. Mottled reddish brown.		32		
			Brownish yellow 10YR 6/8, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.				
34	3.4/2.5	S1/7 to S6/7	Brownish yellow 10YR 6/8, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist. Wet 35.4'-35.8' and 36.8'-37.0'.		34		
36	5.0/2.5	S1/8 to S6/8			36		
38					38		

GROUNDWATER SCIENCES CORPORATION

***GEOLOGIC LOG:* MW-161**

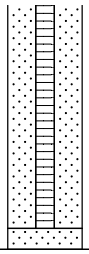
PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
	3.3/2.5	S1/9 to S6/9					
40	4.4/2.5	S1/10 to S6/10	Brownish yellow 10YR 6/6, CLAY & SILT, little fine to coarse Sand, little fine Gravel. Moist.		40		8" HSA borehole (0-66')
42			Brownish yellow 10YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine Gravel. Moist.		42		2" PVC riser, (0'-55.7')
44	2.0/2.5	S1/11 to S4/11	No Recovery. Sample fell out of bottom of tube into borehole.		44		
46	5.0/2.5	S1/12 to S6/12	Brownish yellow 10YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine Gravel. Moist. Wet 43.3'-43.7'.		46		Portland/benseal grout (2.0'-49.8')
48	3.6/2.5	N/A	Yellowish brown 10YR 5/6 CLAY & SILT, little fine to coarse Sand, trace fine Gravel. Very moist with wet pockets & seams, wet below 49.5'.		48		
50			Soil not sampled. The borehole was deepened with augers after macrocore refusal. The lower 15 feet of augers and cutter head were coated in Silt & Clay.		50		Bentonite chip annular seal (49.8'-53')
52					52		
54					54		#1 Sand pack (53'-66')
56					56		
58	N/A	N/A			58		2" PVC 10-slot screen, (55.7'-65.7')
60					60		
62					62		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-161**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
64					64		8" HSA borehole (0-66') 2" PVC 10-slot screen, (55.7'-65.7')
66					66		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-162

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***11/6/14, 12/29/14, 2/5/15-2/6/15***

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***HSA, Geoprobe Dual-Tube Sampling***
DEVELOPMENT DATE:	***2/12/15-2/13/15***
LOCATION:	***South Property Boundary Area***

NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to refusal at 56.9'. 4 1/4 ID HSA advanced to 57'. 2" PVC monitoring well installed 2/6/15.

SURFACE ELEVATION	413.37' AMSL
EASTING	2260012.338
NORTHING	238996.758

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
-4					-4		
-2					-2		6" Standpipe with locking cap
0			Yellowish brown (10YR 5/4), Topsoil. Dry.		0		Locking compression cap
			Yellowish brown (10YR 5/4), fine to coarse GRAVEL and Cobbles, , little fine to coarse Sand, little Clayey Silt. Dry.				Concrete surface pad
2			Brownish yellow (10YR 6/6), Clayey SILT, little fine to coarse Sand, trace fine Gravel. Dry.		2		#1 Sand pack (1.0'-2.0')
4			Yellowish red (5YR 5/6), Clayey SILT, little fine to coarse Sand, little fine Gravel. Moist.		4		8" HSA borehole (0-57')
6			Red (2.5YR 4/6), Clayey SILT, little fine to coarse Sand, little fine Gravel. Moist.		6		
	3.6/4.0	S1/1 to S8/1	Strong brown (7.5YR 5/6), fine to coarse SAND, some fine to coarse subangular Gravel, some Silt & Clay. Moist.				2" PVC riser, (0'-43')
8					8		
10					10		Portland/benseal grout (2.0'-37')
	4.0/4.0	S1/2 to S8/2	Red (2.5R 5/8), SILT & CLAY, little fine to coarse subangular to subrounded Gravel, trace fine to coarse Sand. Moist.				
12					12		
			Red (2.5R 5/8), SILT & CLAY, some fine to coarse subangular to subrounded quartzite Gravel, trace fine to coarse Sand. Moist.				
14					14		
	3.3/4.0	S1/3 to					

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
16		S8/3	Reddish yellow (5YR 6/6), CLAY & SILT, some fine to coarse Sand, trace fine Gravel. Moist.		16		
18	3.9/4.0	S1/4 to S8/4	Brownish yellow (10YR 6/6), CLAY & SILT, little fine to coarse quartzite Gravel, trace fine to coarse Sand. Moist. Reddish brown & white mottles.		18		
20					20		8" HSA borehole (0-57')
22	3.2/4.0	S1/5 to S7/5	Brownish yellow (10YR 6/8), SILT & CLAY, little fine to medium Sand. Moist. Mottled white.		22		
24					24		
26	4.0/4.0	S1/6 to S8/6	Brownish yellow (10YR 6/8), CLAY & SILT, trace fine to coarse Sand, trace fine Gravel. Moist. Mottled white & reddish brown.		26		2" PVC riser, (0'-43')
28					28		
30	4.0/4.0	S1/7 to S8/7	Reddish yellow (7.5YR 6/8), CLAY & SILT, little fine to medium Sand. Moist.		30		Portland/benseal grout (2.0'-37')
32			Reddish yellow (5YR 6/8), CLAY & SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist.		32		
34	4.0/4.0	S1/8 to S8/8	Brownish yellow (10YR 6/6), SILT & CLAY, some fine to coarse Gravel, little fine to coarse Sand. Moist.		34		
36			Brownish yellow (10YR 6/6), fine to coarse subangular to subrounded quartzite GRAVEL, some Silt & Clay, little fine to coarse Sand. Moist.		36		
			Red (2.5YR 5/6), fine to coarse subangular to subrounded quartzite GRAVEL, little Silt & Clay, little fine to coarse Sand. Moist.				
			Brownish yellow (10YR 6/6), SILT & CLAY, some fine to coarse Gravel, little fine to coarse Sand. Moist.				
38			Brownish yellow (10YR 6/6), SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.		38		Bentonite chip annular seal (37'-41')

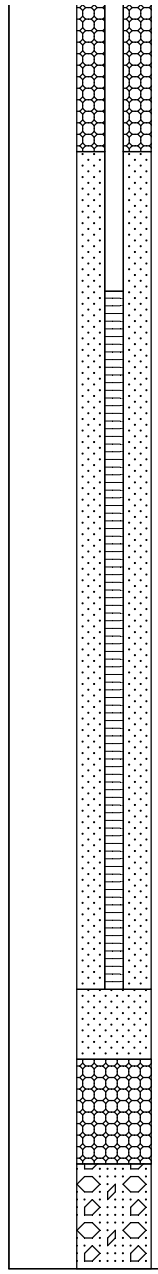
GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-162**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION
40	4.0/4.0	S1/9 to S8/9	Brownish yellow (10YR 6/6), CLAY & SILT, little fine to coarse Sand, trace fine to coarse Gravel. Moist. Coarse quartzite Gravel 39.0'-39.2'.
42	1.6/4.0	S1/10 to S4/10	No recovery.
44			Brownish yellow (10YR 6/6), SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist. Coarse Gravel 43.9'-44.1'.
46			
48	4.2/5.0	S1/11 to S10/11	Yellowish brown (10YR 5/6), CLAY & SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist. Reddish brown mottles.
			Yellowish brown (10YR 5/6), CLAY & SILT, trace fine Sand. Moist.
50			Light yellowish brown (10YR 6/4), CLAY & SILT, some fine to coarse Sand, little fine Gravel. Moist.
52	5.0/4.2	S1/12 to S10/12	Light yellowish brown (10YR 6/4), CLAY & SILT, some fine to coarse Sand. Moist.
54			Light yellowish brown (10YR 6/4), fine to coarse subangular to subrounded quartzite GRAVEL, some fine to coarse Sand, some Silt & Clay. Moist.
	4.2/2.7	S1/13 to S6/13	Yellowish brown (10YR 5/4), SILT & CLAY,some fine to coarse Sand, some fine to coarse Gravel. Moist. Wet seam of Sand at 55.6'.
56			Yellowish brown (10YR 5/6), CLAY & SILT, trace fine to coarse Sand, trace fine Gravel. Moist. Reddish brown mottles.
			Yellowish brown (10YR 5/6), SILT & CLAY, trace fine to coarse Sand, trace fine Gravel. Moist. Reddish brown mottles.
			Reddish brown (5YR 5/4), fine to coarse SAND, some Silt & Clay. Wet.

GRAPHIC



WELL CONSTRUCTION DETAILS
Bentonite chip annular seal (37'-41')
2" PVC riser, (0'-43')
#1 Sand pack (41'-54')
2" PVC 10-slot screen, (43'-53')
8" HSA borehole (0-57')
Bentonite chip annular seal (54'-55.5')
Collapsed formation (55.5'-57')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-163

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***11/4/14, 1/30/15, 2/2/15-2/4/15***

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***HSA, Geoprobe Dual-Tube Sampling, Air Rotary***
DEVELOPMENT DATE:	***2/12/15***
LOCATION:	***South Property Boundary Area***

NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to refusal at 32.5'. 6 1/4 ID HSA overdrilled to 32.5. 5" hammer bit advanced to 57' with air rotary. Well constructed 2/4/15.

SURFACE ELEVATION	416.97' AMSL
EASTING	2259838.321
NORTHING	238999.212

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
-4					-4		
-2					-2		6" Standpipe with locking cap
							Locking compression cap
0			Very pale brown (10YR 7/4), Topsoil. Moist.		0		Concrete surface pad
2			Brownish yellow (10YR 6/6), Clayey SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist.		2		#1 Sand pack (1.0'-2.0')
4					4		10" HSA borehole (0-32.5')
6	4.0/4.0	S1/1 to S10/1	Strong brown (7.5YR 5/6),Clayey SILT, little fine to coarse Sand, trace fine Gravel. Moist.		6		
			Red (2.5YR 5/6), SILT & CLAY, little fine to coarse Sand, trace fine to coarse Gravel. Moist.				
			Red (2.5YR 5/6), fine to coarse GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist. Gravel is SA-SR quartzite.				2" PVC riser, (0'-35')
8			Red (2.5YR 5/6), SILT & CLAY, little fine to coarse Sand, trace fine to coarse Gravel. Moist.		8		
10	4.0/4.0	S1/2 to S10/2	Red (2.5YR 5/6), SILT & CLAY, some fine to coarse Sand, trace fine Gravel. Moist.		10		Portland/benseal grout (2.0'-28.5')
			Reddish brown (5YR 5/4), Clayey SILT, trace fine to coarse Sand, trace fine Gravel. Moist.				
12			Red (2.5YR 5/6), Clayey SILT, some fine to medium Sand, trace fine Gravel. Moist. Gravelly seams at 9.7' and 12.6'.		12		
			Red (10R 4/6), CLAY & SILT, trace fine to coarse Sand, trace fine to coarse Gravel. Moist.				
14			Red (10R 4/6), CLAY & SILT, some fine to coarse Gravel, trace fine to coarse Sand. Moist.		14		
	4.0/4.0	S1/3 to					

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
16		S10/3	Red (2.5YR 5/6), CLAY & SILT, trace fine to medium Sand. Moist.		16		
18	4.0/4.0	S1/4 to S10/4	Red (2.5YR 5/6), CLAY & SILT, some fine to coarse Gravel, trace fine to coarse Sand. Moist. Gravel is quartzite.		18		
20			Reddish yellow (5YR 6/6), Clayey SILT, some fine to coarse Sand, trace fine Gravel. Moist.		20		10" HSA borehole (0-32.5')
22	4.0/4.0	S1/5 to S10/5	Yellowish red (5YR 5/6), SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.		22		2" PVC riser, (0'-35')
24			Brownish yellow (10YR 6/6), Clayey SILT, little fine to medium Sand, trace fine Gravel. Moist.		24		
26	4.0/4.0	S1/6 to S10/6	Yellowish red (5YR 5/6), Clayey SILT, some fine to coarse Gravel, little fine to coarse Sand. Moist. May be sluff?		26		Portland/benseal grout (2.0'-28.5')
			Reddish yellow (7.5 YR 6/8), CLAY & SILT, little fine to coarse Gravel, trace fine to coarse Sand. Moist.				
28			Brownish yellow (10YR 6/8), subrounded to rounded fine to coarse Gravel, some fine to coarse Sand, trace Silt. Wet.		28		
			Brownish yellow (10YR 6/8), fine SAND,little Silt. Wet.				
30	3.6/3.5	S1/7 to S10/7	Reddish yellow (5YR 6/6), subrounded to rounded fine to coarse GRAVEL, little fine to coarse Sand, little Clayey Silt. Wet.		30		Bentonite chip annular seal (28.5'-32.8')
			Brownish yellow (10YR 6/6), subrounded to rounded fine to coarse GRAVEL, little fine to coarse Sand, little Silt & Clay. Wet.				
32			Brownish yellow (10YR 6/8), CLAY & SILT, some fine to coarse Sand, trace fine Gravel. Coarse Sandstone Gravel 32.2-32.4. Limestone shards in toe of macrocore at 32.5'. Moist. Refusal at 32.5'.		32		
34			Hard, slightly weathered, gray (N5/) LIMESTONE. Dry. Thin calcite veins present.		34		5" air rotary borehole (32.5'-57')
36			Void filled with Sand and Gravel from 35.5'-37', Silt & Clay from 37'-39'.		36		#1 Sand pack (32.8'-56')
38			Hard, moderately weathered, gray (N6/) LIMESTONE.		38		2" PVC 10-slot screen, (35'-55')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-163**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
			Solution features evident.				
40			No returns. No sound from the hammer bit, downward resistance indicates sediment is present, presumably Silt & Clay. From 49'-51' hammer bit produces soft thuds, suggesting more resistant material such as gravel or weathered bedrock.		40		
42					42		5" air rotary borehole (32.5'-57')
44					44		
46					46		#1 Sand pack (32.8'-56')
48					48		
50					50		2" PVC 10-slot screen, (35'-55')
			No returns. Hammer bit sounds as if in competent rock. Limestone dust on hammer bit when removed from borehole.				
52					52		
54					54		
56					56		Collapsed formation (56'-57')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-164

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***11/4/14, 1/29/15***

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***HSA, Air Rotary***
DEVELOPMENT DATE:	***2/12/15***
LOCATION:	***South Property Boundary Area***

NOTES: Vacuum excavation to 5'. 6 1/4 HSA advanced to refusal at 10.3'.
5" hammer bit advanced using air rotary to 53'.
2" PVC monitoring well installed 1/30/15.

SURFACE ELEVATION	422.48' AMSL
EASTING	2259623.933
NORTHING	238954.174

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
-4					-4		
-2					-2		6" Standpipe with locking cap Locking compression cap
0			Yellowish brown (10YR 5/6), fine to coarse GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.		0		Concrete surface pad
2			Light brown (5YR 5/6), weathered sandstone Cobbles & Gravel, little fine to coarse Sand, little Clayey Silt. Moist.		2		#1 Sand pack (1.0'-3.0')
4					4		10" HSA borehole (0-10.3')
6			No returns. Augers are chattery as if in Cobbles & Gravel.		6		2" PVC riser, (0'-43')
8	No recovery		No returns. Slow progress with augers, grinding as if in weathered bedrock.		8		Portland/benseal grout (3'-37')
10					10		
12	air rotary cuttings		Soft to very soft, highly weathered, brown (10YR 4/3) to light yellowish brown (10YR 6/4), fine-grained SANDSTONE. Locally recrystallized to Quartzite.		12		5" air rotary borehole (10.3'-53')
14					14		

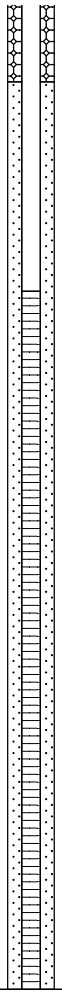
PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
16					16		
18					18		
20	air rotary cuttings				20		5" air rotary borehole (10.3'-53')
22					22		
24					24		2" PVC riser, (0'-43')
26					26		
28			Medium hard to soft, moderately weathered, very pale brown (10YR 7/3), QUARTZITE.		28		Portland/benseal grout (3'-37')
30					30		
32					32		
34					34		
36					36		
38					38		Bentonite chip annular seal (37'-40')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-164**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
40	air rotary cuttings				40		Bentonite chip annular seal (37'-40') 2" PVC riser, (0'-43') #1 Sand pack (40'-53') 2" PVC 10-slot screen, (43'-53') 5" air rotary borehole (10.3'-53')
42					42		
44					44		
46			Wet fracture at 46.5'.		46		
48			Soft zone 47.5'-48'.		48		
50					50		
52					52		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-165

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***11/4/14, 2/12/15***

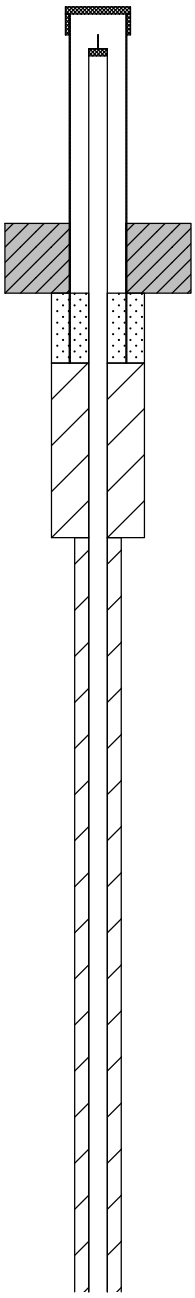
DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***HSA, Air Rotary***
DEVELOPMENT DATE:	***2/20/15***
LOCATION:	***South Property Boundary Area***

NOTES: Vacuum excavation to 4.5'. 6 1/4 ID HSA advanced to refusal at 4.5'.
5" hammer bit advanced using air rotary to 72.5'.
2" PVC monitoring well installed 2/13/15 & 2/18/15.

SURFACE ELEVATION	418.74' AMSL
EASTING	2259411.882
NORTHING	238842.029

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
-4					-4		
-2					-2		6" Standpipe with locking cap Locking compression cap
0			Yellowish brown (10YR 5/6), Clayey SILT, little fine to coarse Sand, little fine to coarse GRAVEL. Moist.		0		Concrete surface pad
2					2		#1 Sand pack (1.0'-2.0') 10" HSA borehole (0-4.5')
4			Light reddish brown (5YR 6/3), weathered sandstone Cobbles & Gravel, trace fine to coarse Sand, trace Clayey Silt. Moist.		4		
6	air rotary cuttings		Moderately hard to medium hard, moderately weathered, olive brown (2.5Y 4/3), fine-grained SANDSTONE.		6		5" air rotary borehole (4.5'-72.5')
8			Moderately hard to soft, moderately to highly weathered, light yellowish brown (10YR 6/4), fine-grained SANDSTONE.		8		2" PVC riser, (0'-50.5')
10					10		Portland/benseal grout (2'-42.5')
12			Hard to moderately hard, moderately weathered, light yellowish brown (10YR 6/4), fine-grained SANDSTONE.		12		
14					14		



PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
16	air rotary cuttings				16		5" air rotary borehole (4.5'-72.5')
18					18		
20					20		
22					22		
24			Medium to very soft, highly weathered, dark yellowish brown (10YR 4/4), fine-grained SANDSTONE.		24		2" PVC riser, (0'-50.5')
26					26		
28					28		
30			Hard, slightly weathered, gray (N5/ to N6/), DOLOSTONE.		30		Portland/benseal grout (2'-42.5')
32			Moderately hard, moderately weathered, grayish brown (10YR 5/2), fine-grained SANDSTONE.		32		
34					34		
36					36		
38			Moderately hard, moderately weathered, grayish brown (10YR 5/2), fine-grained SANDSTONE; with interbedded		38		

PROJECT: ***Harley Davidson***

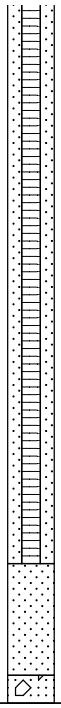
DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
40	air rotary cuttings		hard, slightly weathered, gray (N5/ to N6/), DOLOSTONE.		40		Portland/benseal grout (2'-42.5')
42					42		2" PVC riser, (0'-50.5')
44					44		Bentonite chip annular seal (42.5'-47.5')
46					46		
48					48		#1 Sand pack (47.5'-72.1')
50			Hard, slightly weathered, gray (N5/ to N6/), DOLOSTONE. Texture is sugary.		50		2" PVC 10-slot screen, (50.5'-70.5')
52			Moderately hard, moderately weathered, grayish brown (10YR 5/2), fine-grained SANDSTONE.		52		
54					54		5" air rotary borehole (4.5'-72.5')
56			Hard, slightly weathered, gray (N5/ to N6/), DOLOSTONE with sugary texture; with interbedded moderately hard, moderately weathered, grayish brown (10YR 5/2), fine-grained SANDSTONE.		56		
58					58		
60					60		
62					62		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-165**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
64	air rotary cuttings				64		2" PVC 10-slot screen, (50.5'-70.5')
66					66		#1 Sand pack (47.5'-72.1')
68					68		5" air rotary borehole (4.5'-72.5')
70					70		
72					72		Collapsed formation (72-1'-72.5')



GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-166

PROJECT INFORMATION

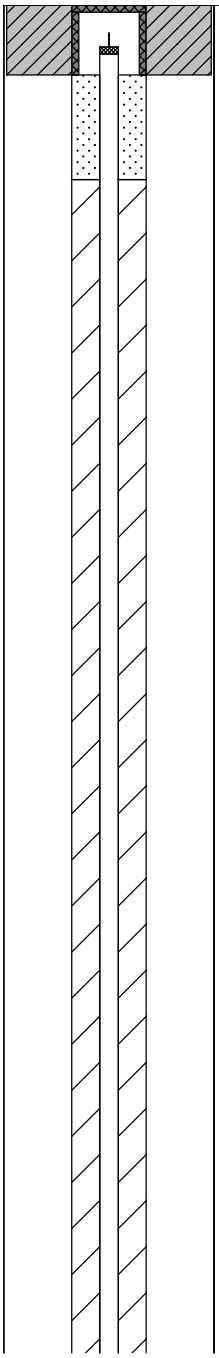
PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***KB Fleming***
DATES DRILLED:	***11/12/14-11/17/14***

NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 60'. 4 1/4 ID HSA overdrilled to 60'. 2" PVC monitoring well installed 12/9/14.

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***Geoprobe Dual-tube sampling***
DEVELOPMENT DATE:	***1/7/15, 1/9/15, 1/15/15-1/16/15***
LOCATION:	***Northeast Canterbury Lane***
SURFACE ELEVATION	402.79' AMSL
EASTING	2260239.616
NORTHING	238860.837

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION
0			Asphalt and gravel base.
2			Brown (7.5 YR 4/4) Sub-angular to sub-rounded fine to coarse GRAVEL, little fine to coarse sand, little clayey silt, moist.
4			
6	4.0/4.0	S1/1 to S10/1	Brownish yellow (10 YR 6/6) CLAY and SILT, little fine to coarse Gravel, little fine to coarse Sand, moist. Coarse quartzite cobbles 7.5'-7.8'.
8			Brownish yellow (10 YR 6/8) SILT, some fine Sand, trace sub-rounded quartzite Gravel, moist.
10	4.0/4.0	S1/2 to S10/2	Red (2.5 YR 4/8) SILT and CLAY, little fine to coarseSand, trace fine Gravel, moist.
12			Brownish yellow (10 YR 6/8) SILT & CLAY, little fine to medium Sand, trace fine Gravel, moist.
14	4.0/4.0	S1/3 to S10/3	Brownish yellow (10 YR 6/8) CLAYEY SILT, some coarse Sand, trace sub-angular quartzite Gravel, large quartzite cobbles 13.7'-13.8', moist.
16			Brownish yellow (10 YR 6/8) CLAYEY SILT and fine to coarse GRAVEL, gravel is cobble to pebble size quartzite, trace fine Sand, moist.
			Brownish yellow (10 YR 6/8) grading to red (2.5 YR 5/8) CLAYEY SILT, little fine-medium Sand, trace coarse Sand, moist.
18	4.0/4.0	S1/4 to	Yellowish Red (5 YR 5/8) CLAYEY SILT and fine to coarse sub-angular to sub-rounded GRAVEL,, trace coarse Sand, moist.
			Sub-angular quartzite GRAVEL and medium to coarse SAND, some Silt, trace fine Sand, moist.



WELL CONSTRUCTION DETAILS
Flushmount manhole completion and concrete pad
Locking compression cap
#1 Sand pack (1.0'- 2.5')
8" HSA borehole (0- 60')
2" PVC riser, (0'- 41')
Portland/benseal grout (2.5'-36')

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20		S10/4	(5 YR 5/8) to (2.5 YR 4/8) CLAY & SILT, some fine to medium Sand, moist.		20		8" HSA borehole (0-60')
			Gray, Coarse SAND and fine GRAVEL quartzite, moist.				
22			Brownish yellow (10 YR 6/8) SILTY CLAY, trace fine Sand, moist.		22		
	4.0/4.0	S1/5 to S10/5	(2.5 YR 4/8) CLAYEY SILT and coarse sub-angular to sun-rounded quartzite GRAVEL, trace fine Sand, trace coarse Sand, moist.				
24					24		
			Yellowish Red (5 YR 5/8) SILT & CLAY, some fine to medium Sand, trace fine Gravel, moist.				2" PVC riser, (0'- 41')
26					26		
	4.0/4.0	S1/6 to S10/6					
28					28		
30			Yellowish Red (5 YR 5/8) CLAYEY SILT, little fine to medium Sand,m trace coarse Sand, moist.		30		Portland/benseal grout (2.5'-36')
	4.0/4.0	S1/7 to S10/7	Yellowish Red (5 YR 5/8) fine to coarse SAND and Clay & Silt, some fine to coarse quartzite Gravel, moist.				
32			Brownish yellow (10 YR 6/8) CLAY and SILT, little coarse Sand, trace fine Gravel, moist.		32		
			Brownish yellow (10 YR 6/8) CLAYEY SILT, some medium to coarse Sand, trace fine Sand, trace fine Gravel, moist.				
34					34		
	4.0/4.0	S1/8 to S10/8	Brownish yellow (10 YR 6/8) CLAYEY SILT, some coarse Sand, little fine Gravel, trace coarse Gravel, moist.				
36			Brownish yellow (10 YR 6/8) CLAYEY SILT, some medium to coarse Sand, trace fine Sand, trace fine Gravel, moist.		36		
			Brownish yellow (10 YR 6/8) CLAYEY SILTand fine to coarse Sand, trace fine to coarse Gravel, trace fine , moist. trace black streaking.				Bentonite chip annular seal (36'-39')
38					38		
	4.0/4.0	S1/9 to S10/9					
40					40		#1 Sand pack (39'-52')
			Brownish yellow (10 YR 6/8) CLAY & SILT, some fine to coarse Sand, little fine to coarse Gravel, moist. some black streaking, coarse Sub-rounded to sub-angular quartzite Gravel 40.6'-40.7', 42.4'-42.5', 43', 43.5', 45', 45.5'. 50'-53'. Wet at 53'.				
42					42		2" PVC 10-slot screen, (41'-51')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-166**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
44	4.0/4.0	S1/10 to S10/10			44		2" PVC 10-slot screen, (41'-51')
46	4.0/4.0	S1/11 to S8/11			46		
48					48		#1 Sand pack (39'-52')
50	4.0/4.0	S1/12 to S8/12			50		
52			Brownish yellow (10 YR 6/8) to Yellowish Red (5 YR 5/8) fine to medium SAND and fine GRAVEL, some Clayey Silt, wet.		52		8" HSA borehole (0-60')
54	2.0/2.0	S1/13 to S4/13	Brownish yellow (10 YR 6/8) to Yellowish Red (5 YR 5/8) CLAYEY SILT and fine to medium SAND, little coarse Sand, trace fine Gravel, wet.		54		
			Brownish yellow (10 YR 6/8) fine to coarse SAND and fine GRAVEL, some Clayey Silt, wet.				Bentonite chip annular seal (52'-60')
56			Brownish yellow (10 YR 6/8) fine to medium SAND and CLAYEY SILT, trace coarse Gravel, wet.		56		
58	5.2/5.0	S1/14 to S10/14	Brownish yellow (10 YR 6/8) CLAYEY SILT, some medium to coarse Sand, trace fine Sand, trace coarse Gravel, wet.		58		
60					60		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-167

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***11/24/14, 12/4/14***

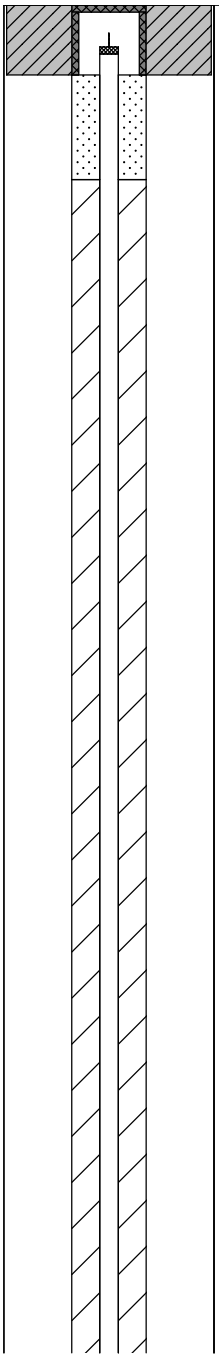
NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 60'. 4 1/4 ID HSA overdrilled to 60'. 2" PVC monitoring well installed 12/4/14-12/5/14.

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***HSA, Geoprobe Dual-tube sampling***
DEVELOPMENT DATE:	***1/9/15, 1/15/15-1/16/15***
LOCATION:	***North central Canterbury Lane***
SURFACE ELEVATION	399.55' AMSL
EASTING	2260043.563
NORTHING	238861.218

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION
0			Asphalt & gravel base.
2			Yellowish red 5YR 5/6, Clayey SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist.
4			
6	3.8/5.0	S1/1 to S10/1	Reddish yellow 10YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.
8			Reddish yellow 7.5YR 6/8, SILT & CLAY, some fine to medium Sand, trace fine Gravel. Moist.
10			
12	5.0/5.0	S1/2 to S12/2	Yellowish red 5YR 5/6, Clayey SILT, some fine to coarse Sand, little fine to coarse Gravel. Moist.
			Red 2.5YR 5/8, fine to coarse subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.
14			Red 2.5YR 5/6, SILT & CLAY and fine to coarse Sand, little fine subangular to subrounded quartzite GRAVEL. Moist.
16			
18	5.0/5.0	S1/3 to S12/3	Reddish yellow 5YR 6/6, Clayey SILT, some fine Sand. Moist.
			Yellowish red 5YR 4/6, Clayey SILT, some fine to coarse Sand, little fine Gravel. Moist.

GRAPHIC



WELL CONSTRUCTION DETAILS

- Flushmount manhole completion and concrete pad
- Locking compression cap
- #1 Sand pack (1.0'- 2.5')
- 8" HSA borehole (0- 60')
- 2" PVC riser, (0'- 41')
- Portland/benseal grout (2.5'-36')

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20					20		
			Red 10R 4/6, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.				8" HSA borehole (0-60')
			Reddish yellow 5YR 6/8, CLAY & SILT, trace fine Sand. Moist.				
22	5.0/5.0	S1/4 to S12/4			22		
			Red 2.5YR 5/6, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.				
24					24		
			Yellowish red 5YR 5/6, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.				2" PVC riser, (0'- 41')
26			Red 10R 5/8, SILT & CLAY, little fine Sand. Moist.		26		
	5.0/5.0	S1/5 to S12/5					
28					28		
30					30		Portland/benseal grout (2.5'-36')
32	5.0/5.0	S1/6 to S12/6			32		
34					34		
36					36		
			Red 2.5YR 5/8, SILT & CLAY, little fine to medium Sand. Moist.				Bentonite chip annular seal (36'-39')
38	5.0/5.0	S1/7 to S12/7			38		
40					40		#1 Sand pack (39'-52')
42					42		
	5.0/5.0	S1/8 to	Red 2.5YR 5/8, SILT & CLAY, little fine to coarse Sand, little fine to coarse subrounded to rounded Gravel. Moist.				2" PVC 10-slot screen, (41'-51')

GROUNDWATER SCIENCES CORPORATION

***GEOLOGIC LOG:* MW-167**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
44		S12/8	Brownish yellow 10YR 6/6, CLAY & SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist.		44		2" PVC 10-slot screen, (41'-51')
46	5.0/5.0	S1/9 to S12/9	Reddish yellow 7.5YR 6/6, CLAY & SILT, trace fine to coarse Sand, trace fine Gravel. Moist.		46		
48			Yellowish red 5YR 5/6, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.		48		#1 Sand pack (39'-52')
50			Red 5YR 5/6, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.		50		
52	4.3/4.0	S1/10 to S10/10	Light yellowish brown 2.5Y 6/4, SILT & CLAY, some fine to coarse Sand, trace fine Gravel. Moist. Gravelly seam 52.5'-52.8'.		52		8" HSA borehole (0-60')
54					54		
56	4.7/4.0	S1/11 to S10/11			56		Bentonite chip annular seal (52'-60')
58					58		
60	4.0/2.0	N/A	Dark yellowish brown 10YR 4/4, SILT & CLAY, little fine to coarse Sand, little fine Gravel. Wet.		60		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-168

PROJECT INFORMATION

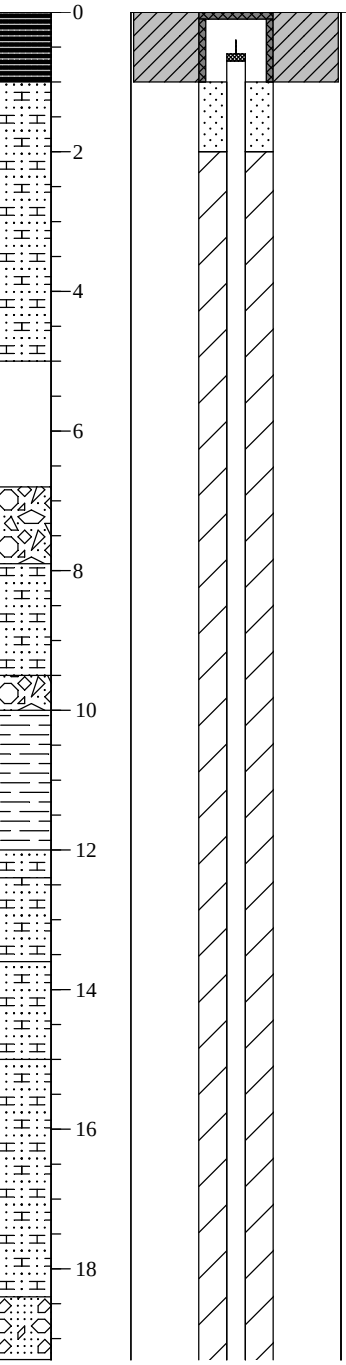
PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***12/2/14-12/3/14, 12/11/14***

NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 57'. 4 1/4 ID HSA overdrilled to 57'. 2" PVC monitoring well installed 12/11/14-12/12/14.

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***Geoprobe Dual-tube sampling***
DEVELOPMENT DATE:	***1/7/15, 1/15/15-1/16/15***
LOCATION:	***Northwest Canterbury Lane***
SURFACE ELEVATION	396.05' AMSL
EASTING	2259872.680
NORTHING	238861.827

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION
0			Asphalt road & gravel base
			Reddish yellow 5YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.
2			
4			
			No Recovery
6			
	3.2/5.0	S1/1 to S8/1	Brownish yellow 10YR 6/8, fine to coarse subangular quartzite GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.
8			Light brown 7.5 YR 6/4, CLAY & SILT, little fine to medium Sand. Moist.
			Reddish yellow 7.5YR 6/8, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.
10			Reddish yellow 7.5YR 6/6, Clayey SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist.
			Reddish yellow 7.5YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.
12	5.0/5.0	S1/2 to S12/2	Reddish yellow 7.5YR 6/6, SILT & CLAY, some fine to coarse Gravel, little fine to coarse Sand. Moist.
			Reddish yellow 10YR 6/8, CLAY & SILT, little fine Sand. Moist.
14			
			Yellowish brown 10YR 6/4, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.
16			
	5.0/5.0	S1/3 to S12/3	
18			Yellow 10YR 7/6, fine to coarse GRAVEL, some fine to coarse Sand, little Silt & Clay. Moist.



WELL CONSTRUCTION DETAILS
Flushmount manhole completion and concrete pad
Locking compression cap
#1 Sand pack (1.0'-2.0')
8" HSA borehole (0-57')
2" PVC riser, (0'-31')
Portland/benseal grout (2.0'-25.4')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-168

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20			Yellow 10YR 7/6, SILT & CLAY, little fine to coarse Sand, little fine Gravel. Moist.		20		2" PVC riser, (0'-31')
			Yellow 10YR 7/6, SILT & CLAY, some fine to coarse Gravel, little fine to coarse Sand. Moist.				
22			Yellowish red 5YR 5/6, CLAY & SILT, and fine to coarse Sand, trace fine Gravel. Moist.		22		
	5.0/5.0	S1/4 to S12/4					Portland/benseal grout (2.0'-25.4')
24			Yellowish red 5YR 5/6, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.		24		
26			Brown 5YR 5/4, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.		26		Bentonite chip annular seal (25.4'-28.5')
			Very pale brown 10YR 7/3, fine to coarse SAND, some fine to coarse Gravel, little Clayey Silt. Moist.				
28	5.0/5.0	S1/5 to S12/5	Reddish yellow 5YR 7/6, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, little to trace Silt & Clay. Moist.		28		
							#1 Sand pack (28.5'-42')
30					30		
32			Very pale brown 10YR 7/4, fine to coarse SAND, and Silt & Clay, trace fine Gravel. Moist.		32		2" PVC 10-slot screen, (31'-41')
	5.0/5.0	S1/6 to S12/6					
34					34		
36			Reddish yellow 5YR 6/6, fine to coarse subrounded GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.		36		8" HSA borehole (0-57')
	5.0/5.0	S1/7 to S12/7					
38					38		
			Reddish yellow 5YR 6/6, CLAY & SILT, some fine to coarse Sand, little fine to coarse subrounded GRAVEL. Moist.				
40			Reddish yellow 7.5YR 6/8, SILT & CLAY, little fine to coarse Sand, little fine Gravel. Dark gray laminae 40.5'-40.9'. Wet 40'-40.4', moist below.		40		
42					42		Bentonite chip annular seal (42'-57')
	5.0/5.0	S1/8 to					

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-168**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
44		S12/8	Reddish yellow 7.5YR 6/8, SILT & CLAY, some fine to coarse Gravel, little fine to coarse Sand. Moist.		44		
			Pale yellow 2.5Y, SILT & CLAY, little fine Sand, trace fine Gravel. Moist. Dark gray laminae 44.5'-44.7', wet.				
46	5.0/4.0	S1/9 to S10/9	Light brown 7.5YR 6/4, SILT & CLAY, little fine to coarse Sand, little fine Gravel. Moist, except wet 46.6'-46.8'.		46		8" HSA borehole (0-57')
48					48		
50	5.0/4.0	S1/10 to S10/10	Pale brown 10YR 6/3, SILT & CLAY, little fine to coarse Sand, little fine to coarse subrounded Gravel. Moist, except Wet 49.0'-49.3' and 53.0'-53.3'.		50		Bentonite chip annular seal (42'-57')
52					52		
54	5.0/4.0	S1/11 to S9/11	Pale brown 10YR 6/3, SILT & CLAY, trace fine to coarse Sand, trace fine Gravel. Moist, except Wet 54.9'-57.0'. Dark gray laminae 56.5'-56.9'.		54		
56					56		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-169

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***12/16/14, 2/23/15-2/25/15***

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***Geoprobe Dual-tube sampling***
DEVELOPMENT DATE:	***3/3/15***
LOCATION:	***Southeast Canterbury Lane***

NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 40'. 6 1/4 ID HSA overdrilled to 30'., 4 1/4 augers to 47'. 2" PVC monitoring well installed 2/25/15.

SURFACE ELEVATION	389.87 AMSL
EASTING	2260197.951
NORTHING	238579.721

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
0			Asphalt Road & gravel base		0		Flushmount manhole completion and concrete pad
2			Reddish yellow 7.5YR 6/6, fine to coarse subangular to subrounded GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.		2		Locking compression cap #1 Sand pack (1.0'-2.0')
4					4		10" HSA borehole (0-30')
6	2.0/5.0	S1/1 to S6/1	No Recovery.		6		2" PVC riser, (0'-37')
8			Red 2.5 YR 5/8, fine to coarse subangular quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Wet.		8		
10			Reddish yellow 5YR 6/8, fine to coarse (predominantly fine) SAND, little Clayey Silt, trace fine Gravel. Moist.		10		Portland/benseal grout (2.0'-31.9')
12	3.2/5.0	S1/2 to S8/2	Reddish yellow 5YR 6/6, SILT & CLAY, and fine to coarse Sand, trace fine Gravel. Moist.		12		
14			No Recovery.		14		
16	4.9/5.0	S1/3 to S12/3	Reddish yellow 5YR 6/8, fine SAND, some Clayey Silt. Moist.		16		
			Reddish yellow 5YR 6/8, SILT & CLAY, some fine Sand. Moist.				
18			Reddish yellow 5YR 6/8, SILT & CLAY, some fine Sand. Seam of fine to coarse Sand, little Silt 18.3-18.5. Moist.		18		

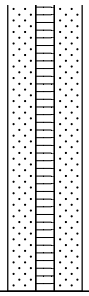
PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20			Reddish yellow 5YR 6/8, fine SAND, little Clayey Silt. Wet.		20		10" HSA borehole (0-30')
22	4.8/5.0	S1/4 to S12/4	Light yellowish brown 10YR 6/4, SILT & CLAY, little fine Sand. Moist.		22		
24			Light yellowish brown 10YR 6/4, Clayey SILT, little fine Sand. Moist.		24		2" PVC riser, (0'-37')
26			Light yellowish brown 10YR 6/4, SILT & CLAY, trace fine Sand. Moist.		26		
28	5.0/5.0	S1/5 to S12/5	Light yellowish brown 10YR 6/4, SILT & CLAY, little fine Sand. Moist.		28		Portland/benseal grout (2.0'-31.9')
30			Yellow 10YR 7/6, SILT & CLAY, and fine to coarse Sand, little fine Gravel. Moist.		30		
32	5.0/5.0	S1/6 to S12/6	Reddish yellow 7.5 YR 6/8, SILT & CLAY, little fine Sand. Moist.		32		8" HSA borehole (30'-47')
34			Reddish yellow 7.5YR 6/8, Clayey SILT, little fine Sand. Wet. Coarse Gravel at 31.6'.		34		Bentonite chip annular seal (31.9'-35.2')
36	4.8/5.0	S1/7 to S12/7	Reddish yellow 5YR 6/6, fine to coarse GRAVEL, some fine to coarse Sand, little Clayey Silt. Moist, except wet below 35'.		36		#1 Sand pack (35.2'-47')
38			Reddish yellow 5YR 6/6, fine to coarse GRAVEL, some fine to coarse Sand, trace Silt. Wet.		38		
40			Borehole deepened, soil was not sampled.		40		2" PVC 10-slot screen, (37'-47')
42					42		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-169**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
44	N/A	N/A			44		8" HSA borehole (30'-47') #1 Sand pack (35.2'-47') 2" PVC 10-slot screen, (37'-47')
46					46		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-170

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***12/16/14, 12/19/14***

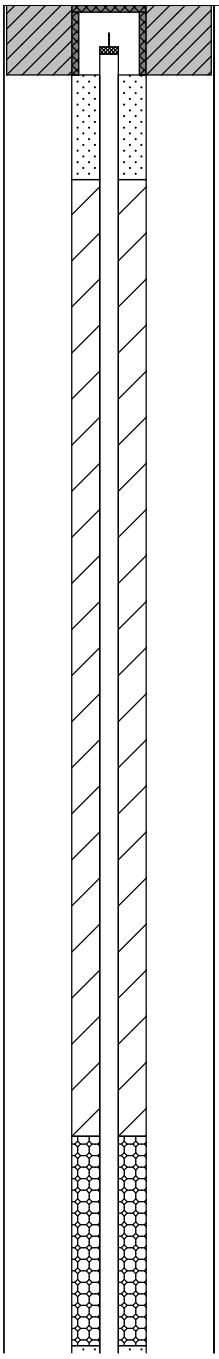
NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 40'. 4 1/4 ID HSA overdrilled to 40'. 2" PVC Monitoring Well Constructed 12/19/14.

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***Geoprobe Dual-tube sampling***
DEVELOPMENT DATE:	***1/14/15, 1/16/15***
LOCATION:	***South central Canterbury Lane***
SURFACE ELEVATION	385.96' AMSL
EASTING	2259962.593
NORTHING	238575.643

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION
0			Asphalt road & gravel base.
			Reddish yellow 7.5YR 6/8, SILT & CLAY, little fine to coarse subangular to subrounded Gravel, little fine to coarse Sand. Moist.
2			
4			
			No Recovery.
6			
	2.6/5.0	S1/1 to S6/1	Yellowish brown 10YR 5/4, fine to coarse subangular quartzite GRAVEL, some fine to coarse Sand, trace Clayey Silt. Moist.
8			Brownish yellow 10YR 6/6, SILT & CLAY, and fine to coarse Sand, trace fine Gravel. Moist.
			Brownish yellow 10YR 6/6, SILT & CLAY, some fine to medium Sand, trace fine Gravel. Moist.
10			
	3.7/5.0	S1/2 to S10/2	
12			
			Light yellowish brown 10YR 6/4, Clayey SILT, trace fine to medium Sand. Moist.
14			
			Light yellowish brown 10YR 6/4, SILT & CLAY, little fine to medium Sand. Moist. Mottled reddish brown and dark gray.
16			
	5.0/5.0	S1/3 to S12/3	
18			

GRAPHIC



WELL CONSTRUCTION DETAILS

- Flushmount manhole completion and concrete pad
- Locking compression cap
- #1 Sand pack (1.0'-2.5')
- 8" HSA borehole (0-40')
- 2" PVC riser, (0'-21.3')
- Portland/benseal grout (2.5'-16.2')
- Bentonite chip annular seal (16.2'-19.2')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-170

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20			Light yellowish brown 10YR 6/4, SILT & CLAY, trace fine to coarse Sand, trace fine Gravel. Moist.		20		
	5.0/5.0	S1/4 to S12/4	Reddish yellow 5YR 6/6, SILT & CLAY, little fine Sand. Moist.				#1 Sand pack (19.2'-32.3')
22					22		
			Reddish yellow 5YR 6/6, SILT & CLAY, little fine subrounded quartzite Gravel, trace fine Sand. Moist.				
24			Light brown 7.5YR 6/4, fine to coarse quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.		24		2" PVC 10-slot screen, (21.3'-31.3')
26	5.0/5.0	S1/5 to S12/5	Light brown 7.5YR 6/4, fine to coarse quartzite GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.		26		
28			Yellow 10YR 7/6, SILT & CLAY, some fine to medium Sand, trace fine Gravel. Moist.		28		8" HSA borehole (0-40')
30					30		
	5.0/5.0	S1/6 to S12/6	Pale brown 10YR 6/3, SILT & CLAY, trace fine to coarse Sand, trace fine Gravel. Wet.				
32					32		
							Bentonite chip annular seal (32.3'-40')
34			Pale brown 10YR 6/3, SILT & CLAY, little fine to coarse Gravel, trace fine to coarse Sand. Wet.		34		
36	5.0/5.0	S1/7 to S8/7	Light yellowish brown 10YR 6/4, SILT & CLAY, little fine to coarse Sand, little fine to coarse quartzite Gravel. Wet.		36		
38					38		
40					40		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-171

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***12/17/14, 1/16/15, 1/20/15-1/21/15***

DRILLING INFORMATION

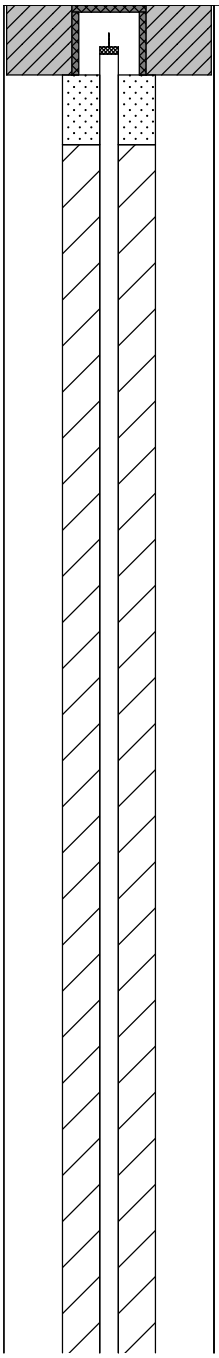
DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***6 1/4" ID HSA to 35', 5" Air Rotary to 45.5'***
DEVELOPMENT DATE:	***2/13/15***
LOCATION:	***Southwest Canterbury Lane***

NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 34.8'. 6 1/4 ID HSA overdrilled to 35'. 5" hammer bit advanced with air rotary to 45.5'. Well constructed 1/21/15-1/22/15.

SURFACE ELEVATION	387.01' AMSL
EASTING	2259762.499
NORTHING	238616.679

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION
0			Asphalt road & gravel base.
			Light yellowish brown 10YR 6/4, fine to coarse subangular GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.
4			
6			No Recovery.
8	2.5/5.0	S1/1 to S6/1	Light yellowish brown 10YR 6/4, SILT & CLAY, trace fine to coarse Sand, trace fine Gravel. Moist.
			Brownish yellow 10YR 6/8, SILT & CLAY, some fine to medium Sand. Moist.
10			Brownish yellow 10YR 6/6, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.
12	5.0/5.0	S1/2 to S12/2	Brownish yellow 10YR 6/6, SILT & CLAY, and fine to coarse Sand, trace fine Gravel. Moist.
14			
16			
18	5.0/5.0	S1/3 to S12/3	Yellowish brown 10YR 5/6, fine to coarse subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.

GRAPHIC



WELL CONSTRUCTION DETAILS

- Flushmount manhole completion and concrete pad
- Locking compression cap
- #1 Sand pack (1.0'-2.5')
- 10" HSA borehole (0-35')
- 2" PVC riser, (0'-32.8')
- Portland/benseal grout (2'-26')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-171**

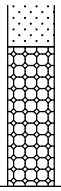
PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20	5.0/5.0	S1/4 to S12/4	Grayish brown 10YR 5/2, SILT & CLAY, some fine to coarse Sand, trace fine Gravel. Moist. Mottled brownish yellow.		20		10" HSA borehole (0-35')
22			Grayish brown 10YR 5/2, fine to coarse subrounded GRAVEL, some Silt & Clay, little fine to coarse Sand. Moist.		22		
			Grayish brown 10YR 5/2, SILT & CLAY, little fine to medium Sand, trace fine Gravel. Moist to 22.5'. Wet 22.5'-23.8'. Gravelly at base.				Portland/benseal grout (2'-26')
24			Yellowish brown 10YR 5/6, fine to coarse subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.		24		
26	5.0/5.0	S1/5 to S12/5	Yellowish brown 10YR 5/6, SILT & CLAY, trace fine to medium Sand. Moist.		26		Bentonite chip annular seal (26'-30.8')
			Mottled light & dark brown, light & dark gray, and orange, Clayey SILT, little fine to medium Sand. Wet.				
28			Light yellowish brown 10YR 6/4, fine to coarse subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.		28		2" PVC riser, (0'-32.8')
30	5.0/5.0	S1/6 to S12/6	Brownish yellow 10YR 6/6, CLAY & SILT. Moist.		30		
			Brownish yellow 10YR 6/6, fine to coarse subrounded GRAVEL, some fine to coarse Sand, little Silt & Clay. Wet.				
32			Mottled as 26.5'-28.5', CLAY & SILT, trace fine Sand. Wet.		32		#1 Sand pack (30.8'-43.5')
34					34		2" PVC 10-slot screen, (32.8'-42.8')
36	No Recovery	N/A	No Recovery.		36		
38					38		17" dia. annular opening from air lift (35'-40')
40			Hard to moderately hard, fresh, N5/ gray, LIMESTONE. Wet.		40		5" air rotary borehole (40'-45.5')
42					42		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-171**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
44					44		5" air rotary borehole (40'-45.5') Bentonite chip annular seal (43.5'-45.5')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-172

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***11/25/14, 12/8/14***

NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 40'. 4 1/4 ID HSA overdrilled to 40'. 2" PVC monitoring well installed 12/8/14.

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***Geoprobe Dual-tube sampling***
DEVELOPMENT DATE:	***1/14/15-1/16/15***
LOCATION:	***East Old Arsenal Road***
SURFACE ELEVATION	385.48' AMSL
EASTING	2260196.735
NORTHING	238253.888

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
0			Asphalt road & gravel base.		0		Flushmount manhole completion and concrete pad
2			Cobbles & boulders.		2		Locking compression cap #1 Sand pack (1.0'-2.0')
4			Brownish yellow 10YR 6/6, Clayey SILT, some fine to coarse Sand, little fine to coarse Gravel. Moist.		4		8" HSA borehole (0-40')
6	4.0/5.0	S1/1 to S10/1	Reddish yellow 5YR 6/8, fine to coarse subangular GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist. 6.8'-7.0' seam of Silt, trace fine Sand.		6		2" PVC riser, (0'-27.5')
8			Brownish yellow 10YR 6/6, SILT, little fine Sand. Moist.		8		
10			Yellowish red 5YR 5/6, fine to coarse SAND, and Silt & Clay, trace fine to coarse subangular Gravel. Moist.		10		Portland/benseal grout (2'-20.9')
12	4.4/5.0	S 1/2 to S12/2	Yellowish red 5YR 5/6, Clayey SILT, little fine Sand. Moist.		12		
14			Reddish yellow 5YR 6/8, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.		14		
16	5.0/5.0	S1/3 to S12/3	Reddish yellow 5YR 6/8, SILT & CLAY, trace fine to medium Sand. Moist.		16		
18			Brownish yellow 10YR 6/8, SILT & CLAY, little fine to medium Sand. Some fine to medium Sand 18.9-19.5. Moist.		18		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-172

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION
20			
	4.6/5.0	S 1/4 to S 12/4	Light yellowish brown 10YR 6/4, fine to coarse SAND, and Silt & Clay, some fine to coarse subangular quartzite Gravel. Moist.
22			
24			
26			Light yellowish brown 10YR 6/4, fine to coarse subangular quartzite GRAVEL, little fine to coarse Sand, trace Silt. Moist.
	4.4/5.0	S 1/5 to S 11/5	Light yellowish brown 10YR 6/4, fine to coarse SAND and Silt & Clay, some fine subangular quartzite Gravel. Moist.
28			
30			
	5.0/5.0	S 1/6 to S 12/6	Yellow 10YR 7/6, SILT & CLAY, little fine Gravel, little fine to coarse Sand. Moist.
32			
34			Yellowish brown 10YR 5/6, SILT & CLAY, trace fine to coarse Sand. Moist.
			Yellowish brown 10YR 5/4, CLAY & SILT, trace fine to coarse Sand, trace fine Gravel. Wet.
36			Yellowish brown 10YR 5/4, fine to coarse subangular Gravel, little fine to coarse Sand, little Clayey Silt. Wet.
			Yellowish brown 10YR 5/4, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Wet.
	5.0/5.0	S 1/7 to S 12/7	
38			Yellowish brown 10YR 5/4, Clayey SILT, little fine to coarse Sand, little fine to coarse Gravel. Wet.
40			

GRAPHIC

DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20		Portland/benseal grout (2'-20.9')
22		Bentonite chip annular seal (20.9'-23.9')
24		2" PVC riser, (0'-27.5')
26		
28		#1 Sand pack (23.9'-38.5')
30		2" PVC 10-slot screen, (27.5'-37.5')
32		
34		8" HSA borehole (0-40')
36		
38		Bentonite chip annular seal (38.5'-40')
40		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-173

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***12/1/14, 12/10/14***

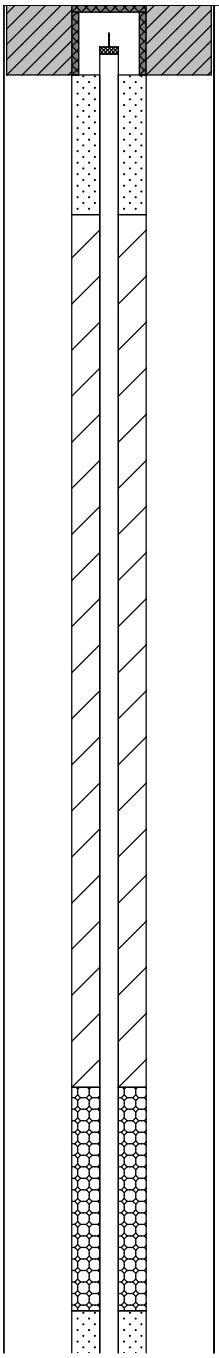
NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 40'. 4 1/4 ID HSA overdrilled to 40'. 2" PVC monitoring well installed 12/10/14.

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***Geoprobe Dual-tube sampling***
DEVELOPMENT DATE:	***1/9/15, 1/13/15, 1/15/15***
LOCATION:	***East central Old Arsenal Road at Canterbury Lane***
SURFACE ELEVATION	382.07' AMSL
EASTING	2259945.012
NORTHING	238249.237

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION
0			Asphalt road & gravel base.
			Cobbles & gravel.
2			Pale brown 10YR 6/3, subangular to subrounded fine to coarse GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.
4			
6			Reddish yellow 7.5 YR 6/6, fine to coarse subangular to subrounded GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.
8	3.3/5.0	S1/1 to S9/1	
10			Brown 7.5 YR 5/4, SILT & CLAY and fine to coarse Sand, trace fine subangular to subrounded Gravel. Moist.
12	4.5/5.0	S 1/2 to S12/2	
14			Reddish yellow 7.5YR 6/6, Clayey SILT, little fine to coarse Sand, trace fine Gravel. Moist.
16			Reddish yellow 7.5YR 6/6, SILT & CLAY, trace fine Sand. Moist.
18	4.9/5.0	S1/3 to S12/3	Yellowish brown 10YR 5/4, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.

GRAPHIC



DEPTH FEET	WELL CONSTRUCTION DETAILS
0	Flushmount manhole completion and concrete pad
	Locking compression cap
2	#1 Sand pack (1.0'-3.0')
4	8" HSA borehole (0-40')
6	
8	2" PVC riser, (0'-21.6')
10	Portland/benseal grout (3'-15.5')
12	
14	
16	Bentonite chip annular seal (15.5'-18.7')
18	

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-173**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20	5.0/5.0	S 1/4 to S 12/4	Yellowish brown 10YR 5/4, fine to coarse SAND, little fine to coarse Gravel, little Silt & Clay. Moist.		20		#1 Sand pack (18.7'-32.8')
22			Brownish yellow 10YR 6/6, SILT & CLAY, little fine to medium Sand. Moist.		22		
24			Brownish yellow 10YR 6/6, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.		24		2" PVC 10-slot screen, (21.6'-31.6')
26	5.0/5.0	S 1/5 to S 11/5	Brownish yellow 10YR 6/6, SILT & CLAY, some fine to coarse Sand, trace fine Gravel. Moist.		26		
28			Brownish yellow 10YR 6/6, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.		28		8" HSA borehole (0-40')
30	5.0/5.0	S 1/6 to S 12/6	Brownish yellow 10YR 5/6, SILT & CLAY, some fine to coarse Sand, trace fine Gravel. Moist.		30		
32			Light yellowish brown 10YR 6/4, fine to coarse subangular quartzite GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.		32		
34					34		
36	5.0/5.0	S 1/7 to S 12/7	Light yellowish brown 2.5Y 6/4, fine to coarse SAND, little Clayey Silt, little fine to coarse Gravel. Wet.		36		Bentonite chip annular seal (32.8'-40')
38			Light yellowish brown 10YR 6/4, fine to coarse GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.		38		
40					40		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-174

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***12/1/14, 12/15/14***

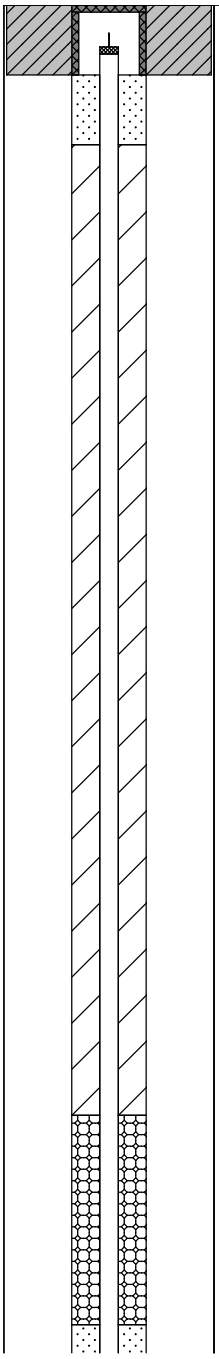
NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 35'. 4 1/4 ID HSA overdrilled to 35'. 2" PVC monitoring well installed 12/15/14.

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***Geoprobe Dual-tube sampling***
DEVELOPMENT DATE:	***1/13/15, 1/15/15-1/16/16***
LOCATION:	***West central Old Arsenal Road***
SURFACE ELEVATION	379.01' AMSL
EASTING	2259640.885
NORTHING	238247.838

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION
0			Asphalt & gravel base.
			Cobbles & boulders.
2			Brownish yellow 10YR 6/8, SILT & CLAY, some fine to coarse Sand, little fine Gravel. Moist.
4			
6			Reddish yellow 5 YR 6/6, fine to coarse subangular quartzite GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.
8	4.6/5.0	S 1/1 to S 12/1	Light yellowish brown 10YR 6/4, SILT & CLAY, some fine to coarse Sand, trace fine Gravel. Moist.
10			
12	5.0/5.0	S 1/2 to S 12/2	Strong brown 7.5YR 5/6, CLAY & SILT, some fine to coarse subangular quartzite GRAVEL, some fine to coarse Sand. Moist.
14			
16			
18	4.7/5.0	S 1/3 to S 12/3	Reddish yellow 7.5YR 6/8, Clayey SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist.
			Reddish yellow 7.5YR 6/8, Clayey SILT, some fine to coarse Gravel, little fine to coarse Sand. Moist.

GRAPHIC



WELL CONSTRUCTION DETAILS

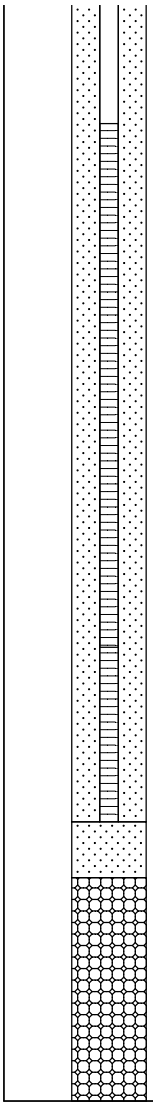
- Flushmount manhole completion and concrete pad
- Locking compression cap
- #1 Sand pack (1.0'- 2.0')
- 8" HSA borehole (0- 35')
- 2" PVC riser, (0'- 21')
- Portland/benseal grout (3'-15.9')
- Bentonite chip annular seal (15.9'-18.9')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-174

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20			Reddish yellow 7.5YR 6/8, fine to coarse subangular to subrounded GRAVEL, some Clayey Silt, little fine to coarse Sand. Moist.		20		#1 Sand pack (18.9'-31.8')
	5.0/5.0	S 1/4 to S 12/4	Brownish yellow 10YR 6/6, CLAY & SILT, little fine to coarse Sand, trace fine Gravel. Moist.				
22					22		
24					24		2" PVC 10-slot screen, (21'-31')
			Reddish yellow 7.5YR 6/6, SILT & CLAY, some fine to coarse Sand, little fine Gravel. Moist.				
26					26		
	5.0/5.0	S 1/5 to S 11/5	Reddish yellow 7.5YR 6/6, SILT & CLAY, little fine to coarse Sand, trace fine to coarse subrounded quartzite Gravel. Moist.				
28					28		8" HSA borehole (0-35')
30			Reddish yellow 7.5YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine Gravel. Wet.		30		
32					32		
	4.3/5.0	S 1/6 to S 12/6	Reddish yellow 7.5YR 6/6, SILT & CLAY, some fine to coarse Sand, trace fine Gravel. Wet.				Bentonite chip annular seal (31.8'-35')
34					34		
			Soil sample not recovered.				



GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: MW-175

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***1/5/15, 1/7/15***

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***John Peters***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***Geoprobe Dual-tube sampling***
DEVELOPMENT DATE:	***1/13/15-1/14/15***
LOCATION:	***West Old Arsenal Road at cul-de-sac***

NOTES: Vacuum excavation to 5'. 3" dia dual-tube direct push macrocore advanced to 37'. 4 1/4 ID HSA overdrilled to 37'. 2" PVC monitoring well installed 1/7/15.

SURFACE ELEVATION	376.49' AMSL
EASTING	2259407.100
NORTHING	238248.740

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
0			Asphalt road & gravel base.		0		Flushmount manhole completion and concrete pad
			Gravel & cobbles.				Locking compression cap
2					2		#1 Sand pack (1.0'-2.0')
			Light yellowish brown 10YR 6/4, subangular fine to coarse GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.				
4					4		8" HSA borehole (0-37')
			No Recovery.				
6			Brownish yellow 10YR 6/6, fine to coarse subangular quartzite GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.		6		
	4.2/5.0	S 1/1 to S 10/1	Brownish yellow 10YR 6/6, CLAY & SILT, and fine to coarse Sand, some fine to coarse subangular quartzite Gravel. Moist.				2" PVC riser, (0'-18.8')
8					8		
10					10		Portland/benseal grout (2'-12.2')
			Very pale brown 10YR 7/3, fine to coarse subangular quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.				
12					12		
	4.5/5.0	S 1/2 to S 12/2	Light gray 2.5Y 7/2, fine to coarse SAND, trace fine Gravel, trace Silt. Moist.				
			Pale yellow 2.5Y 7/3, fine to coarse SAND, some fine to coarse Gravel, trace Silt. Moist.				
14					14		Bentonite chip annular seal (12.2'-16.6')
			Pale yellow 2.5Y 7/3, fine to coarse SAND, some fine Gravel, some Silt & Clay. Moist.				
			No Recovery.				
16					16		
			Grayish brown 10YR 6/2, fine to coarse subangular GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.				#1 Sand pack (16.6'-29.8')
	3.9/5.0	S 1/3 to S 10/3	White quartzite cobble.				
18					18		
			White fine to coarse GRAVEL, trace fine to coarse Sand, trace Clayey Silt. Moist.				2" PVC 10-slot screen, (18.8'-28.8')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **MW-175**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20			Brownish yellow 10YR 6/6, fine to coarse SAND, some Clay & Silt, little fine Gravel. Moist.		20		2" PVC 10-slot screen, (18.8'-28.8')
			Brownish yellow 10YR 6/6, fine to coarse SAND, some Clayey Silt, trace fine Gravel. Moist.				
22	5.0/5.0	S 1/4 to S 12/4	Yellow 10YR 7/6, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.		22		
			Reddish yellow 7.5YR 6/6, CLAY & SILT, some fine to coarse Sand, trace fine Gravel. Moist.				
24			Brown 7.5YR 6/4, fine to coarse SAND, some Clay & Silt, some fine to coarse subangular to subrounded GRAVEL. Moist.		24		#1 Sand pack (16.6'-29.8')
			Brown 7.5YR 5/4, Clayey SILT, some fine to coarse Gravel, little fine to coarse Sand, Wet. Dark gray silty seams.				
26			Brown 7.5YR 6/4, fine to coarse GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.		26		
	5.0/5.0	S 1/5 to S 11/5	Brownish yellow 10YR 6/6, SILT & CLAY and fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand. Moist.				
28			Brownish yellow 10YR 6/6, Clayey SILT, little fine to medium Sand. Wet. 1" sandy, gravelly seam at 29.7'.		28		8" HSA borehole (0-37')
30			Brownish yellow 10YR 6/6, SILT & CLAY, some fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand. Moist.		30		
32	5.0/5.0	S 1/6 to S 10/6	Brownish yellow 10YR 6/6, fine to coarse subrounded GRAVEL, some fine to coarse Sand, little Clayey Silt. Moist to 32.3'. Wet below 32.3'.		32		Bentonite chip annular seal (29.8'-37')
34			Brownish yellow 10YR 6/6, fine to coarse subrounded GRAVEL and fine to coarse Sand, little Clayey Silt. Wet.		34		
			Brownish yellow 10YR 6/6, fine to coarse subrounded GRAVEL and fine to coarse Sand, trace Clayey Silt. Wet.				
36	1.9/2.0	N/A	Brownish yellow 10YR 6/6, fine to coarse subrounded GRAVEL and fine to coarse Sand, little Clayey Silt. Wet.		36		
			Yellowish brown 10YR 5/6, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Wet.				

Appendix B

Soil Vapor Probes Construction Specifications and Logs

Memorandum

GROUNDWATER SCIENCES CORPORATION

To: fYNOP Technical Team

From: Steve Snyder

Date: January 16, 2015

Re: Near Source Soil Gas Vapor Point Installation

The attached Figure 1 explains the dimensions and boring method for near source soil gas (NSSG) vapor point installation to be installed during the completion of Addendum 15 of the Field Sampling Plan for Part 2 of the Groundwater Remedial Investigation (GSC, April 2012). The following steps will be taken to complete the installation:

1. The depth of the bottom of the boring will be established by determining the equilibrated water table in the temporary well point or final monitoring well paired with the vapor point to be installed. The depth will be determined by subtracting 5 feet plus the height of the capillary zone. The capillary zone will be determined by referring to Table 10 of the J&E Users Guide (attached), which provides a calculated height of the capillary zone based on the soil texture.
2. Three to five undisturbed samples will be collected from the boring. The undisturbed samples will be collected from zones based on the geologist's log and laboratory analyses from the adjacent paired well boring. Zones selected for undisturbed sampling are;
    a. 8' below the ground surface, representing the zone below basement level in adjacent homes,
    b. the zone representing the finest textured soils,
    c. the zone immediately below the deepest extent of the augers, representing the capillary zone.
    d. Depending on the depth of the boring one or two additional samples could be spaced throughout the boring to characterize materials penetrated.
3. The boring will be completed using 4.25" I.D. hollow stem augers to a depth to be calculated using Figure 1, such that the deeper of two NSSG vapor points is installed above the water table in an 18" glass bead pack, and the second point is installed 10 feet higher (10 feet between the top of the lower permeable pack and the upper permeable pack). The lower portion of the boring is made using the dual tube soil sampling system through the augers.
4. Volumes of materials (sand pack and grout zones) will be calculated, and sounded for verification.
5. Grout with 5% bentonite will be required because the zones to be sealed will be above the water table, and therefore are potentially subject to dehydration and cracking. Grout will be a consistency that will pour through a tremie pipe, and will

not penetrate the sand pack (six [6] gallons of water per bag of Portland cement). A small amount of choke sand and bentonite pellets could be used above the lower sand layer to prevent grout penetration. Above the top of the grout layer between the lower and upper vapor point, choke sand and bentonite pellets will also be placed. Similarly, above the top of the upper sand, choke sand and pellets will be used to prevent grout from penetrating the sand pack. Bentonite pellets will be hydrated for approximately 30 minutes prior to installing the next layer.

6. Care must be taken to positively identify shallow versus deep implant tubing.
7. The top hole will be finished with a flush-mounted driveover cover as described in Addendum 15.

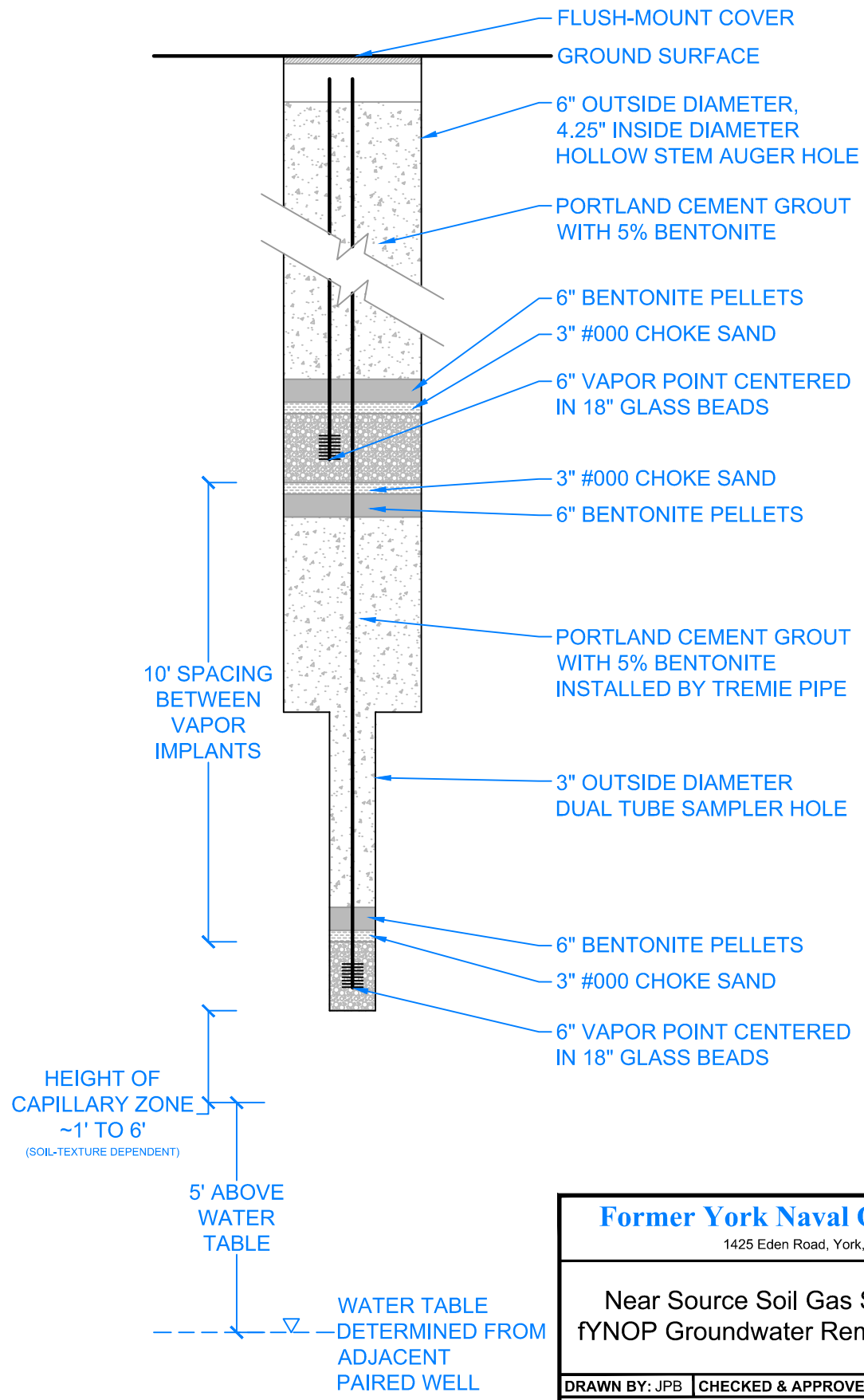


Figure I

Former York Naval Ordnance Plant

1425 Eden Road, York, PA 17402

Near Source Soil Gas Sample Implants
fYNOP Groundwater Remedial Investigation

DRAWN BY: JPB	CHECKED & APPROVED BY: SMS	DATE: 12/18/2014

Q:\10000\10012\Data\CAD\10012-023.dwg

GROUNDWATER SCIENCES CORPORATION

TABLE 10. SOIL-DEPENDENT PROPERTIES FOR THE VAPOR INTRUSION MODEL - FIRST TIER ASSESSMENT

U.S. Soil Conservation Service (SCS) Soil Texture	Saturated Water Content Total Porosity θ_s (cm^3/cm^3)	Residual Water Content θ_r (cm^3/cm^3)	Unsaturated Zone: Water-Filled Porosity — Mean or Typical $(FC_{1/3bar}+\theta_r)/2$ $\theta_{w,unsat}$ (cm^3/cm^3)	Range $\theta_{w,unsat}$ (cm^3/cm^3)	Conservative $\theta_{w,unsat}$ (cm^3/cm^3)	Modeled $\theta_{w,unsat}$ (cm^3/cm^3)	Capillary Transition Zone: Saturated Water Content Total Porosity θ_s (cm^3/cm^3)	$\theta_{w,cap}$ Cap @ air-entry	Height Cap Zone Fetter (94) (cm)
Clay	0.459	0.098	0.215	0.098-0.33	0.098	0.215	0.459	0.412	81.5
Clay Loam	0.442	0.079	0.168	0.079-0.26	0.079	0.168	0.442	0.375	46.9
Loam	0.399	0.061	0.148	0.061-0.24	0.061	0.148	0.399	0.332	37.5
Loamy Sand	0.39	0.049	0.076	0.049-0.1	0.049	0.076	0.39	0.303	18.8
Silt	0.489	0.05	0.167	0.05-0.28	0.050	0.167	0.489	0.382	163.0
Silt Loam	0.439	0.065	0.180	0.065-0.3	0.065	0.180	0.439	0.349	68.2
Silty Clay	0.481	0.111	0.216	0.11-0.32	0.111	0.216	0.481	0.424	192.0
Silty Clay Loam	0.482	0.09	0.198	0.09-0.31	0.090	0.198	0.482	0.399	133.9
Sand	0.375	0.053	0.054	0.053-0.055	0.053	0.054	0.375	0.253	17.0
Sandy Clay	0.385	0.117	0.197	0.117-0.28	0.117	0.197	0.385	0.355	30.0
Sandy Clay Loam	0.384	0.063	0.146	0.063-0.23	0.063	0.146	0.384	0.333	25.9
Sandy Loam	0.387	0.039	0.103	0.039-0.17	0.039	0.103	0.387	0.320	25.0
Loamy Sand	0.39	0.049	0.076	0.049-0.1	0.049	0.076	0.39	0.303	18.8

Source: Environmental Quality Management, Inc., February 22, 2004, User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings, Page 37.

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: SV-167

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***3/3/15***

NOTES: 4 1/4 ID HSA advanced to 31'.
Soil descriptions are from MW-167 well log.

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***Hollow Stem Auger***
DEVELOPMENT DATE:	***N/A***
LOCATION:	***10' west of MW-167***
SURFACE ELEVATION	Not Surveyed
EASTING	Not Surveyed
NORTHING	Not Surveyed

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
0			Asphalt & gravel base.		0		Flushmount manhole completion and concrete pad
			Yellowish red 5YR 5/6, Clayey SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist.				Swagelok fitting
2					2		#1 Sand pack (1.0'-2.5')
4					4		8" HSA borehole (0-31')
			Reddish yellow 10YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.				
6					6		
							3/8" ID Poly tubing from surface to two SV points
8			Reddish yellow 7.5YR 6/8, SILT & CLAY, some fine to medium Sand, trace fine Gravel. Moist.		8		
10					10		Portland/benseal grout (2.5'-16')
			Yellowish red 5YR 5/6, Clayey SILT, some fine to coarse Sand, little fine to coarse Gravel. Moist.				
12			Red 2.5YR 5/8, fine to coarse subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.		12		
			Red 2.5YR 5/6, SILT & CLAY and fine to coarse Sand, little fine subangular to subrounded quartzite GRAVEL. Moist.				
14					14		
							Bentonite chip annular seal (16'-16.5')
							#00 Choke sand (16.5'-16.8')
16					16		Glass beads (16.8'-18.3')
							Stainless steel SV point screen (17.3'-17.7')
			Reddish yellow 5YR 6/6, Clayey SILT, some fine Sand. Moist.				
18					18		#00 Choke sand (18.3'-18.6')
			Yellowish red 5YR 4/6, Clayey SILT, some fine to coarse Sand, little fine Gravel. Moist.				Bentonite chip annular seal (18.6'-20')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **SV-167**

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20			Red 10R 4/6, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.		20		Bentonite chip annular seal (18.6'-20')
22			Reddish yellow 5YR 6/8, CLAY & SILT, trace fine Sand. Moist.		22		Portland/benseal grout (20'-27.4')
24			Red 2.5YR 5/6, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.		24		8" HSA borehole (0-31')
26			Yellowish red 5YR 5/6, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.		26		Bentonite chip annular seal (27.4'-27.9')
28			Red 10R 5/8, SILT & CLAY, little fine Sand. Moist.		28		#00 Choke sand (27.9'-28.2')
30					30		Glass beads (28.2'-29.7')
							Stainless steel SV point screen (28.7'-29.2')
							Collapsed formation (29.7'-31')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: SV-168

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	***Harley Davidson***	DRILLING CO.:	***Eichelbergers, Inc.***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***	DRILLER:	***Shane Albert***
JOB NO.:	***10012.26***	RIG TYPE:	***Geoprobe 7822DT***
LOGGED BY:	***R. Ulrich***	DRILLING METHOD:	***Hollow Stem Auger***
DATES DRILLED:	***2/26/15***	DEVELOPMENT DATE:	***N/A***
		LOCATION:	***10' west of MW-168***
NOTES: 4 1/4 ID HSA advanced to 16.6'. Soil descriptions are from MW-168 well log.		SURFACE ELEVATION	Not Surveyed
		EASTING	Not Surveyed
		NORTHING	Not Surveyed

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
0			Asphalt road & gravel base		0		Flushmount manhole completion and concrete pad
2			Reddish yellow 5YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.		2		Swagelok fitting #1 Sand pack (1.0'-2.5') 8" HSA borehole (0-16.8') 3/8" ID Poly tubing from surface to two SV points
4					4		
6			No Recovery		6		Portland/benseal grout (2.5'-7.3')
8			Brownish yellow 10YR 6/8, fine to coarse subangular quartzite GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.		8		Bentonite chip annular seal (7.3'-7.9') #00 Choke sand (7.9'-8.5') Glass beads (8.5'-9.95')
			Light brown 7.5 YR 6/4, CLAY & SILT, little fine to medium Sand. Moist.				
10			Reddish yellow 7.5YR 6/8, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.		10		Stainless steel SV point screen (9.0'-9.5') #00 Choke sand (9.95'-10.2') Bentonite chip annular seal (10.2'-10.7')
			Reddish yellow 7.5YR 6/6, Clayey SILT, little fine to coarse Sand, little fine to coarse Gravel. Moist.				
12			Reddish yellow 7.5YR 6/6, SILT & CLAY, little fine to coarse Sand, little fine to coarse Gravel. Moist.		12		Portland/benseal grout (10.7'-14.25')
			Reddish yellow 7.5YR 6/6, SILT & CLAY, some fine to coarse Gravel, little fine to coarse Sand. Moist.				
14			Reddish yellow 10YR 6/8, CLAY & SILT, little fine Sand. Moist.		14		Bentonite chip annular seal (14.25'-14.7') #00 Choke sand (14.7'-15.0') Glass beads (15.0'-16.6') Stainless steel SV point screen (15.5'-16.0')
			Yellowish brown 10YR 6/4, SILT & CLAY, little fine to coarse Sand, trace fine Gravel. Moist.				
16					16		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: SV-171

PROJECT INFORMATION

PROJECT:	***Harley Davidson***
SITE LOCATION:	***Former York Naval Ordnance Plant, York, PA***
JOB NO.:	***10012.26***
LOGGED BY:	***R. Ulrich***
DATES DRILLED:	***1/13/15-1/14/15, 1/23/15***

NOTES: 6 1/4 ID HSA advanced to 35'. 5" air rotary to 60'. Backfilled with holeplug to 29.1'. Soil descriptions are from MW-171 well log.

DRILLING INFORMATION

DRILLING CO.:	***Eichelbergers, Inc.***
DRILLER:	***Shane Albert***
RIG TYPE:	***Geoprobe 7822DT***
DRILLING METHOD:	***HSA, Air Rotary***
DEVELOPMENT DATE:	***N/A***
LOCATION:	***10' northwest of MW-171***
SURFACE ELEVATION	Not Surveyed
EASTING	Not Surveyed
NORTHING	Not Surveyed

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
0			Asphalt road & gravel base.		0		Flushmount manhole completion and concrete pad
2			Light yellowish brown 10YR 6/4, fine to coarse subangular GRAVEL, little fine to coarse Sand, trace Clayey Silt. Moist.		2		Swagelok fitting #1 Sand pack (1.0'-2.5')
4					4		10" HSA borehole (0-35')
6			No Recovery.		6		3/8" ID Poly tubing from surface to two SV points
8			Light yellowish brown 10YR 6/4, SILT & CLAY, trace fine to coarse Sand, trace fine Gravel. Moist.		8		Portland/benseal grout (1.5'-14.5')
			Brownish yellow 10YR 6/8, SILT & CLAY, some fine to medium Sand. Moist.				
10			Brownish yellow 10YR 6/6, fine to coarse subangular to subrounded quartzite GRAVEL, little fine to coarse Sand, little Clayey Silt. Moist.		10		
12			Brownish yellow 10YR 6/6, SILT & CLAY, and fine to coarse Sand, trace fine Gravel. Moist.		12		
14					14		Bentonite chip annular seal (14.5'-15.0') #00 Choke sand (15.0'-15.3') Glass beads (15.3'-16.8')
16					16		Stainless steel SV point screen (15.8'-16.3') #00 Choke sand (16.8'-17.1')
18			Yellowish brown 10YR 5/6, fine to coarse subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.		18		Bentonite chip annular seal (17.1'-17.6') Portland/benseal grout (17.6'-26.0')

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: SV-171

PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
20			Grayish brown 10YR 5/2, SILT & CLAY, some fine to coarse Sand, trace fine Gravel. Moist. Mottled brownish yellow.		20		Portland/benseal grout (17.6'-26.0')
22			Grayish brown 10YR 5/2, fine to coarse subrounded GRAVEL, some Silt & Clay, little fine to coarse Sand. Moist.		22		10" HSA borehole (0-35')
24			Grayish brown 10YR 5/2, SILT & CLAY, little fine to medium Sand, trace fine Gravel. Moist to 22.5'. Wet 22.5'-23.8'. Gravelly at base.		24		
			Yellowish brown 10YR 5/6, fine to coarse subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.				Bentonite chip annular seal (26.0'-26.5')
26			Yellowish brown 10YR 5/6, SILT & CLAY, trace fine to medium Sand. Moist.		26		#00 Choke sand (26.5'-26.8')
			Mottled light & dark brown, light & dark gray, and orange, Clayey SILT, little fine to medium Sand. Wet.				Glass beads (26.8'-28.3')
28					28		Stainless steel SV point screen (27.3'-27.8')
			Light yellowish brown 10YR 6/4, fine to coarse subrounded quartzite GRAVEL, little fine to coarse Sand, little Silt & Clay. Moist.				#00 Choke sand (28.3'-28.6')
30			Brownish yellow 10YR 6/6, CLAY & SILT. Moist.		30		Bentonite chip annular seal (28.6'-60')
			Brownish yellow 10YR 6/6, fine to coarse subrounded GRAVEL, some fine to coarse Sand, little Silt & Clay. Wet.				
32			Mottled as 26.5'-28.5', CLAY & SILT, trace fine Sand. Wet.		32		
34					34		
			Hard to moderately hard, fresh, N5/ gray, LIMESTONE. Wet.				
36					36		5" Air Rorary borehole (35'-60')
38					38		
40					40		
42					42		

GROUNDWATER SCIENCES CORPORATION

GEOLOGIC LOG: **SV-171**

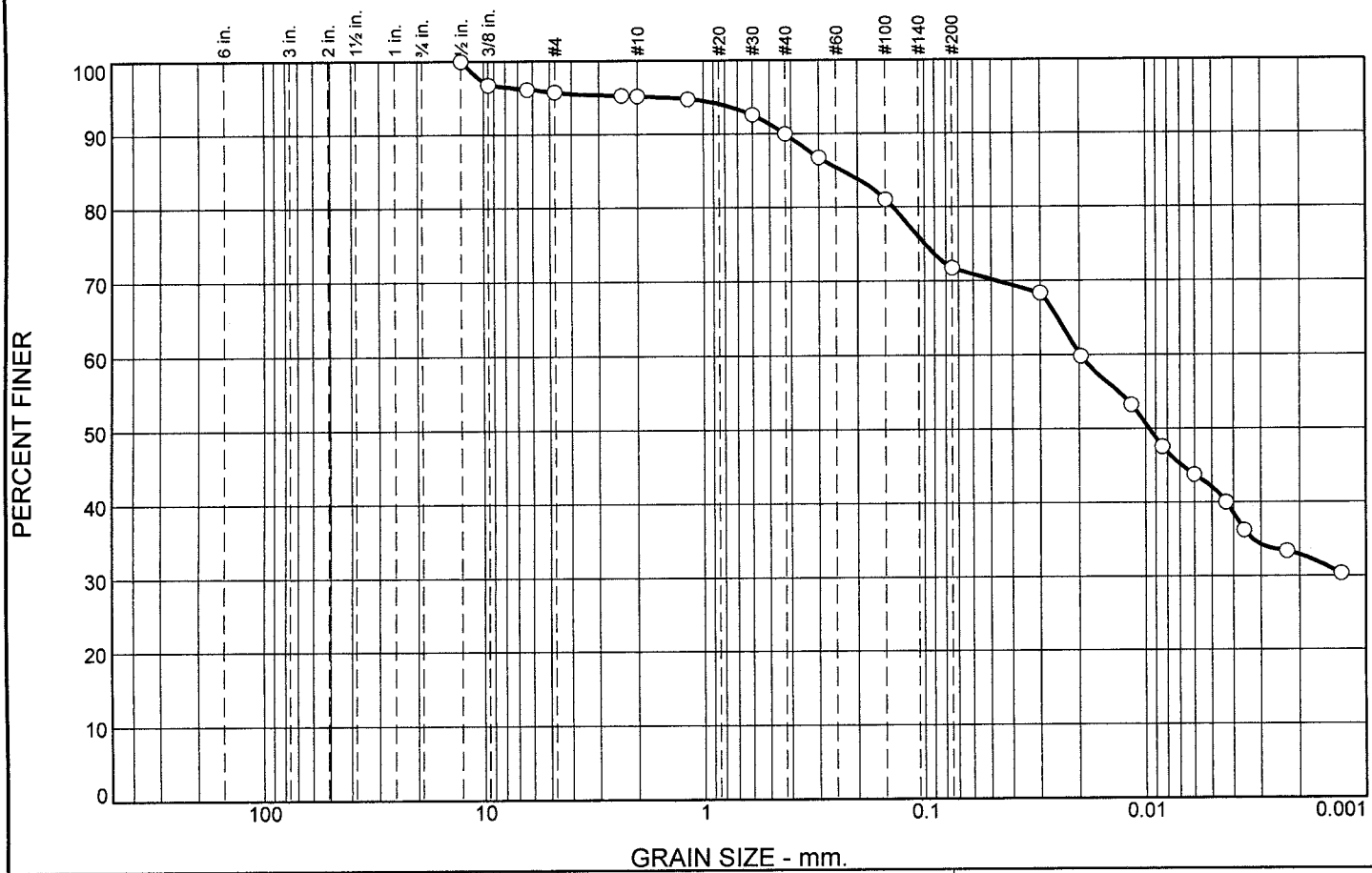
PROJECT: ***Harley Davidson***

DEPTH FEET	RECOVERY	SAMPLE	SOIL DESCRIPTION	GRAPHIC	DEPTH FEET	WELL CONSTRUCTION	WELL CONSTRUCTION DETAILS
44			Hard to moderately hard, fresh, N5/ gray, LIMESTONE. Wet.		44		
46					46		5" Air Rorary borehole (35'-60')
48					48		
50					50		Bentonite chip annular seal (28.6'-60')
52					52		
54					54		
56					56		
58					58		
60					60		

Appendix C

Particle Size Distribution Reports

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	0.6	5.2	18.3	29.6	42.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50	100.0		
.375	96.8		
.25	96.2		
#4	95.8		
#8	95.3		
#10	95.2		
#16	94.8		
#30	92.6		
#40	90.0		
#50	86.8		
#100	81.1		
#200	71.7		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4249 D_{85}= 0.2348 D_{60}= 0.0198
D_{50}= 0.0097 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 23.3%

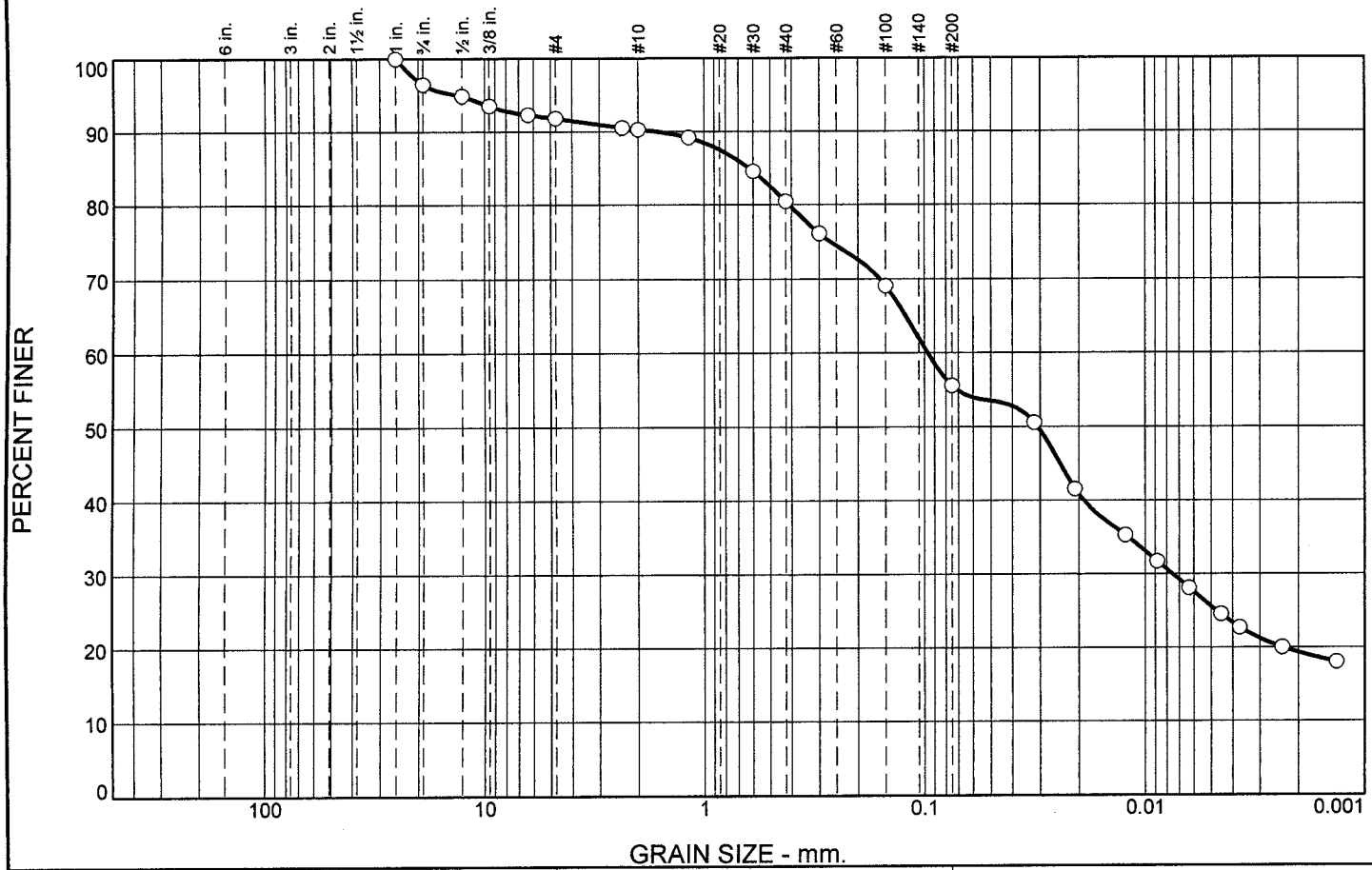
Source of Sample: Test Boring #HD-MW-161 **Depth:** 12.4' to 12.8'
Sample Number: 1 **Date:** 01/16/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.5	4.7	1.5	9.8	24.9	30.0	25.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0	100.0		
.75	96.5		
.50	94.9		
.375	93.5		
.25	92.3		
#4	91.8		
#8	90.6		
#10	90.3		
#16	89.2		
#30	84.6		
#40	80.5		
#50	76.1		
#100	69.1		
#200	55.6		

* (no specification provided)

Material Description

Brown Clayey Silt And Sand With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.6111 D_{85}= 0.6239 D_{60}= 0.0970
D_{50}= 0.0308 D_{30}= 0.0075 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 16.0%

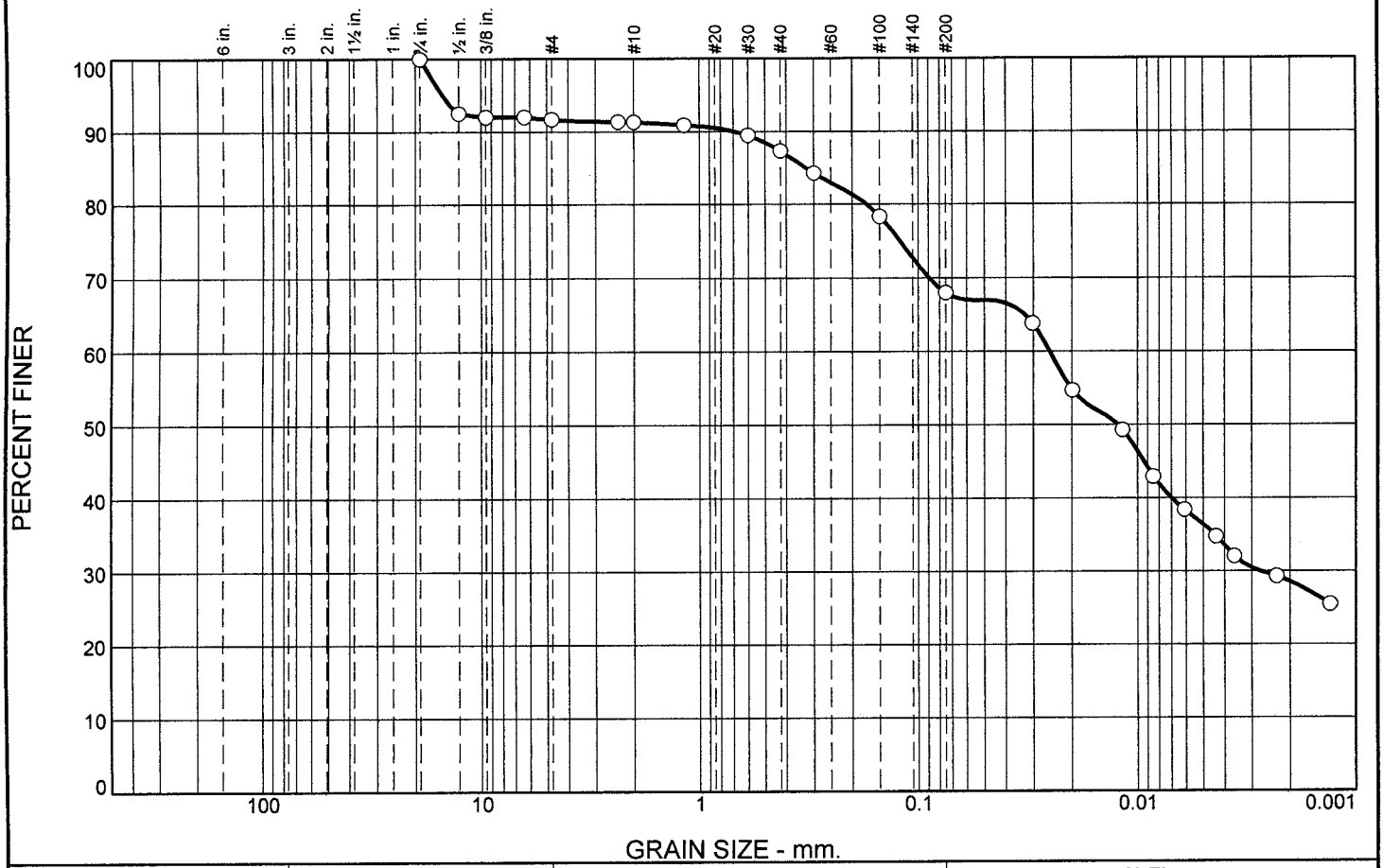
Source of Sample: Test Boring #HD-MW-161 **Depth:** 17.4' to 17.8'
Sample Number: 2 **Date:** 01/16/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.3	0.4	4.0	19.3	31.6	36.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	92.6		
.375	92.1		
.25	92.1		
#4	91.7		
#8	91.4		
#10	91.3		
#16	90.9		
#30	89.5		
#40	87.3		
#50	84.3		
#100	78.4		
#200	68.0		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6761 D_{85}= 0.3262 D_{60}= 0.0253
D_{50}= 0.0123 D_{30}= 0.0027 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 21.8%

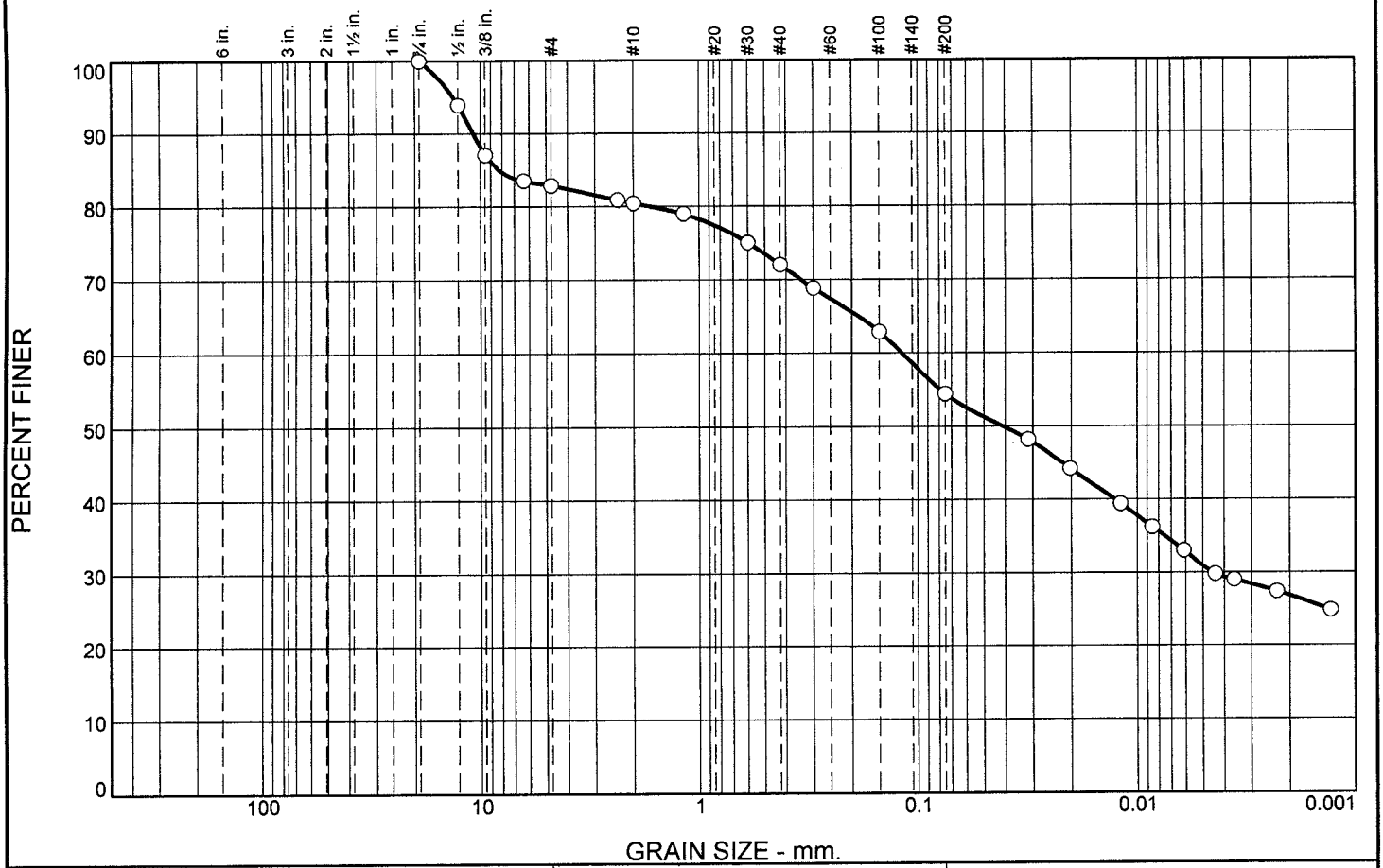
Source of Sample: Test Boring #HD-MW-161 **Depth:** 22.0' to 22.4'
Sample Number: 3 **Date:** 01/16/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	17.1	2.4	8.5	17.5	23.6	30.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	93.9		
.375	87.1		
.25	83.5		
#4	82.9		
#8	80.9		
#10	80.5		
#16	79.0		
#30	75.1		
#40	72.0		
#50	68.9		
#100	62.9		
#200	54.5		

* (no specification provided)

Material Description

Reddish Brown Silty Sand And Clay With Some Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.8269 D_{85}= 8.2572 D_{60}= 0.1179
D_{50}= 0.0407 D_{30}= 0.0045 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 18.4%

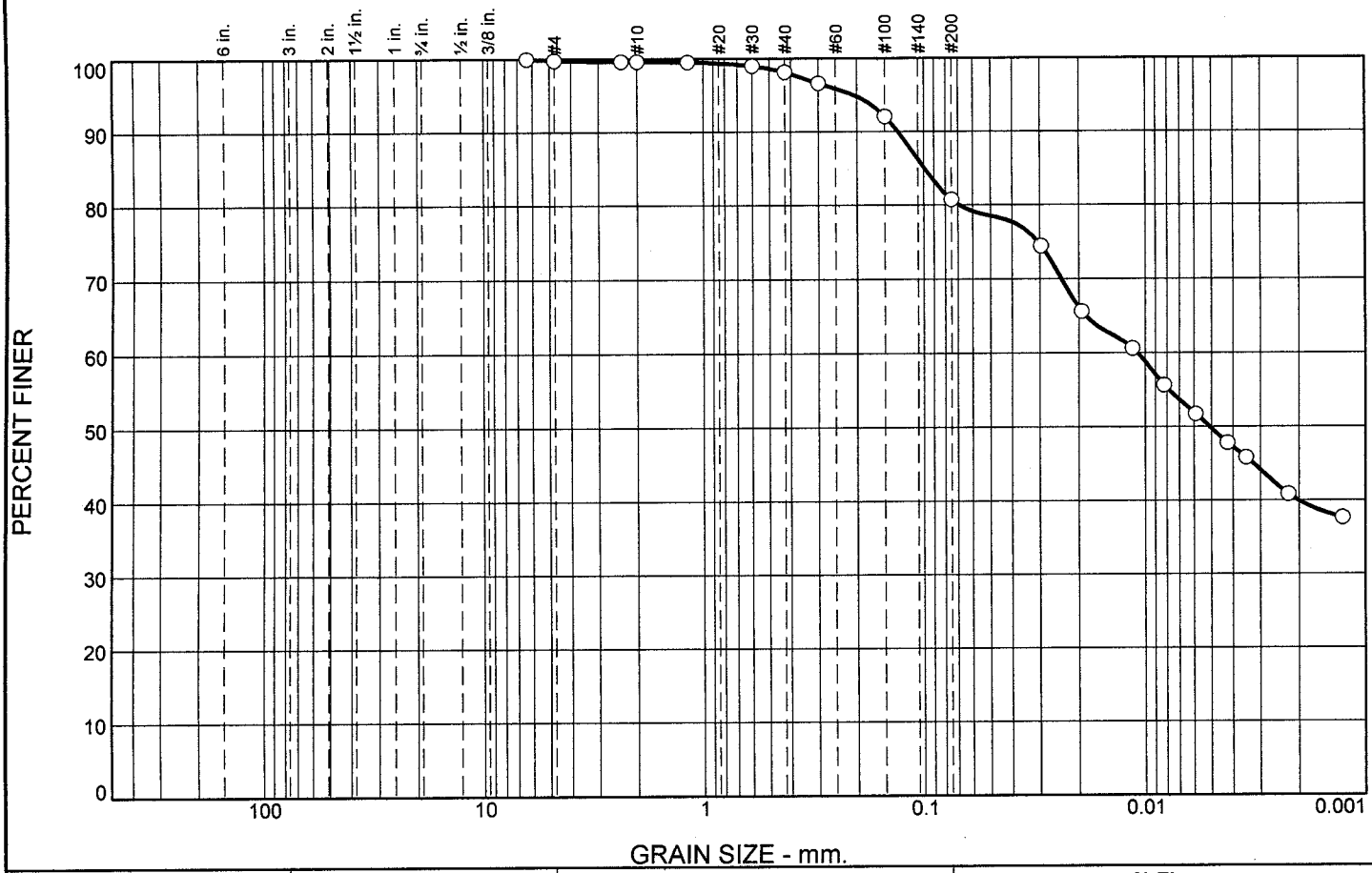
Source of Sample: Test Boring #HD-MW-161 **Depth:** 26.6' to 27.0'
Sample Number: 4 **Date:** 01/16/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.2	1.5	17.3	31.1	49.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.25	100.0		
#4	99.8		
#8	99.6		
#10	99.6		
#16	99.5		
#30	99.0		
#40	98.1		
#50	96.6		
#100	92.1		
#200	80.8		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1308 D_{85}= 0.0993 D_{60}= 0.0109
D_{50}= 0.0051 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 18.4%

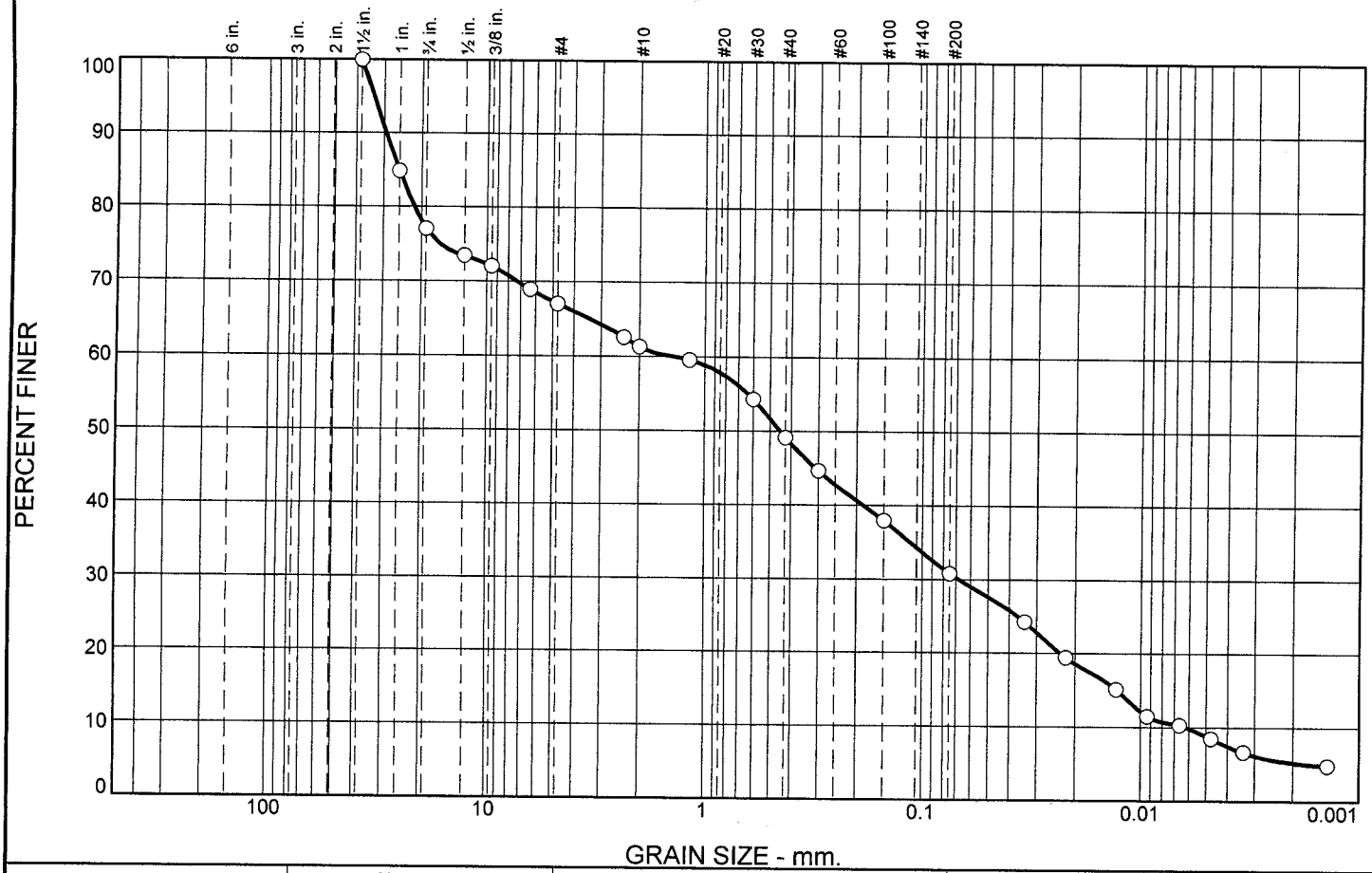
Source of Sample: Test Boring #HD-MW-161 **Depth:** 31.6' to 32.0'
Sample Number: 5 **Date:** 01/16/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.9	10.1	5.7	12.1	18.4	22.0	8.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1.0	84.9		
.75	77.1		
.50	73.5		
.375	72.0		
.25	68.9		
#4	67.0		
#8	62.6		
#10	61.3		
#16	59.6		
#30	54.3		
#40	49.2		
#50	44.7		
#100	38.0		
#200	30.8		

* (no specification provided)

Material Description

Brown Silty Sand And Gravel With A Trace Of Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 29.3605 D_{85}= 25.4810 D_{60}= 1.3693
D_{50}= 0.4495 D_{30}= 0.0679 D_{15}= 0.0128
D_{10}= 0.0062 C_u= 221.13 C_c= 0.54

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 10.9%

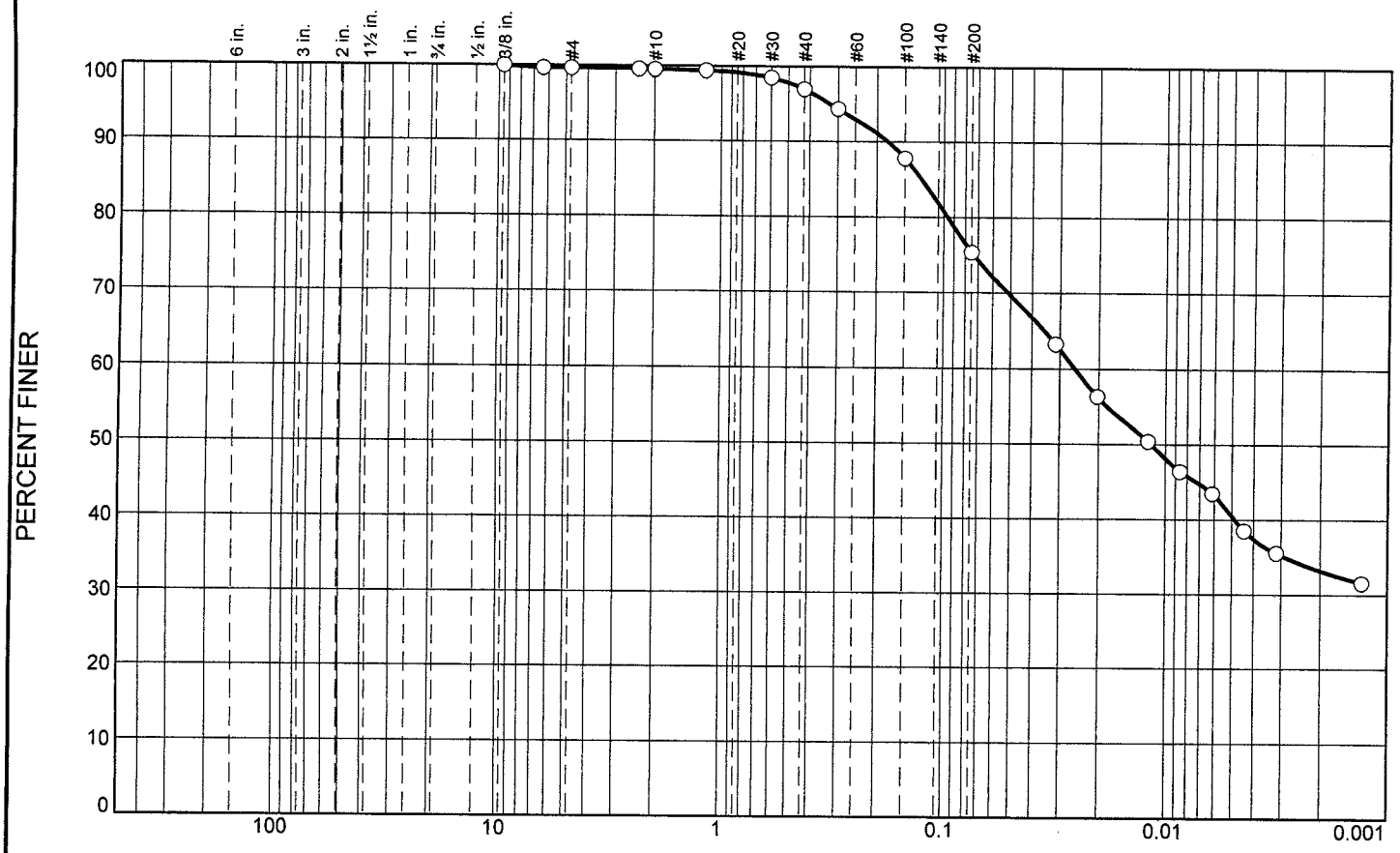
Source of Sample: Test Boring #HD-MW-162 **Depth:** 8.0' to 8.5'
Sample Number: 1 **Date:** 01/29/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.2	2.5	21.6	35.0	40.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
.25	99.7		
#4	99.7		
#8	99.6		
#10	99.5		
#16	99.4		
#30	98.5		
#40	97.0		
#50	94.4		
#100	87.8		
#200	75.4		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1785 D_{85}= 0.1259 D_{60}= 0.0257
D_{50}= 0.0116 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 22.6%

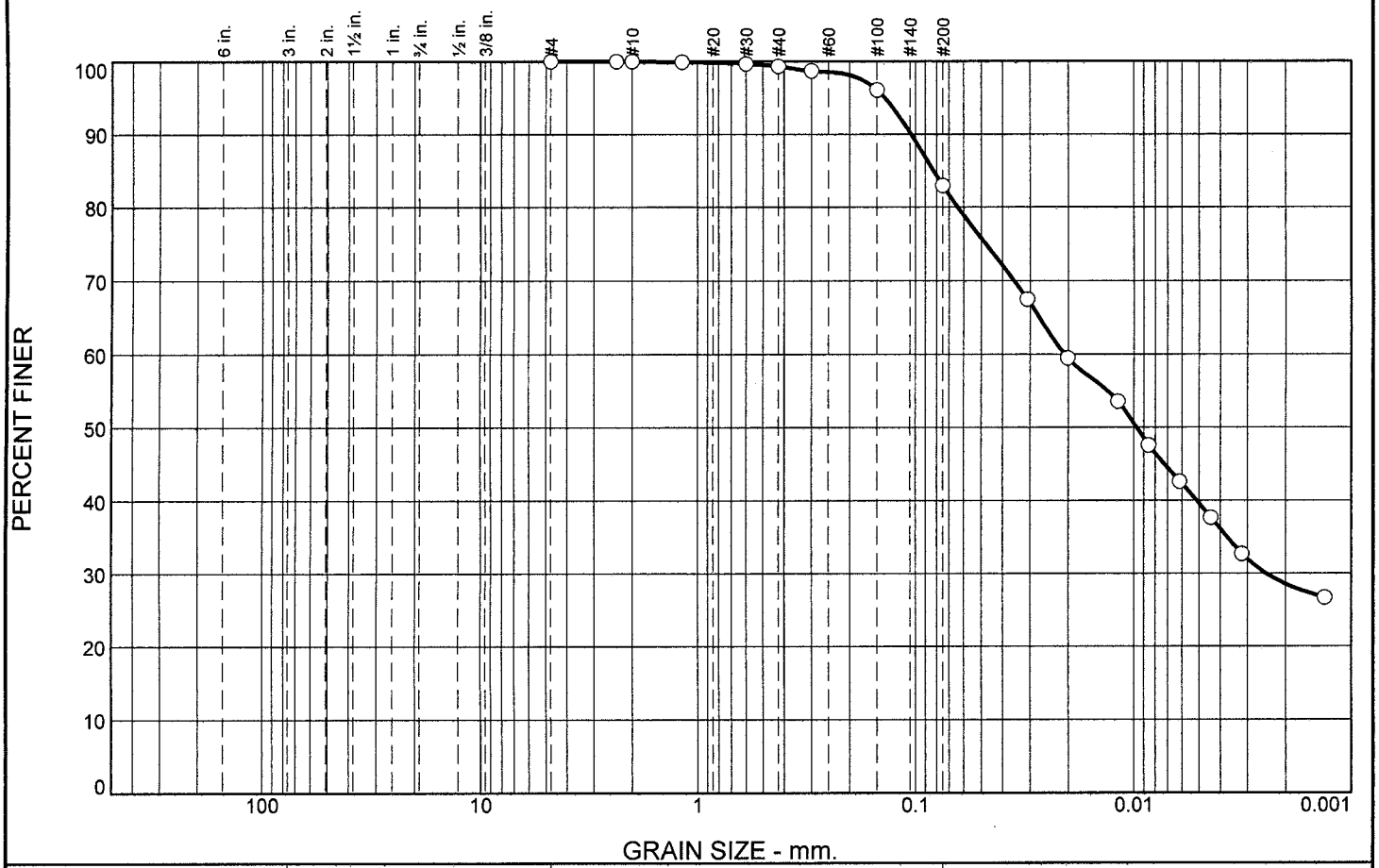
Source of Sample: Test Boring #HD-MW-162 **Depth:** 16.0' to 16.5'
Sample Number: 2 **Date:** 01/29/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.7	16.3	43.4	39.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#10	100.0		
#16	99.9		
#30	99.7		
#40	99.3		
#50	98.7		
#100	96.1		
#200	83.0		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1049 D_{85}= 0.0829 D_{60}= 0.0208
D_{50}= 0.0097 D_{30}= 0.0025 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 22.0%

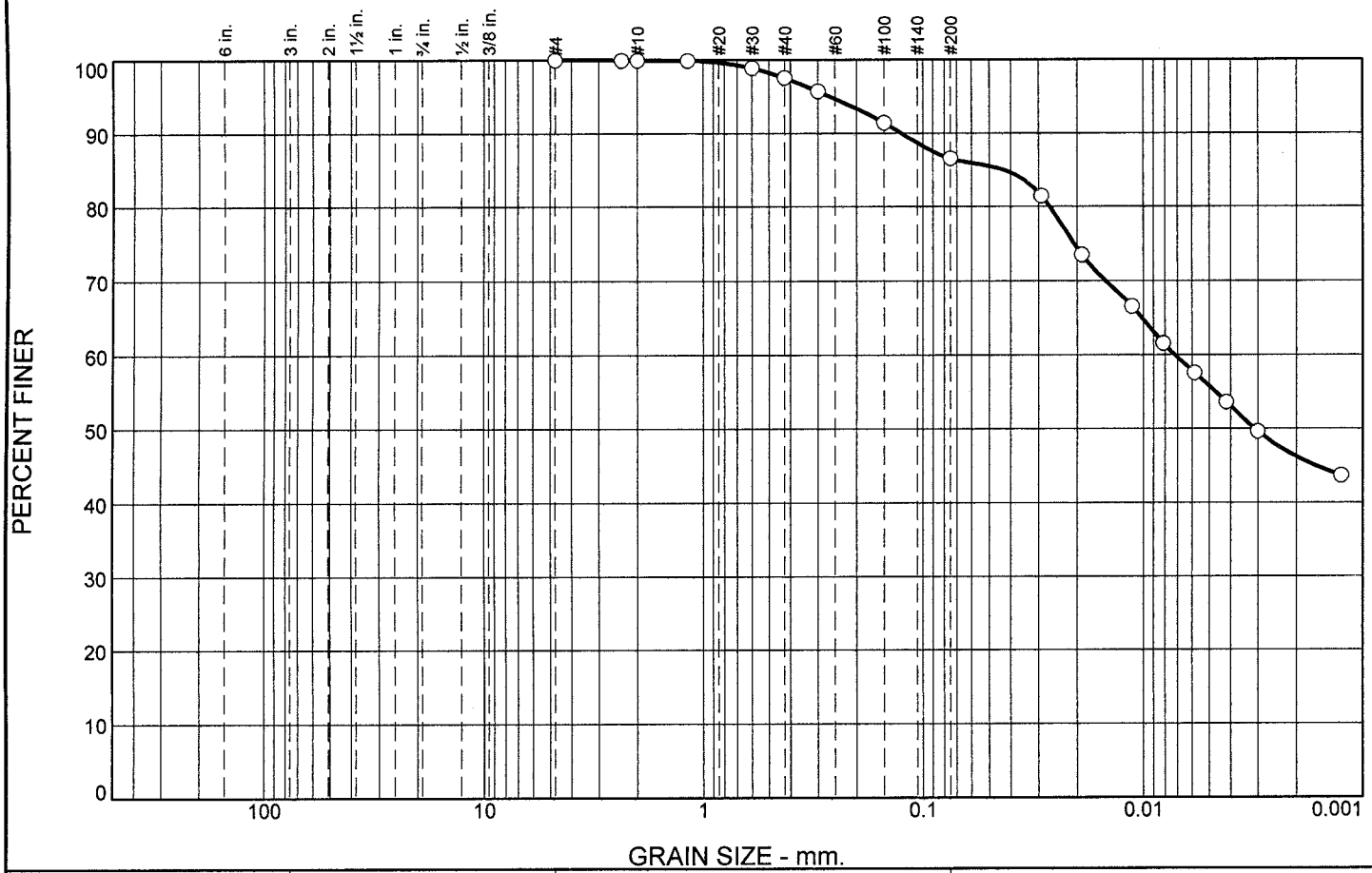
Source of Sample: Test Boring #HD-MW-162 **Depth:** 23.0' to 23.5'
Sample Number: 3 **Date:** 01/29/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	2.3	11.0	30.8	55.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#10	99.9		
#16	99.9		
#30	98.9		
#40	97.6		
#50	95.8		
#100	91.5		
#200	86.6		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1246 D_{85}= 0.0425 D_{60}= 0.0072
D_{50}= 0.0031 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 34.1%

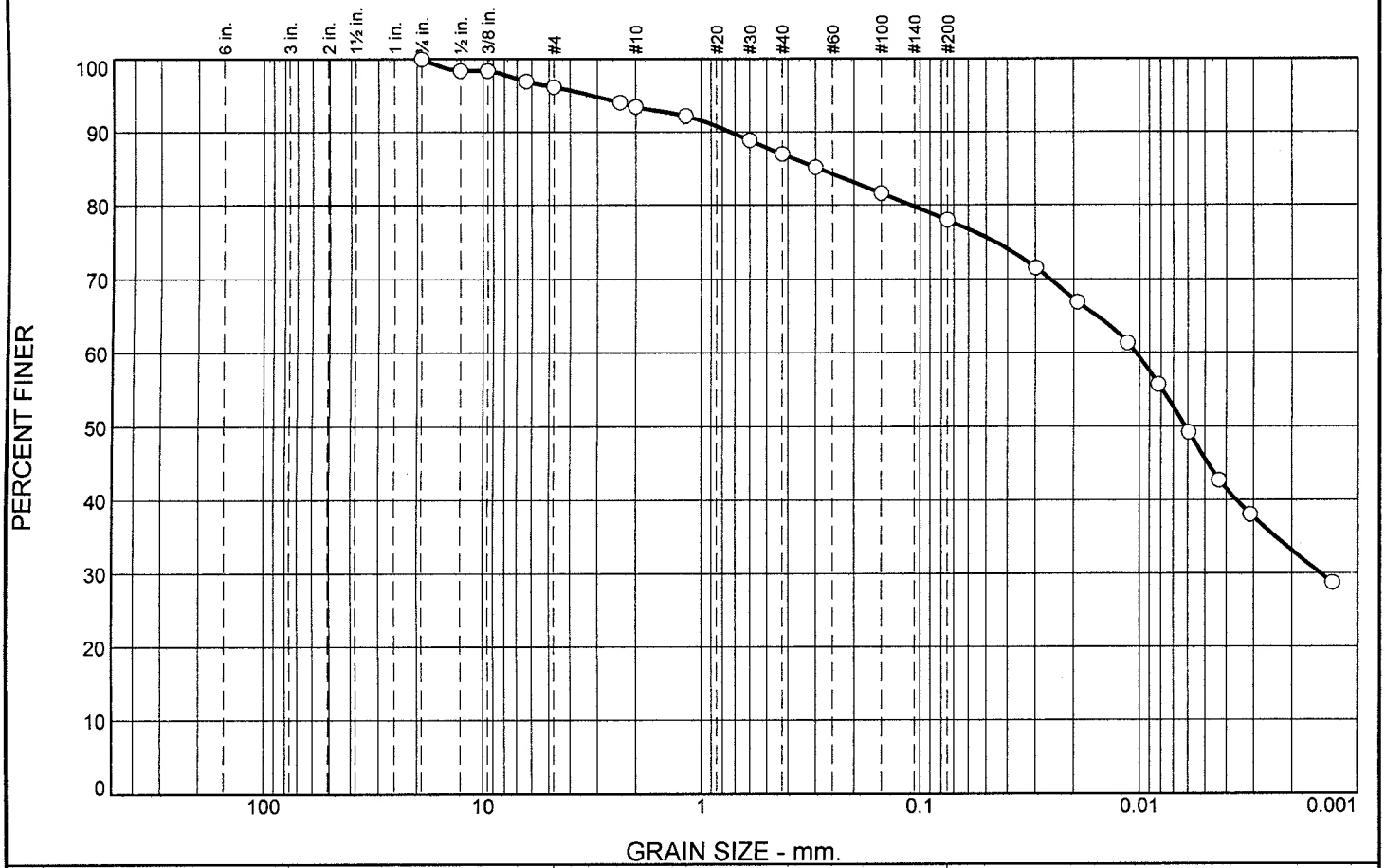
Source of Sample: Test Boring #HD-MW-162 **Depth:** 30.5' to 31.0'
Sample Number: 4 **Date:** 01/29/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.8	2.7	6.5	9.0	32.5	45.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	98.4		
.375	98.4		
.25	96.9		
#4	96.2		
#8	94.0		
#10	93.5		
#16	92.2		
#30	88.9		
#40	87.0		
#50	85.2		
#100	81.7		
#200	78.0		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.7282 D_{85}= 0.2873 D_{60}= 0.0104
D_{50}= 0.0062 D_{30}= 0.0015 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 31.7%

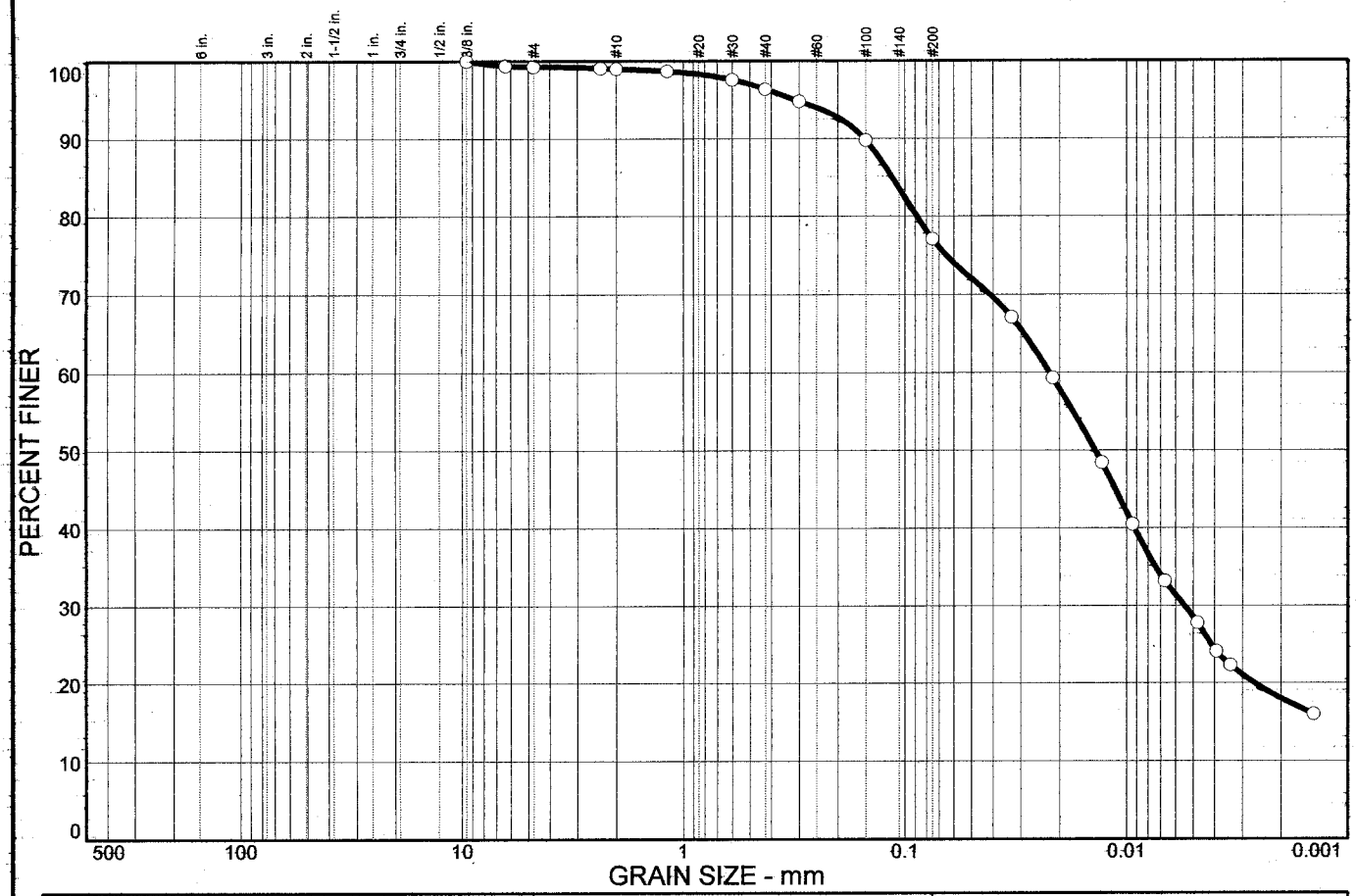
Source of Sample: Test Boring #HD-MW-162 **Depth:** 38.0' to 38.5
Sample Number: 5 **Date:** 01/29/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 5

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.7	0.3	2.6	19.3	48.5	28.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
.25 in.	99.4		
#4	99.3		
#8	99.1		
#10	99.0		
#16	98.7		
#30	97.6		
#40	96.4		
#50	94.8		
#100	89.8		
#200	77.1		

* (no specification provided)

Material Description

Brown Clayey Sandy Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.114 D_{60}= 0.0223 D_{50}= 0.0138
D_{30}= 0.0055 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

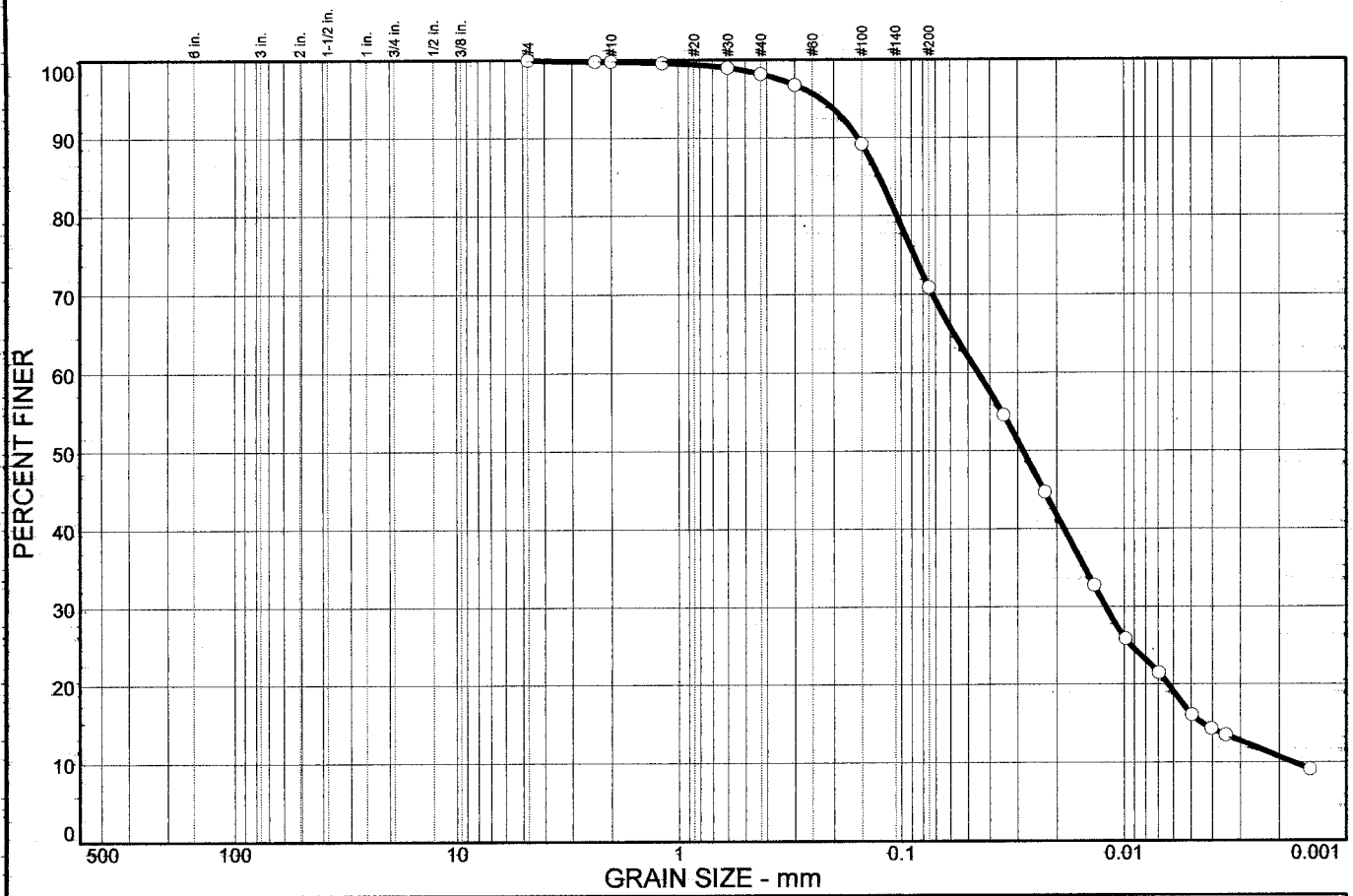
Natural Moisture Content = 17.8%

Sample No.: 1 **Source of Sample:** Test Boring #HD-MW-163 **Date:** 11/18/2014
Location: **Elev./Depth:** 8.3' to 8.6'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 1

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.2	1.6	27.3	54.7	16.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.8		
#10	99.8		
#16	99.6		
#30	99.0		
#40	98.2		
#50	96.8		
#100	89.2		
#200	70.9		

* (no specification provided)

Material Description

Brown Sandy Silt With Some Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.125 D_{60}= 0.0451 D_{50}= 0.0283
D_{30}= 0.0121 D_{15}= 0.0044 D_{10}= 0.0017
C_u= 25.96 C_c= 1.86

Classification

USCS= ML AASHTO= A-4(0)

Remarks

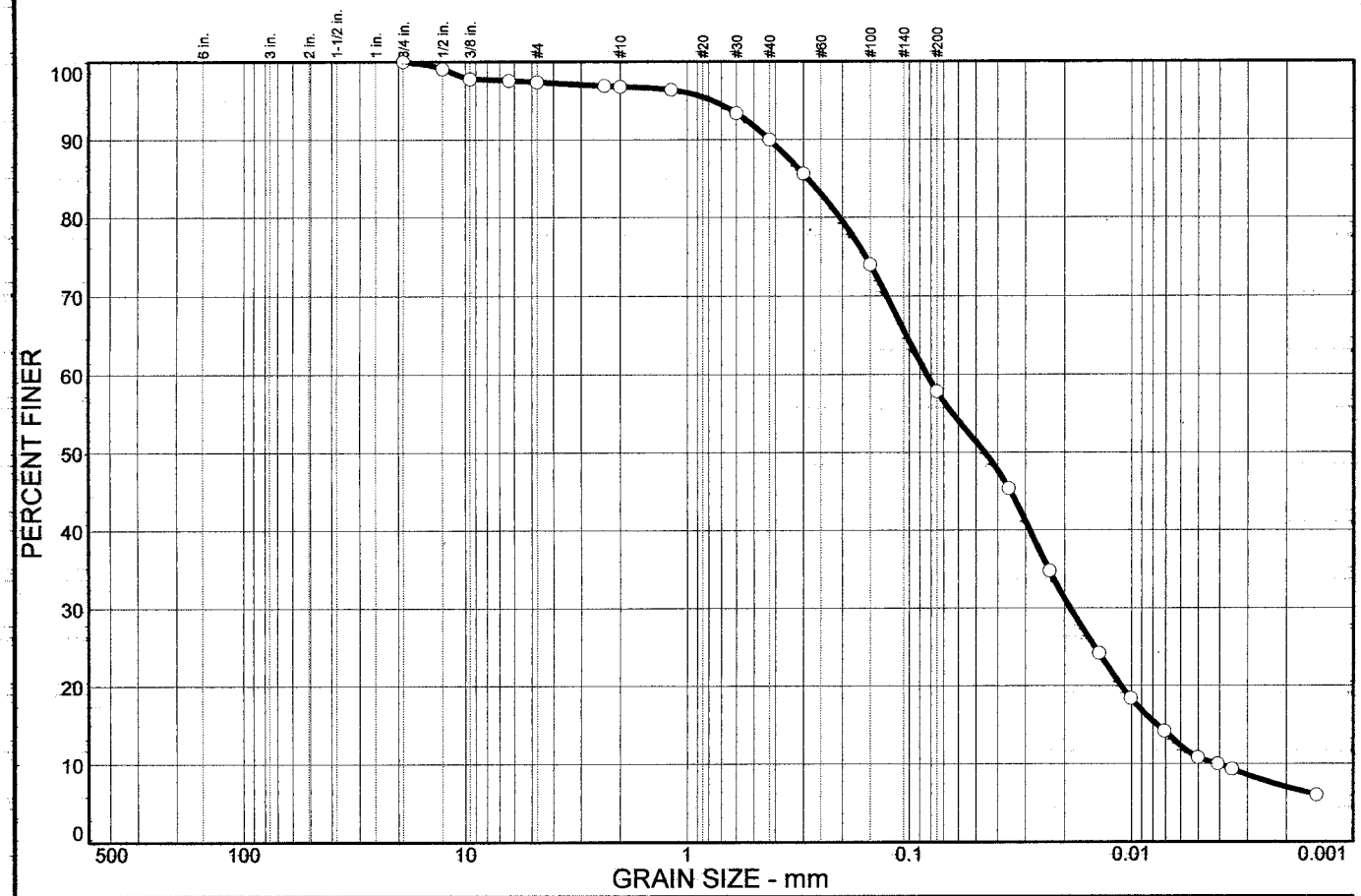
Natural Moisture Content = 18.2%

Sample No.: 2 **Source of Sample:** Test Boring #HD-MW-163 **Date:** 11/18/2014
Location: **Elev./Depth:** 11.0' to 11.4'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 2

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	2.6	0.6	6.8	32.2	47.0	10.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.50 in.	99.1		
.375 in.	97.8		
.25 in.	97.6		
#4	97.4		
#8	96.9		
#10	96.8		
#16	96.4		
#30	93.4		
#40	90.0		
#50	85.6		
#100	74.0		
#200	57.8		

* (no specification provided)

Material Description

Brown Sandy Silt With Some Clay And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.287 D_{60}= 0.0834 D_{50}= 0.0458
D_{30}= 0.0188 D_{15}= 0.0076 D_{10}= 0.0041
C_u= 20.47 C_c= 1.04

Classification

USCS= ML AASHTO= A-4(0)

Remarks

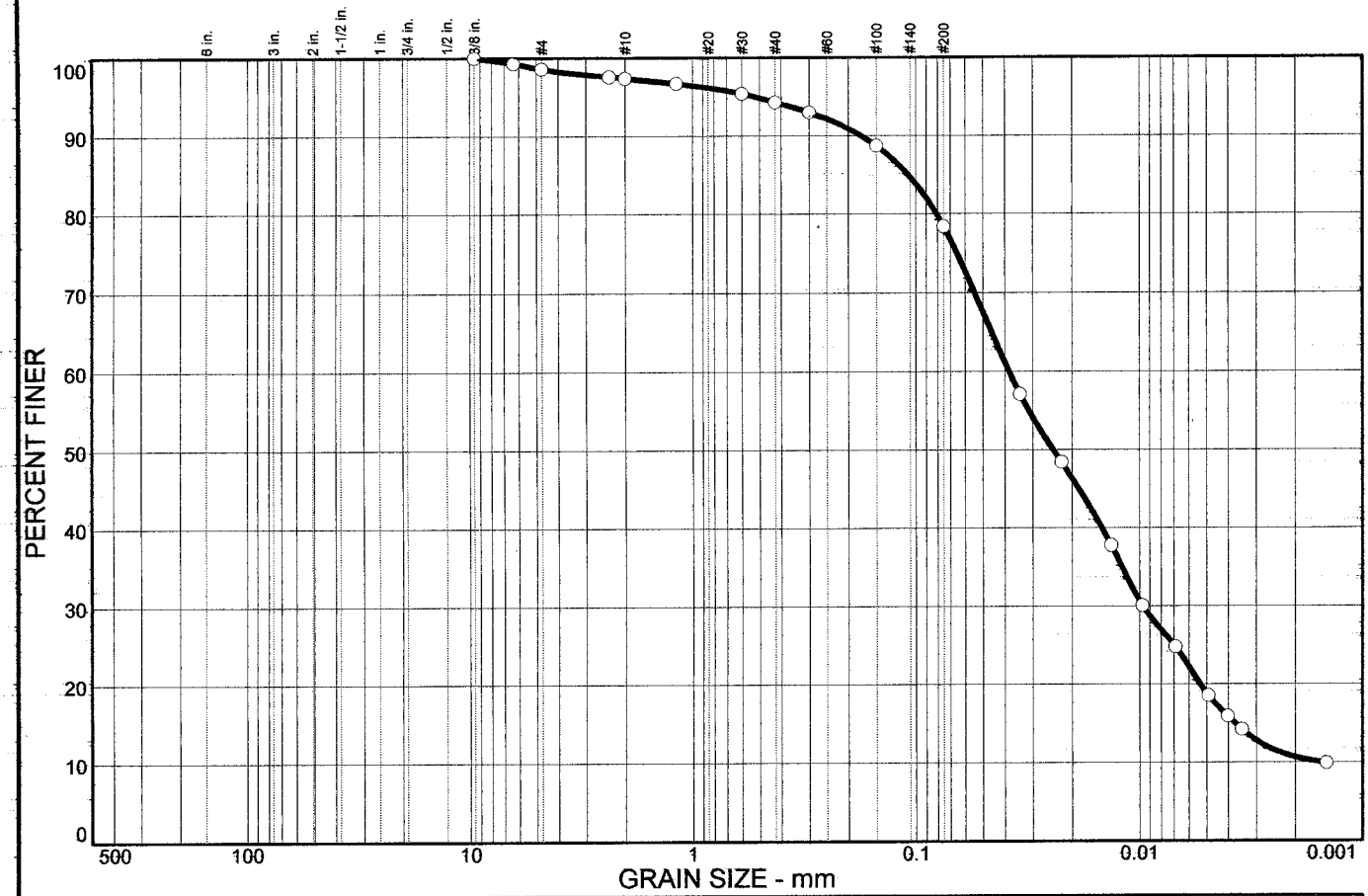
Natural Moisture Content = 19.8%

Sample No.: 3 **Source of Sample:** Test Boring #HD-MW-163 **Date:** 11/18/2014
Location: **Elev./Depth:** 19.4' to 19.8'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 3

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	1.4	1.2	3.1	15.9	59.6	18.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
.25 in.	99.3		
#4	98.6		
#8	97.6		
#10	97.4		
#16	96.7		
#30	95.4		
#40	94.3		
#50	93.0		
#100	88.7		
#200	78.4		

* (no specification provided)

Material Description

Brown Clayey Sandy Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.108 D_{60}= 0.0383 D_{50}= 0.0243
D_{30}= 0.0096 D_{15}= 0.0037 D_{10}= 0.0015
C_u= 25.05 C_c= 1.59

Classification

USCS= ML AASHTO= A-4(0)

Remarks

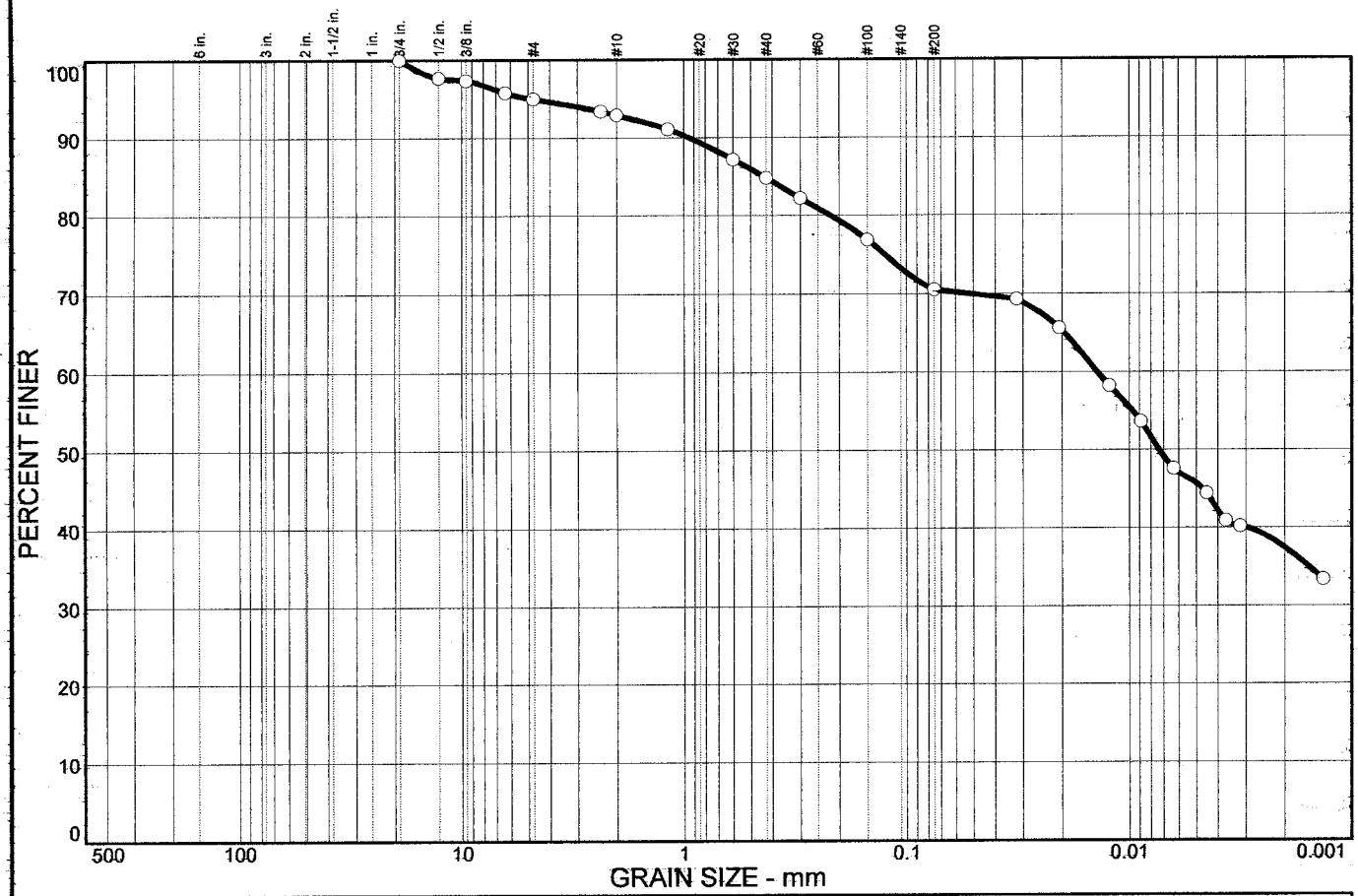
Natural Moisture Content = 27.3%

Sample No.: 4 **Source of Sample:** Test Boring #HD-MW-163 **Date:** 11/18/2014
Location: **Elev./Depth:** 24.6' to 25.0'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 4

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	5.0	2.1	8.1	14.3	24.8	45.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.50 in.	97.7		
.375 in.	97.4		
.25 in.	95.8		
#4	95.0		
#8	93.4		
#10	92.9		
#16	91.1		
#30	87.2		
#40	84.8		
#50	82.2		
#100	76.9		
#200	70.5		

* (no specification provided)

Material Description

Brown Sandy Silty Clay With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.437 D_{60}= 0.0139 D_{50}= 0.0073
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

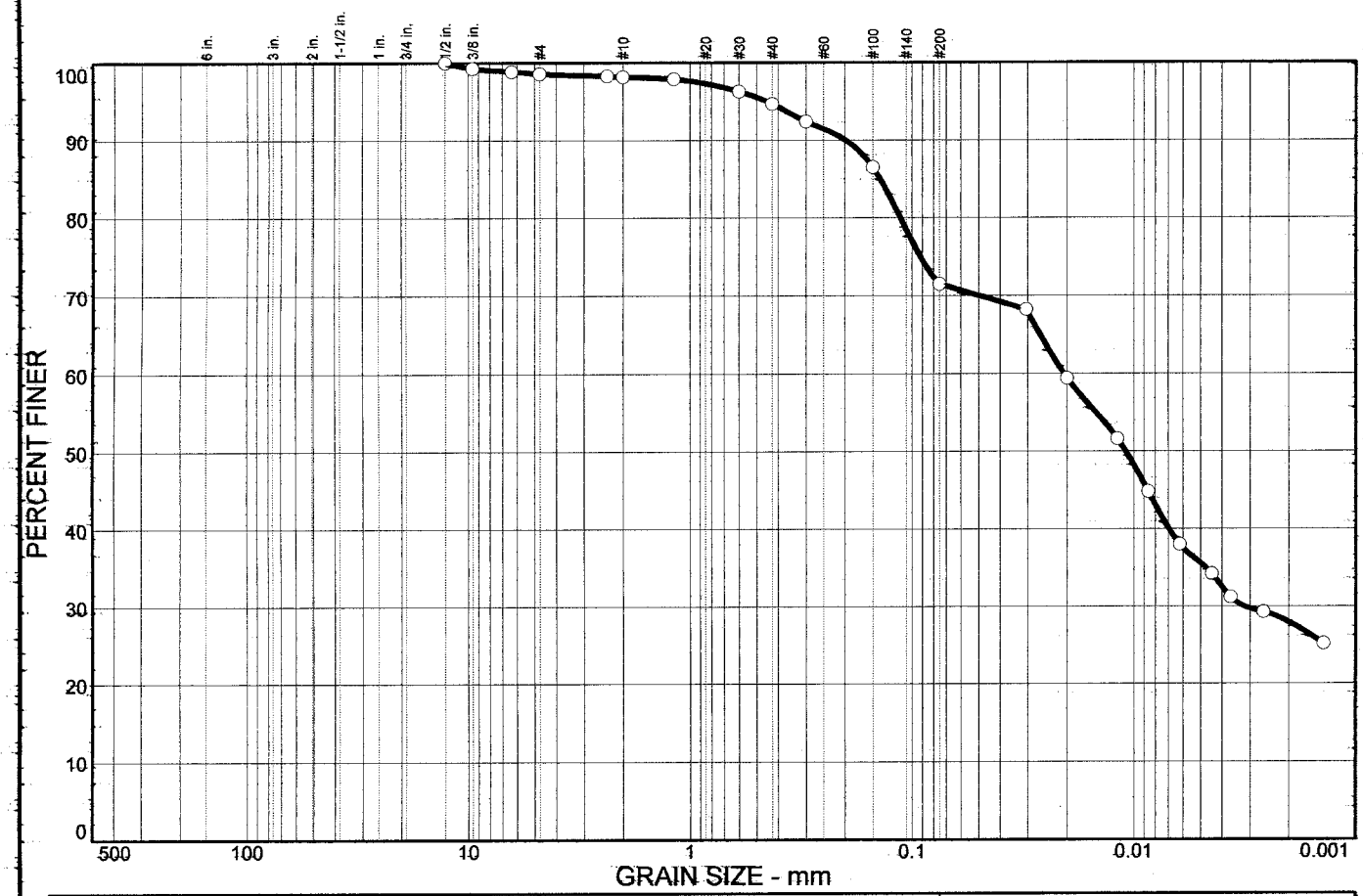
Natural Moisture Content = 20.5%

Sample No.: 5 **Source of Sample:** Test Boring #HD-MW-163 **Date:** 11/18/2014
Location: **Elev./Depth:** 31.0' to 31.4'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 5

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	1.4	0.4	3.5	23.2	35.9	35.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50 in.	100.0		
.375 in.	99.3		
.25 in.	98.9		
#4	98.6		
#8	98.3		
#10	98.2		
#16	97.9		
#30	96.3		
#40	94.7		
#50	92.4		
#100	86.5		
#200	71.5		

* (no specification provided)

Material Description

Brown Sandy Clay And Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.139 D_{60}= 0.0206 D_{50}= 0.0109
D_{30}= 0.0032 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

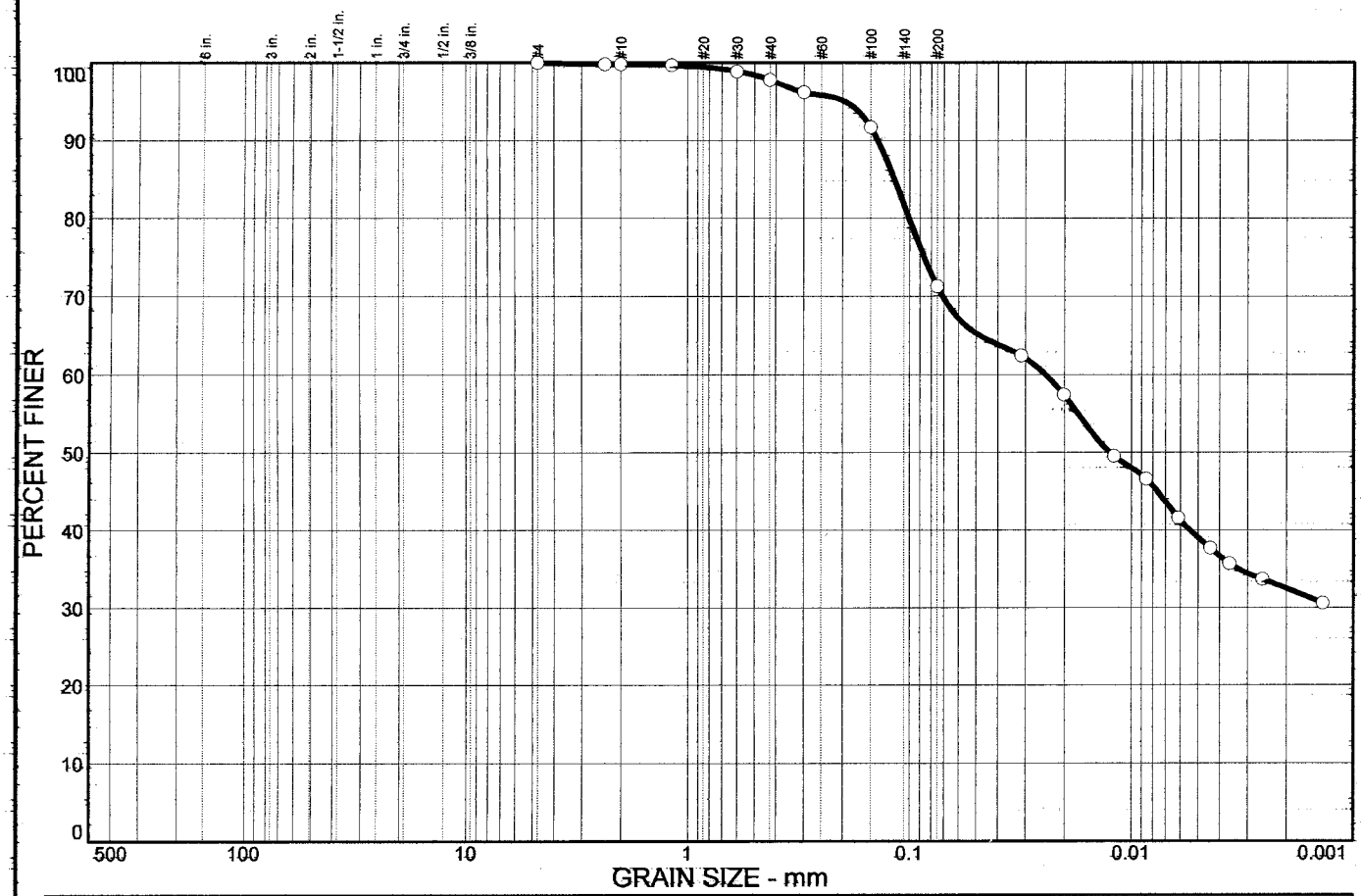
Natural Moisture Content = 22.3%

Sample No.: 1 **Source of Sample:** Test Boring #HD-MW-166 **Date:** 11/24/2014
Location: **Elev./Depth:** 11.8' to 12.2'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 1

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.2	2.0	26.5	32.2	39.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.8		
#10	99.8		
#16	99.7		
#30	98.9		
#40	97.8		
#50	96.2		
#100	91.7		
#200	71.3		

* (no specification provided)

Material Description

Brown Sandy Clay And Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.117 D_{60}= 0.0244 D_{50}= 0.0125
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

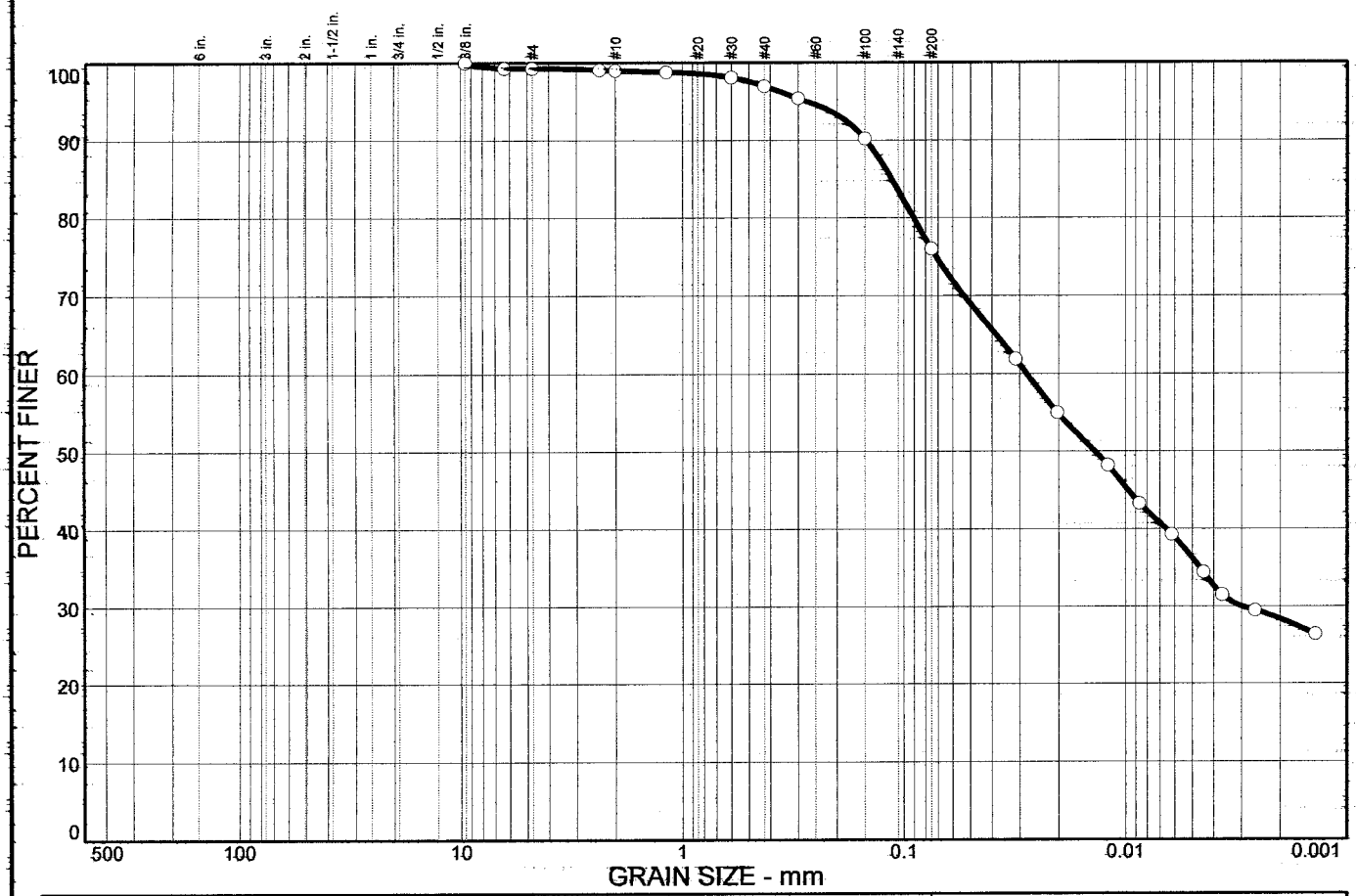
Natural Moisture Content = 24.0%

Sample No.: 2 **Source of Sample:** Test Boring #HD-MW-166 **Date:** 11/24/2014
Location: **Elev./Depth:** 19.0' to 19.4'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 2

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.7	0.3	2.0	21.0	39.7	36.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
.25 in.	99.3		
#4	99.3		
#8	99.1		
#10	99.0		
#16	98.8		
#30	98.1		
#40	97.0		
#50	95.4		
#100	90.2		
#200	76.0		

* (no specification provided)

Material Description

Brown Sandy Clay And Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.113 D_{60}= 0.0278 D_{50}= 0.0137
D_{30}= 0.0030 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

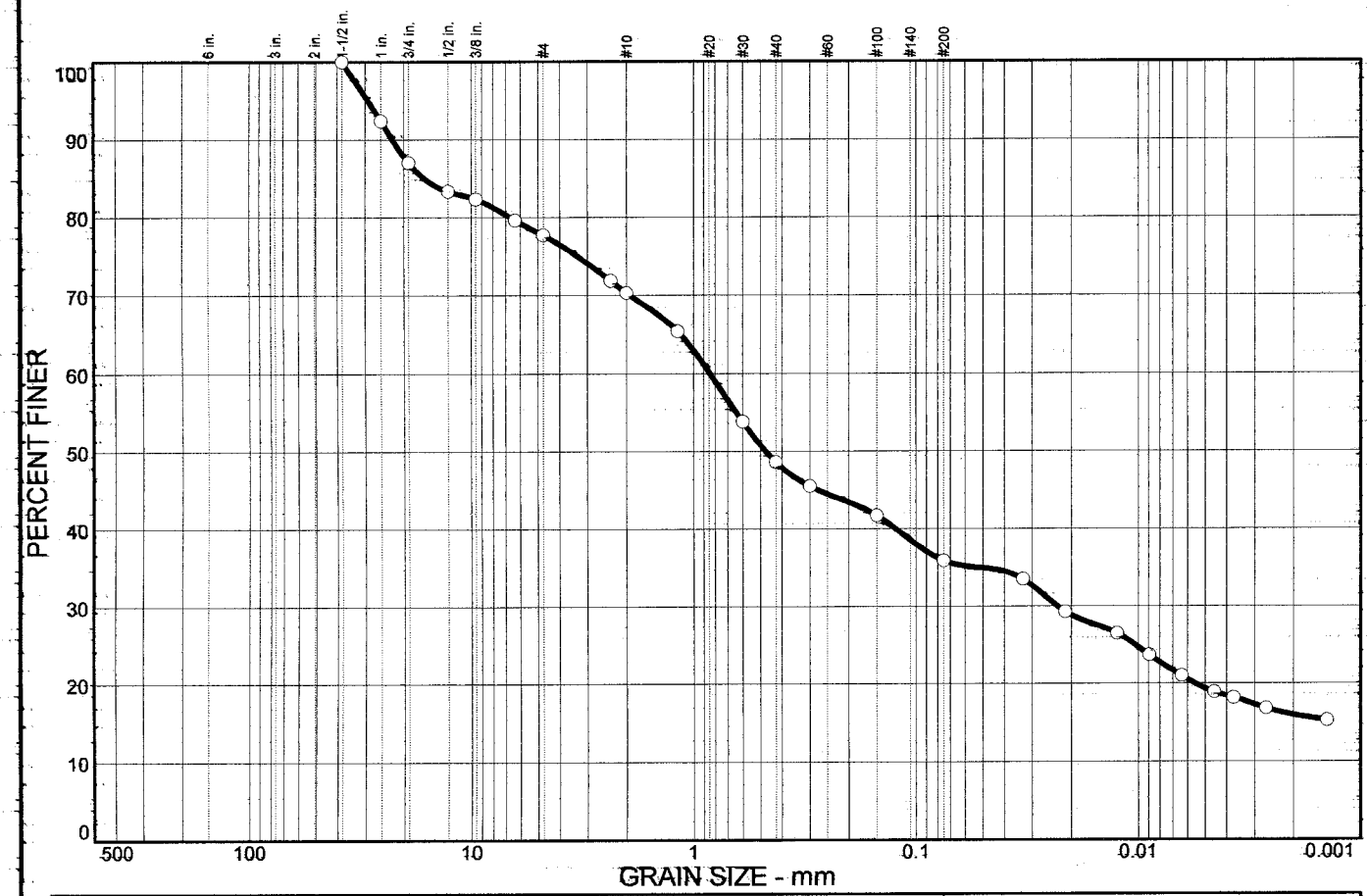
Natural Moisture Content = 26.7

Sample No.: 3 **Source of Sample:** Test Boring #HD-MW-166 **Date:** 11/24/2014
Location: **Elev./Depth:** 25.4' to 25.8'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP – Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 3

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	13.0	9.3	7.4	21.7	12.7	16.5	19.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1.0 in.	92.4		
.75 in.	87.0		
.50 in.	83.3		
.375 in.	82.3		
.25 in.	79.6		
#4	77.7		
#8	71.9		
#10	70.3		
#16	65.4		
#30	53.8		
#40	48.6		
#50	45.5		
#100	41.7		
#200	35.9		

* (no specification provided)

Material Description

Brown Clayey Sand With Some Silt And Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 16.3 D_{60}= 0.841 D_{50}= 0.473
D_{30}= 0.0230 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

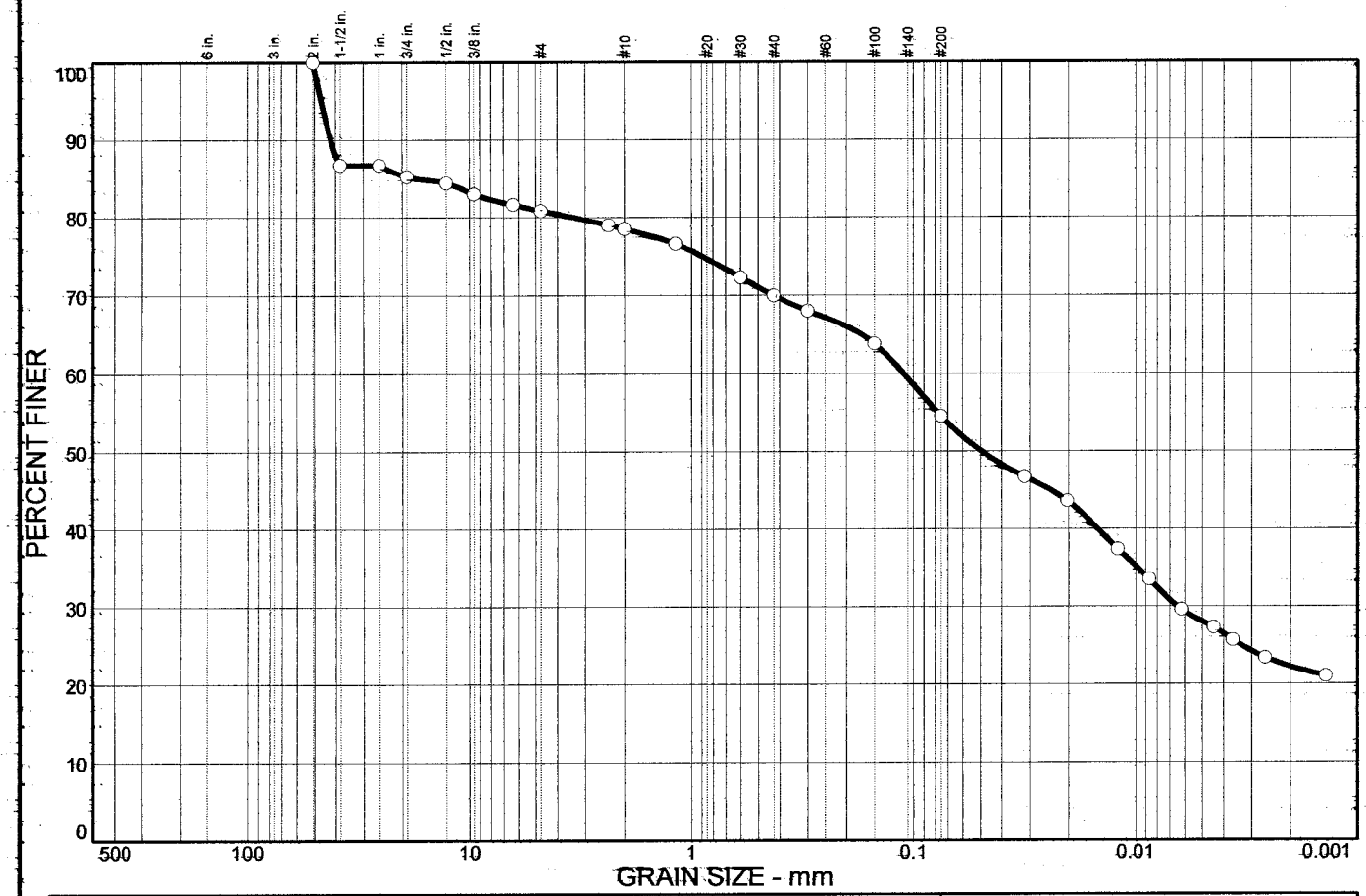
Natural Moisture Content = 17.5%

Sample No.: 4 **Source of Sample:** Test Boring #HD-MW-166 **Date:** 11/24/2014
Location: **Elev./Depth:** 31.0' to 31.4'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 4

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	14.8	4.4	2.3	8.5	15.5	26.4	28.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2.0 in.	100.0		
1.5 in.	86.7		
1.0 in.	86.7		
.75 in.	85.2		
.50 in.	84.4		
.375 in.	83.0		
.25 in.	81.6		
#4	80.8		
#8	79.0		
#10	78.5		
#16	76.6		
#30	72.3		
#40	70.0		
#50	68.0		
#100	63.8		
#200	54.5		

* (no specification provided)

Material Description

Brown Sandy Silty Clay With Some Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 17.7 D_{60}= 0.111 D_{50}= 0.0495
D_{30}= 0.0065 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

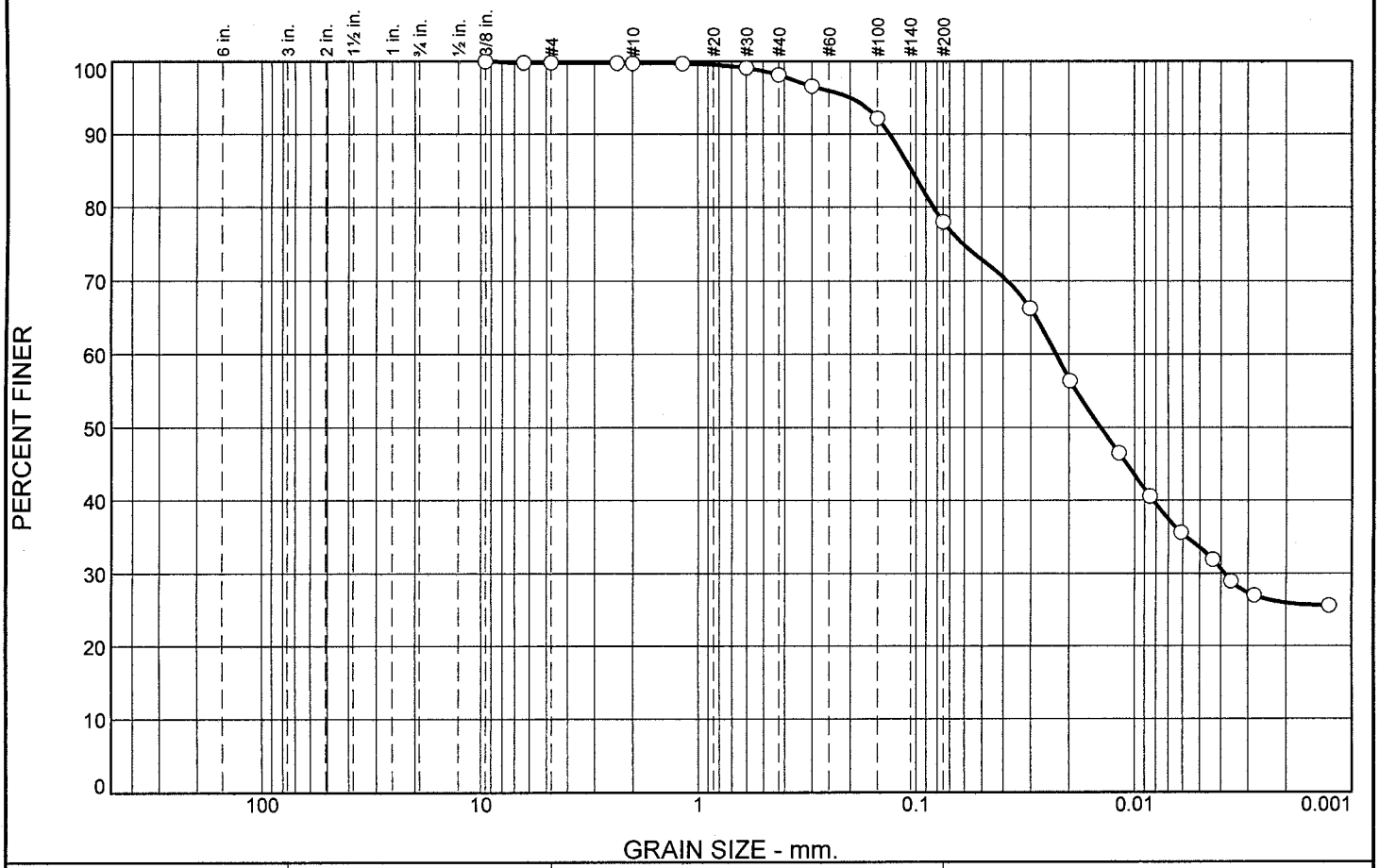
Natural Moisture Content = 17.3%

Sample No.: 5 **Source of Sample:** Test Boring #HD-MW-166 **Date:** 11/24/2014
Location: **Elev./Depth:** 42.5' to 43.0'

F.T. KITLINSKI & ASSOCIATES, INC.

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure No.** 5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.0	1.6	20.2	44.4	33.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
.25	99.8		
#4	99.8		
#8	99.8		
#10	99.8		
#16	99.7		
#30	99.1		
#40	98.2		
#50	96.6		
#100	92.2		
#200	78.0		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1321 D_{85}= 0.1046 D_{60}= 0.0230
D_{50}= 0.0144 D_{30}= 0.0039 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Mosture Content = 27.7%

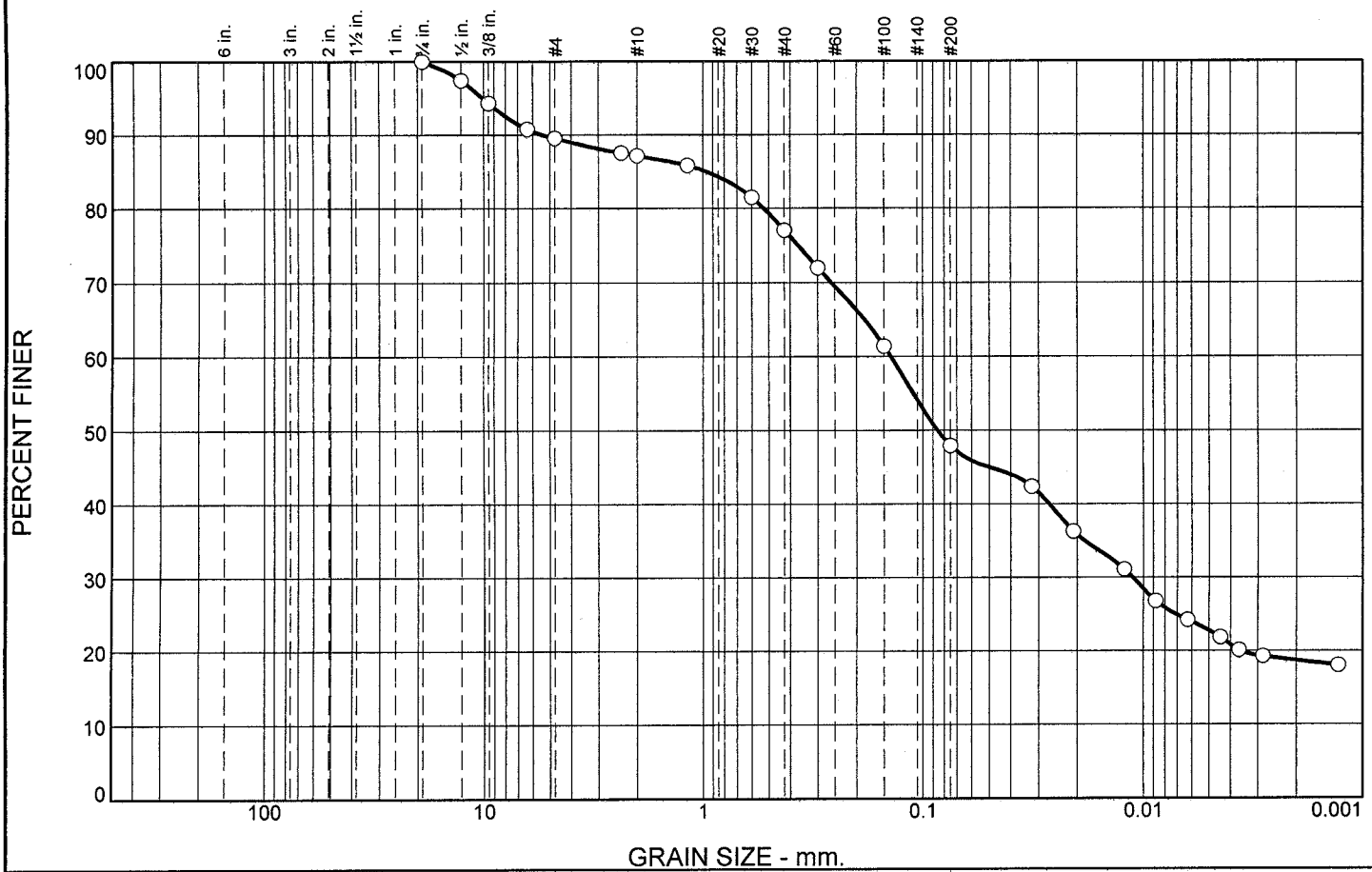
Source of Sample: Test Boring #HD-MW-167 **Depth:** 8.4' to 9.2
Sample Number: 1 **Date:** 11/28/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project #10012.26, York, PA
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.4	2.4	10.1	29.2	25.1	22.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	97.4		
.375	94.3		
.25	90.8		
#4	89.6		
#8	87.6		
#10	87.2		
#16	85.9		
#30	81.5		
#40	77.1		
#50	72.0		
#100	61.4		
#200	47.9		

* (no specification provided)

Material Description

Brown Clayey Silty Sand With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.3494 D_{85}= 0.9534 D_{60}= 0.1396
D_{50}= 0.0860 D_{30}= 0.0112 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 19.2%

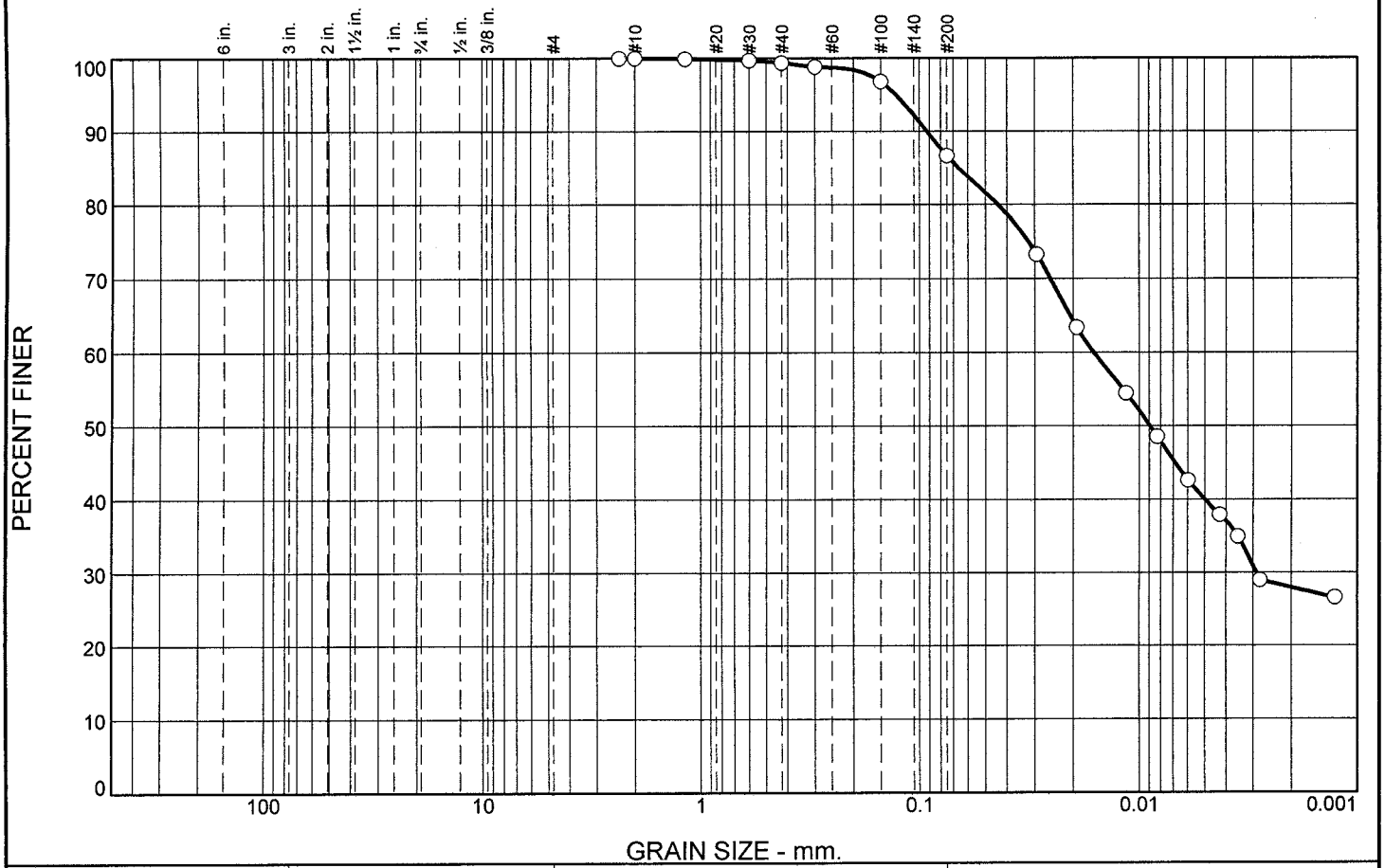
Source of Sample: Test Boring #HD-MW-167 **Depth:** 16.2' to 17.0'
Sample Number: 2 **Date:** 11/28/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project #10012.26, York, PA
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.6	12.7	46.8	39.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	100.0		
#16	99.9		
#30	99.7		
#40	99.4		
#50	98.8		
#100	96.8		
#200	86.7		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0926 D_{85}= 0.0662 D_{60}= 0.0162
D_{50}= 0.0090 D_{30}= 0.0029 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 25.4%

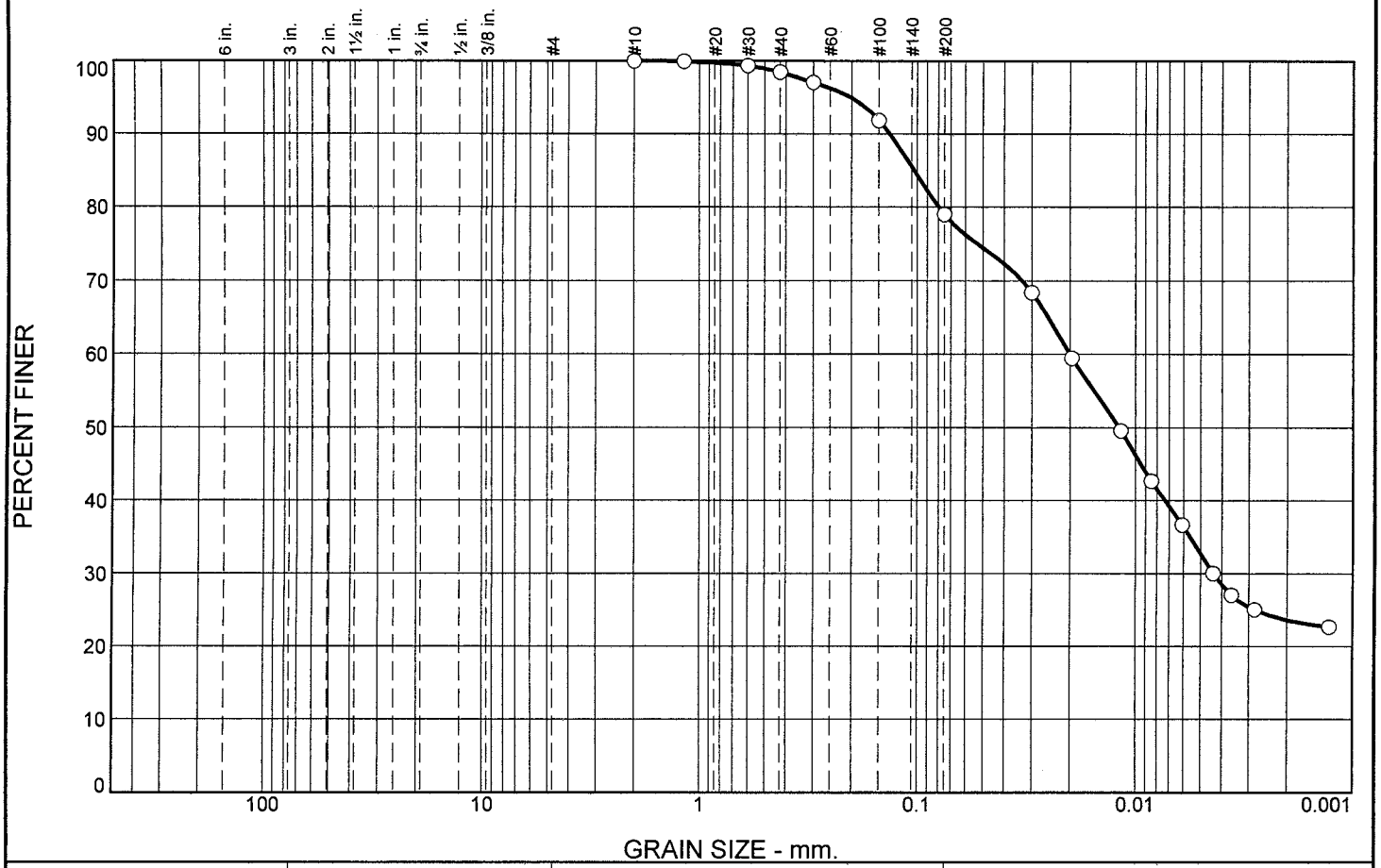
Source of Sample: Test Boring #HD-MW-167 **Depth:** 28.2' to 29.0'
Sample Number: 3 **Date:** 11/28/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project #10012.26, York, PA
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.5	19.5	46.4	32.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	99.9		
#30	99.3		
#40	98.5		
#50	97.1		
#100	91.9		
#200	79.0		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1338 D_{85}= 0.1035 D_{60}= 0.0201
D_{50}= 0.0120 D_{30}= 0.0044 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 21.8%

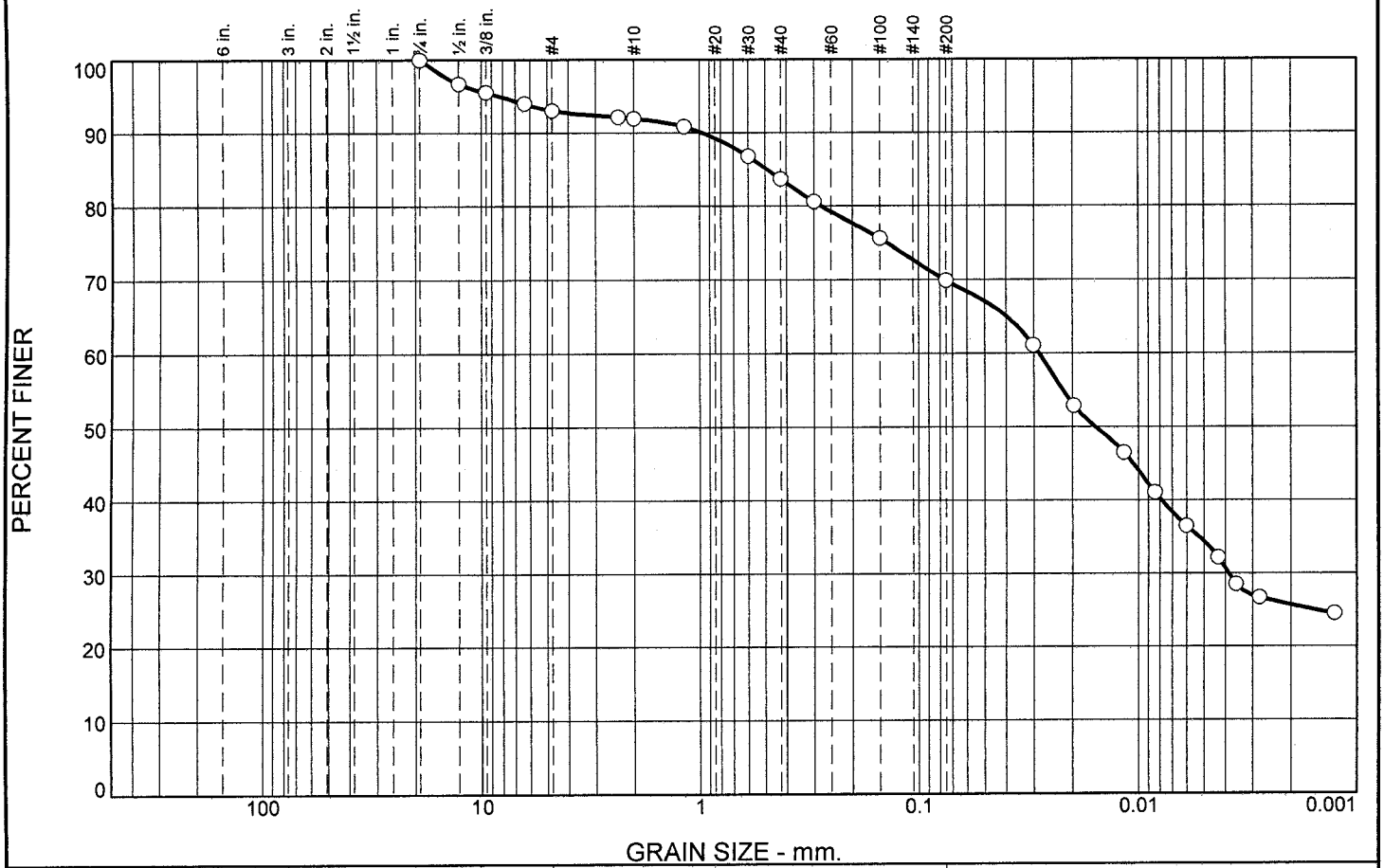
Source of Sample: Test Boring #HD-MW-167 **Depth:** 38.2' to 39.0
Sample Number: 4 **Date:** 11/28/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project #10012.26, York, PA
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.9	1.1	8.3	13.8	35.5	34.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	96.7		
.375	95.6		
.25	94.0		
#4	93.1		
#8	92.2		
#10	92.0		
#16	90.9		
#30	86.8		
#40	83.7		
#50	80.6		
#100	75.6		
#200	69.9		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.9632 D_{85}= 0.4890 D_{60}= 0.0284
D_{50}= 0.0157 D_{30}= 0.0039 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 17.5%

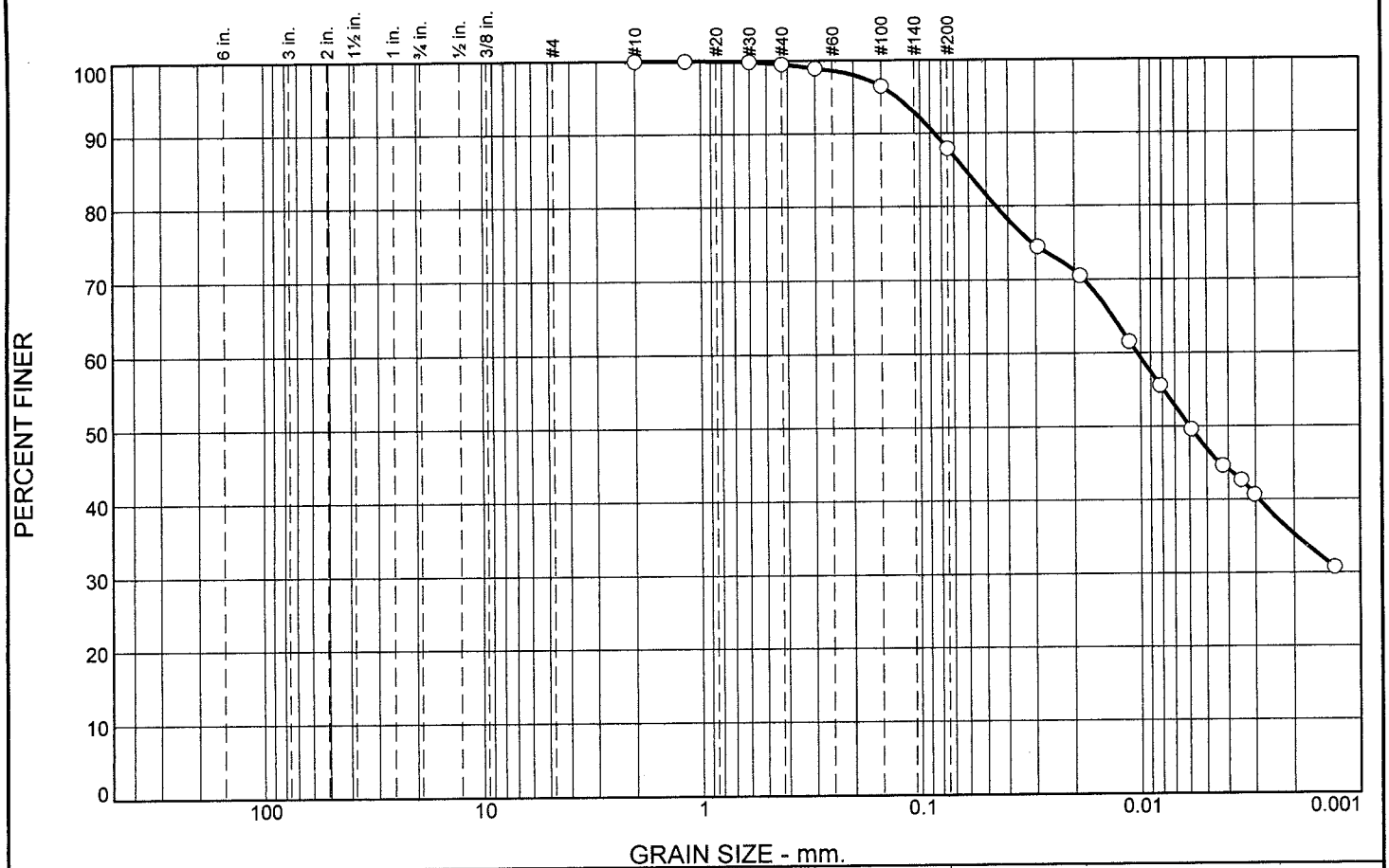
Source of Sample: Test Boring #HD-MW-167 **Depth:** 50.5' to 51.2'
Sample Number: 5 **Date:** 11/28/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project #10012.26, York, PA
Project No: 14-11-10302 **Figure** 5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.5	11.6	41.0	46.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	99.8		
#40	99.5		
#50	99.0		
#100	96.5		
#200	87.9		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0859 D_{85}= 0.0624 D_{60}= 0.0104
D_{50}= 0.0060 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 23.3%

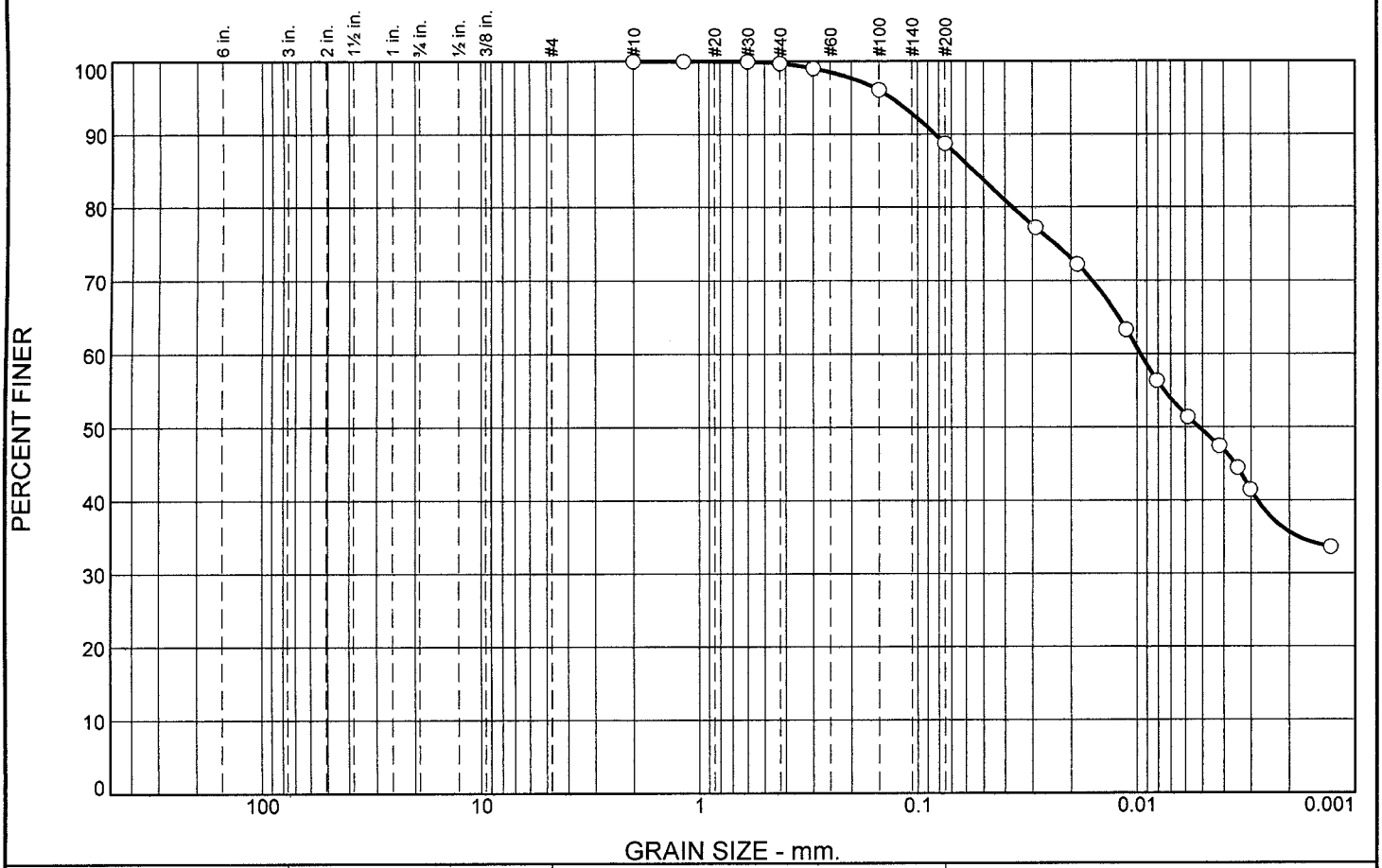
Source of Sample: Test Boring#HD-MW-168 **Depth:** 8.4' to 8.8'
Sample Number: 1 **Date:** 12/09/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.3	10.9	39.2	49.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	99.9		
#40	99.7		
#50	99.0		
#100	96.1		
#200	88.8		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0828 D_{85}= 0.0555 D_{60}= 0.0097
D_{50}= 0.0052 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 25.1%

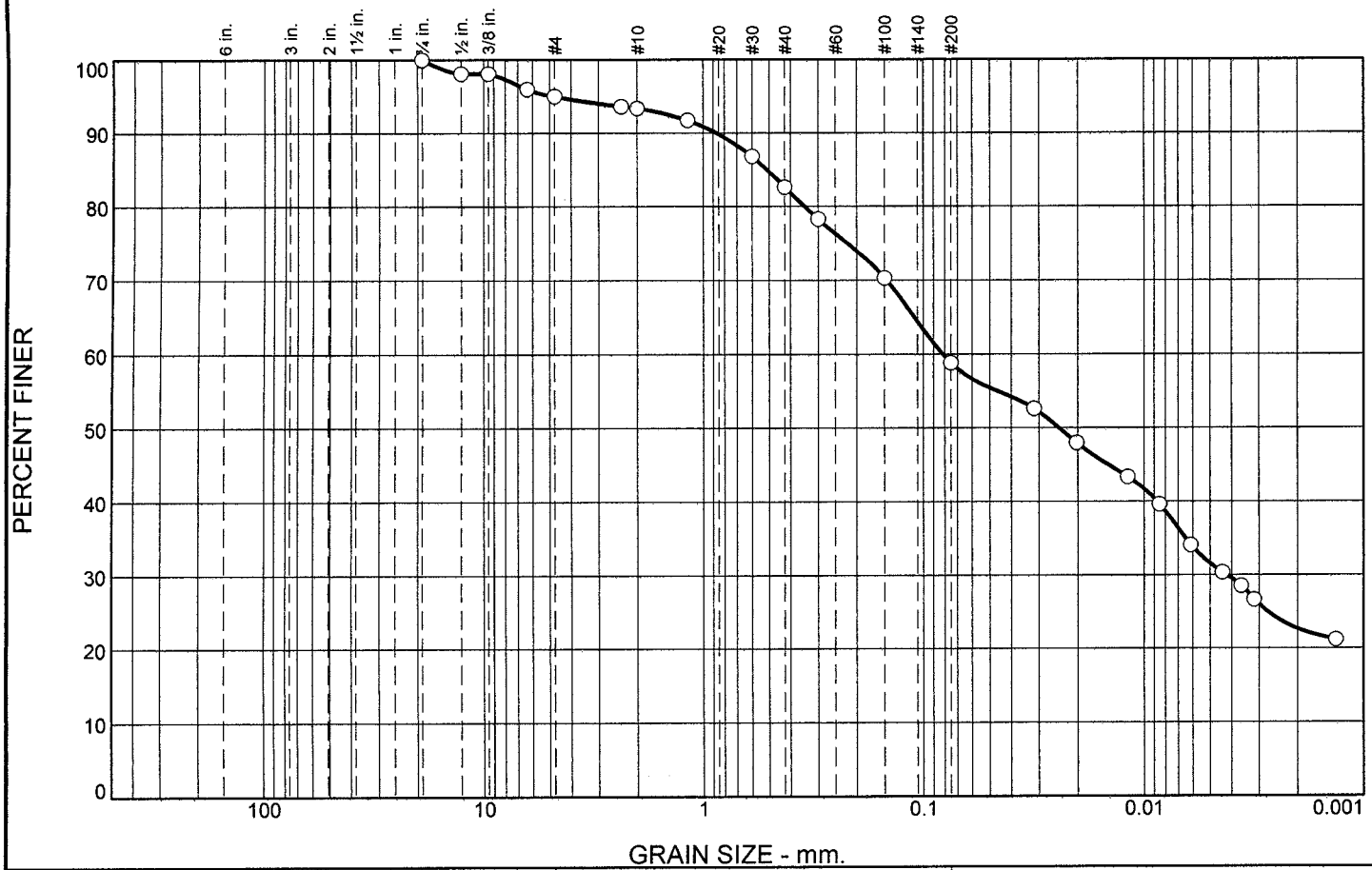
Source of Sample: Test Boring#HD-MW-168 **Depth:** 14.0' to 14.4'
Sample Number: 2 **Date:** 12/09/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.0	1.6	10.8	23.8	27.3	31.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	98.1		
.375	98.1		
.25	96.0		
#4	95.0		
#8	93.6		
#10	93.4		
#16	91.8		
#30	86.8		
#40	82.6		
#50	78.3		
#100	70.3		
#200	58.8		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.8653 D_{85}= 0.5121 D_{60}= 0.0817
D_{50}= 0.0244 D_{30}= 0.0042 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 21.1%

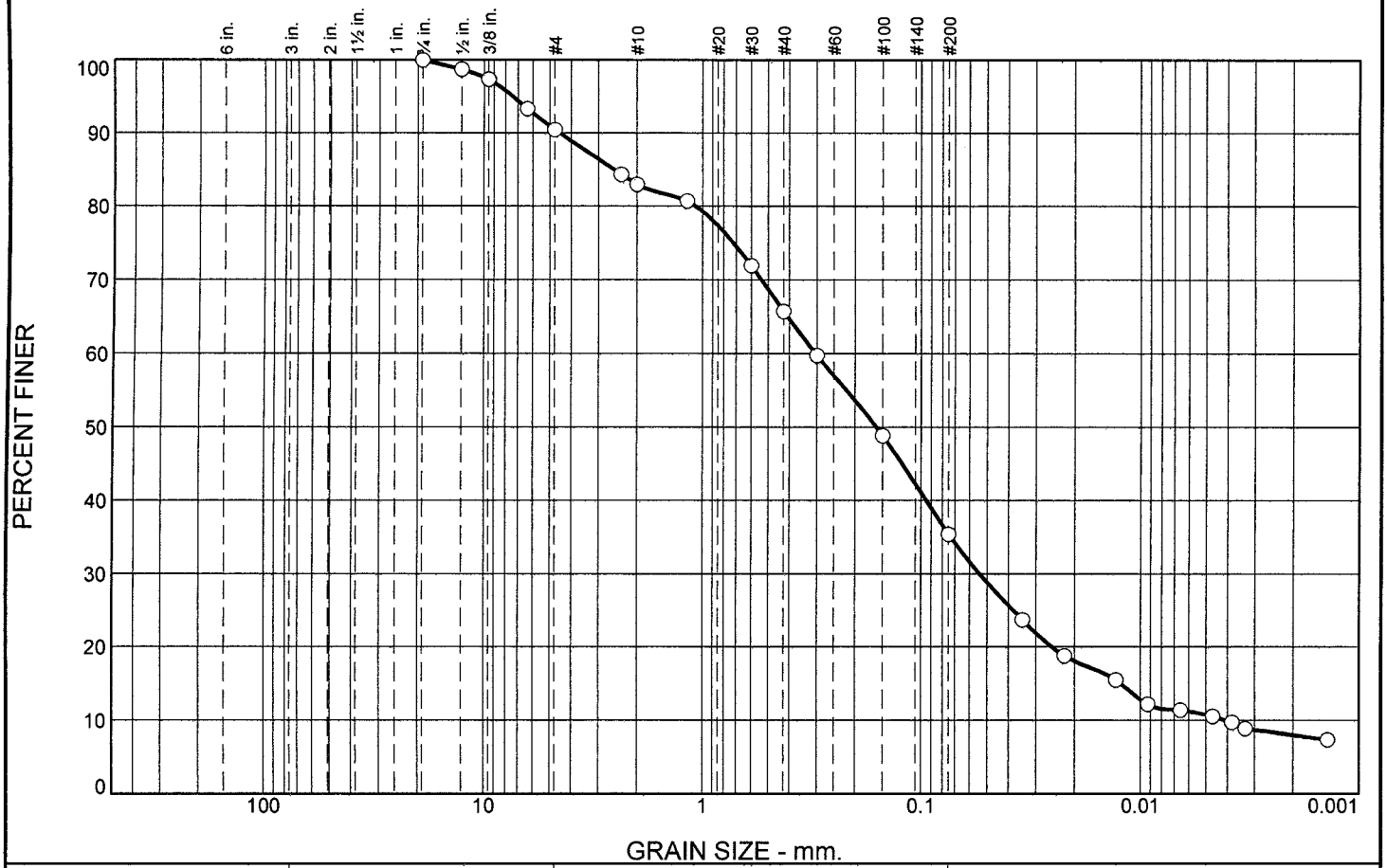
Source of Sample: Test Boring#HD-MW-168 **Depth:** 22.4' to 22.8'
Sample Number: 3 **Date:** 12/09/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.5	7.5	17.3	30.3	24.6	10.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	98.7		
.375	97.3		
.25	93.4		
#4	90.5		
#8	84.4		
#10	83.0		
#16	80.7		
#30	71.9		
#40	65.7		
#50	59.8		
#100	48.9		
#200	35.4		

* (no specification provided)

Material Description

Brown Silty Sand With A Trace Of Clay And Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.5118 D_{85}= 2.5393 D_{60}= 0.3042
D_{50}= 0.1602 D_{30}= 0.0542 D_{15}= 0.0124
D_{10}= 0.0040 C_u= 75.17 C_c= 2.38

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 14.3%

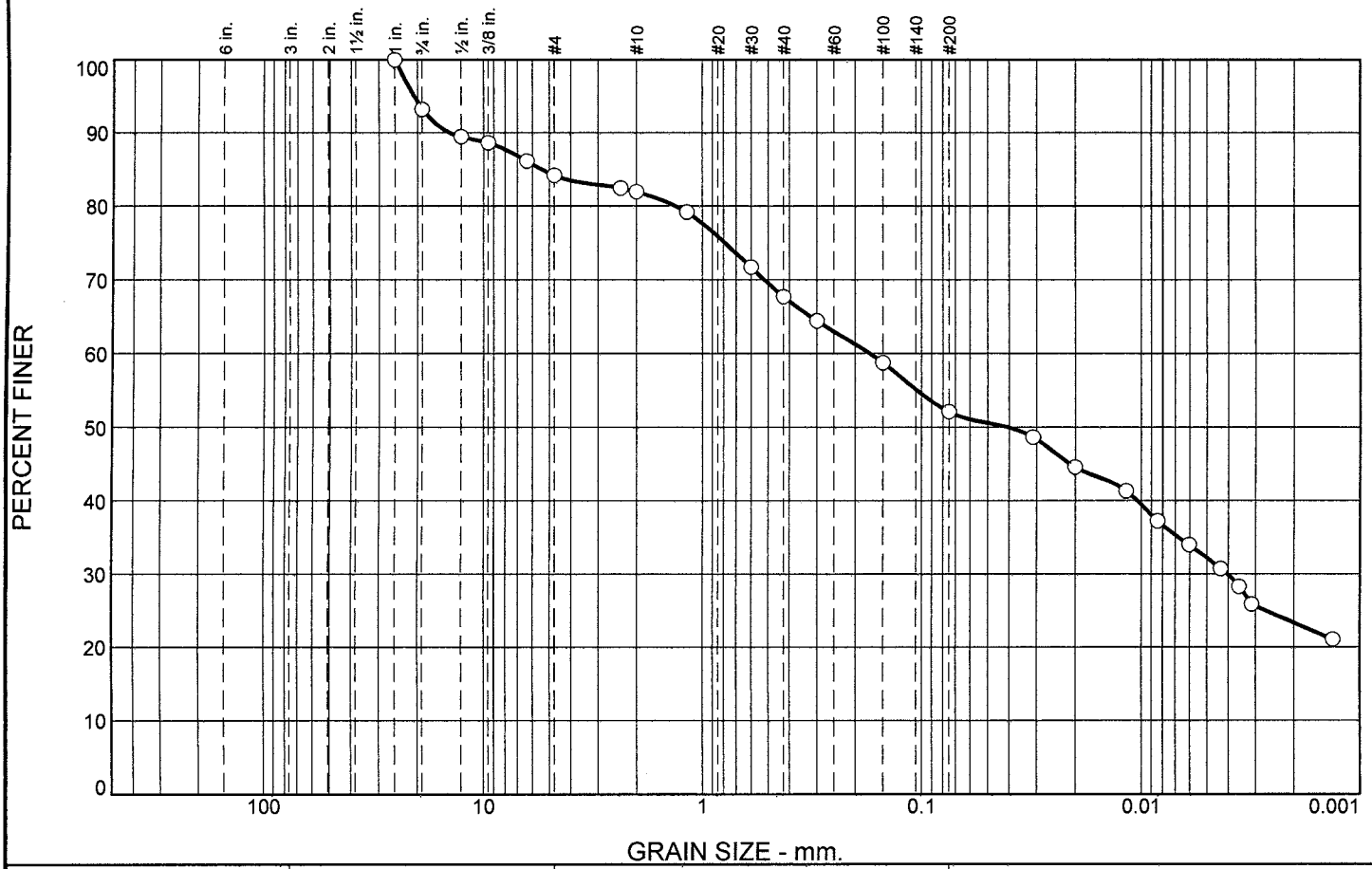
Source of Sample: Test Boring#HD-MW-168 **Depth:** 31.6' to 32.0'
Sample Number: 4 **Date:** 12/09/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.8	9.0	2.2	14.3	15.6	19.9	32.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0	100.0		
.75	93.2		
.50	89.5		
.375	88.7		
.25	86.1		
#4	84.2		
#8	82.5		
#10	82.0		
#16	79.2		
#30	71.7		
#40	67.7		
#50	64.4		
#100	58.8		
#200	52.1		

* (no specification provided)

Material Description

Brown Silty Clay And Sand With Some Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 14.3127 D_{85}= 5.4217 D_{60}= 0.1715
D_{50}= 0.0400 D_{30}= 0.0040 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 14.5%

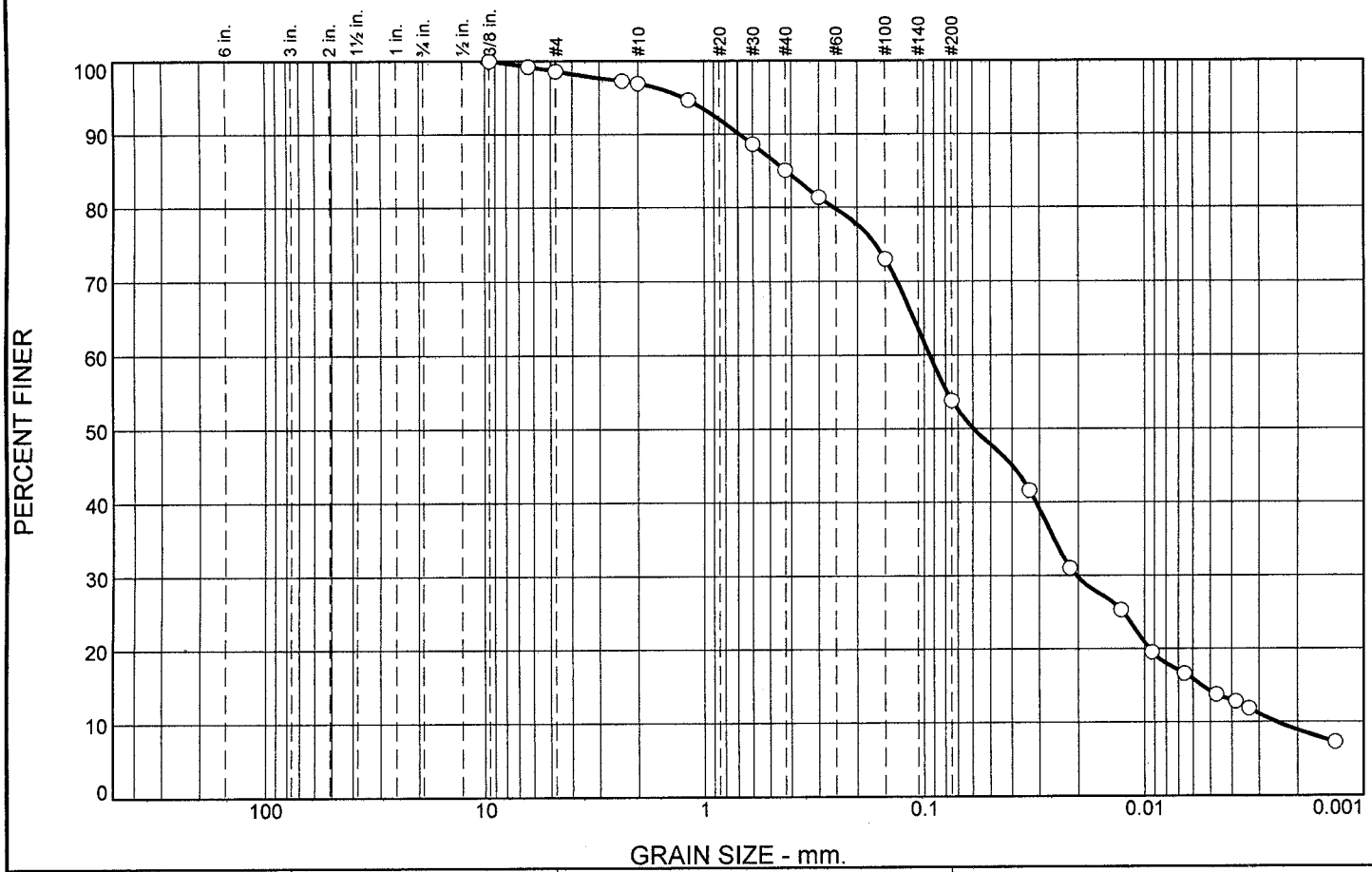
Source of Sample: Test Boring#HD-MW-168 **Depth:** 39.0'to 39.4'
Sample Number: 5 **Date:** 12/09/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.4	1.6	11.9	31.2	39.7	14.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
.25	99.3		
#4	98.6		
#8	97.3		
#10	97.0		
#16	94.7		
#30	88.6		
#40	85.1		
#50	81.4		
#100	73.0		
#200	53.9		

* (no specification provided)

Material Description

Brown Clayey Silt And Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6875 D_{85}= 0.4216 D_{60}= 0.0947
D_{50}= 0.0597 D_{30}= 0.0205 D_{15}= 0.0055
D_{10}= 0.0025 C_u= 38.28 C_c= 1.79

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 15.8%

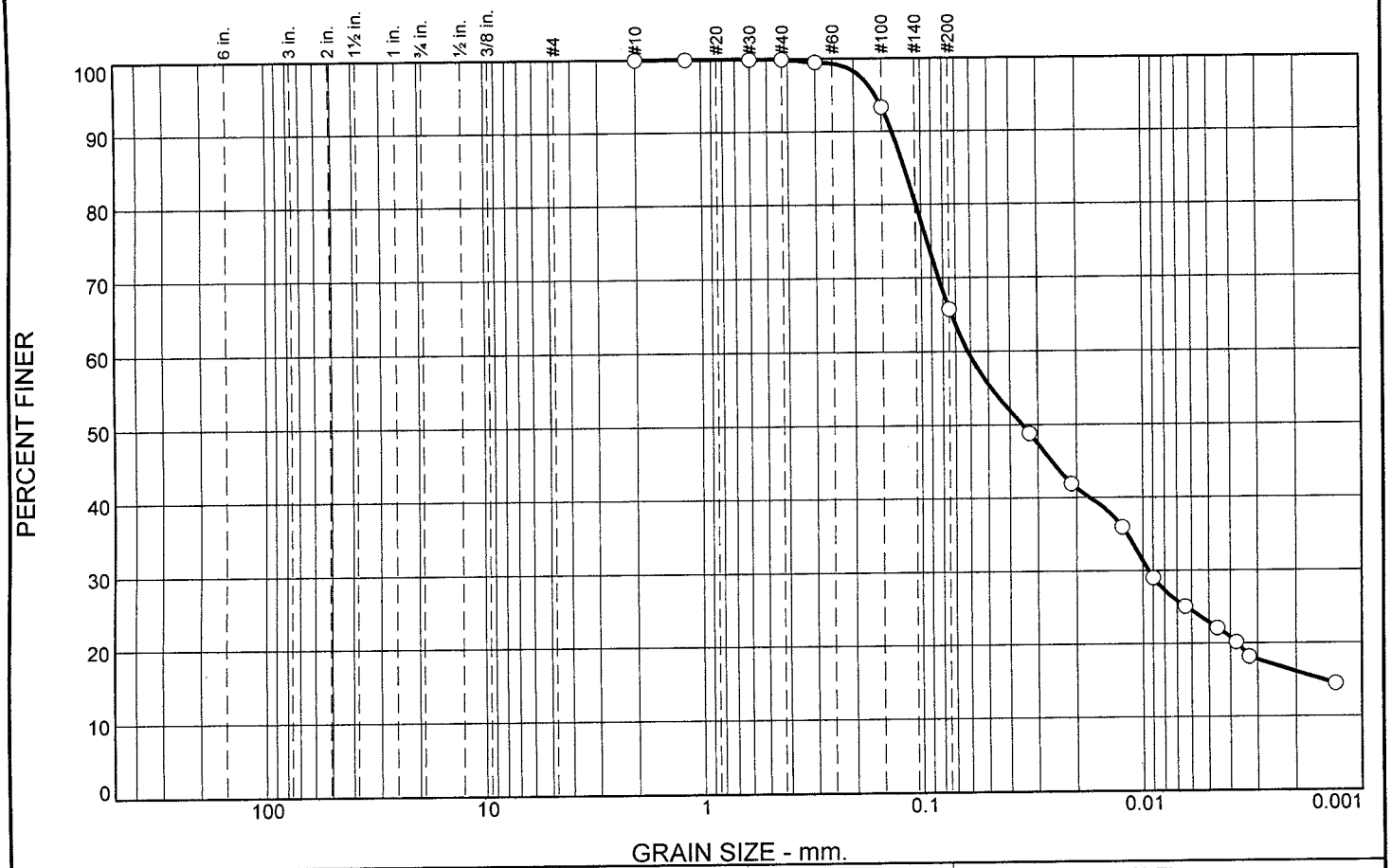
Source of Sample: Test Boring #HD-MW-169 **Depth:** 11.2' to 11.6'
Sample Number: 1 **Date:** 12/26/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	34.2	42.8	22.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	100.0		
#40	99.9		
#50	99.5		
#100	93.4		
#200	65.7		

* (no specification provided)

Material Description

Brown Clayey Silt And Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1349 D_{85}= 0.1186 D_{60}= 0.0619
D_{50}= 0.0351 D_{30}= 0.0094 D_{15}= 0.0015
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 21.4%

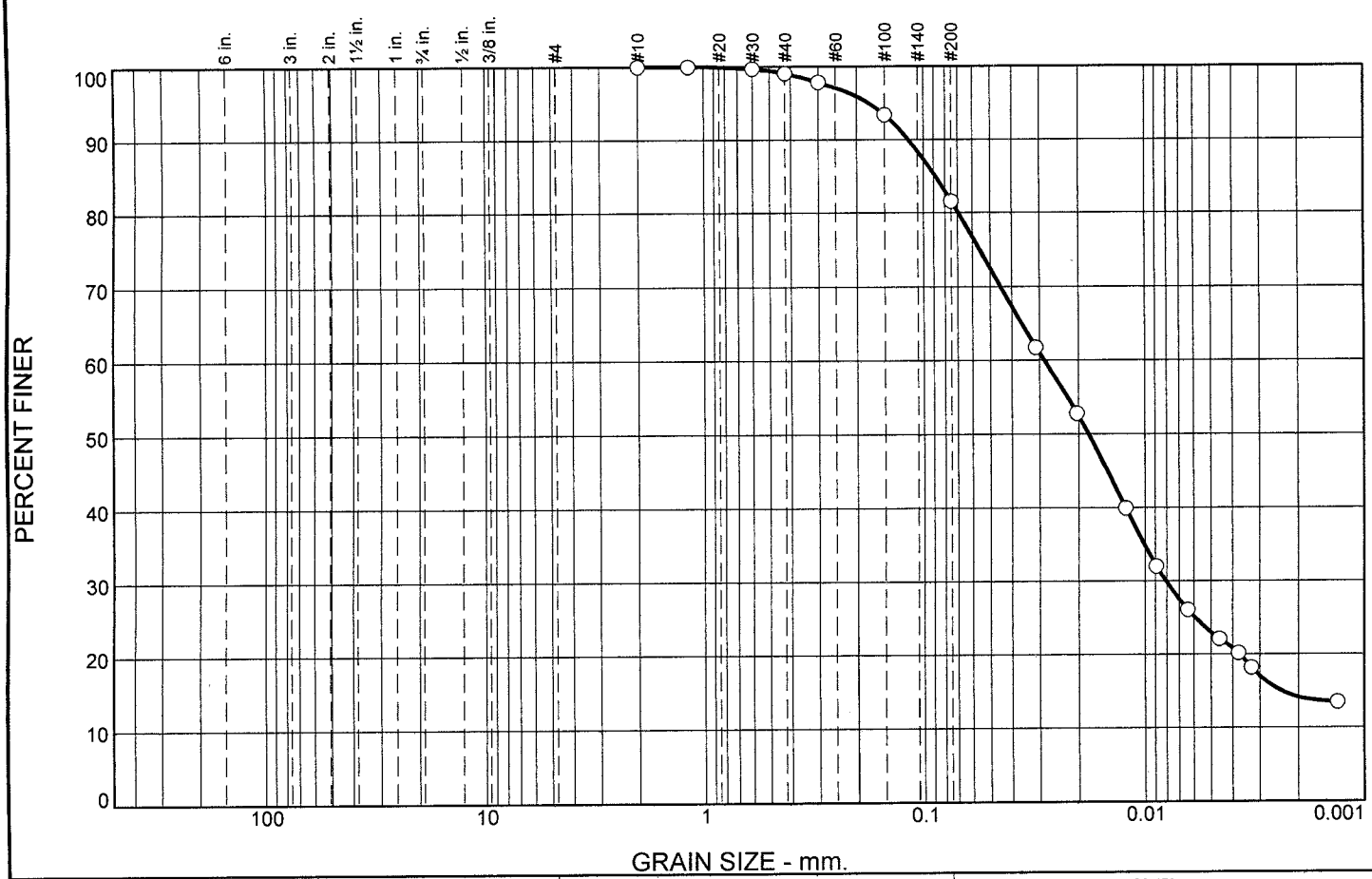
Source of Sample: Test Boring #HD-MW-169 **Depth:** 17.0' to 17.4'
Sample Number: 2 **Date:** 12/26/2014.

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.9	17.5	58.6	23.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	99.7		
#40	99.1		
#50	97.9		
#100	93.4		
#200	81.6		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1167 D_{85}= 0.0885 D_{60}= 0.0287
D_{50}= 0.0181 D_{30}= 0.0081 D_{15}= 0.0024
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 22.6%

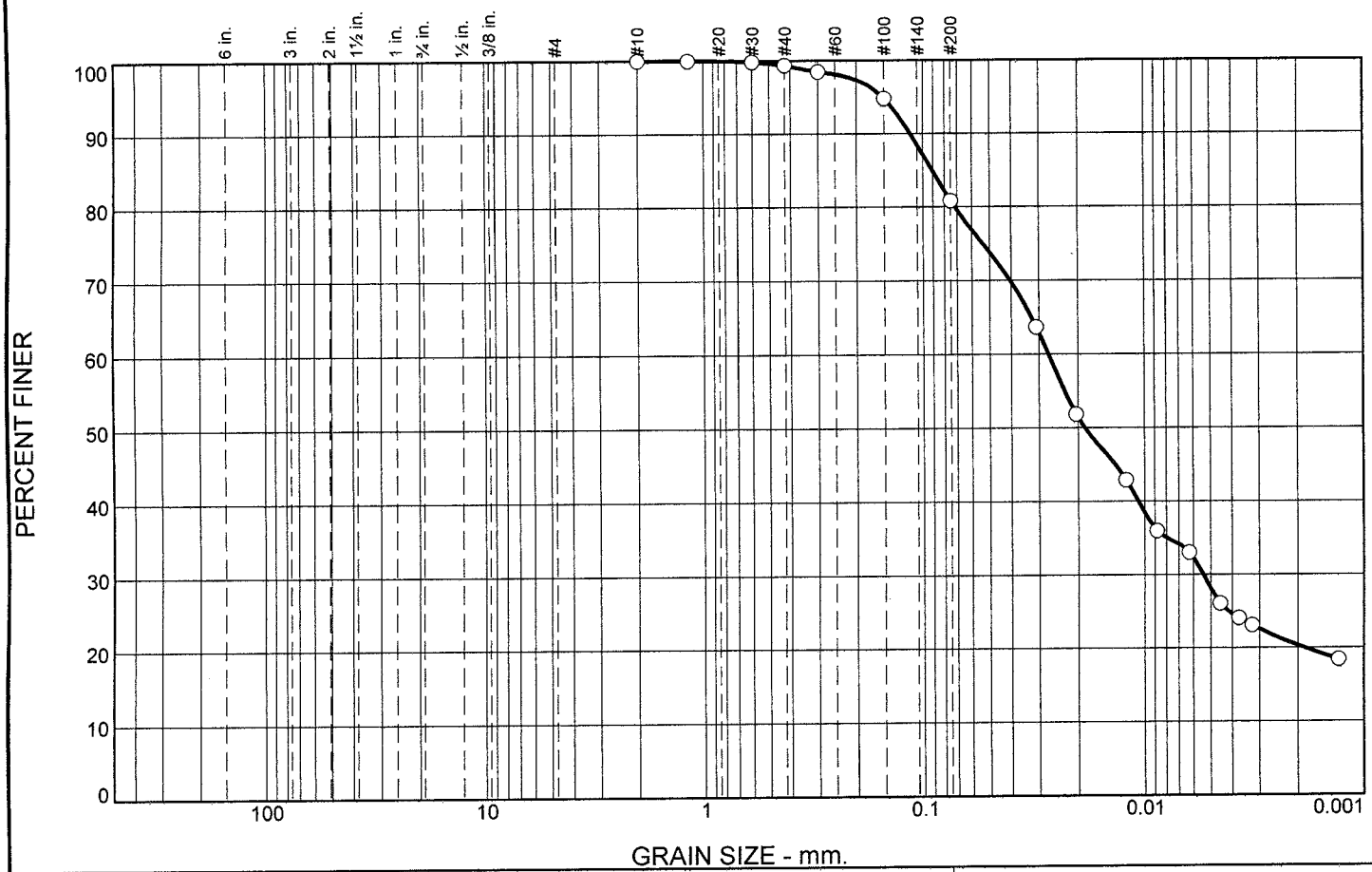
Source of Sample: Test Boring #HD-MW-169 **Depth:** 22.4' to 22.8'
Sample Number: 3 **Date:** 12/26/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.6	18.5	52.8	28.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	99.8		
#40	99.4		
#50	98.5		
#100	94.8		
#200	80.9		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1143 D_{85}= 0.0911 D_{60}= 0.0273
D_{50}= 0.0187 D_{30}= 0.0054 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 23.1%

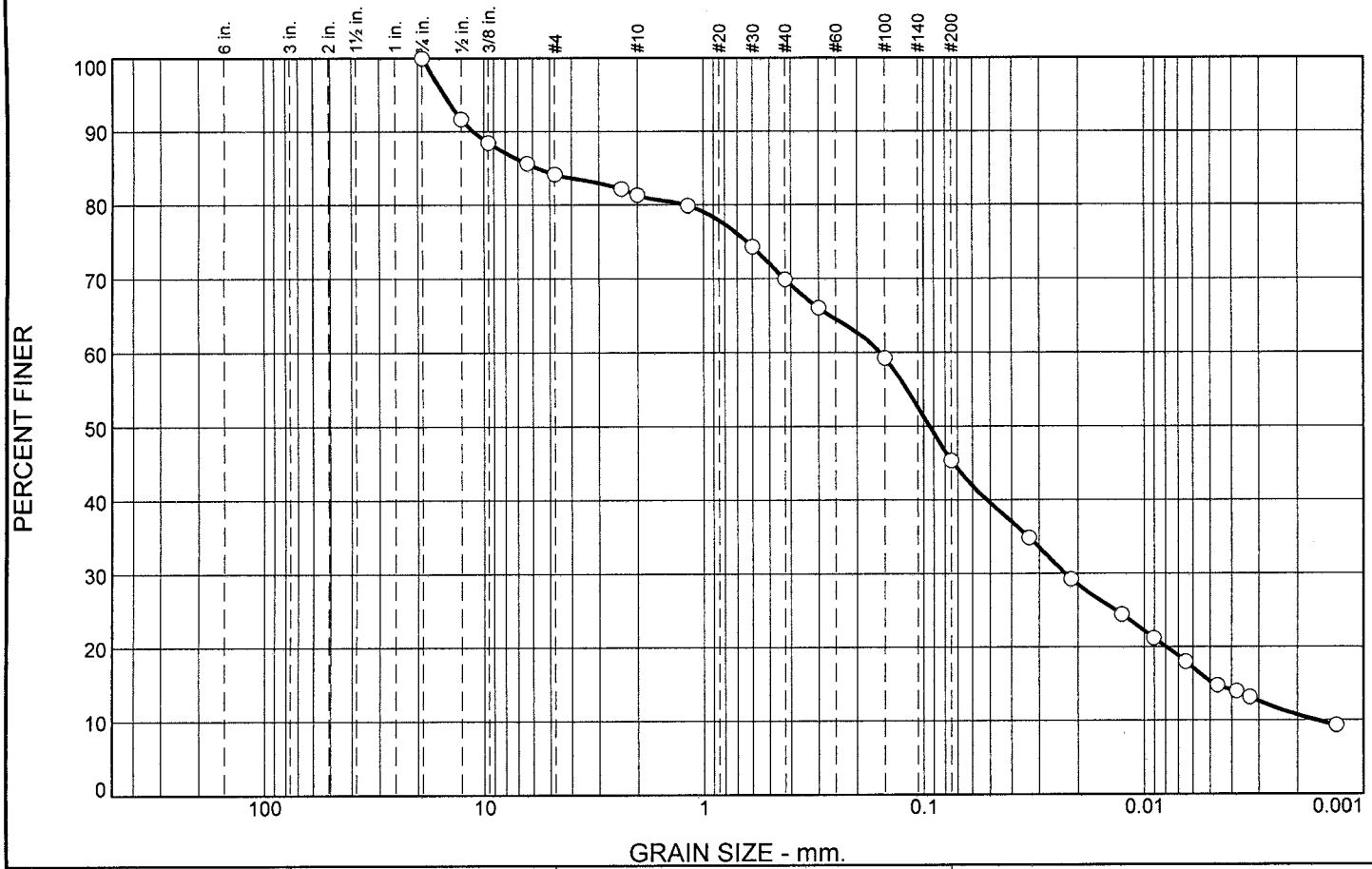
Source of Sample: Test Boring #HD-MW-169 **Depth:** 27.0' to 27.4'
Sample Number: 4 **Date:** 12/26/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.8	2.9	11.4	24.5	30.1	15.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	91.7		
.375	88.5		
.25	85.6		
#4	84.2		
#8	82.2		
#10	81.3		
#16	79.9		
#30	74.3		
#40	69.9		
#50	66.1		
#100	59.3		
#200	45.4		

* (no specification provided)

Material Description

Brown Clayey Silt And Sand With Some Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 11.1662 D_{85}= 5.6664 D_{60}= 0.1576
D_{50}= 0.0944 D_{30}= 0.0229 D_{15}= 0.0048
D_{10}= 0.0016 C_u= 97.30 C_c= 2.06

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 15.0%

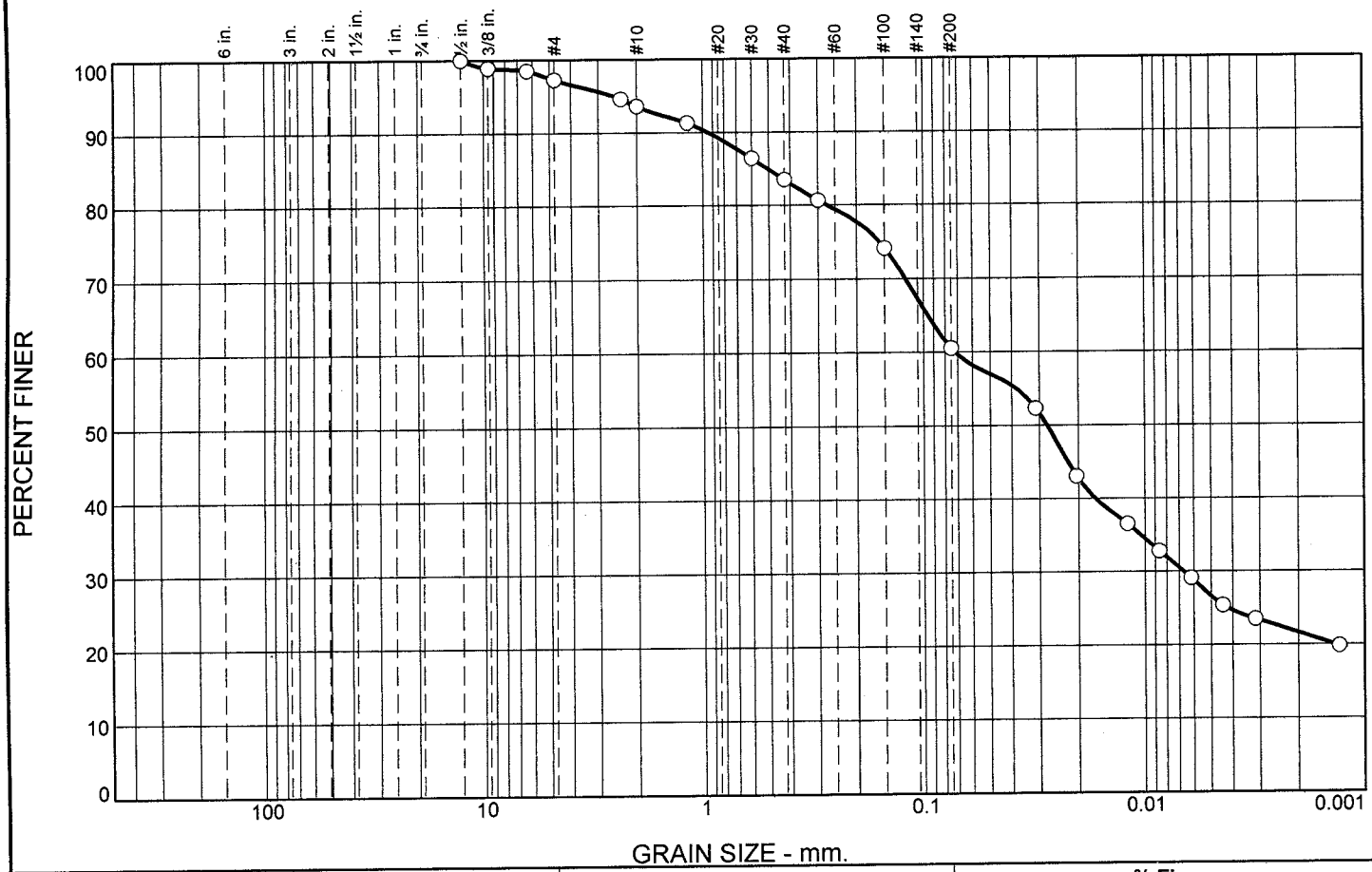
Source of Sample: Test Boring #HD-MW-169 **Depth:** 28.6' to 29.0'
Sample Number: 5 **Date:** 12/26/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.7	3.7	10.1	23.0	33.9	26.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50	100.0		
.375	98.9		
.25	98.5		
#4	97.3		
#8	94.6		
#10	93.6		
#16	91.4		
#30	86.5		
#40	83.5		
#50	80.7		
#100	74.2		
#200	60.5		

* (no specification provided)

Material Description

Brown Clayey Sand And Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.9375 D_{85}= 0.5042 D_{60}= 0.0720
D_{50}= 0.0278 D_{30}= 0.0067 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 21.4%

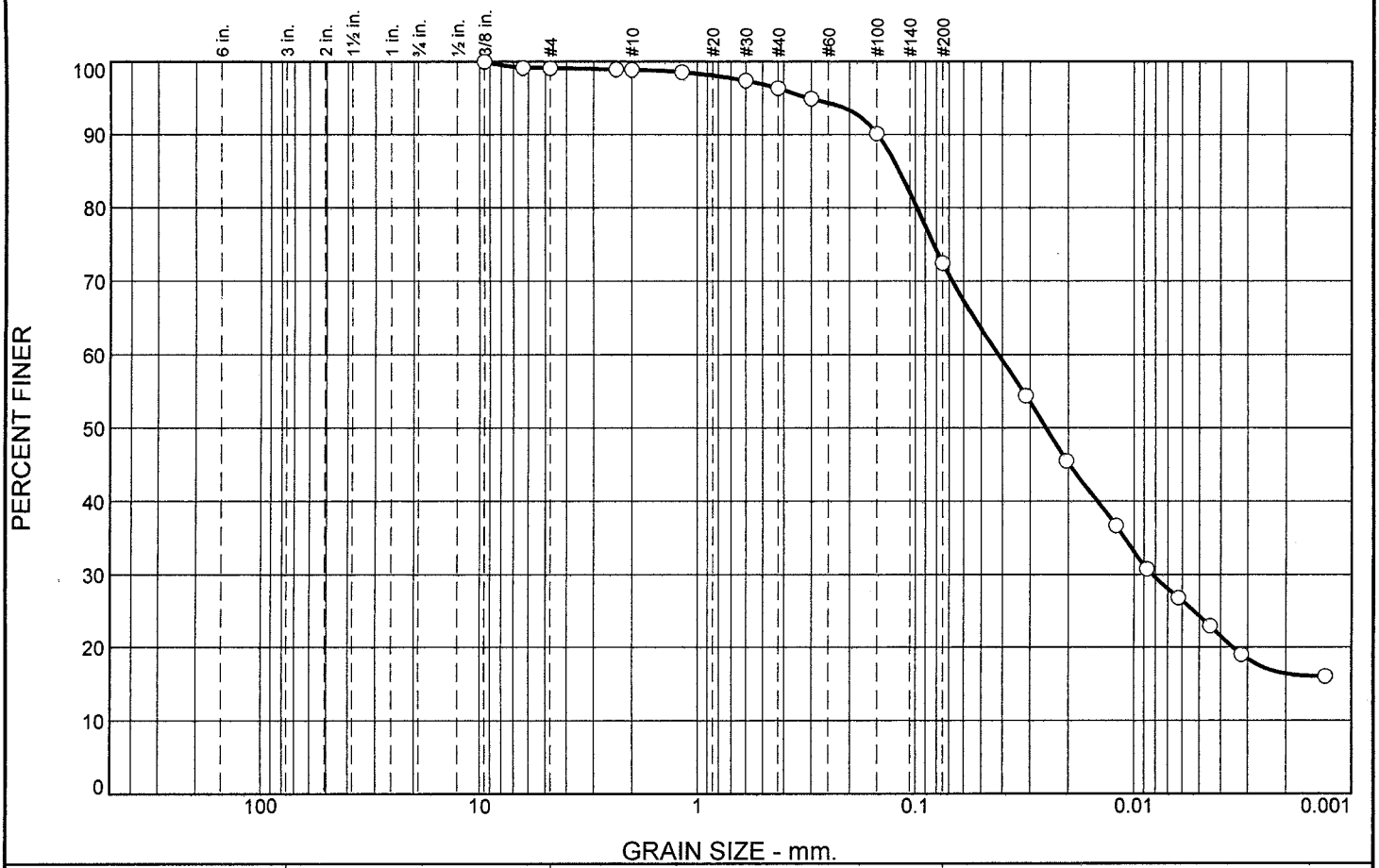
Source of Sample: Test Boring #HD-MW-170 **Depth:** 7.8' to 8.2'
Sample Number: 1 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	0.2	2.5	23.9	48.2	24.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
.25	99.2		
#4	99.1		
#8	98.9		
#10	98.9		
#16	98.6		
#30	97.4		
#40	96.4		
#50	94.9		
#100	90.2		
#200	72.5		

* (no specification provided)

Material Description

Brown Clayey Sandy Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1486 D_{85}= 0.1184 D_{60}= 0.0418
D_{50}= 0.0255 D_{30}= 0.0083 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 21.4%

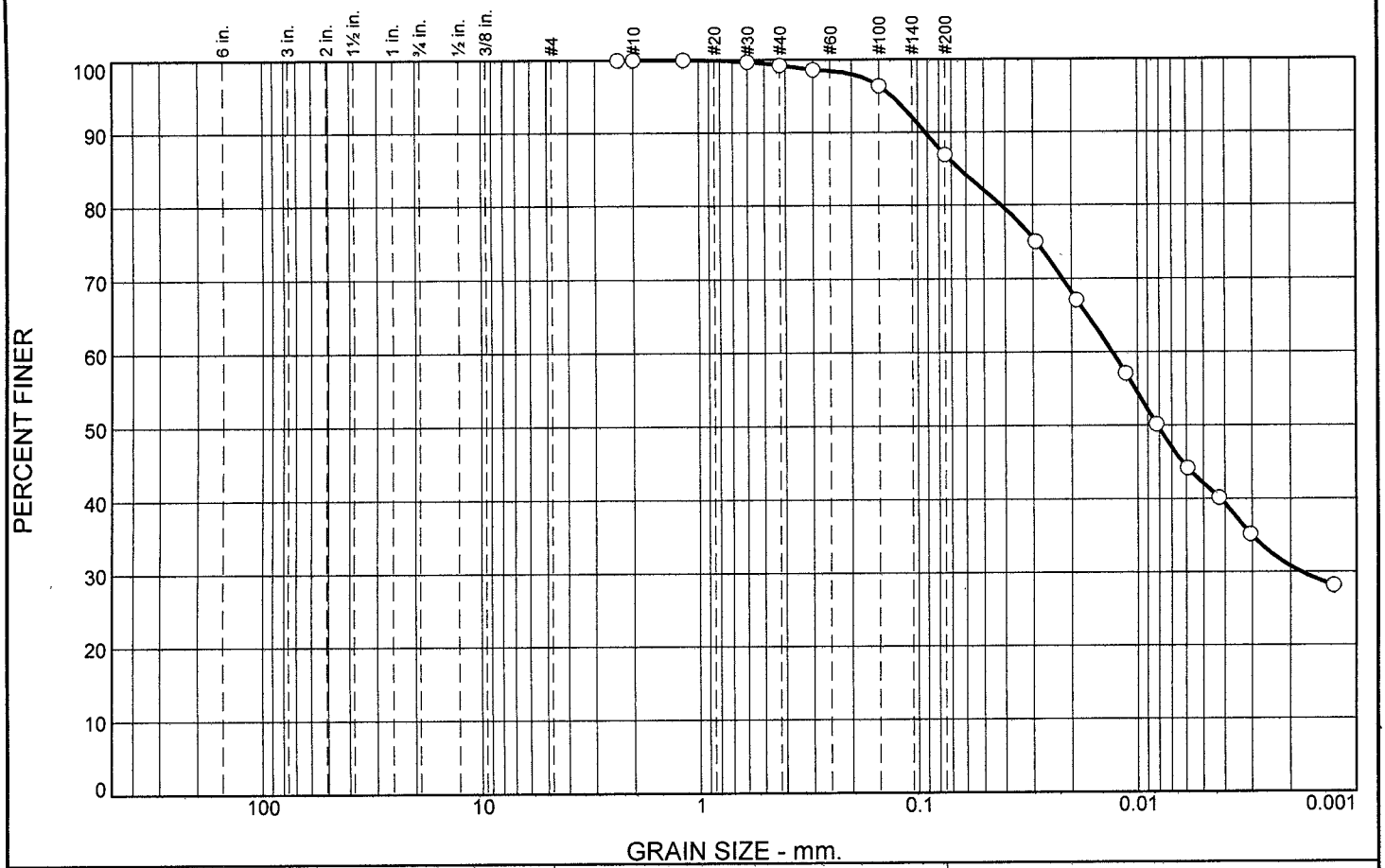
Source of Sample: Test Boring #HD-MW-170 **Depth:** 11.8' to 12.2'
Sample Number: 2 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.8	12.3	44.8	42.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	100.0		
#16	100.0		
#30	99.7		
#40	99.2		
#50	98.6		
#100	96.4		
#200	86.9		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0924 D_{85}= 0.0646 D_{60}= 0.0131
D_{50}= 0.0082 D_{30}= 0.0018 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 28.0%

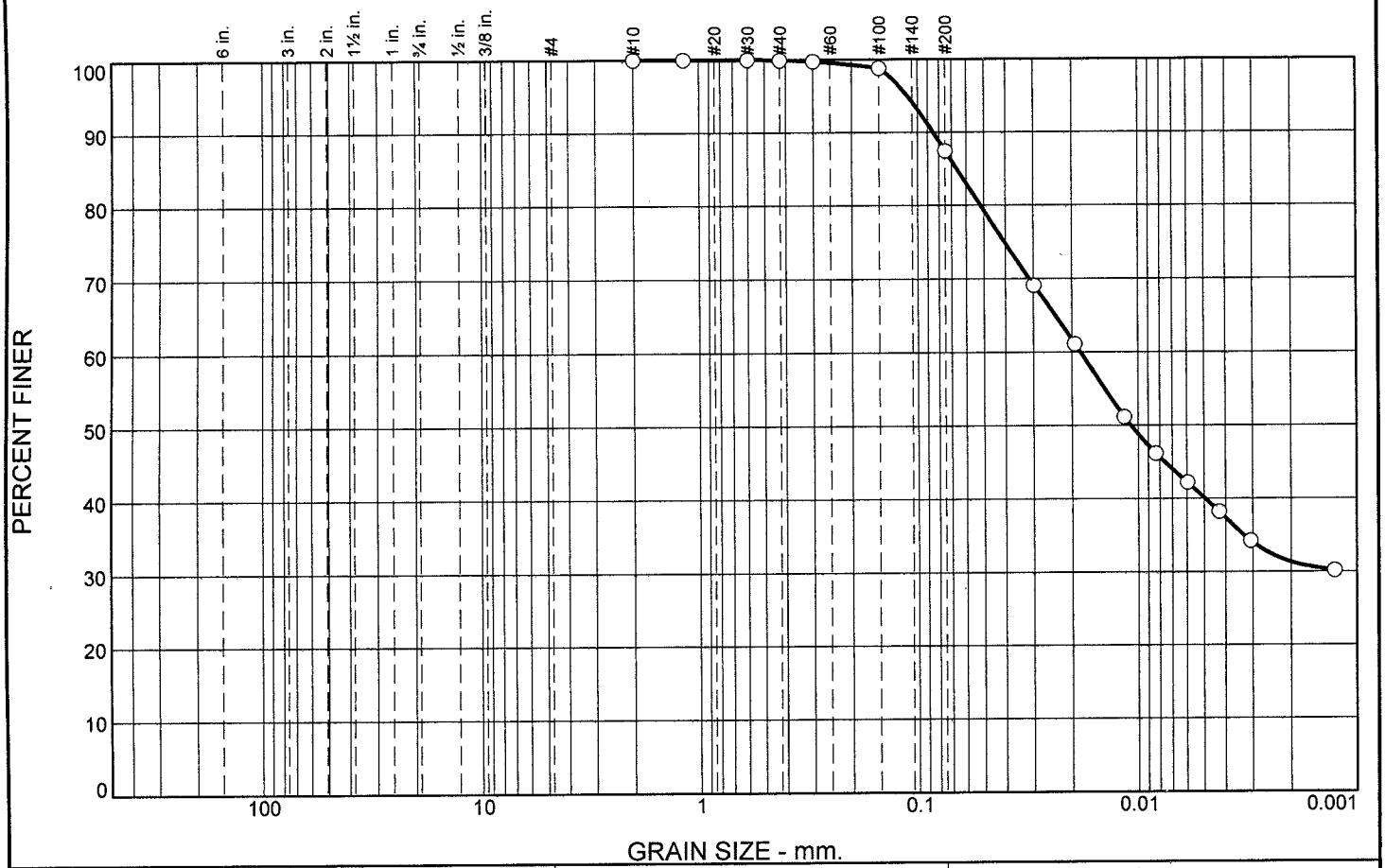
Source of Sample: Test Boring #HD-MW-170 **Depth:** 16.6' to 17.0'
Sample Number: 3 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	12.5	47.3	40.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	100.0		
#40	99.9		
#50	99.7		
#100	98.8		
#200	87.4		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0850 D_{85}= 0.0666 D_{60}= 0.0183
D_{50}= 0.0108 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 28.4%

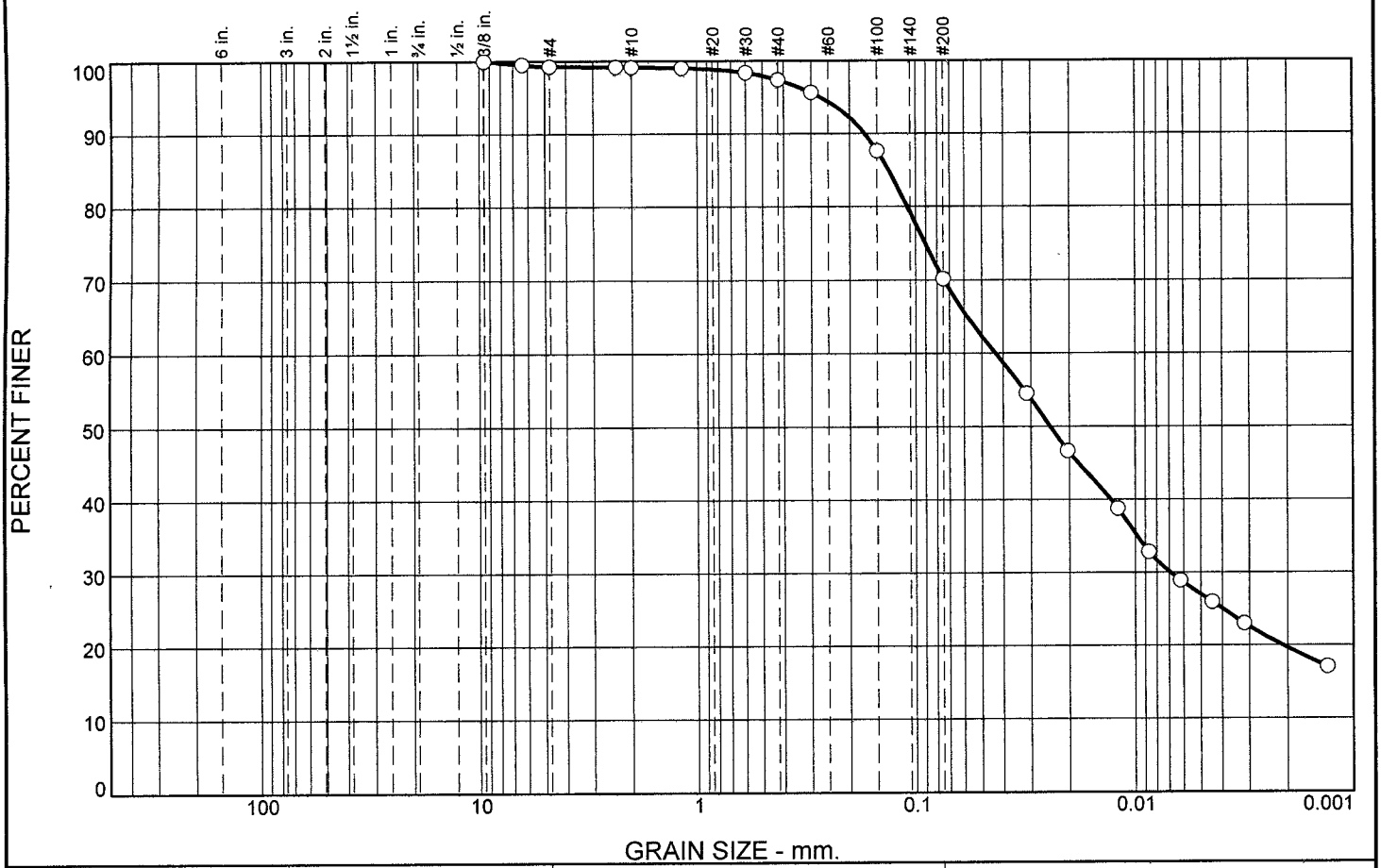
Source of Sample: Test Boring #HD-MW-170 **Depth:** 20.8' to 21.2'
Sample Number: 4 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.7	0.1	1.8	27.2	43.2	27.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
.25	99.5		
#4	99.3		
#8	99.2		
#10	99.2		
#16	99.0		
#30	98.4		
#40	97.4		
#50	95.7		
#100	87.7		
#200	70.2		

* (no specification provided)

Material Description

Brown Clayey Sandy Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1707 D_{85}= 0.1330 D_{60}= 0.0435
D_{50}= 0.0245 D_{30}= 0.0069 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 18.5%

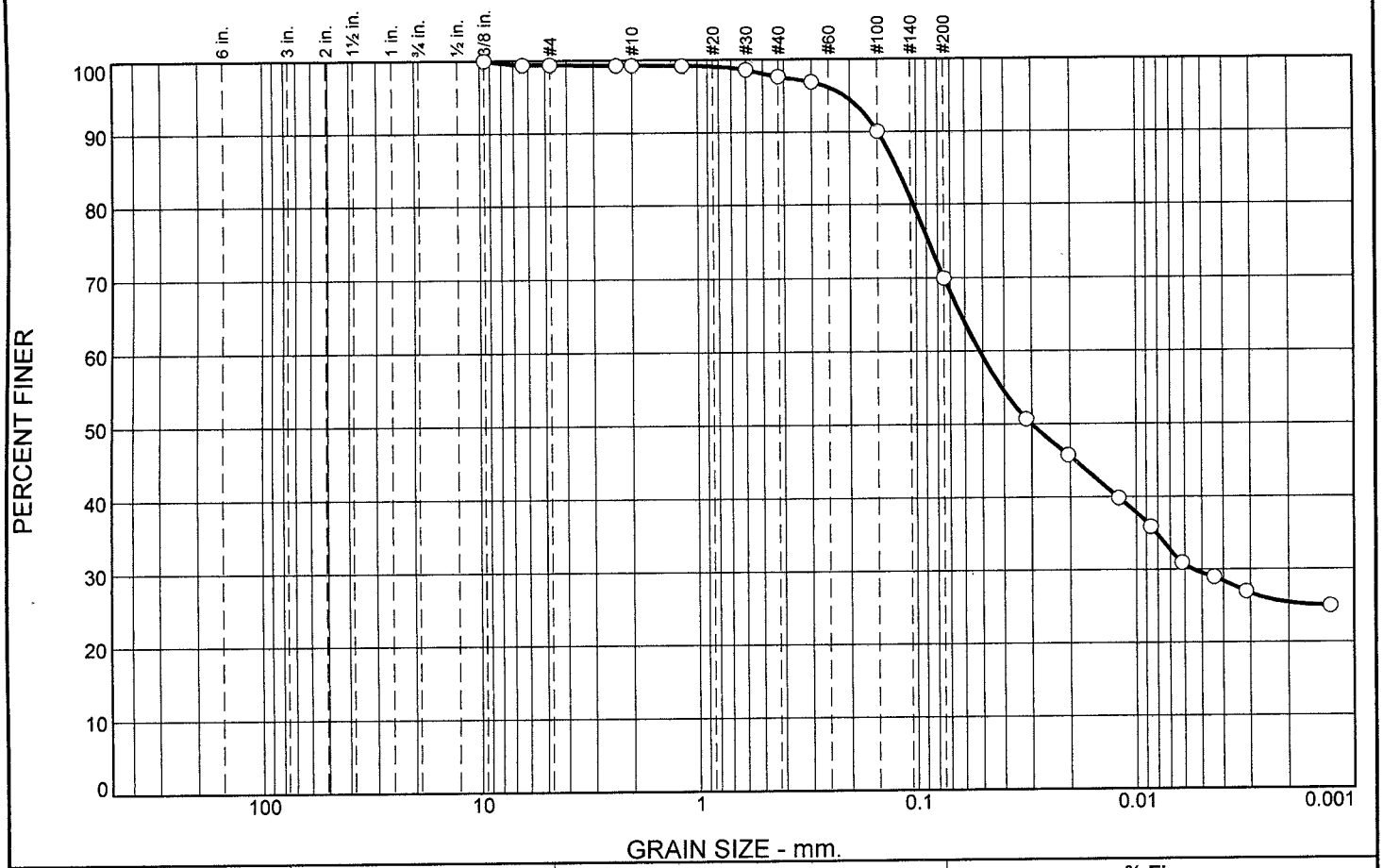
Source of Sample: Test Boring #HD-MW-170 **Depth:** 28.6' to 29.0'
Sample Number: 5 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	0.1	1.6	27.7	40.5	29.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
.25	99.4		
#4	99.4		
#8	99.3		
#10	99.3		
#16	99.2		
#30	98.6		
#40	97.7		
#50	96.9		
#100	90.1		
#200	70.0		

* (no specification provided)

Material Description

Brown Clayey Sandy Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1494 D_{85}= 0.1221 D_{60}= 0.0518
D_{50}= 0.0301 D_{30}= 0.0055 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 20.6%

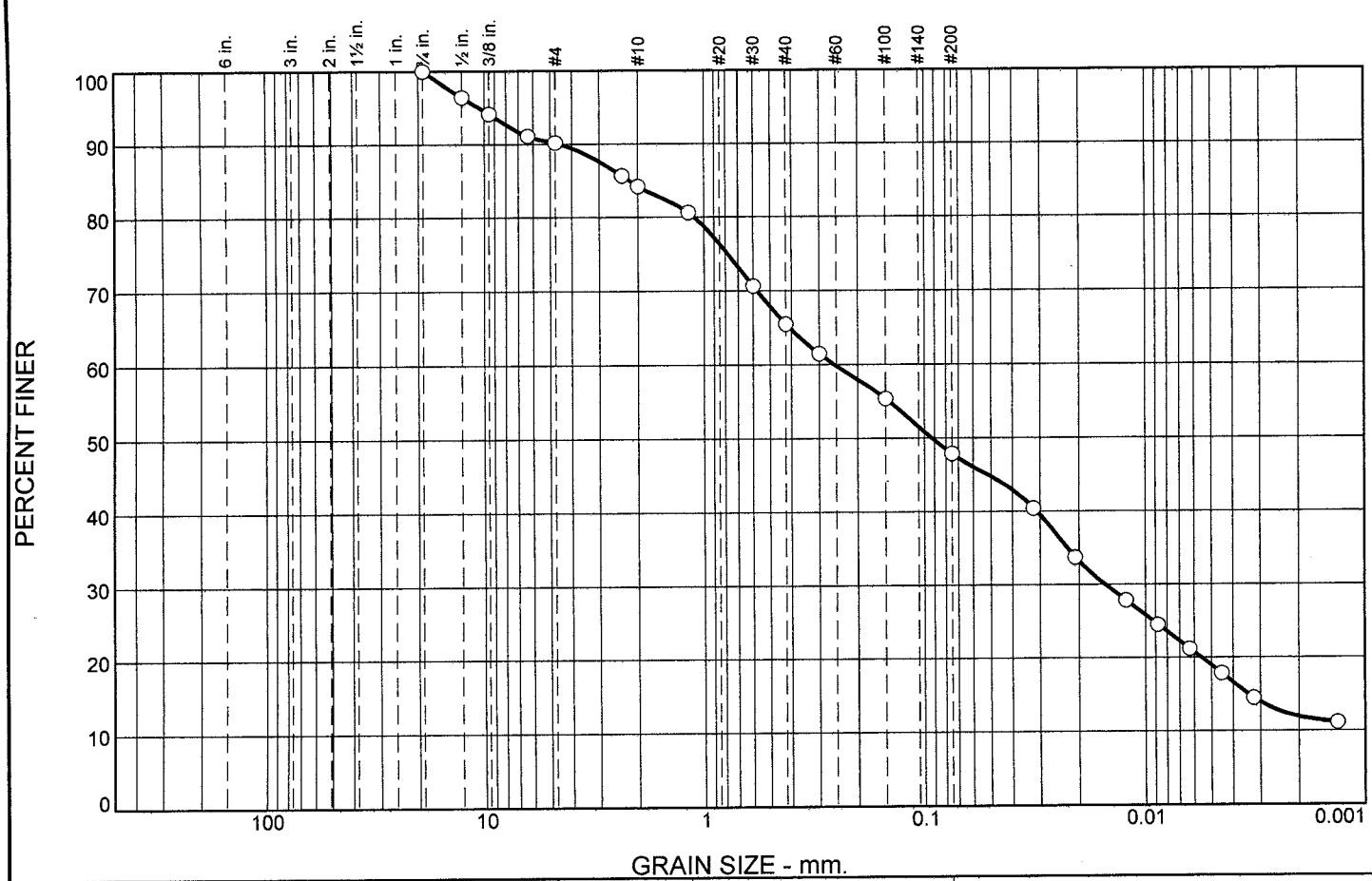
Source of Sample: Test Boring #HD-MW-171 **Depth:** 8.6' to 9.0'
Sample Number: 1 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.8	6.0	18.7	17.6	29.0	18.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	96.4		
.375	94.2		
.25	91.1		
#4	90.2		
#8	85.6		
#10	84.2		
#16	80.6		
#30	70.7		
#40	65.5		
#50	61.5		
#100	55.4		
#200	47.9		

* (no specification provided)

Material Description

Brown Clayey Sand and Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.4790 D_{85}= 2.1939 D_{60}= 0.2549
D_{50}= 0.0925 D_{30}= 0.0152 D_{15}= 0.0034
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 15.7%

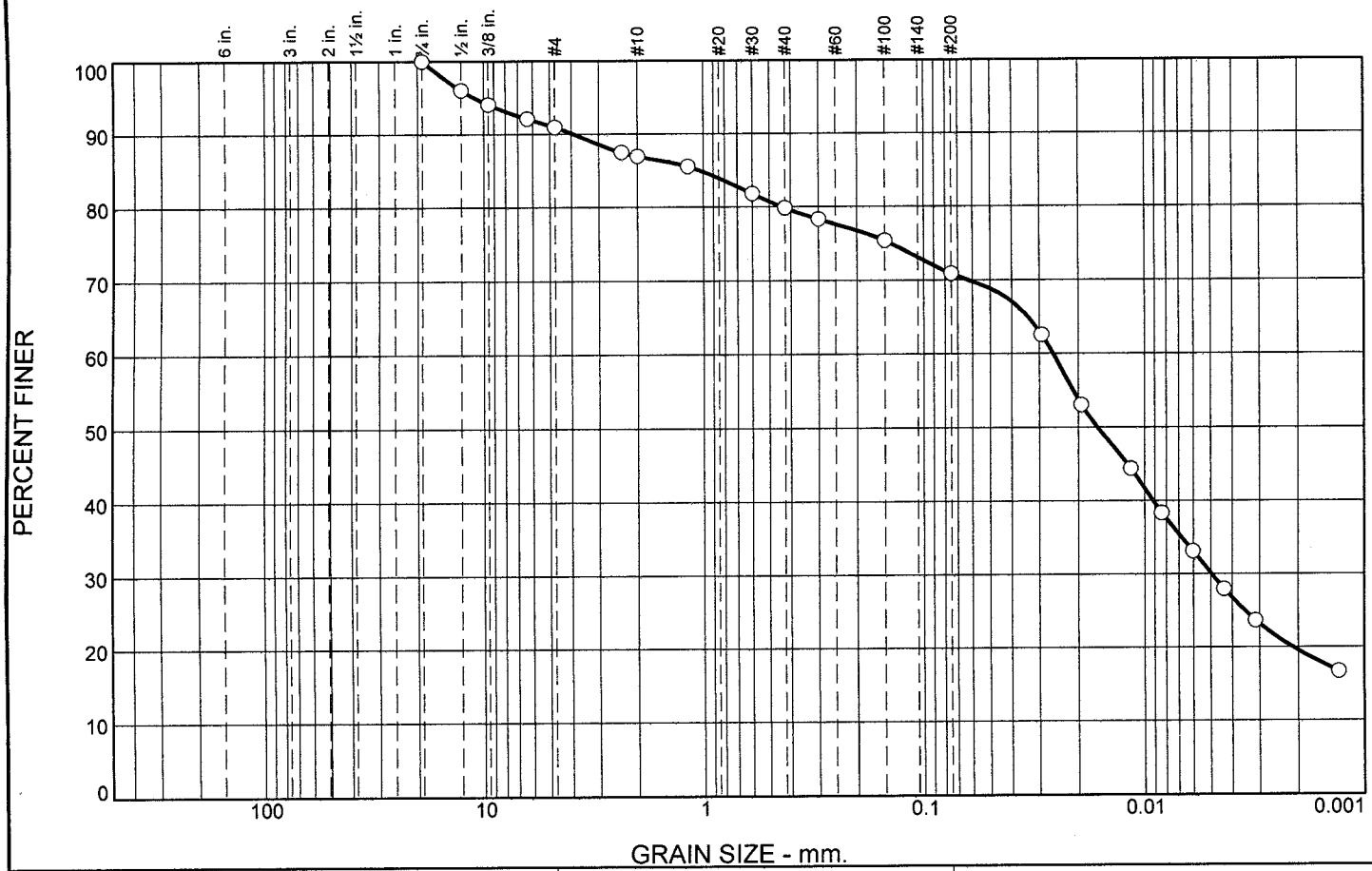
Source of Sample: Test Boring #HD-MW-171 **Depth:** 13.2' to 13.6'
Sample Number: 2 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.0	4.0	7.1	9.0	40.8	30.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	96.0		
.375	94.1		
.25	92.1		
#4	91.0		
#8	87.5		
#10	87.0		
#16	85.6		
#30	81.8		
#40	79.9		
#50	78.4		
#100	75.4		
#200	70.9		

* (no specification provided)

Material Description

Brown Clayey Sandy Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.8738 D_{85}= 1.0291 D_{60}= 0.0261
D_{50}= 0.0164 D_{30}= 0.0050 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 23.2%

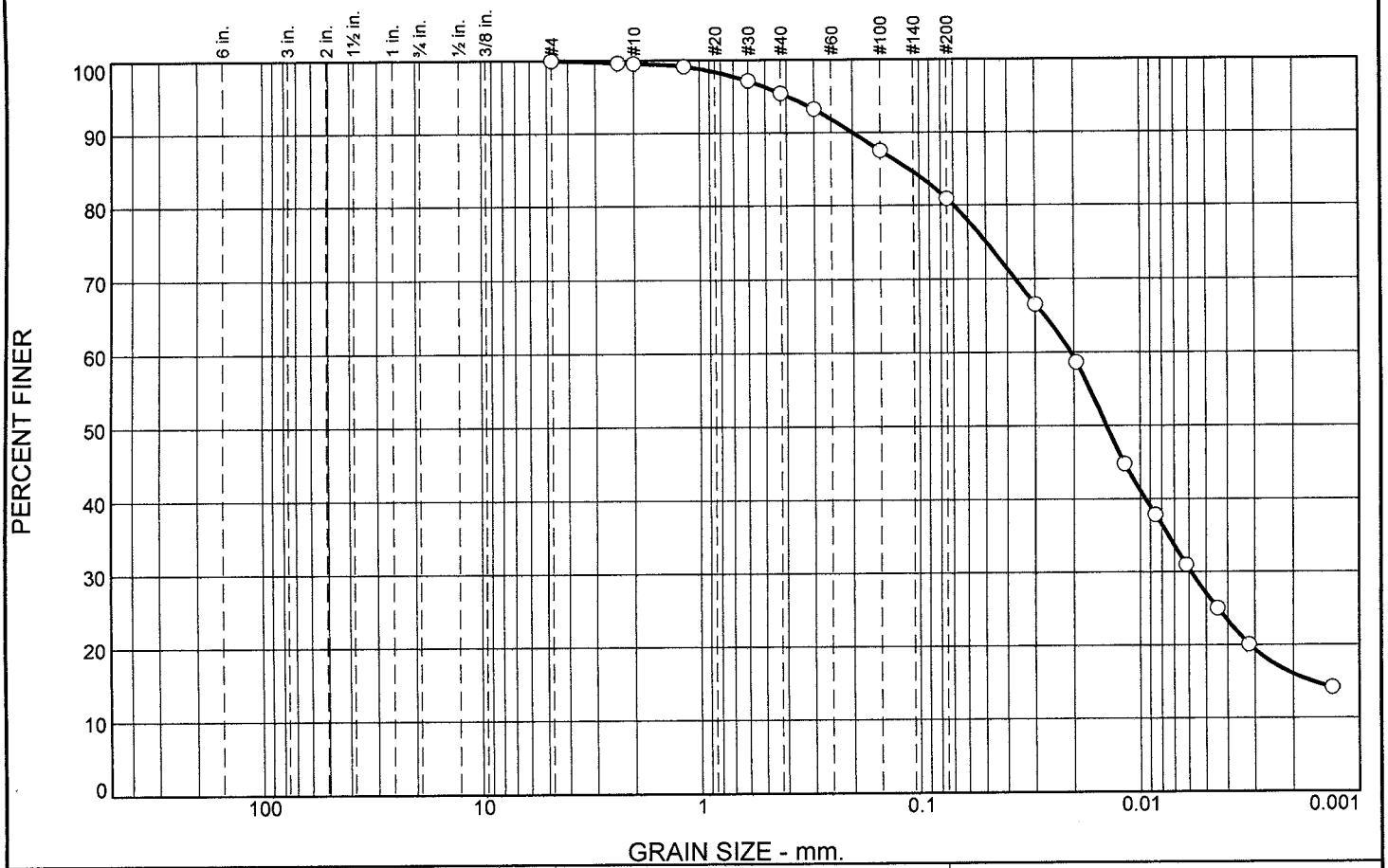
Source of Sample: Test Boring #HD-MW-171 **Depth:** 20.0' to 20.4'
Sample Number: 3 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	4.2	14.5	53.9	27.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.7		
#10	99.6		
#16	99.1		
#30	97.1		
#40	95.4		
#50	93.3		
#100	87.6		
#200	80.9		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1991 D_{85}= 0.1110 D_{60}= 0.0207
D_{50}= 0.0143 D_{30}= 0.0059 D_{15}= 0.0016
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 29.3%

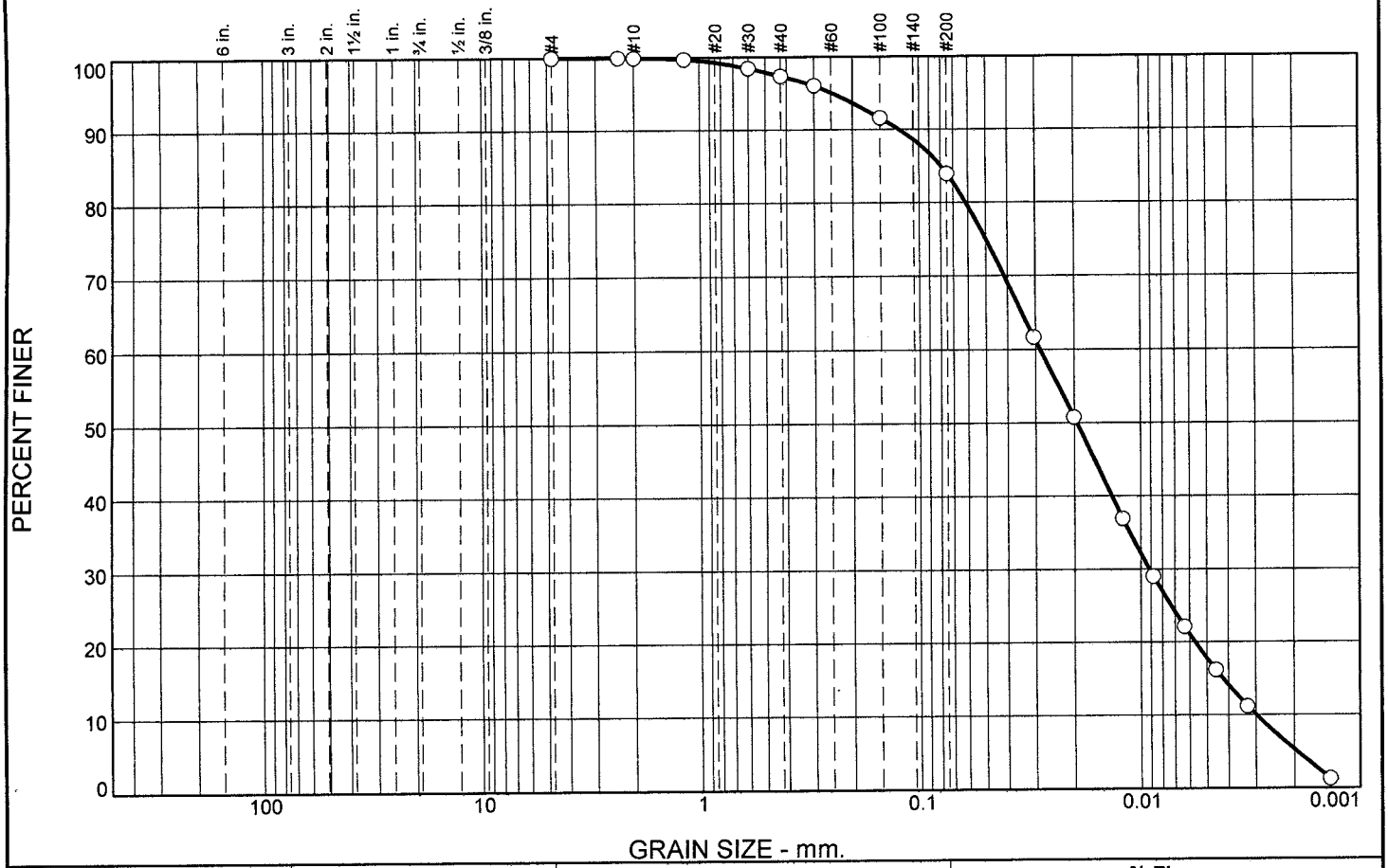
Source of Sample: Test Boring #HD-MW-171 **Depth:** 22.4' to 22.8'
Sample Number: 4 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	2.5	13.4	66.3	17.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#10	99.9		
#16	99.7		
#30	98.5		
#40	97.4		
#50	96.1		
#100	91.6		
#200	84.0		

* (no specification provided)

Material Description

Brown Clayey Sandy Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1222 D_{85}= 0.0797 D_{60}= 0.0287
D_{50}= 0.0195 D_{30}= 0.0092 D_{15}= 0.0042
D_{10}= 0.0030 C_u= 9.60 C_c= 0.98

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 39.5%

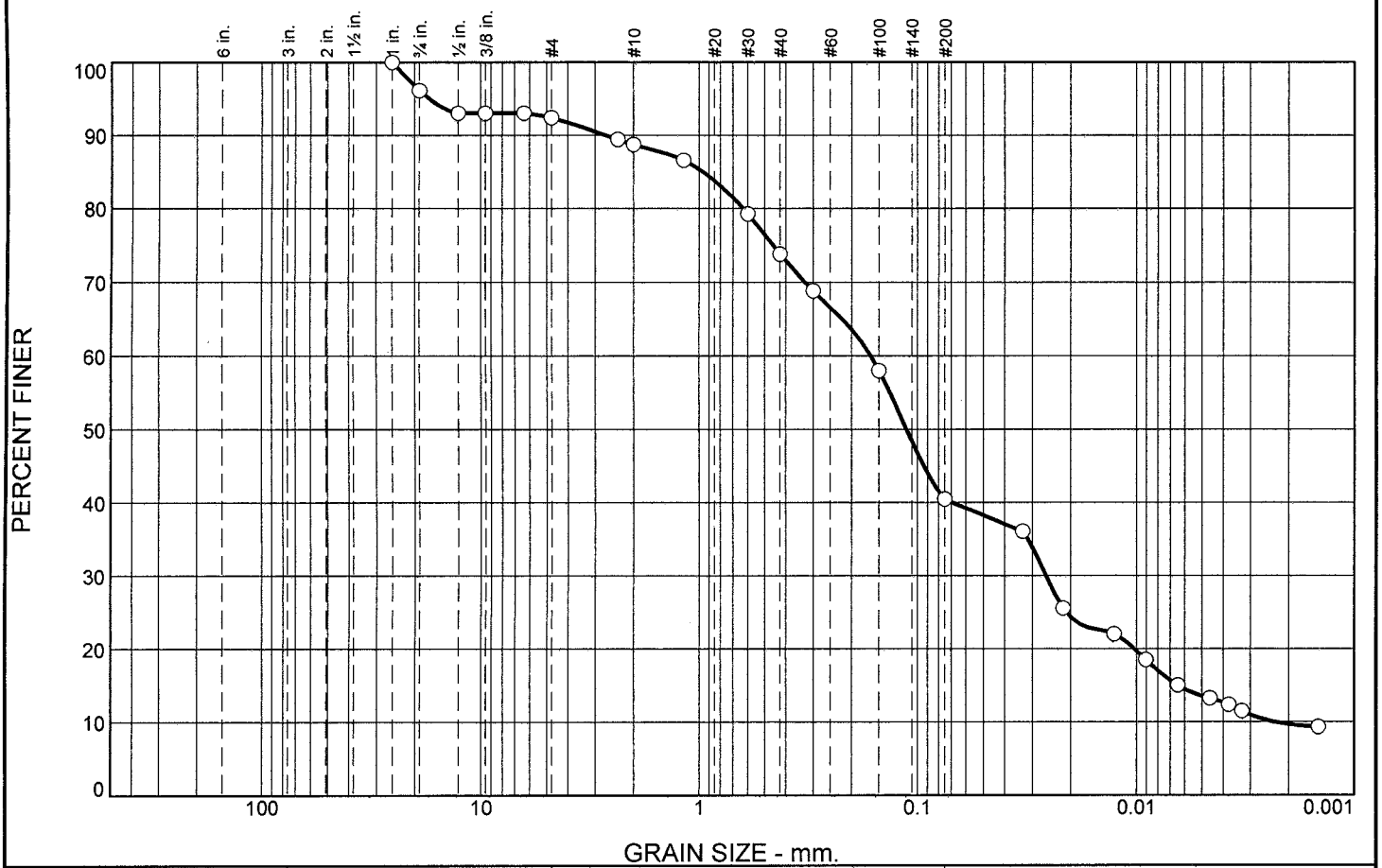
Source of Sample: Test Boring #HD-MW-171 **Depth:** 27.4' to 27.8'
Sample Number: 5 **Date:** 12/29/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.9	3.7	3.6	15.0	33.3	26.9	13.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.00	100.0		
.75	96.1		
.50	93.0		
.375	93.0		
.25	93.0		
#4	92.4		
#8	89.5		
#10	88.8		
#16	86.6		
#30	79.3		
#40	73.8		
#50	68.9		
#100	58.0		
#200	40.5		

* (no specification provided)

Material Description

Brown Silty Sand With Some Clay And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.6540 D_{85}= 0.9567 D_{60}= 0.1638
D_{50}= 0.1124 D_{30}= 0.0260 D_{15}= 0.0065
D_{10}= 0.0023 C_u= 71.44 C_c= 1.80

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 15.4%

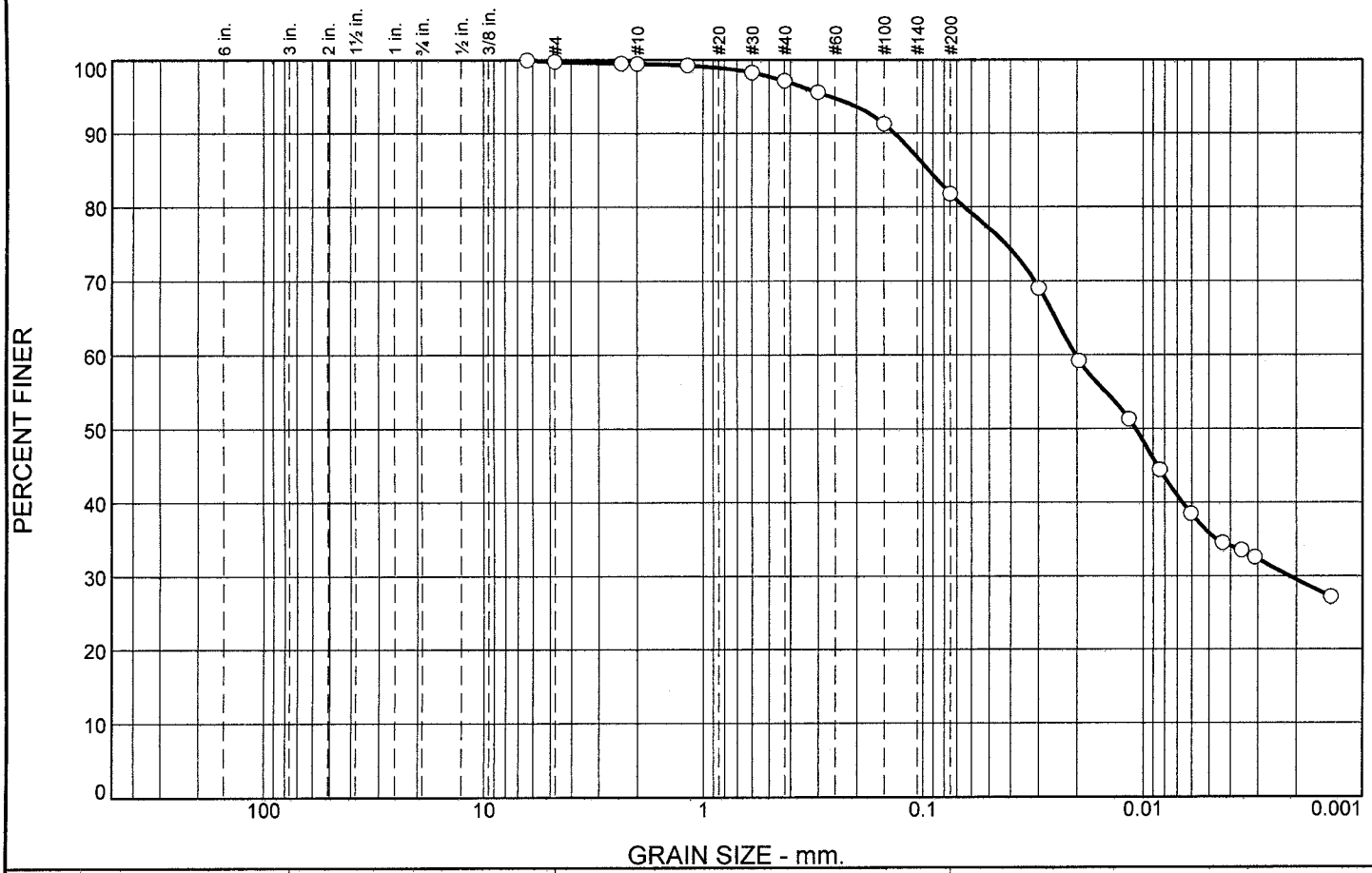
Source of Sample: Test Boring HD-MW-172 **Depth:** 10.2' to 10.6'
Sample Number: 1 **Date:** 12/03/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.3	2.3	15.4	45.9	35.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.25	100.0		
#4	99.8		
#8	99.5		
#10	99.5		
#16	99.3		
#30	98.3		
#40	97.2		
#50	95.6		
#100	91.3		
#200	81.8		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1339 D_{85}= 0.0942 D_{60}= 0.0204
D_{50}= 0.0109 D_{30}= 0.0021 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 24.3%

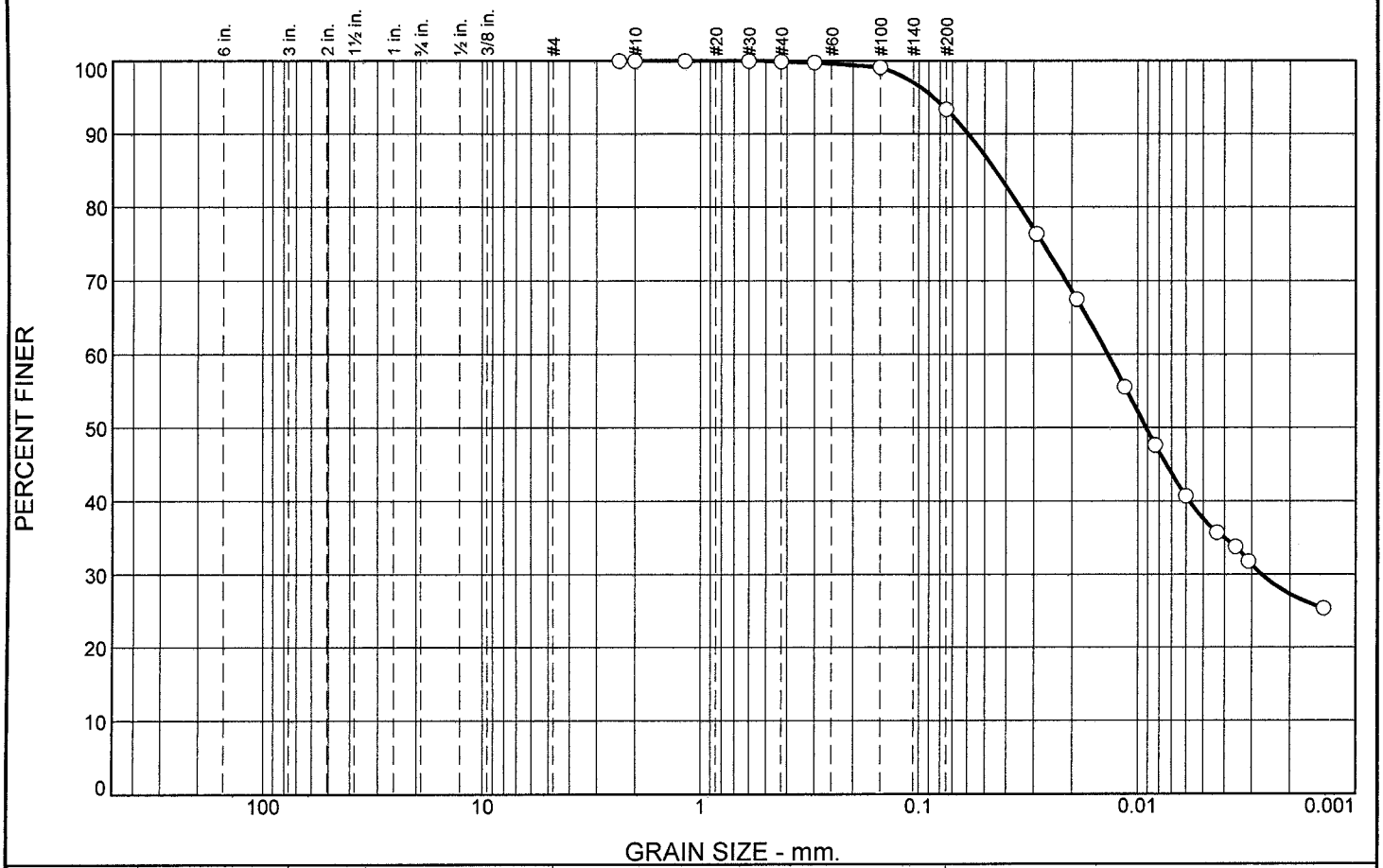
Source of Sample: Test Boring HD-MW-172 **Depth:** 13.0' to 13.4'
Sample Number: 2 **Date:** 12/03/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	6.5	55.9	37.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	100.0		
#16	100.0		
#30	100.0		
#40	99.9		
#50	99.8		
#100	99.1		
#200	93.4		

* (no specification provided)

Material Description

Brown Clayey Silt With A Trace Of Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0596 D_{85}= 0.0448 D_{60}= 0.0138
D_{50}= 0.0092 D_{30}= 0.0027 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 28.8%

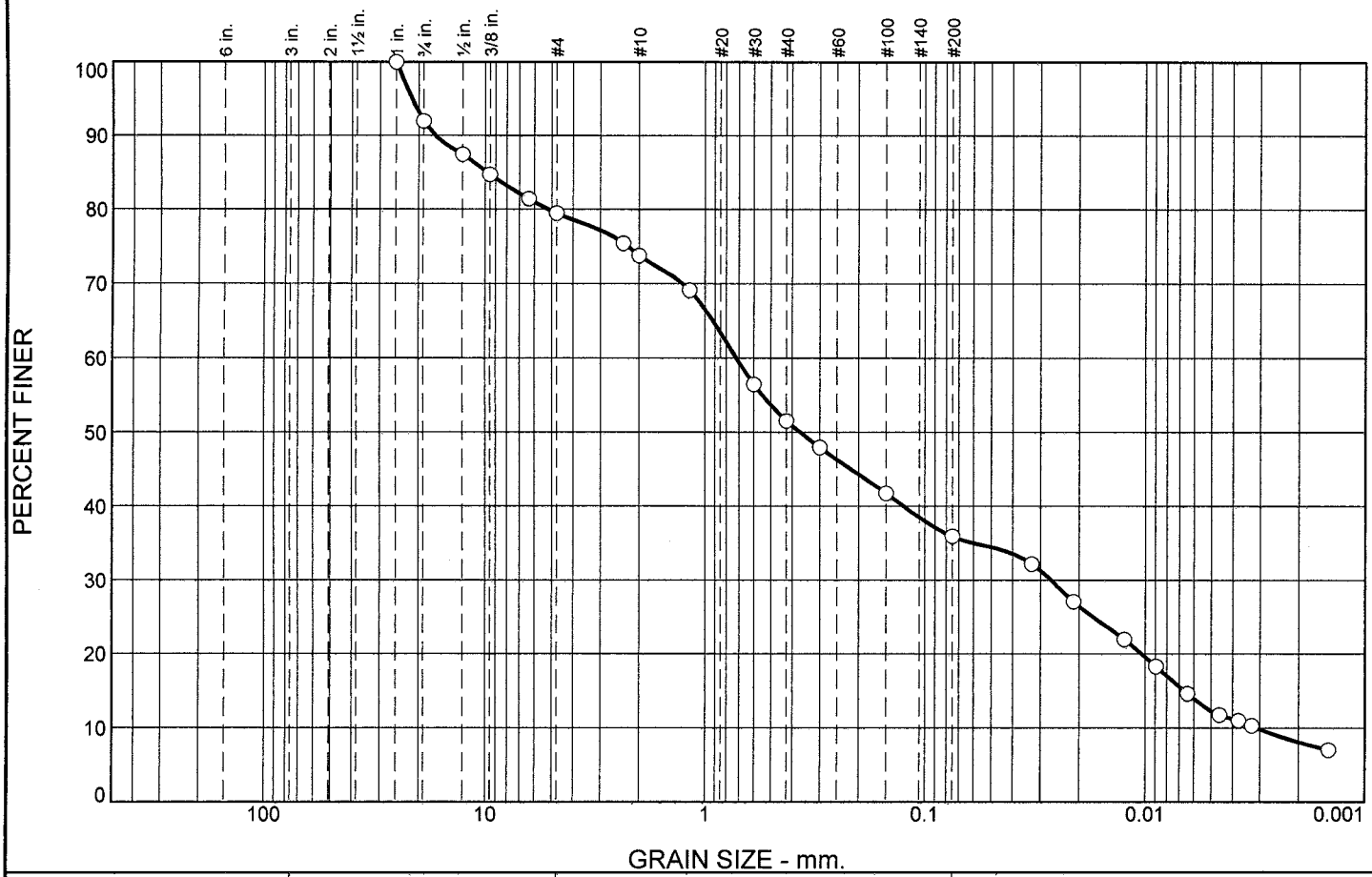
Source of Sample: Test Boring HD-MW-172 **Depth:** 16.0' to 16.4'
Sample Number: 3 **Date:** 12/03/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.0	12.5	5.7	22.2	15.7	23.6	12.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0	100.0		
.75	92.0		
.50	87.5		
.375	84.7		
.25	81.4		
#4	79.5		
#8	75.5		
#10	73.8		
#16	69.1		
#30	56.5		
#40	51.6		
#50	48.0		
#100	41.8		
#200	35.9		

* (no specification provided)

Material Description

Brown Silty Sand With Some Clay And Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 16.9022 D_{85}= 9.8251 D_{60}= 0.7210
D_{50}= 0.3690 D_{30}= 0.0269 D_{15}= 0.0066
D_{10}= 0.0031 C_u= 232.37 C_c= 0.32

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 13.5%

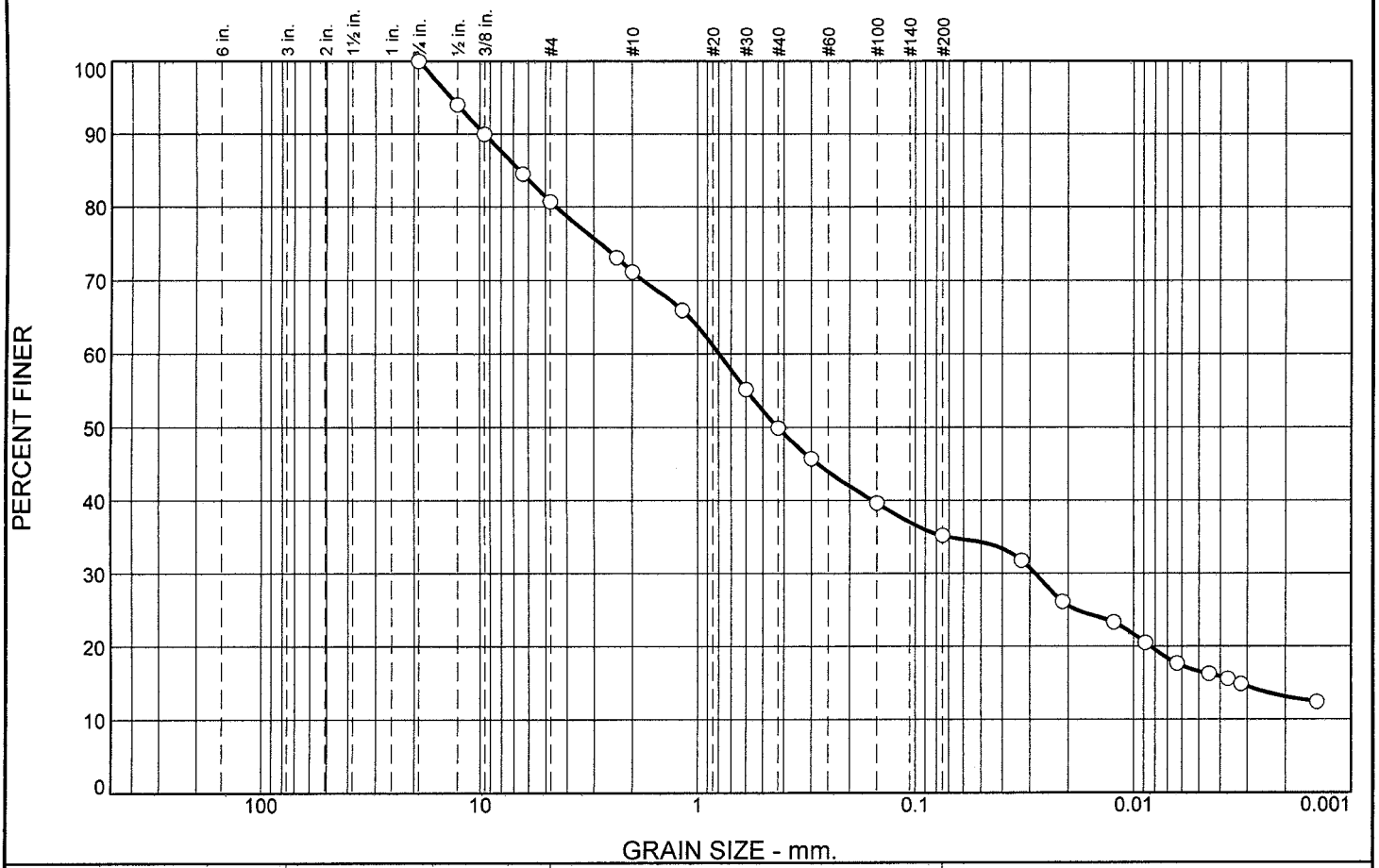
Source of Sample: Test Boring HD-MW-172 **Depth:** 23.0' to 23.4'
Sample Number: 4 **Date:** 12/03/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	19.3	9.5	21.3	14.7	18.6	16.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	94.0		
.375	90.0		
.25	84.5		
#4	80.7		
#8	73.1		
#10	71.2		
#16	66.0		
#30	55.2		
#40	49.9		
#50	45.7		
#100	39.7		
#200	35.2		

* (no specification provided)

Material Description

Brown Clayey Silty Sand With Some Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 9.5398 D_{85}= 6.5712 D_{60}= 0.7946
D_{50}= 0.4275 D_{30}= 0.0284 D_{15}= 0.0033
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 11.7%

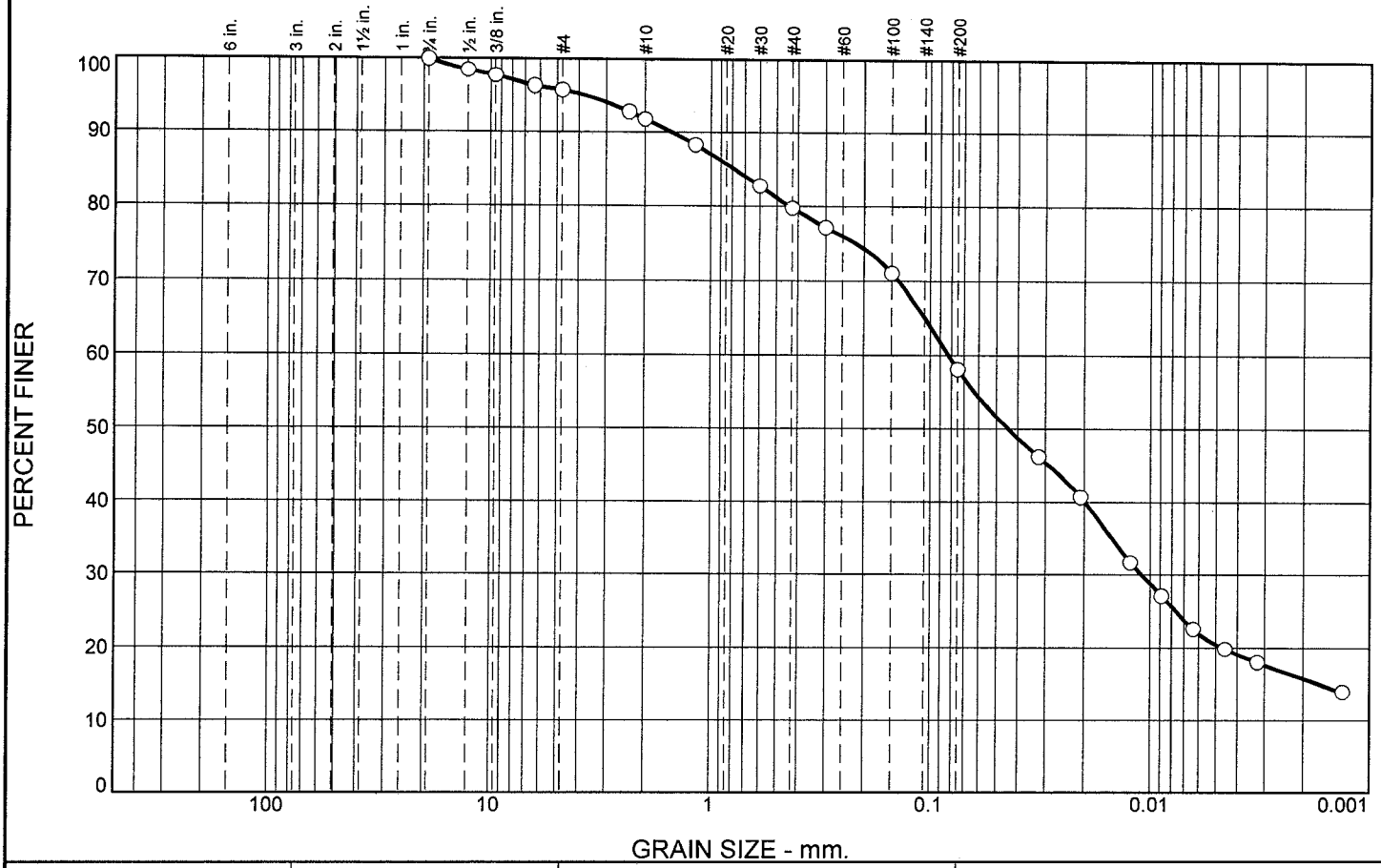
Source of Sample: Test Boring HD-MW-172 **Depth:** 30.8' TO 31.2'
Sample Number: 5 **Date:** 12/03/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	4.0	12.0	21.7	37.7	20.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	98.5		
.375	97.8		
.25	96.3		
#4	95.8		
#8	92.8		
#10	91.8		
#16	88.3		
#30	82.7		
#40	79.8		
#50	77.2		
#100	71.1		
#200	58.1		

* (no specification provided)

Material Description

Brown Clayey Silt And Sand With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.4989 D_{85}= 0.7831 D_{60}= 0.0827
D_{50}= 0.0443 D_{30}= 0.0110 D_{15}= 0.0017
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 21.8%

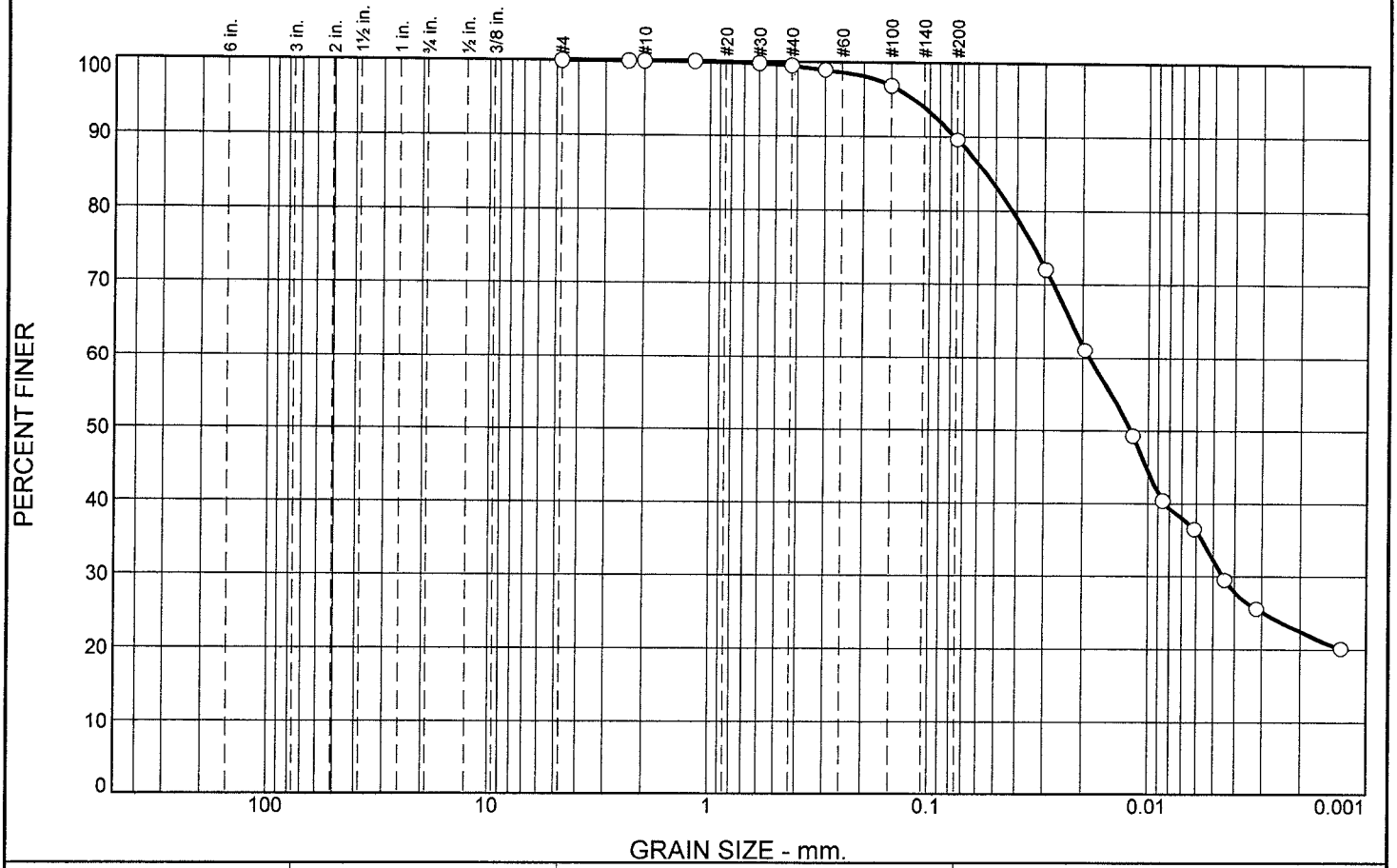
Source of Sample: Test Boring #HD-MW-173 **Depth:** 11.0' to 11.4'
Sample Number: 1 **Date:** 12/08/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.5	9.9	57.5	32.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#10	100.0		
#16	100.0		
#30	99.8		
#40	99.5		
#50	98.9		
#100	96.9		
#200	89.6		

* (no specification provided)

Material Description

Brown Clayey Silt With A Trace Of Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0771 D_{85}= 0.0553 D_{60}= 0.0186
D_{50}= 0.0121 D_{30}= 0.0046 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 25.0%

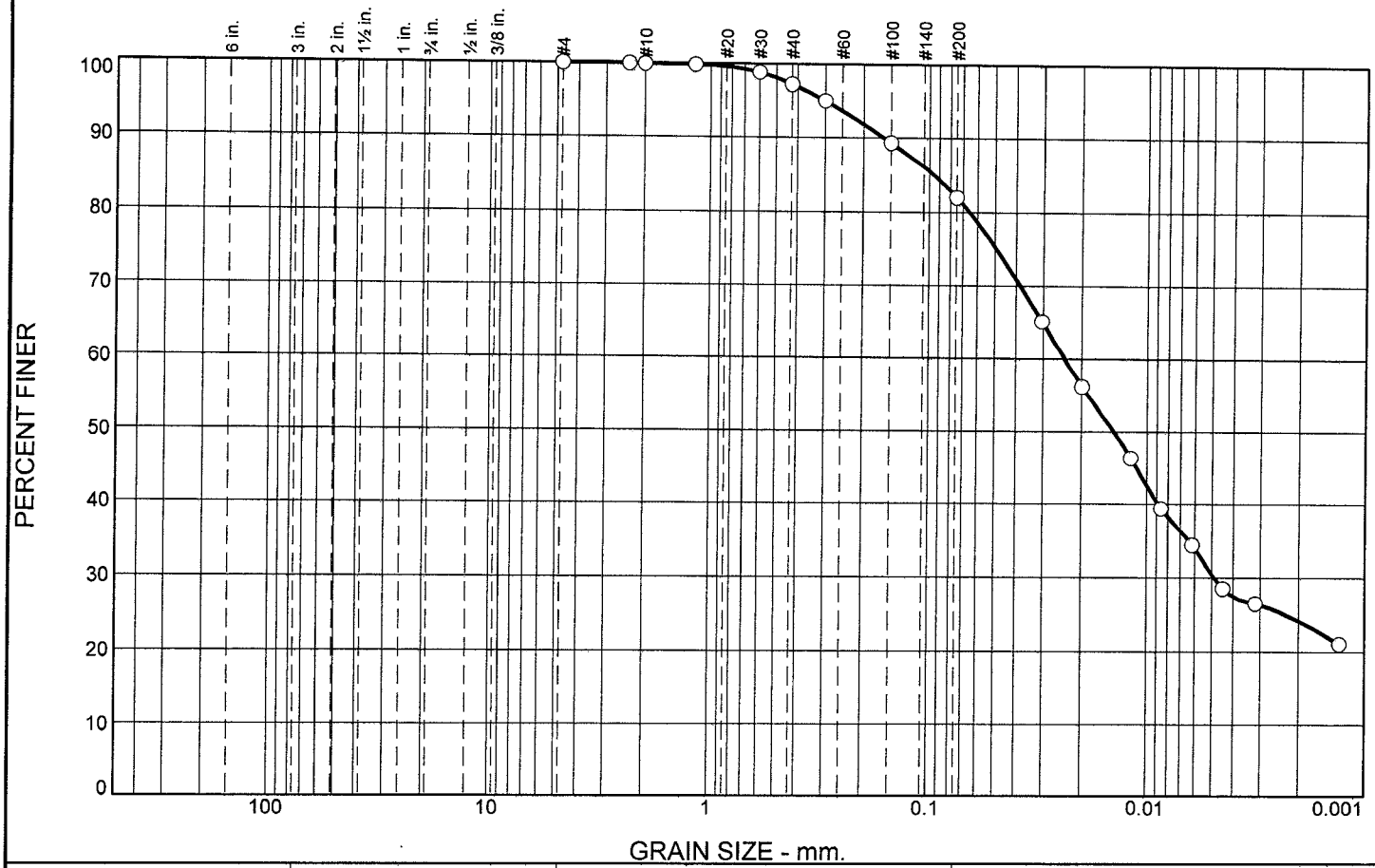
Source of Sample: Test Boring #HD-MW-173 **Depth:** 16.0' to 16.4'
Sample Number: 2 **Date:** 12/08/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	2.6	15.2	51.7	30.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.9		
#10	99.9		
#16	99.8		
#30	98.8		
#40	97.3		
#50	95.0		
#100	89.3		
#200	82.1		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1617 D_{85}= 0.0949 D_{60}= 0.0240
D_{50}= 0.0143 D_{30}= 0.0049 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 30.3%

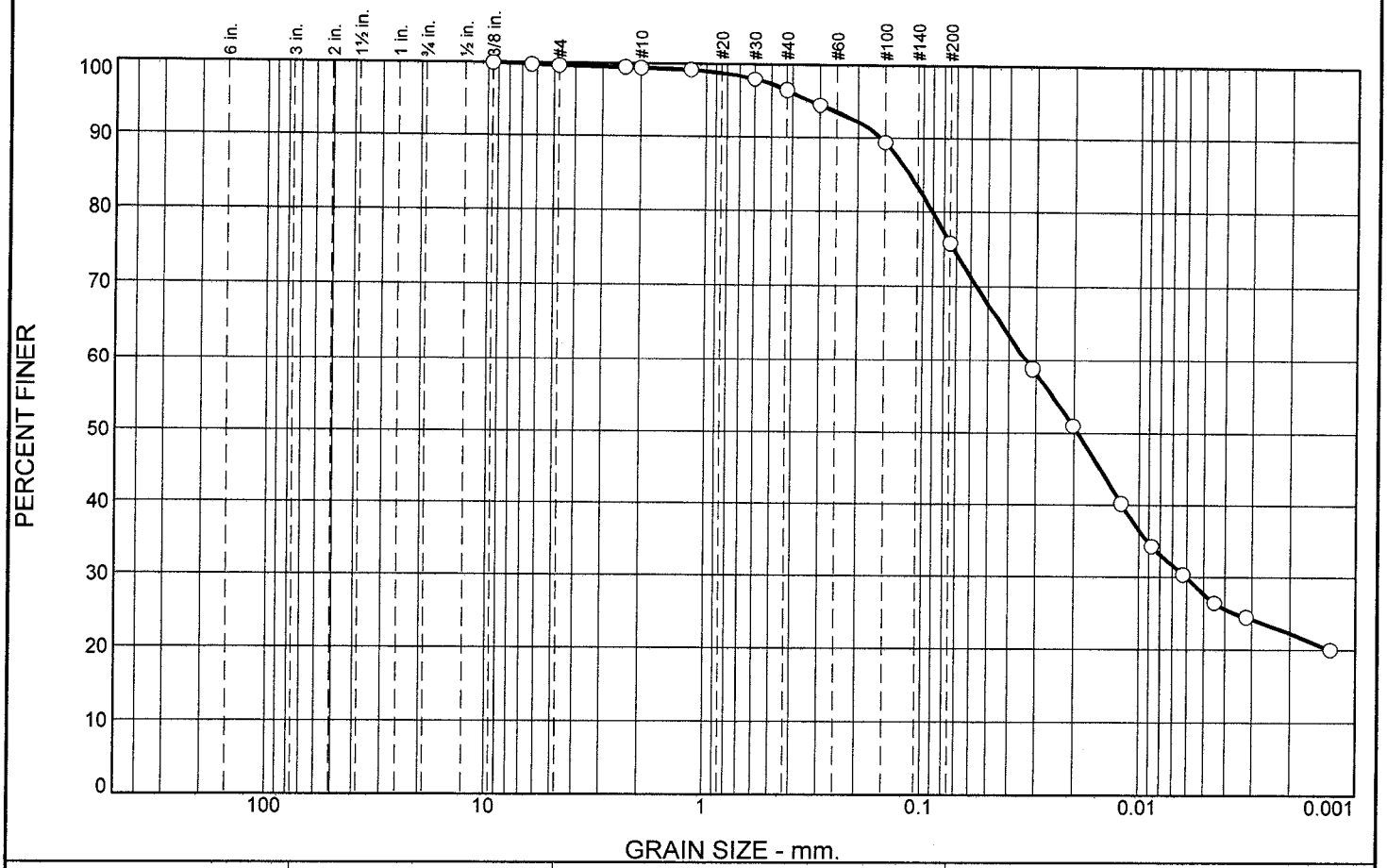
Source of Sample: Test Boring #HD-MW-173 **Depth:** 21.4' to 21.8'
Sample Number: 3 **Date:** 12/08/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.3	2.9	20.7	48.2	27.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
.25	99.8		
#4	99.7		
#8	99.5		
#10	99.4		
#16	99.2		
#30	98.0		
#40	96.5		
#50	94.4		
#100	89.4		
#200	75.8		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1575 D_{85}= 0.1156 D_{60}= 0.0331
D_{50}= 0.0193 D_{30}= 0.0061 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 24.6%

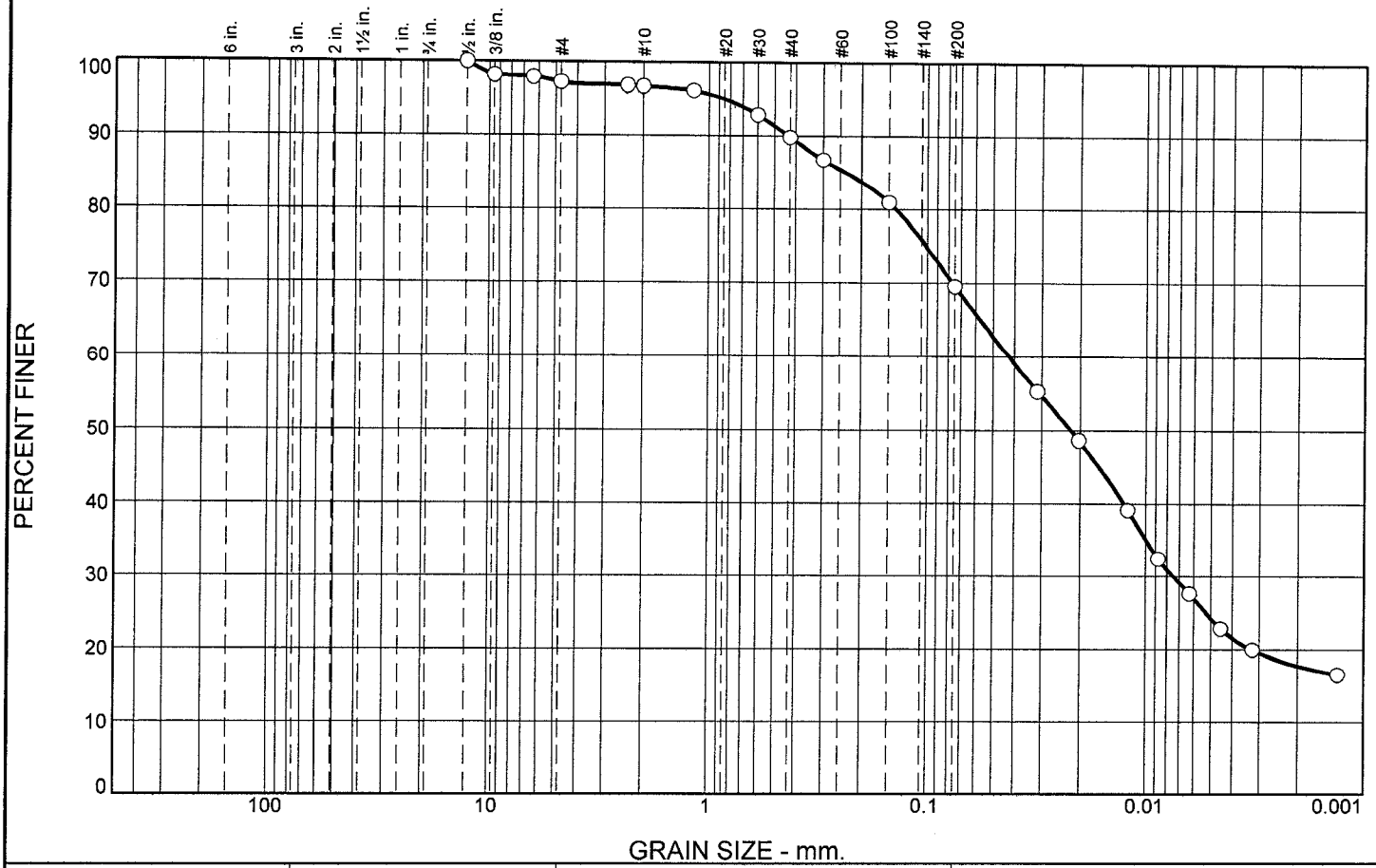
Source of Sample: Test Boring #HD-MW-173 **Depth:** 28.0' to 28.4'
Sample Number: 4 **Date:** 12/08/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.7	0.6	6.9	20.2	45.4	24.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50	100.0		
.375	98.2		
.25	98.0		
#4	97.3		
#8	96.9		
#10	96.7		
#16	96.1		
#30	92.9		
#40	89.8		
#50	86.7		
#100	81.0		
#200	69.6		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4332 D_{85}= 0.2364 D_{60}= 0.0423
D_{50}= 0.0221 D_{30}= 0.0075 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 22.5%

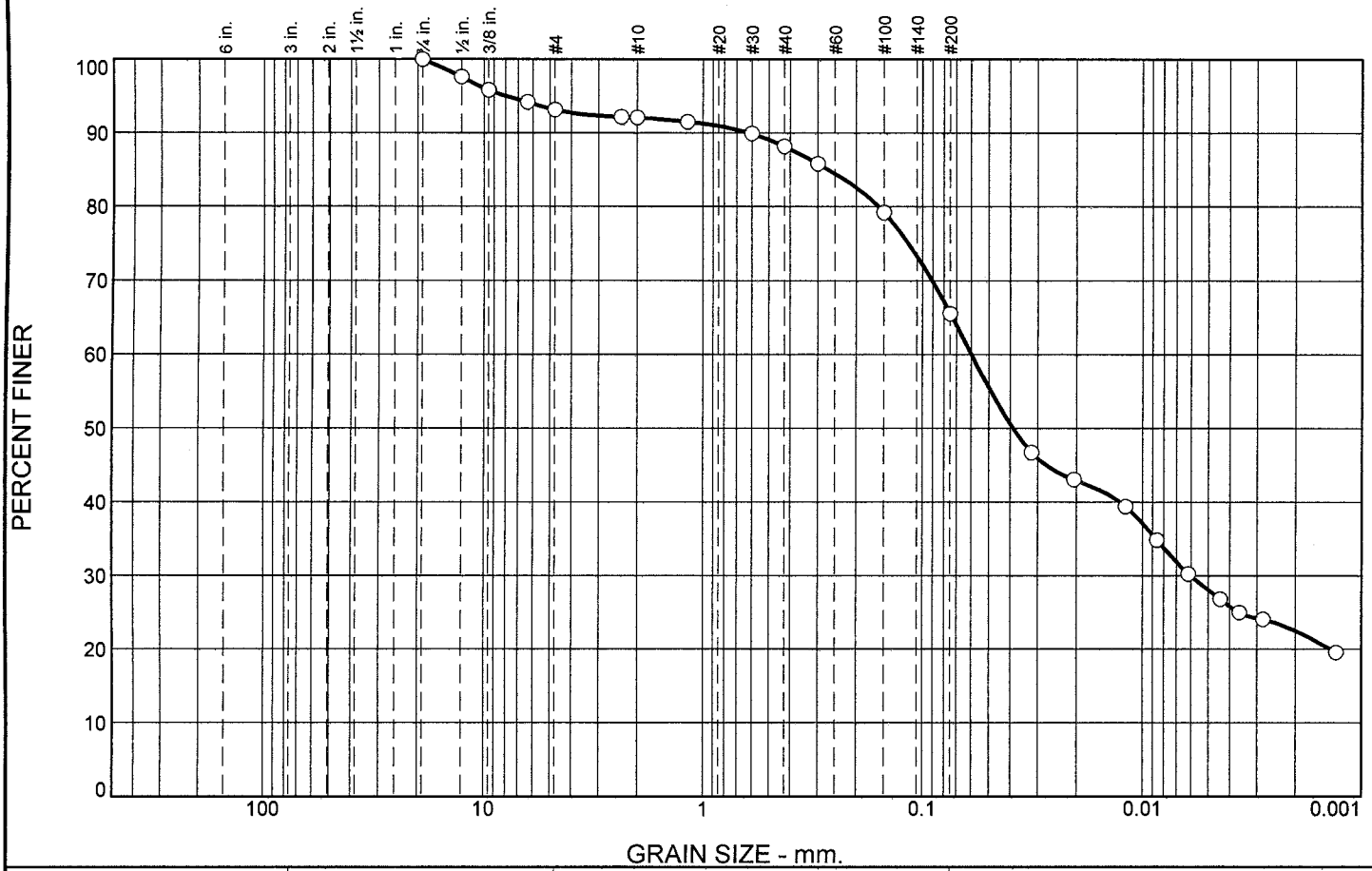
Source of Sample: Test Boring #HD-MW-173 **Depth:** 30.8' to 31.2'
Sample Number: 5 **Date:** 12/08/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.8	1.1	3.9	22.7	37.4	28.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	97.6		
.375	95.8		
.25	94.2		
#4	93.2		
#8	92.2		
#10	92.1		
#16	91.5		
#30	89.9		
#40	88.2		
#50	85.8		
#100	79.2		
#200	65.5		

* (no specification provided)

Material Description

Brown Clayey Sandy Silt With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6088 D_{85}= 0.2682 D_{60}= 0.0600
D_{50}= 0.0389 D_{30}= 0.0060 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 20.7%

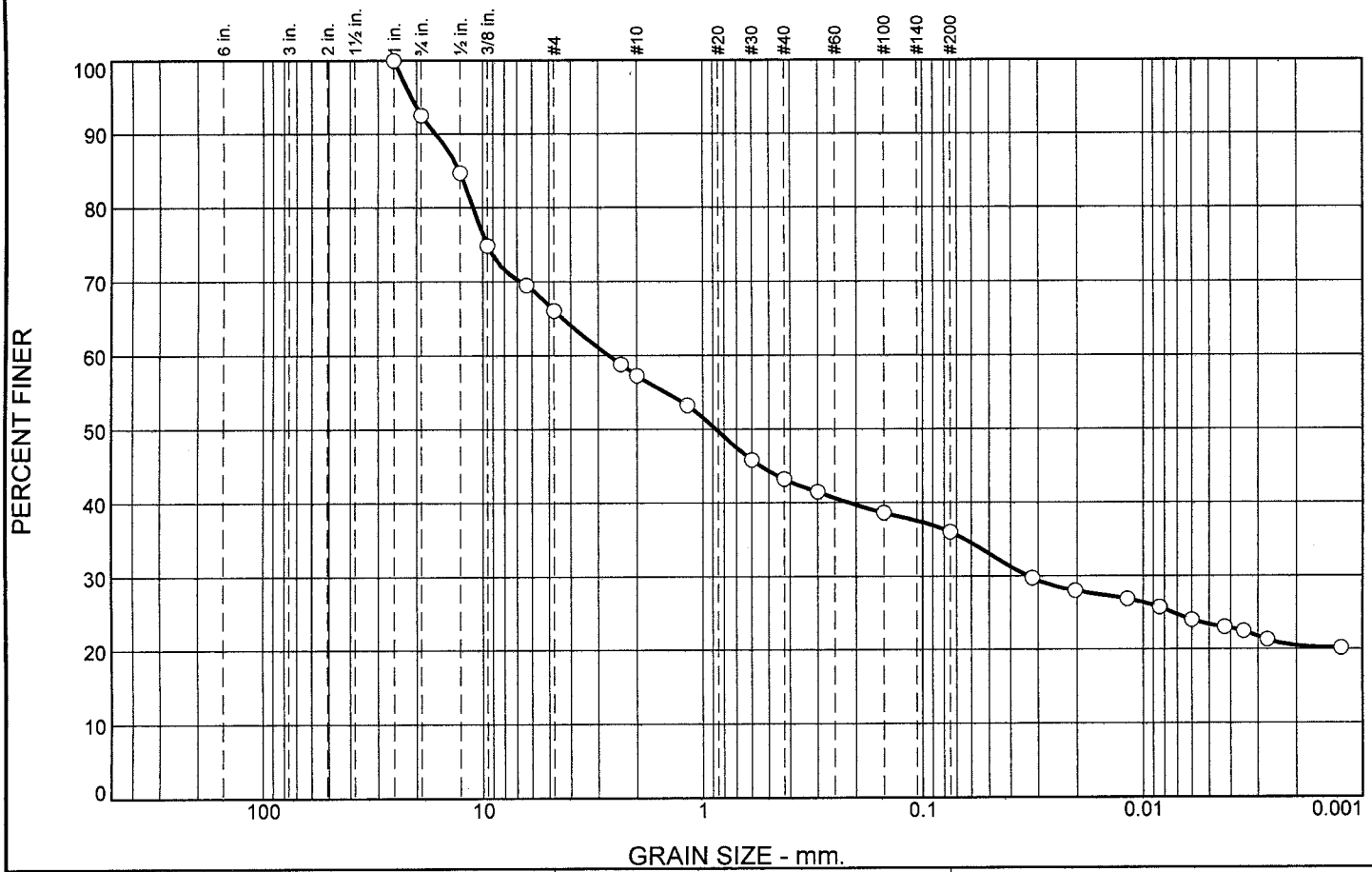
Source of Sample: Test Boring #HD-MW-174 **Depth:** 8.0' to 8.4'
Sample Number: 1 **Date:** 12/09/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.4	26.5	8.8	14.1	7.2	12.6	23.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0	100.0		
.75	92.6		
.50	84.7		
.375	74.9		
.25	69.5		
#4	66.1		
#8	58.8		
#10	57.3		
#16	53.2		
#30	45.9		
#40	43.2		
#50	41.5		
#100	38.6		
#200	36.0		

* (no specification provided)

Material Description

Brown Clayey Sand And Gravel With Some Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 16.4297 D_{85}= 12.8274 D_{60}= 2.6728
D_{50}= 0.8710 D_{30}= 0.0332 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 15.5%

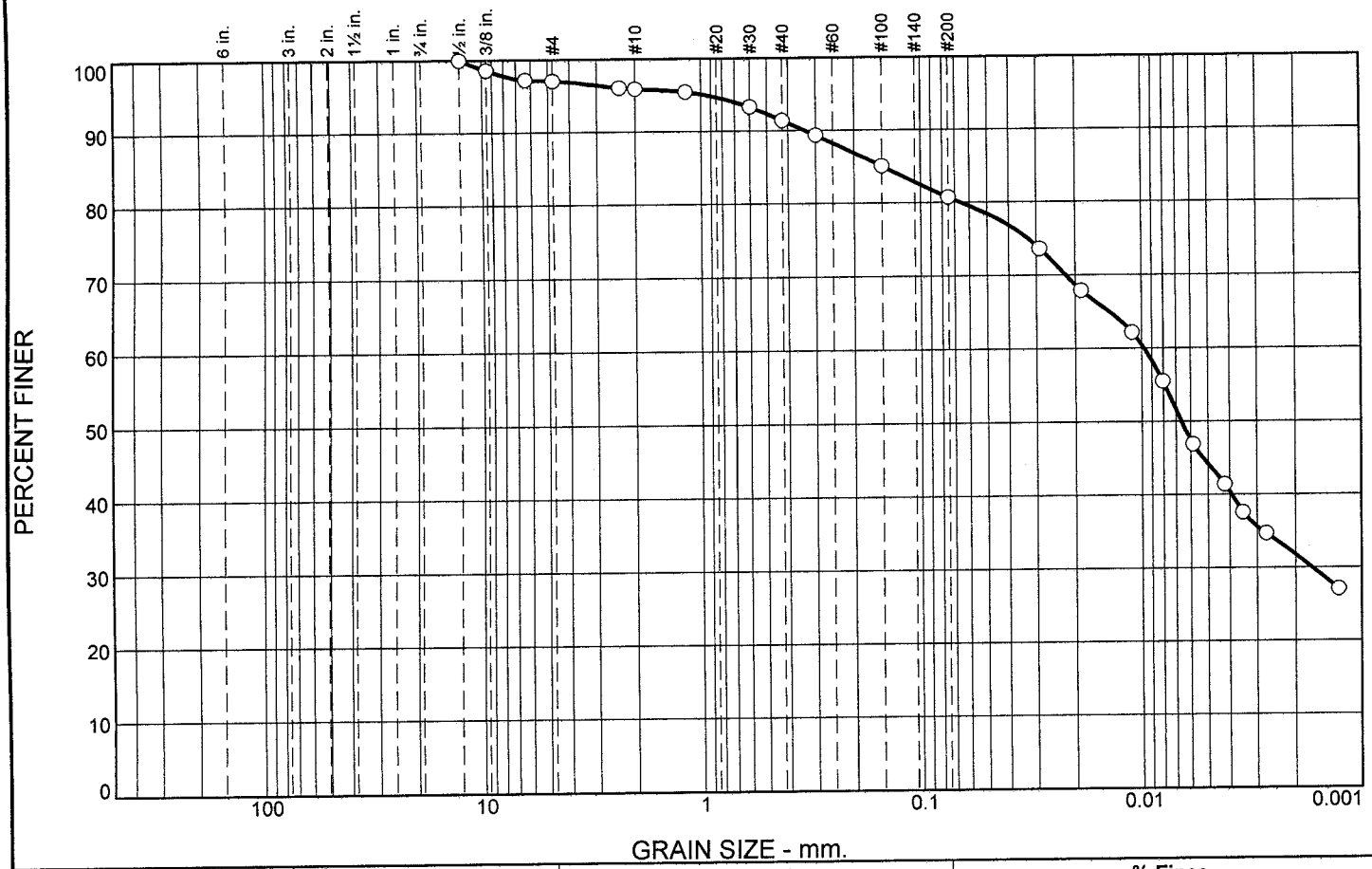
Source of Sample: Test Boring #HD-MW-174 **Depth:** 13.4' to 13.8'
Sample Number: 2 **Date:** 12/09/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.9	1.2	4.4	10.7	36.7	44.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50	100.0		
.375	98.6		
.25	97.2		
#4	97.1		
#8	96.1		
#10	95.9		
#16	95.4		
#30	93.3		
#40	91.5		
#50	89.4		
#100	85.1		
#200	80.8		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3318 D_{85}= 0.1476 D_{60}= 0.0098
D_{50}= 0.0066 D_{30}= 0.0017 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 30.6%

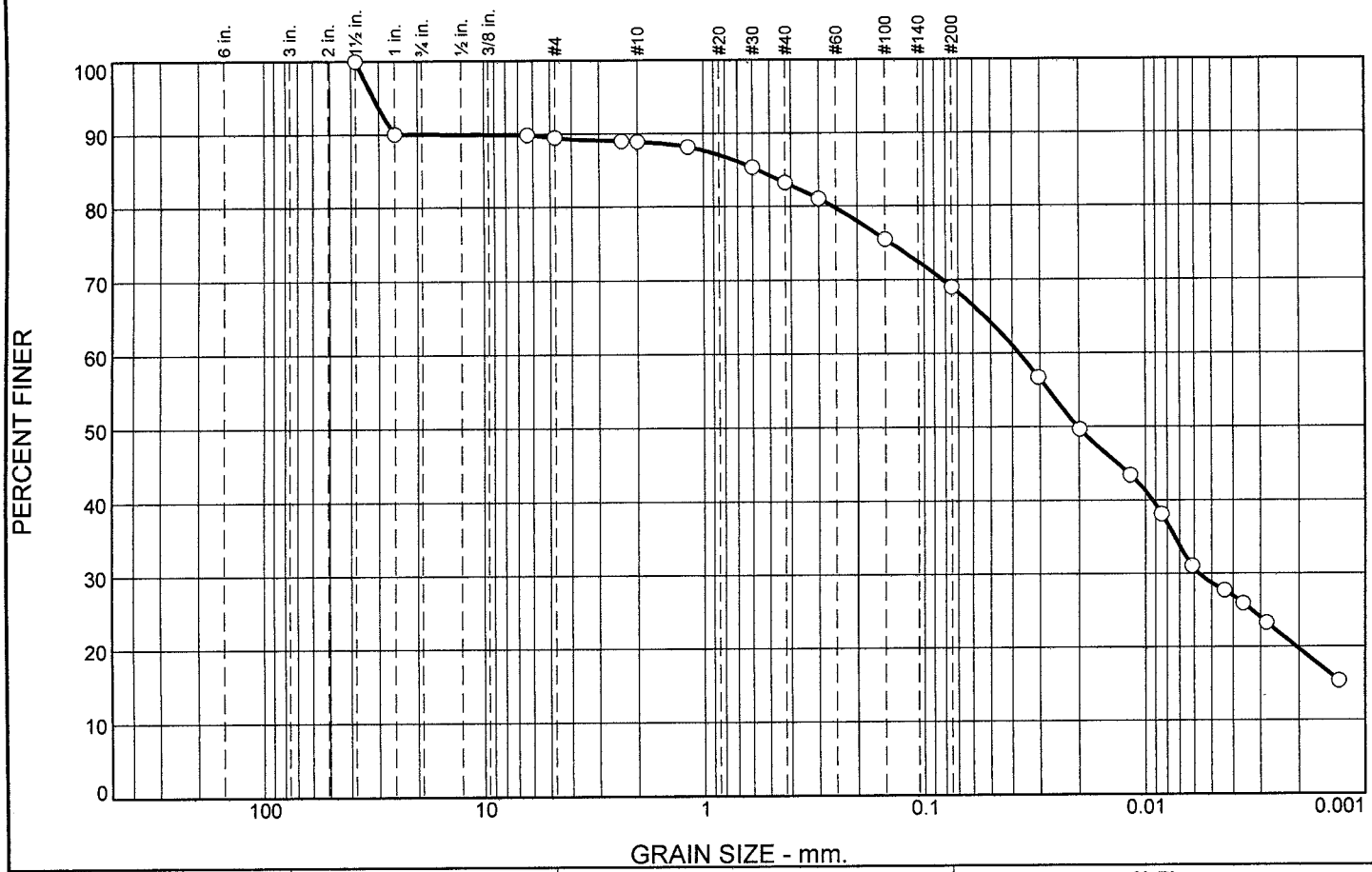
Source of Sample: Test Boring #HD-MW-174 **Depth:** 22.2' to 22.6'
Sample Number: 3 **Date:** 12/09/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.0	0.5	0.6	5.6	14.3	40.3	28.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1.0	90.0		
.25	89.9		
#4	89.5		
#8	89.0		
#10	88.9		
#16	88.2		
#30	85.4		
#40	83.3		
#50	81.1		
#100	75.5		
#200	69.0		

* (no specification provided)

Material Description

Brown Clayey Silt With Some Sand And A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 15.2080 D_{85}= 0.5637 D_{60}= 0.0374
D_{50}= 0.0203 D_{30}= 0.0057 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 25.7

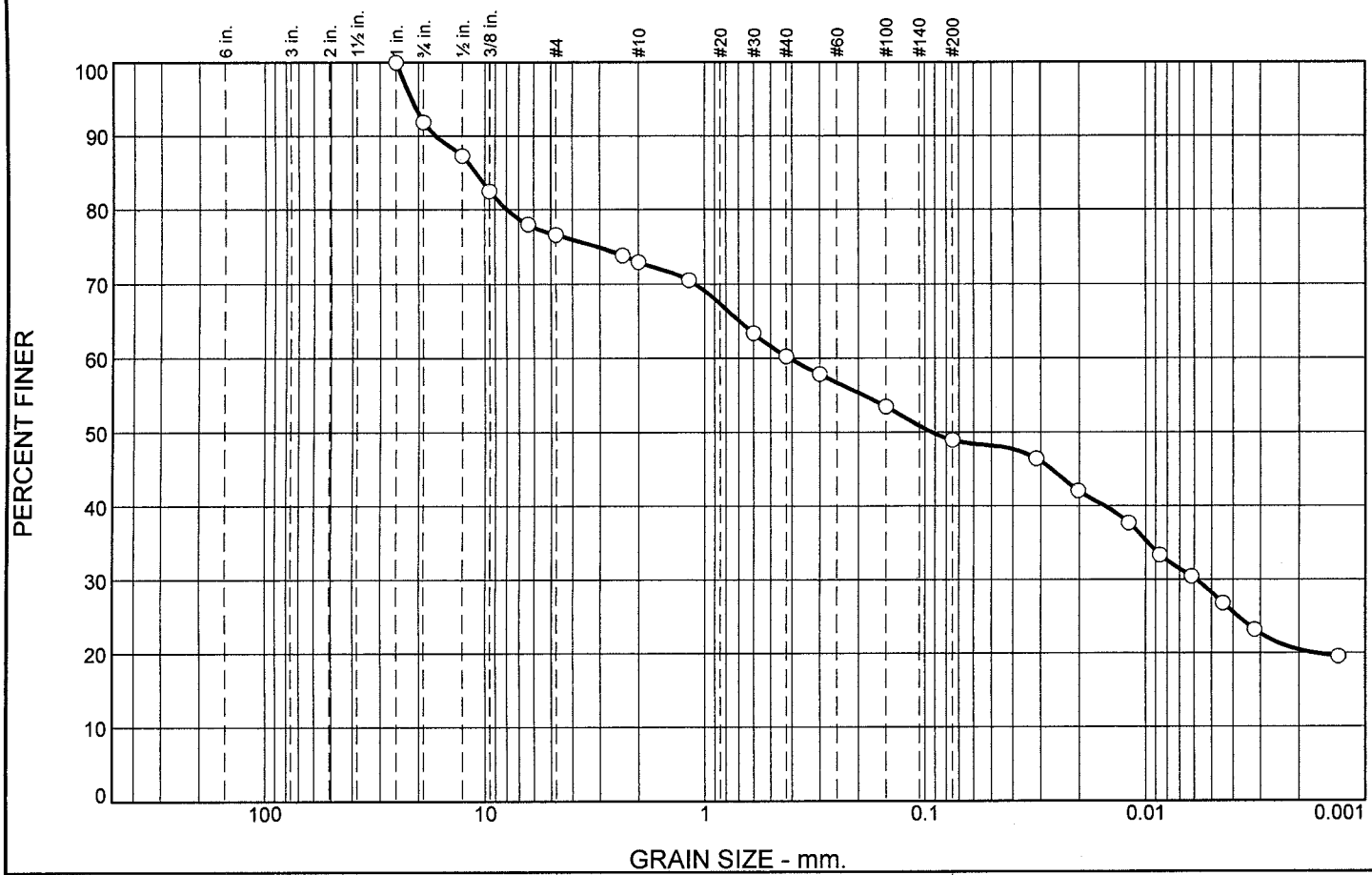
Source of Sample: Test Boring #HD-MW-174 **Depth:** 26.0' to 26.4'
Sample Number: 4 **Date:** 12/09/2014

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.1	15.2	3.7	12.7	11.3	20.8	28.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0	100.0		
.75	91.9		
.50	87.3		
.375	82.5		
.25	78.0		
#4	76.7		
#8	73.9		
#10	73.0		
#16	70.6		
#30	63.4		
#40	60.3		
#50	57.9		
#100	53.5		
#200	49.0		

* (no specification provided)

Material Description

Brown Silty Clay With Some Sand And Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 16.7868 D_{85}= 10.9797 D_{60}= 0.4107
D_{50}= 0.0923 D_{30}= 0.0059 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 15.6%

Source of Sample: Test Boring #HD-MW-175 **Depth:** 8.2' to 8.6'
Sample Number: 1 **Date:** 01/16/2015

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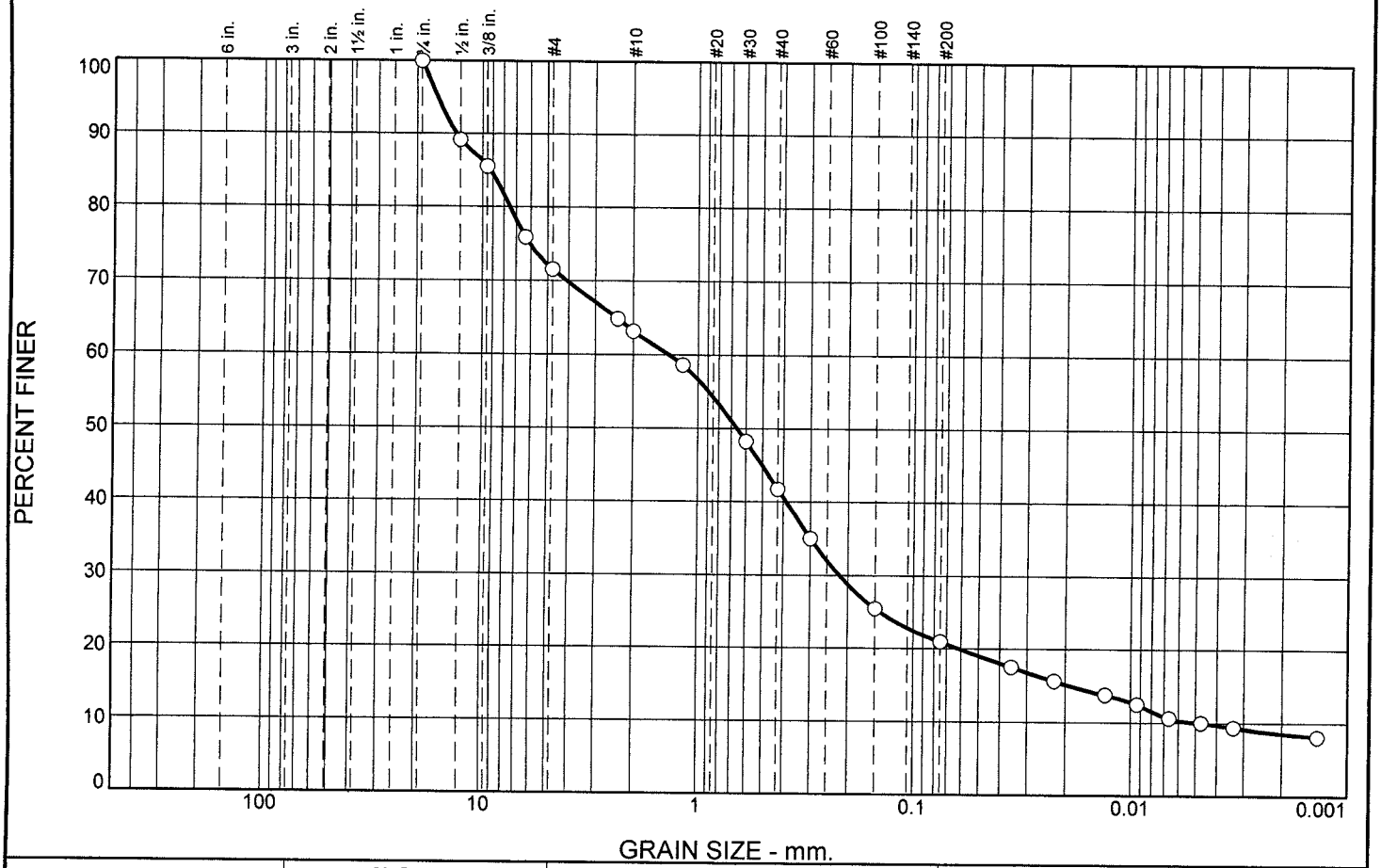
Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	28.4	8.4	21.5	20.8	10.8	10.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	89.2		
.375	85.5		
.25	75.9		
#4	71.6		
#8	64.9		
#10	63.2		
#16	58.6		
#30	48.3		
#40	41.7		
#50	35.0		
#100	25.5		
#200	20.9		

* (no specification provided)

Material Description

Grey Clayey Silty Sand And Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 13.2732 D_{85}= 9.2507 D_{60}= 1.3591
D_{50}= 0.6598 D_{30}= 0.2193 D_{15}= 0.0191
D_{10}= 0.0048 C_u= 285.03 C_c= 7.42

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 8.4%

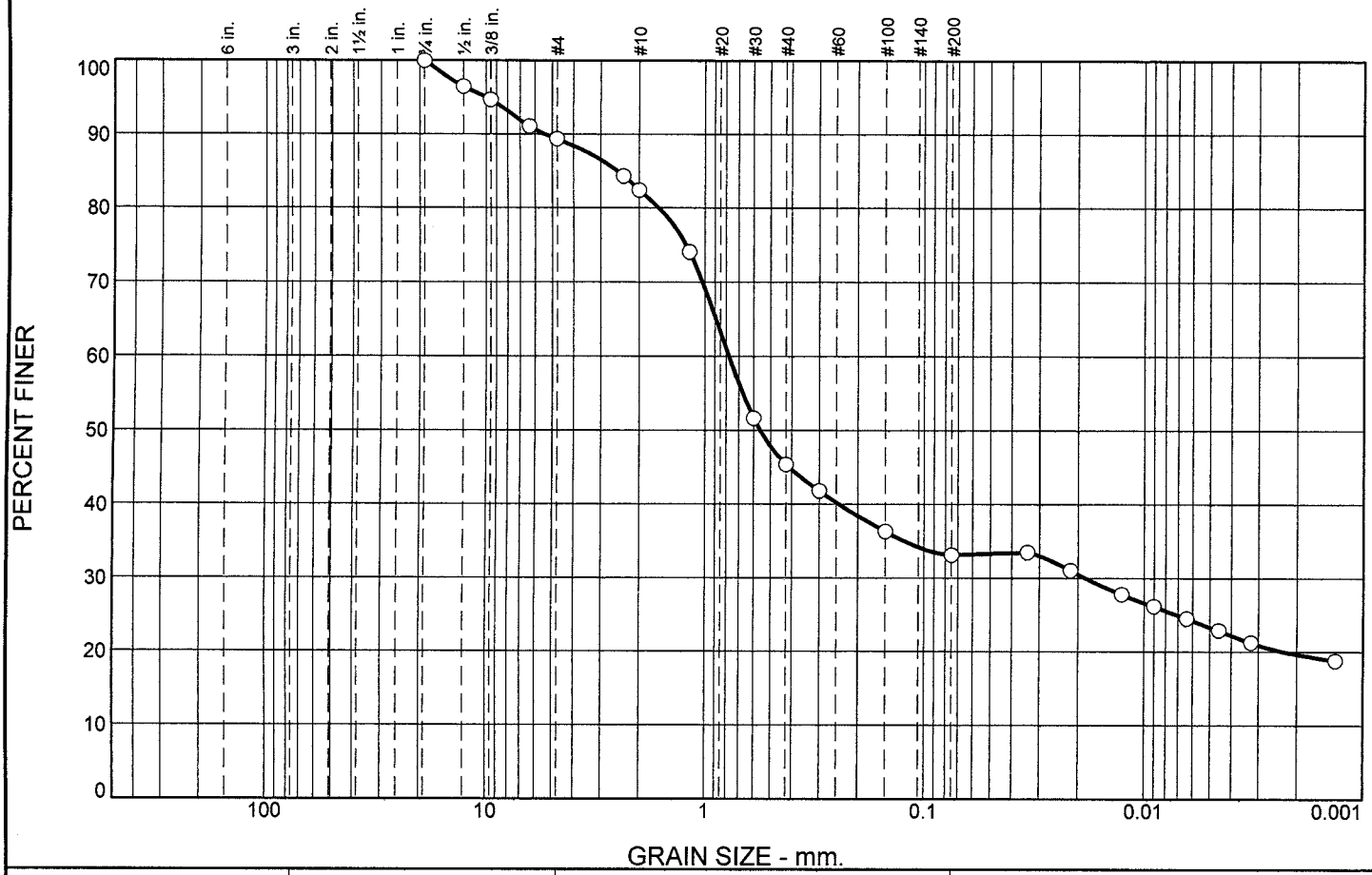
Source of Sample: Test Boring #HD-MW-175 **Depth:** 13.8' to 14.2'
Sample Number: 2 **Date:** 01/16/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.6	7.0	37.0	12.2	9.9	23.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	96.5		
.375	94.7		
.25	91.1		
#4	89.4		
#8	84.3		
#10	82.4		
#16	74.1		
#30	51.7		
#40	45.4		
#50	41.8		
#100	36.4		
#200	33.2		

* (no specification provided)

Material Description

Brown Clayey Sand With Some Silt And Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.3517 D_{85}= 2.5138 D_{60}= 0.7775
D_{50}= 0.5604 D_{30}= 0.0184 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 14.2%

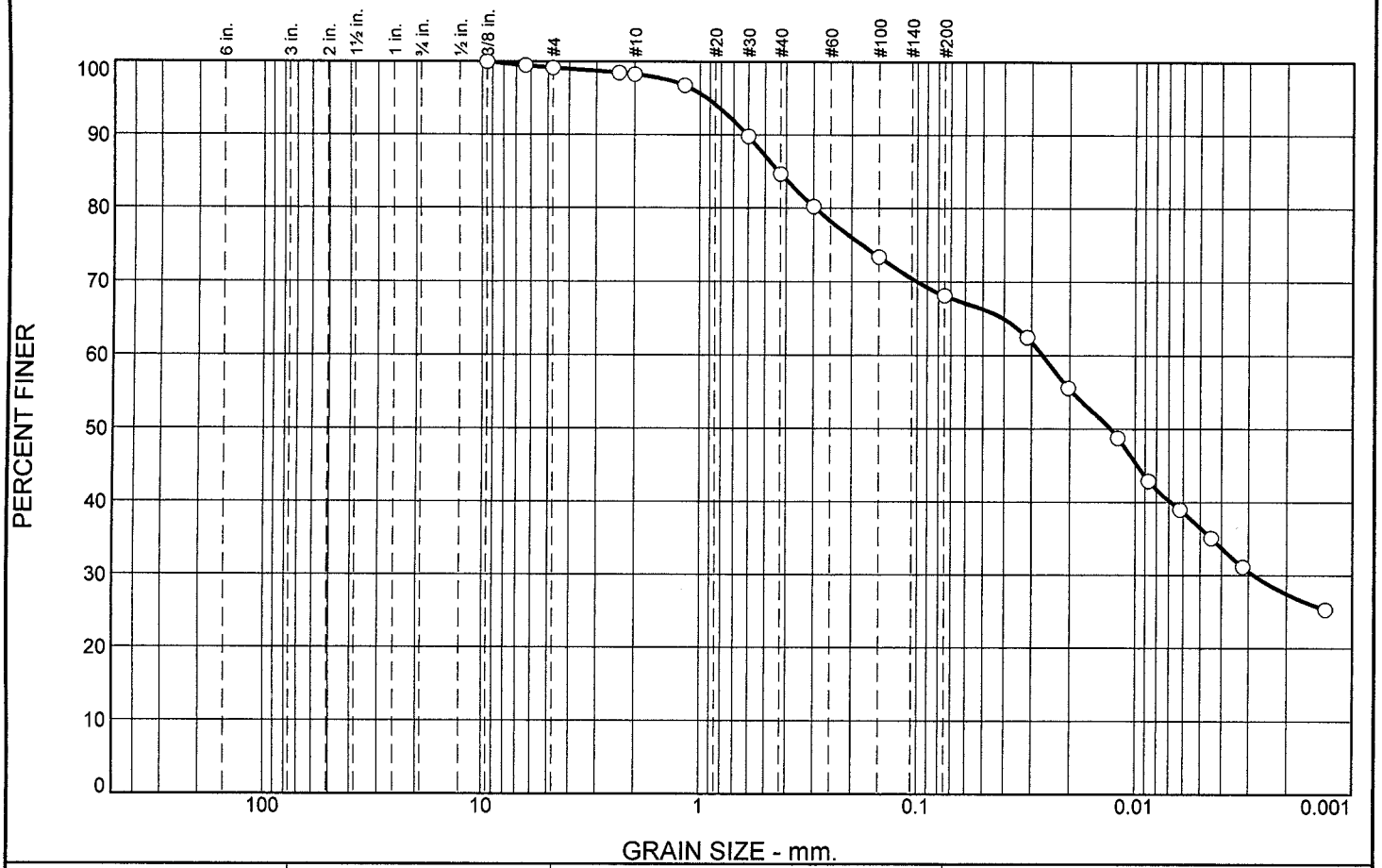
Source of Sample: Test Boring #HD-MW-175 **Depth:** 18.4' to 18.8'
Sample Number: 3 **Date:** 01/16/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	0.8	13.6	16.6	31.6	36.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
.25	99.5		
#4	99.1		
#8	98.5		
#10	98.3		
#16	96.8		
#30	89.8		
#40	84.7		
#50	80.2		
#100	73.4		
#200	68.1		

* (no specification provided)

Material Description

Brown Sandy Silt And Clay With A Trace Of Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6081 D_{85}= 0.4345 D_{60}= 0.0267
D_{50}= 0.0130 D_{30}= 0.0028 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 26.9%

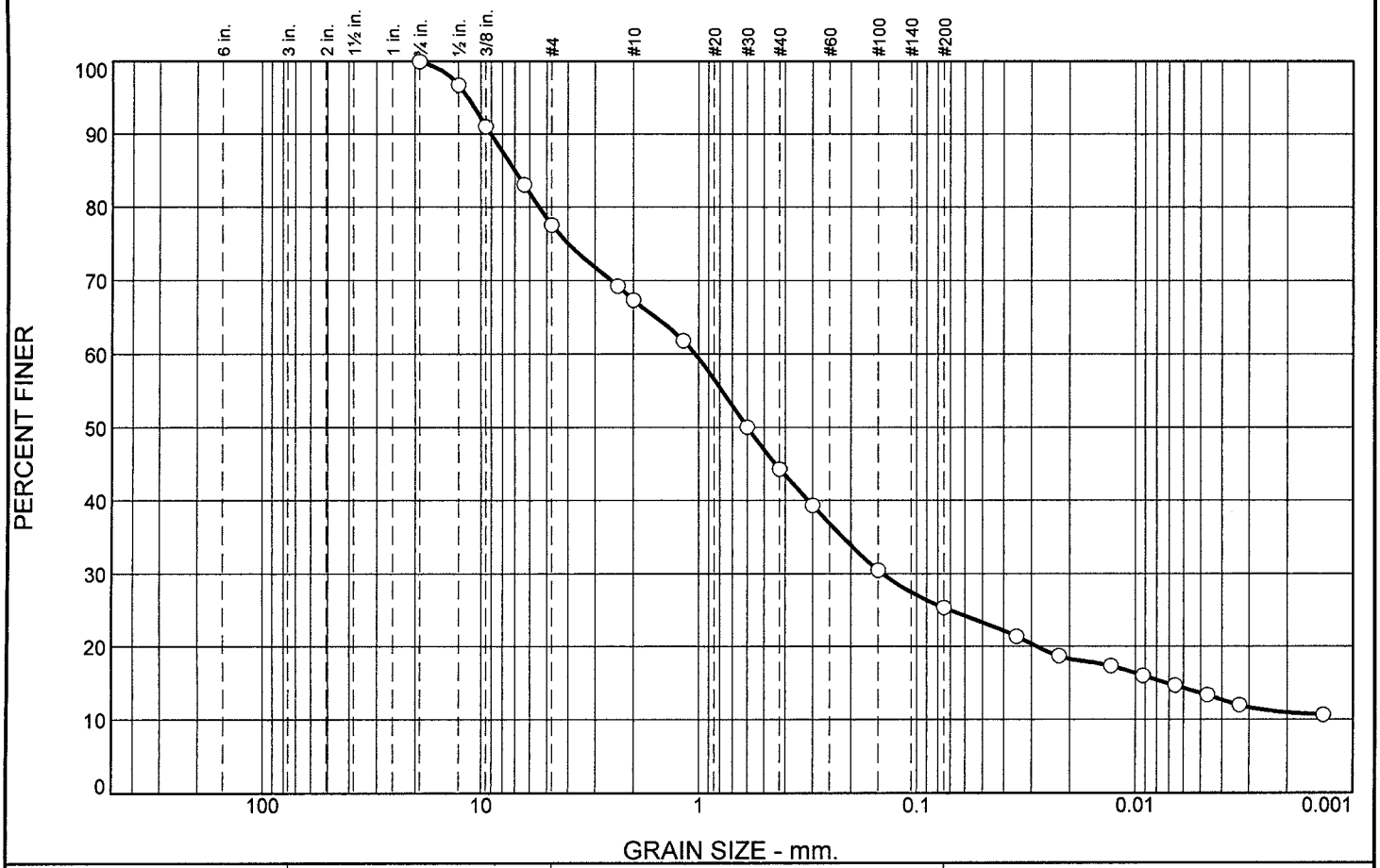
Source of Sample: Test Boring #HD-MW-175 **Depth:** 21.4' to 21.8'
Sample Number: 4 **Date:** 01/16/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	22.4	10.3	23.0	18.9	11.8	13.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	96.8		
.375	91.1		
.25	83.0		
#4	77.6		
#8	69.2		
#10	67.3		
#16	61.9		
#30	50.1		
#40	44.3		
#50	39.4		
#100	30.5		
#200	25.4		

* (no specification provided)

Material Description

Brown Clayey Silty Sand With Some Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 9.0507 D_{85}= 7.0277 D_{60}= 1.0389
D_{50}= 0.5978 D_{30}= 0.1428 D_{15}= 0.0071
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Moisture Content = 13.6%

Source of Sample: Test Boring #HD-MW-175 **Depth:** 22.6' to 23.0'
Sample Number: 5 **Date:** 01/16/2015

F. T. Kitlinski & Associates, Inc.

Harrisburg, PA

Client: Groundwater Sciences Corporation
Project: FYNOP - Harley Davidson
Project No. 10012.26, York, PA
Project No: 14-11-10302 **Figure** 5

Appendix D

Monitoring Well Development Records

Well Development Field Data Sheet

Well MW-161 Site HARLEY-DAVIDSON YORK, PA

Development Personnel CASEY LITTLEFIELD Pump Type MINI MONSOON ≠ 829ØØ/BAILER

Casing Diameter 2" DTW 58.96 DTB 67.7Ø

Well Volume = 1.43gallons. gal/ft* x (DTB - DTW) = gal

x3 = gal

x10 = gal

mS/cm

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
2/12/15	132Ø	67.7Ø	Begin lightly surging well.							
	1323		START PURGE.				VERY	MUDDY	THICK	WITH FINES.
	133Ø	59.17	Ø.35	8.5Ø	7.Ø7	—	1.Ø3	mS/cm	1.5gal.	
	1335	CAVITATED	well.						3.Øgals.	
	1345	6Ø.6Ø	Ø.2Ø	Resume PURGE						Flow rate fluxuates DUE TO THICK SED.
	135Ø	CAVITATED	WELL SECOND TIME.						4.5gals.	
		—	CSL	9.73	7.22	—	Ø.797	—	4.5gals	
	14ØØ	63.9Ø	Purge started again. @ Ø.2Øgpm							
	14Ø8	—	Ø.2Ø	Cavitated	3rd time.				6.5gals.	
		Well	Return	on	2/13/15	CSL.				
2/13/15	12ØØ	Start	bailing	well.						
	1215	63.32	—	NM	NM	—	NM		9.5	DARK BROWN THICK W/ FINES

END DEVELOPMENT CSL TD = 68.6Ø FIRM. 3.Øgallons Bailed.

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-161 Site HARLEY-DAVIDSON YORK, PA

Development Personnel CSL Pump Type ~~MONSOON~~ BAILER

Casing Diameter 2" DTW 63.52 DTB 68.90

Well Volume = 0.89 gal/ft* x (DTB - DTW) _____ = 2 gal CSL

x3 = 2.68 gal

x10 = _____ gal CSL

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
2/29/15	1100	CAN'T	GET PUMP	TO PUSH UP			63 ft.			
↓	1120	63.52	—	—	—	CSL	—	—		BAILER
↓	1145	63.85	TD =	68.50					5.0	NO CHANGE STILL LOTS
			END	DEVELOPMENT						OF FINES & VERY
										TURB. D.

gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

l/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-162 Site HARLEY - DAVIDSON YORK

Development Personnel CSL Pump Type MINI MONSOON # 82900

Casing Diameter 2" DTW 47.05 DTB 55.30

Well Volume = 1.35 gal. gal/ft* x (DTB - DTW) _____ = _____ gal CSL

x3 = _____ gal

mS/cm x10 = _____ gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
2/12/15	1430	Begin Development by lightly surging.							—	
	1435	START	PURGE	@ 0.79gpm						
	1432	—	0.79	9.63	7.43	—	0.455	—	1.0gals	TURBID VERY FINE FINES.
	1437	@52.04 on pump	~0.7	9.99	7.33	—	0.343	—	5.0gals	LIGHT COLORED. STOPPED FOR RECOVERY
	1450	52.50	PURGE Again until cavitation.							
	1453	cavitated	no change in clarity						6.0gals.	
		will	return 2/13/15. CSL						↓	
2/13/14	1140	51.52	Begin Bailing well.						↓	
	1155	54.68	—	7.37	7.78	—	0.326	—	9.0gallons	3gals. Bailed.
		END DEVELOPMENT.			TD =	55.30				very turbid. BROWN All Suspended Fines

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-163 Site HARLEY DAVIDSON YORK, PA

Development Personnel CSL Pump Type MINI MONSOON # 82900

Casing Diameter 2" DTW 34.33 DTB 57.42

Well Volume = 3.76 gal/ft* x (DTB - DTW) _____ = _____ gal

x3 = _____ gal CSL

x10 = _____ gal

mS/cm (gals)

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
2/12/15	1520	35.00	1.7gpm							
	1525	35.02	1.7gpm +10gpm	8.21	6.25	—	0.476	—	10.0	TURBID.
	1535	35.40	1.97gpm +1gpm	8.81	6.23	—	0.483	—	20.0	Started truck to increase pumping rate
	1540	35.40	1.97	—			N	M—	30.0	water gets much lighter in clarity after 2mins
	1545	35.41	1.97	9.59	5.95	—	0.418	—	40.0	Post surge.
	END > DEVELOPMENT CSL				TD =	57.42				

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-164 Site HARLEY DAVIDSON

Development Personnel CASEY LITTLEFIELD Pump Type MINI MONSOON # 82900

Casing Diameter 2" DTW 36.62 DTB 52.50

Well Volume = 2.59 gal. gal/ft* x ~~(DTB - DTW)~~ _____ = _____ gal

x3 = _____ gal

x10 = _____ gal

(GPM)

Date	Time	WL (ft)	Flow Rate	Temp °C	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
2/12/15	1100	START		DEVELOPEMENT						FOR MORE DETAIL REF. LOG BOOK #15
2/12/15	1105	42.30	1.0gpm	8.82	7.02	—	6.07		5.0	Stop purge for recovery & SURGE.
2/12/15	1115	39.92	Begin	purge.						
2/12/15	1120	45.00	1.0gpm	8.83	6.10	—	5.87		10.0	STOP PURGE FOR RECOVERY
	1130	39.16								
	1140	37.00								LIGHTLY BEGIN SURGING.
	1145	36.85	1.65	Begin purge.						Resume PORGE
	~~1147~~ OR 1147	46.70	1.5	8.78	6.32	—	5.80		15.0	
	1153	99.40	1.5	9.81	5.53	—	5.73		20.0	Slight improvement to TURB. less fines in 800ml jar.
2/12/15	1155 END FOR DAY			WILL PURGE	AGAIN		2/13/15	cgl		
		TD Remained		the same @	52.50'					

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-165 Site HD YORK, PA

Development Personnel CSL Pump Type _____

Casing Diameter 2 DTW 43.50 DTB 72.98

Well Volume = 4.81 gal/ft* x (DTB - DTW) _____ gal CSL

x3 = 14.42 gal CSL

x10 = _____ gal

Date	Time	WL (ft)	Flow Rate (gpm)	Temp	pH	ΔpH (units)	Cond. (mS/cm)	ΔCond. (%)	Total Volume	Remarks & Clarity
2/20/14	1221	43.50	START PURGE							
	1226		0.35	10.19	7.32	—	0.763		2.5gallons	TURBID LIGHT BROWN.
		STOP	PURGE & LIGHTLY SURGE w/ pump.							
	1255		0.35	Begin purging again had problems w/ pump, DARK BROWN						
	1257	Becoming	lighter after	2mins	of steady	pumping.				
	~~1340~~ 1305	53.22	0.20	9.30	7.55	—	0.712	—	5.0gallons	LIGHT BROWN TURBID.
	1317	LIGHTLY	0.20	SLIGHT	AS pump is	pumping				VERY FINE SUSPENDED sediment,
↓	1320	53.22	0.20	9.30	7.51	—	0.712	—	7.0gallons	SLIGHLY LIGHTER TURBIDITY
		2ND	PURGE	UNTIL	pump	LIGHTER	DATA,	NEED	A STRONGER	
		pump	so	I can	EVACUATE	WELL.				

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Φ measurements from TOC PVC

Well Development Field Data Sheet

Well MW-166 Site Harley-Davidson

Development Personnel KBF / Mike Livingston Pump Type Whale's

Casing Diameter 2" DTW 46.18 DTB 51.10

Well Volume = .163 gal/ft* x (DTB - DTW) 4.92 = 0.809 gal

x3 = 2.405 gal

x10 = 8.0196 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/7/15	10:32	46.25	2400mL/ 0.63gpm	12.30°C	5.56		0.354			~0.634 gal/min / >500 NTU
1/7/15	10:39	cavitate								well cavitated
1/7/15	10:52	49.20								49.20 Recovery
1/7/15	11:20	49.00								49.00 Recovery
1/9/15	12:00	47.65								surge well
1/9/15	12:15	14.60								Finish surging set pump
1/9/15	12:18	cavitate								turb > 5.0
1/9/15	12:30	DRY	above top of Pump							
1/9/15	12:45	DRY	" " " "							
1/9/15	13:00	DRY	" " " "							
1/9/15	13:05	after Pump pulled 50.95								
1/9/15										

0.0.5.8 mg/L
0.23 TDS

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Φ measurements from TOC PVC

Well Development Field Data Sheet

Well MW-166 Site Harley-Davidson

Development Personnel KBF / Mike Livingston Pump Type Whale's

Casing Diameter 2" DTW 46.18 DTB 51.10

Well Volume = .163 gal/ft* x (DTB - DTW) 4.92 = 0.809 gal

x3 = 2.405 gal

x10 = 8.0196 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/7/15	10:32	46.25	2400mL/ 0.63gal/min	12.30°C	5.56		0.354			~0.634 gal/min / >500 NTU
1/7/15	10:39	cavitate								well cavitated
1/7/15	10:52	49.20								49.20 Recovery
1/7/15	11:20	49.00								49.00 Recovery
1/9/15	12:00	47.65								Surge well
1/9/15	12:15	14.60								Finish surging pump / set pump
1/9/15	12:18	cavitate								Turb 7-5.0
1/9/15	12:30	DRY	above top of Pump							
1/9/15	12:45	DRY	" " " "							
1/9/15	13:00	DRY	" " " "							
1/9/15	13:05	after Pump pulled 50.95								
1/9/15										

0.0.5.8 mg/L 0.23 TDS

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-166 cont. Site Harley-Davidson

Development Personnel KBF / mike livingston Pump Type _____

Casing Diameter 2" DTW 33.65 DTB 34.10

Well Volume = _____ gal/ft* x (DTB - DTW) _____ = _____ gal

x3 = _____ gal

x10 = _____ gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/9/15	1330	33.65								* Not enough water
										to develop further
										asked JSR to move on
										to next location

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-167 Site Harley-Davidson

Development Personnel KBF / Mike Livingston Pump Type _____

Casing Diameter 2" DTW 37.57 DTB 50.80

Well Volume = 0.163 gal/ft* x (DTB - DTW) 13.23 = 2.156 gal

x3 = 6.469 gal

x10 = ~~20.156~~ gal 21.564

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/9/15	0900	37.57								Begin surging
1/9/15	0915	37.15								set pump after surging
1/9/15	0917	37.15								Begin pumping
1/9/15	0920	44.44		11.52	6.78		0.340		~5gal	PD: 3.61 Turb: ~5.0 TDS: 0.34
1/9/15	0922	48.98								
1/9/15	0923	cavitate								let well Recov
1/9/15	0933	47.01								Recovery
1/9/15	0943	46.85								Recovery
1/9/15	1000	46.65								Recovery
1/9/15	1020	46.55								Recovery
1/9/15	1035	46.49								Recovery, Begin pumping again ~5 Turb ~~5.0~~
1/9/15	1038	Cavitate								Cavitate

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW167 cont. Site _____

Development Personnel _____ Pump Type _____

Casing Diameter _____ DTW _____ DTB _____

Well Volume = _____ gal/ft* x (DTB - DTW) _____ = _____ gal

x3 = _____ gal

x10 = _____ gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/9/15	11:54	48.85								Purge w/ pump at max time
1/9/15	11:55	pump								~~Pump evaluate~~
1/9/15	11:56	Cavitate								turb - 5.0

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-167 Site Harley-Davidson

Development Personnel KBF / Mike Livingston Pump Type _____

Casing Diameter 2" DTW 37.57 DTB 50.80

Well Volume = 0.163 gal/ft* x (DTB - DTW) 13.23 = 2.156 gal

x3 = 6.469 gal

x10 = ~~20.156~~ gal 21.564

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/9/15	0900	37.57								Begin surging
1/9/15	0915	37.15								set pump after surg.
1/9/15	0917	37.15								Begin pumping
1/9/15	0920	44.44		11.52	6.78		0.340		~5gal	DO: 8.61 Turb: ~5.0 TDS: 0.34
1/9/15	0922	48.98								
1/9/15	0923	cavitate								let well Recov
1/9/15	0933	47.01								Recovery
1/9/15	0943	46.85								Recovery
1/9/15	1000	46.65								Recovery
1/9/15	1020	46.55								Recovery
1/9/15	1035	46.49								Recovery, Begin pumping again Turb ~~5.0~~ ~5
1/9/15	1038	Cavitate								Cavitate

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW167 cont. Site ______

Development Personnel ______ Pump Type ______

Casing Diameter ______ DTW ______ DTB ______

Well Volume = ______ gal/ft* x (DTB - DTW) ______ = ______ gal

x3 = ______ gal

x10 = ______ gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/9/15	11:54	48.85								Recovery / pump one more time
1/9/15	11:55	pump								~~Pump [illegible]~~
1/9/15	11:56	Cavitate								turb - 5.0

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805$ = ______ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

DTW measurements from TOP OF PVC

Well Development Field Data Sheet

Well MW-168 Site Harley Davidson

Development Personnel K3F / Mike Hampton Pump Type Whales

Casing Diameter 2" DTW 22.30 DTB 40.45

Well Volume = 0.163 gal/ft* x (DTB - DTW) 18.15 = 2.2958 gal

x3 = 8.875 gal

x10 = 22.958 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/7/15	12:00	22.30								
1/7/15	12:16	22.35								Start purging
1/7/15	12:19	33.50	~.85gpm	12.84	6.79		0.302			turb: 5.0 TDS: 0.19 DO: 8.66mg/L ORP: 292
1/7/15	12:24	39.39	"						~18 gal	well cavitated
1/7/15	12:38	35.35								Recovery
1/7/15	12:55	33.30								Recovery
1/7/15	12:58	34.02	"	13.05	6.83		0.316		~5 gal	cavitated @ 13:03
1/7/15	13:15	37.05								Recovery
1/7/15	13:30	37.05								Recovery
1/7/15	13:45	36.40								Recovery
1/7/15	13:46	36.38								Pump
1/7/15	13:49	(no hole)		13.65	5.72		0.196		~3 gal	turb: ~5 (looks visibly cleaner DO: 8.94, TDS: 0.13

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

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Well Development Field Data Sheet

Well _____ Site _____

Development Personnel _____ Pump Type _____

Casing Diameter _____ DTW _____ DTB _____

Well Volume = _____ gal/ft* x (DTB - DTW) _____ = _____ gal

x3 = _____ gal

x10 = _____ gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/7/15	14:27	35.85								pump tub -5.0
1/7/15	14:30	cavitate								cavitate
1/7/15	15:00	35.10								Recover
1/7/15	1545	34.95								cavitate @ 1548

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

ΔDTW measurements from TOP of PVC

Well Development Field Data Sheet

Well MW-168 Site Harley Dawson

Development Personnel K3F / Mike Livingston Pump Type whales

Casing Diameter 2" DTW 22.30 DTB 40.45

Well Volume = 0.163 gal/ft* x (DTB - DTW) 18.15 = 2.2958 gal

x3 = 8.875 gal

x10 = 22.958 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/7/15	12:00	22.30								
1/7/15	12:16	22.35								Start purging
1/7/15	12:19	33.50	~.85gpm	12.84	6.79		0.302			TDS: -5.0 TDS: 0.19 DO: 8.66mg/L ORP: 292
1/7/15	12:24	39.39	"						~18 gal	well cavitated
1/7/15	12:38	35.35								Recovery
1/7/15	12:55	33.30								Recovery
1/7/15	12:58	34.02	"	13.05	6.83		0.316		~5 gal	Cavitated @ 13:03
1/7/15	13:15	37.05								Recovery
1/7/15	13:30	37.05								Recovery
1/7/15	13:45	36.40								Recovery
1/7/15	13:46	36.38								Pump O
1/7/15	13:49	[illegible]		13.65	5.72		0.196		~3 gal	TDS: -5 (looks visibly cleaner DO: 8.94, TDS: 0.13

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

168 cont.ued.

Well Development Field Data Sheet

Well _____ Site _____

Development Personnel _____ Pump Type _____

Casing Diameter _____ DTW _____ DTB _____

Well Volume = _____ gal/ft* x (DTB - DTW) _____ = _____ gal

x3 = _____ gal

x10 = _____ gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/7/15	14:27	35.85								pump tub -5.0
1/7/15	14:30	cavitate								Cavitate
1/7/15	15:00	35.10								Recover
1/7/15	1545	34.95								cavitate @ 1548

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-168 Site FYNOP- South of SPBA

Development Personnel Mike Livingston / Jennifer Reese Pump Type Waleo

Casing Diameter 2" DTW 20.63 DTB 41

Well Volume = 0.163 gal/ft* x (DTB - DTW) 20.37 = 3.32 gal

x3 = 9.96 gal

x10 = 33.2 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/15/15	13:10	ok 20.63		~~+3.74~~	~~6.88~~		~~0.286~~	~~TDS=0.19~~		~~-5.0 turb.~~
1/15/15	13:20			13.74	6.88		0.286	TDS=0.19		-5.0 turb. NTU
	13:22									Cavitate
	14:02			13.85	~~7.88~~		0.209	TDS=0.14		turb=~5.0, but clearer
	14:25	35.35								
	14:30									
										Pump + cavitate 2 gal/ea

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

MW-169 KBF

Well ~~MW-166 cont.~~ Site Harley-Davidson

Development Personnel KBF / mirlingston Pump Type

Casing Diameter 2" DTW 33.65 DTB 34.10

Well Volume = gal/ft* x (DTB - DTW) = gal

x3 = gal

x10 = gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/9/15	1330	33.65								* not enough water to develop further asked JSR to move on to next location

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-169 Site HARLEY-DAVIDSON, YORK, PA

Development Personnel CSL Pump Type TYPHOON

Casing Diameter 2" DTW 35.12 DTB 46.85

Well Volume = 1.91 gals. gal/ft* x (DTB - DTW) _____ = _____ gal

x3 = _____ gal

x10 = _____ gal

Date	Time	WL (ft)	Flow Rate (gpm)	Temp	pH	ΔpH (units)	Cond. (mS/cm)	ΔCond. (%)	Total Volume	Remarks & Clarity
3/3/15	1220	BEGIN SURGING WELL								
	1222	Pump set @ BOTTOM		RATE @			0.60	gpm		VERY TURBID DARK BROWN
	1225	35.75	0.6 gpm	13.3	7.15	—	0.649	—		
	1230	35.82	0.6 gpm	14.2	6.07	—	0.541	—	5.25	
	1232	SURGE WELL								
	1235	STOP	SURGING w/ pump		RATE = 0.6 gpm				10.0	Very TURB. DARK BROWN
	1237	WATER CLEARED up a bit					SURGE WATER column w/ pump a few times.			
	1246	35.92	0.6	12.6	5.88	—	0.434	—	15.0	TURB = 986 NTU's
	1255	~~35.90~~ 35.90	0.6	12.6	5.64	—	0.417	—	20.0	TURB = 928 NTU's
	1305	35.88	0.6	13.2	5.28	—	0.403	—	25.0	TURB = 465 NTU's
	1310	35.88	0.6	13.6	4.94	—	0.389	—	30.0	TURB = 215.0 NTU's
		LITTLE TO NO FINES SETTLING OUT IN 5 GAL. BUCKET								

END DEVELOPEMENT 30.0 gallons evacuated total.

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-17D Site FYNOP South of SPBA

Development Personnel Mike Livingston/Jennifer Reese Pump Type Waterra

Casing Diameter 2" DTW 29.72 DTB 31

Well Volume = 0.163 gal/ft* x (DTB - DTW) 1.28 = 0.21 gal

x3 = 0.63 gal

x10 = 2.1 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
4/9/15	14:25									Add 1 gal. H2O + surge pump to condition. 1.25 gal. out

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-171 Site HARLEY - DAVIDSON YORK, PA

Development Personnel esc Pump Type _____

Casing Diameter 2" DTW 35.50 DTB 41.57

Well Volume = ~~0.78~~ 0.99 gal/ft* x (DTB - DTW) _____ = _____ gal

x3 = _____ gal

x10 = _____ gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
2/13/15	0855									Begin with Bailer pump
	0915	36.17	NA						5.0 gals.	won't pump MUD.
						esc				set up pump.
	0925	~~36.70~~	Begin	purge	w/	pump				
	0930	36.70	1.2gpm	9.45	6.69	—	2.21	—	10.0 gallon	Very turbid DARK
	~~0929~~ 0932	Pump	stopped	working						Brown. no course/JUST FINES.
	1035	Bailed	another		5.0 gallons				15.0	No change.
		36.68	HARD	Bottom	@	42.98				

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-172 Site FYNOP - South of SPBA

Development Personnel Mike Livingston / Jennifer Reese Pump Type Wales

Casing Diameter 2 DTW 31.84 DTB 37.35

Well Volume = 0.163 gal/ft* x (DTB - DTW) 5.51 = 0.9 gal

x3 = 2.7 gal

x10 = 9 gal

PVC

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/14/15	12:45	31.33								H2O is reddish brown
	12:52									6 gallons out before continuous
	13:02	34.32								
	13.18	33.55								1.25 gal. pump off to conserve
	13:58	33.57								
	14:08	33.26								add 1 gall. distilled H2O, pump back on to continue
										2.70 gals out. Continue @ 14:17
	14:56	33.11								Surge + pump
	15:00			13.33	6.92		0.951	TDS=	0.61	turb = -5, but cleaner than before. Pump 2 gals
	15:30	33.82		12.27	6.10		0.940	TDS=	0.60	turb = -5, but cleaner
	16:00	34.02		13.17	5.81		0.940	TDS=	0.60	turb = -5.0 (no change)
1/15/15	11:18			13.09	5.88		0.970			turb = -5.0 TDS = 0.6

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-173 Site Harley-Davidson (old arsenal Rd)

Development Personnel KBF/ Mike Livingston Pump Type Whales

Casing Diameter 2" DTW 16.22 DTB 30.82

Well Volume = 0.163 gal/ft* x (DTB - DTW) 14.6 = 2.379 gal

x3 = 7.134 gal

x10 = 23.79 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/9/15	~~1345~~ 1395	16.15								setup on well TSVgc
1/9/15	1400	16.15								pump well
1/9/15	1404	cavitate							~7 gallons	turb -5.0 NTU
1/9/15	1407	26.60								Recovery
1/9/15	14:17	26.28								Recovery
1/9/15	14:30	26.03								Recovery
1/9/15	14:45	26.00								pump - 5.0 NTU
1/9/15	14:47	cavitate								Cavitate
1/9/15	14:52	28.10								Recovery
1/9/15	15:08	27.85								Recovery
1/9/15	15:15	27.85 pump								pump
1/9/15	15:17	cavitate								cavitate turb - 5.0 ntu

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-173 Site Harley-Davidson (old arsenal Rd)

Development Personnel KBF/ Mike Livingston Pump Type Whales

Casing Diameter 2" DTW 16.22 DTB 30.82

Well Volume = 0.163 gal/ft* x (DTB - DTW) 14.6 = 2.379 gal

x3 = 7.139 gal

x10 = 23.79 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/9/15	~~1345~~ 1355	16.15								setup on well TSvge
1/9/15	1400	16.15								pump well
1/9/15	1404	cavitate							~7 gallons	turb -5.0 NTU
1/9/15	1407	26.60								Recov
1/9/15	14:17	26.28								Recov
1/9/15	14:30	26.03								Recov
1/9/15	14:45	26.00								pump -5.0 NTU
1/9/15	14:47	cavitate								Cavitate
1/9/15	14:52	28.10								Recov
1/9/15	15:08	27.85								Recov
1/9/15	15:15	27.85 pump								pump
1/9/15	15:17	cavitate								cavitate turb - 5.0 ntu

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-173 Site FYNOP

Development Personnel Mike Livingston / Jennifer Reese Pump Type Wales

Casing Diameter 2 DTW 18.33 DTB 31

Well Volume = 0.163 gal/ft* x (DTB - DTW) 12.67 = 2.1 gal

x3 = 6.2 gal

x10 = 21 gal

Date	Time	WL (ft) AVG	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/13/15	10:01	17.82	Water looks like chocolate milk.							Surge the well, then pump
1/13/15	10:04									pumped dry. - pump 5 gals
1/13/15	10:45	27.14								
1/13/15	10:57	27.05								
1/13/15	11:07	26.94		11.86	5.91		0.666		~~6~~ (one) 1	turb = -5.0 pump- 0 gal
1/13/15	12:25	28.77	Water still looks like chocolate milk						6	
1/15/15	11:03	28.76		~~6.43~~ 13.37	6.43		0.655			Pumped + cautioned. Recovery to wl = 28.76 bgs - 5.0 NTU turbs

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

'ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-174 Site FYNOP - South of SPBA

Development Personnel Mike Livingston / Jennifer Reese Pump Type Wales

Casing Diameter 2" DTW 21.92 DTB 31

Well Volume = 0.163 gal/ft* x (DTB - DTW) 9.08 = 1.48 gal

x3 = 4.44 gal

x10 = 14.8 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/13/15	11:20	20.35	No parameters measured.							Surge + Pump - continuati
↓	11:40	28.30	water looks like chocolate							2 gallons purged
	12:08	28.05	milkshake.							
	12:40 12:10									
	12:54	28.40								Pump 0.5 gal, water level at top of
1/13/15	13:08	28.40							2.5 gal.	pump.

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Well Development Field Data Sheet

Well MW-175 Site FYNOP - South of SPBA

Development Personnel Mike Livingston / Jennifer Reese Pump Type Waterra

Casing Diameter 2" DTW 25.81 DTB 28.9

Well Volume = 0.163 gal/ft* x (DTB - DTW) 3.09 = 0.50 gal

x3 = 1.51 gal

x10 = 5.0 gal

Date	Time	WL (ft)	Flow Rate	Temp	pH	ΔpH (units)	Cond.	ΔCond. (%)	Total Volume	Remarks & Clarity
1/13/15	13:25		No parameters measured; water							Surge pump 0.25 gals carbtabs
1/13/15	13:40		looks like chocolate milkshake							
1/13/15	13:57									pump + carbtabs
1/13/15	14:35	26.45								pump
1/13/15	15:12	26.65								
1/13/15	15:48	26.55								pump - about 3 gals out total
1/14/15	09:05 ~~10:00~~	25.44								
	10:00									add 1 gallon distilled H2O pump out
	10:37	26.73								
	10:45	25.78								Add 1 gal. H2O
		26.65								
	12:26			6.53 in cold weather	6.81		.573			Turb = -5 TDS = 0.37 add 1 gal. surge & pump out

*gal/ft: 1" = 0.041; 1.5" = 0.092; 2" = 0.163; 3" = 0.367; 4" = 0.65; 6" = 1.47; 8" = 2.61

or

gal/ft calculation: $(1/4d^2\pi h) \times 7.4805 =$ _____ gal/ft (h = 1; d = diameter in feet)

Revised 8/25/95

Appendix E

Monitoring Well Sampling Purge Logs

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-64S
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/15/2015
Pump ID:
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82679
Purge Method: Hand Bail
Total Purge Vol (gal) 2.75
Pump Set Depth (Ft BGS) :
Total Depth of Well (Ft BGS): 42.28
Initial Depth to Water (Ft BGS): 34.6

Sample Information

Sampled By: Kaitlin Fleming
Sampled Method: Hand Bailer
Sample Date: 4/16/2015
Unit ID: Hand bailer
Sample Time: 9:20
Duplicate ID:
Sample ID: HD-MW-64S-0/1-0
MS/MSD ID:

Notes: Recovering waterlevel on 4/16. = 40.48'

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
4/15/2015	8:50	14.3	4.81	12.8	0.164	9.08	0	312				Initial
4/15/2015	9:00	14.4	5.2	211	0.086	9.24	0	302		1.25	39.28	First Well Volume
4/15/2015	9:10	13.9	5.13	-5	0.076	8.97	0	312		1.25	40.72	Second well volume

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-64D
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/14/2015
Pump ID: Grundfos 82184
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 82679
Purge Method: Positive Displacement
Total Purge Vol (gal) 6.8
Pump Set Depth (Ft BGS) : 72.5
Total Depth of Well (Ft BGS): 77
Initial Depth to Water (Ft BGS): 61.02

Sample Information

Sampled By: Casey Littlefield
Sampled Method: Positive Displacement
Sample Date: 4/14/2015
Unit ID: Grundfos 82184
Sample Time: 13:35
Duplicate ID:
Sample ID: HD-MW-64D-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
4/14/2015	13:10	13.6	7.74	5.6	0.311	9.77	0	108	0.34		61.11	Pink purge water.
4/14/2015	13:15	15.1	7.35	7.5	0.367	7.66	0	85	0.34	1.7	61.11	
4/14/2015	13:20	15.2	7.31	2.4	0.37	7.66	0	105	0.34	1.7	61.11	
4/14/2015	13:25	15.2	7.33	1	0.368	7.63	0	110	0.34	1.7	61.1	
4/14/2015	13:30	15.2	7.32	0.7	0.369	7.68	0	113	0.34	1.7	61.1	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-141A
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/14/2015
Pump ID: dedicated
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID:
Purge Method: Positive Displacement
Total Purge Vol (gal) 420.45
Pump Set Depth (Ft BGS) : 293.85
Total Depth of Well (Ft BGS): 300
Initial Depth to Water (Ft BGS): 47.92

Sample Information

Sampled By: Casey Littlefield
Sampled Method: Hand Bailer
Sample Date: 4/15/2015
Unit ID: Bailer
Sample Time: 9:32
Duplicate ID:
Sample ID: HD-MW-141A-0/1-0
MS/MSD ID:

Notes: Strong sulfur odor.
Tank total gallons at around 375 gallons.

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
4/14/2015	11:45	13.7	7.03	12.9	0.291	3.91	0	-91	10		66.1	
4/14/2015	11:50	13.8	7.63	3.2	0.285	2.83	0	-138	9.68	50	91.5	
4/14/2015	11:55	13.8	7.7	18.4	0.282	4.22	0	-143	9.38	48.4	112.8	
4/14/2015	12:00	13.8	7.73	12.8	0.283	5.55	0	-149	8.82	46.9	130.1	
4/14/2015	12:05	13.9	7.81	15.6	0.278	5.05	0	-184	8.57	44.1	151.2	
4/14/2015	12:10	14	7.85	15.6	0.271	5.72	0	-217	8.11	42.85	182.4	
4/14/2015	12:15	14.2	7.87	15.6	0.256	4.09	0	-211	7.69	40.55	209.6	
4/14/2015	12:20	14.2	7.89	22.5	0.235	5.53	0	-211	6.67	38.45	231.2	
4/14/2015	12:25	14.2	8.03	66.6	0.222	5.44	0	-208	6.52	33.35	250.1	Purge water light brown
4/14/2015	12:30	14.1	8.15	175	0.212	5	0	-95	6.25	32.6	269.9	
4/14/2015	12:35	14.3	8.3	364	0.218	5.2	0	-39	6	31.25	287.8	
4/14/2015	12:37									12		

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-161
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/17/2015
Pump ID: monsoon # 82951
Purged By: Ryan Ulrich
Water Quality Inst: Horiba W-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 15.7
Pump Set Depth (Ft BGS) : 66
Total Depth of Well (Ft BGS): 67.7
Initial Depth to Water (Ft BGS): 58.57

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Positive Displacement
Sample Date: 3/17/2015
Unit ID: 82951
Sample Time: 15:38
Duplicate ID:
Sample ID: HD-MW-161-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/17/2015	14:55								0.2	0.4	58.92	
3/17/2015	15:00								0.34	1.7	59.3	
3/17/2015	15:05								0.34	1.7	59.4	
3/17/2015	15:10	11.43	7.07	226	0.502	8.54	0.02	346	0.4	2	59.57	
3/17/2015	15:15	11.43	7.11	116	0.483	8.27	0.02	332	0.4	2	59.6	
3/17/2015	15:20	11.47	7.13	70.1	0.478	8.24	0.02	322	0.4	2	59.63	
3/17/2015	15:25	11.47	7.13	48.5	0.477	8.3	0.02	313	0.4	2	59.66	
3/17/2015	15:30	11.83	7.15	32.6	0.475	8.23	0.02	296	0.39	1.95	59.64	
3/17/2015	15:35	11.77	7.15	16.6	0.474	8.24	0.02	288	0.39	1.95	59.63	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-161
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/9/2015
Pump ID: monsoon # 82737
Purged By: Ryan Ulrich
Water Quality Inst: Horiba U-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 16358
Purge Method: Positive Displacement
Total Purge Vol (gal) 24.02
Pump Set Depth (Ft BGS) : 66
Total Depth of Well (Ft BGS): 67.7
Initial Depth to Water (Ft BGS): 60.11

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Positive Displacement
Sample Date: 4/9/2015
Unit ID: 82737
Sample Time: 14:12
Duplicate ID:
Sample ID: HD-MW-161-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
4/9/2015	13:00								0.44	1.32	60.9	
4/9/2015	13:05								0.33	1.65	60.77	
4/9/2015	13:10	13.7	7.42	466	0.417	8.03	0.02	285	0.32	1.6	60.75	
4/9/2015	13:15	13.78	7.45	689	0.421	8.04	0.02	280	0.36	1.8	60.98	
4/9/2015	13:20	13.76	7.47	603	0.419	8.01	0.02	276	0.37	1.85	61.08	
4/9/2015	13:25	13.54	7.49	308	0.429	7.81	0.02	273	0.25	1.25	60.63	
4/9/2015	13:30	13.92	7.46	183	0.427	7.91	0.02	272	0.27	1.35	60.7	
4/9/2015	13:35	14.18	7.45	112	0.428	7.9	0.02	269	0.33	1.65	60.75	
4/9/2015	13:40	13.9	7.44	93.3	0.427	7.93	0.02	268	0.33	1.65	60.81	
4/9/2015	13:45	13.52	7.46	61.4	0.429	7.79	0.02	266	0.3	1.5	60.72	
4/9/2015	13:50	13.84	7.45	79.1	0.424	7.97	0.02	259	0.32	1.6	60.77	empty flow-through cell
4/9/2015	13:55	13.76	7.43	39	0.422	8.22	0.02	252	0.34	1.7	60.89	
4/9/2015	14:00	13.72	7.44	23.8	0.427	8.06	0.02	241	0.34	1.7	60.92	
4/9/2015	14:05	13.77	7.45	20.6	0.426	8.04	0.02	227	0.34	1.7	60.94	
4/9/2015	14:10	13.76	7.44	11.2	0.428	8.01	0.02	219	0.34	1.7	60.92	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-162
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/17/2015
Pump ID: monsoon # 82951
Purged By: Ryan Ulrich
Water Quality Inst: Horiba W-22
Purge Technique: Low Yield
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 6.8
Pump Set Depth (Ft BGS) : 53
Total Depth of Well (Ft BGS): 55.3
Initial Depth to Water (Ft BGS): 39.15

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Hand Bailer
Sample Date: 3/18/2015
Unit ID:
Sample Time: 10:30
Duplicate ID:
Sample ID: HD-MW-162-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/17/2015	14:00								0.25	0.75	41.97	
3/17/2015	14:05								0.24	1.2	46.9	
3/17/2015	14:10	12.26	10.3	101	0.412	9.61	0.01	153	0.29	1.45	48.07	
3/17/2015	14:15	12.27	8.09	129	0.272	9.13	0.01	240	0.24	1.2	49.82	
3/17/2015	14:20	12.19	8.41	153	0.287	9.25	0.01	193	0.24	1.2		
3/17/2015	14:24								0.24	1		well cavitated

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-162
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/9/2015
Pump ID: monsoon #82737
Purged By: Ryan Ulrich
Water Quality Inst: Horiba U-22
Purge Technique: Low Yield
Water Quality Inst ID: 16358
Purge Method: Positive Displacement
Total Purge Vol (gal) 4.96
Pump Set Depth (Ft BGS) : 53
Total Depth of Well (Ft BGS): 55.3
Initial Depth to Water (Ft BGS): 40.25

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Hand Bailer
Sample Date: 4/10/2015
Unit ID: Bailer
Sample Time: 9:50
Duplicate ID:
Sample ID: HD-MW-162-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
4/9/2015	11:10	13.03	10.71	153	0.335	8.81	0.01	151	0.25	1	45.68	
4/9/2015	11:15	13.4	10.02	158	0.221	8.6	0.01	167	0.33	1.65	48.2	
4/9/2015	11:20	13.5	9.07	360	0.264	8.43	0.01	171	0.33	1.65	50.83	
4/9/2015	11:22								0.33	0.66		well Cavitated
4/10/2015	9:50										46.94	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-163
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/17/2015
Pump ID: monsoon #82951
Purged By: Ryan Ulrich
Water Quality Inst: Horiba W-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 32.85
Pump Set Depth (Ft BGS) : 55
Total Depth of Well (Ft BGS): 57.42
Initial Depth to Water (Ft BGS): 29.02

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Positive Displacement
Sample Date: 3/17/2015
Unit ID: 82951
Sample Time: 13:12
Duplicate ID:
Sample ID: HD-MW-163-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/17/2015	11:45								0.2	1	29.09	
3/17/2015	11:50								0.16	0.8	29.13	
3/17/2015	11:55								0.44	2.2	29.23	
3/17/2015	12:00	10.74	5.92	147	0.43	11.6	0.02	413	0.44	2.2	29.21	
3/17/2015	12:05	10.76	6.04	111	0.416	10.3	0.02	401	0.38	1.9	29.17	
3/17/2015	12:10	10.73	6.03	95.4	0.401	11.03	0.02	391	0.4	2	29.18	
3/17/2015	12:15	10.8	5.99	84	0.397	11.02	0.02	383	0.37	1.85	29.17	
3/17/2015	12:20	11.02	6	77.7	0.392	11.2	0.02	375	0.35	1.75	29.16	
3/17/2015	12:25	10.82	5.96	63.9	0.38	11.34	0.02	366	0.39	1.95	29.22	
3/17/2015	12:30	10.93	5.91	74.3	0.378	11.13	0.01	360	0.4	2	29.17	
3/17/2015	12:35	11.1	5.93	148	0.379	11.1	0.02	351	0.37	1.85	29.15	Recalibrate turb. On horiba
3/17/2015	12:50	11.04	5.76	21.4	0.381	10.82	0.02	364	0.38	5.7	29.18	
3/17/2015	12:55	11.02	5.83	19.6	0.373	10.24	0.01	353	0.38	1.9	29.19	
3/17/2015	13:00	10.8	5.82	20.2	0.368	10.29	0.01	346	0.39	1.95	29.2	
3/17/2015	13:05	10.99	5.85	19.5	0.367	10.22	0.01	341	0.38	1.9	29.18	
3/17/2015	13:10	11.12	5.85	16.4	0.365	10.28	0.01	337	0.38	1.9	29.19	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-163
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/8/2015
Pump ID: monsoon # 82737
Purged By: Ryan Ulrich
Water Quality Inst: Horiba U-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 16358
Purge Method: Positive Displacement
Total Purge Vol (gal) 43.2
Pump Set Depth (Ft BGS) : 55
Total Depth of Well (Ft BGS): 57.42
Initial Depth to Water (Ft BGS): 31.72

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Positive Displacement
Sample Date: 4/8/2015
Unit ID: 82737
Sample Time: 16:17
Duplicate ID:
Sample ID: HD-MW-163-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
4/8/2015	14:35								0.57	2.85	31.94	
4/8/2015	14:40								0.45	2.25	31.91	
4/8/2015	14:45	12.82	6.49	614	0.396	9.89	0.02	194	0.39	1.95	31.88	
4/8/2015	14:50	12.83	6.47	458	0.388	9.74	0.02	209	0.38	1.9	31.87	
4/8/2015	14:55	12.86	6.41	492	0.382	9.9	0.02	226	0.37	1.85	31.88	
4/8/2015	15:00	12.87	6.34	474	0.378	10.05	0.02	239	0.38	1.9	31.88	
4/8/2015	15:05	12.88	6.32	451	0.376	10.11	0.01	246	0.39	1.95	31.89	
4/8/2015	15:10	12.84	6.29	453	0.373	10.15	0.01	253	0.4	2	31.89	
4/8/2015	15:15	12.84	6.27	405	0.37	10.17	0.01	260	0.43	2.15	31.89	
4/8/2015	15:20	12.79	6.24	456	0.368	10.18	0.01	265	0.4	2	31.89	clean out flow-through cell
4/8/2015	15:30	12.82	6.17	204	0.361	10.08	0.01	271	0.4	4	31.88	
4/8/2015	15:35	12.75	6.18	198	0.362	9.97	0.01	274	0.38	1.9	31.88	
4/8/2015	15:40	12.82	6.14	181	0.363	9.98	0.01	276	0.39	1.95	31.88	
4/8/2015	15:45	12.86	6.12	153	0.362	10	0.01	279	0.41	2.05	31.89	
4/8/2015	15:50	12.84	6.11	125	0.362	10.04	0.01	282	0.42	2.1	31.89	
4/8/2015	15:55	12.76	6.11	118	0.361	9.99	0.01	282	0.45	2.25	31.88	
4/8/2015	16:00	12.78	6.08	77.6	0.36	10.05	0.01	285	0.43	2.15	31.88	
4/8/2015	16:05	12.77	6.07	46.2	0.36	10.16	0.01	287	0.41	2.05	31.89	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-163
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/8/2015
Pump ID: monsoon # 82737
Purged By: Ryan Ulrich
Water Quality Inst: Horiba U-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 16358
Purge Method: Positive Displacement
Total Purge Vol (gal) 43.2
Pump Set Depth (Ft BGS) : 55
Total Depth of Well (Ft BGS): 57.42
Initial Depth to Water (Ft BGS): 31.72

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Positive Displacement
Sample Date: 4/8/2015
Unit ID: 82737
Sample Time: 16:17
Duplicate ID:
Sample ID: HD-MW-163-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
4/8/2015	16:10	12.84	6.05	48.6	0.36	10.17	0.01	289	0.4	2	31.89	
4/8/2015	16:15	12.81	6.05	39.7	0.359	10.17	0.01	290	0.39	1.95	31.89	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-164
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/16/2015
Pump ID: monsoon # 82951
Purged By: Ryan Ulrich
Water Quality Inst: Horiba W-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 21
Pump Set Depth (Ft BGS) : 50
Total Depth of Well (Ft BGS): 55.2
Initial Depth to Water (Ft BGS): 33.04

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Positive Displacement
Sample Date: 3/16/2015
Unit ID: 82951
Sample Time: 15:37
Duplicate ID:
Sample ID: HD-MW-164-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/16/2015	14:35								0.24	1.2	35.61	
3/16/2015	14:40								0.37	1.85	35.83	
3/16/2015	14:45	10.75	5.45	67	5.88	8.9	0.3	326	0.37	1.85	36.94	
3/16/2015	14:50	10.66	5.39	71.5	5.81	8.52	0.3	321	0.37	1.85	37.32	
3/16/2015	14:55	10.68	5.32	57.4	5.77	8.86	0.3	325	0.37	1.85	37.49	
3/16/2015	15:00	10.65	5.3	52.4	5.78	8.61	0.3	325	0.34	1.7	37.34	
3/16/2015	15:05	10.75	5.29	50.6	5.76	8.7	0.3	324	0.34	1.7	36.74	
3/16/2015	15:10	10.8	5.28	49.8	5.74	8.96	0.3	321	0.34	1.7	36.34	
3/16/2015	15:15	10.66	5.31	49.3	5.71	8.97	0.3	308	0.42	2.1	38.9	
3/16/2015	15:20	10.75	5.29	49.9	5.75	8.86	0.3	308	0.26	1.3	36.51	
3/16/2015	15:25	10.67	5.29	23.2	5.72	8.84	0.3	308	0.26	1.3	36.5	
3/16/2015	15:30	10.69	5.29	17	5.71	8.82	0.3	306	0.26	1.3	36.48	
3/16/2015	15:35	10.72	5.29	16.4	5.72	8.8	0.3	304	0.26	1.3	36.47	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-164
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/8/2015
Pump ID: monsoon #82737
Purged By: Ryan Ulrich
Water Quality Inst: Horiba U-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 16358
Purge Method: Positive Displacement
Total Purge Vol (gal) 12.05
Pump Set Depth (Ft BGS) : 50
Total Depth of Well (Ft BGS): 55.2
Initial Depth to Water (Ft BGS): 37.02

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Positive Displacement
Sample Date: 4/8/2015
Unit ID: 82737
Sample Time: 13:10
Duplicate ID:
Sample ID: HD-MW-164-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
4/8/2015	12:20								0.25	1.25	39.73	
4/8/2015	12:25								0.25	1.25	40.27	
4/8/2015	12:30								0.25	1.25	39.99	
4/8/2015	12:35	12.57	5.43	16.3	4.53	8.03	0.23	143	0.26	1.3	40.05	
4/8/2015	12:40	12.72	5.52	7.8	4.51	7.98	0.23	135	0.26	1.3	40.07	
4/8/2015	12:45	12.44	5.53	5.6	4.48	8.07	0.23	149	0.21	1.05	39.32	
4/8/2015	12:50	12.54	5.55	4.6	4.46	8.17	0.23	150	0.2	1	39.09	
4/8/2015	12:55	12.69	5.59	3.4	4.42	8.01	0.22	149	0.25	1.25	39.14	
4/8/2015	13:00	12.55	5.6	4	4.41	8.02	0.22	153	0.24	1.2	39.18	
4/8/2015	13:05	12.73	5.59	3.7	4.39	8.07	0.22	162	0.24	1.2	39.17	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-165
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/16/2015
Pump ID: Monsoon #82951
Purged By: Ryan Ulrich
Water Quality Inst: Horiba W-22
Purge Technique: Low Yield
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 12
Pump Set Depth (Ft BGS) : 70
Total Depth of Well (Ft BGS): 72.98
Initial Depth to Water (Ft BGS): 32.87

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Hand Bailer
Sample Date: 3/17/2015
Unit ID:
Sample Time: 9:45
Duplicate ID:
Sample ID: HD-MW-165-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/16/2015	11:40								0.11	0.55	34.2	
3/16/2015	11:45								0.11	0.55	37.95	
3/16/2015	11:50								0.12	0.6	42.71	
3/16/2015	11:55								0.12	0.6	45.38	
3/16/2015	12:00	11.22	6.82	95.8	1.5	4.82	0.07	300	0.13	0.65	47.19	
3/16/2015	12:05	10.94	6.82	89.7	1.41	4.37	0.06	276	0.13	0.65	49.21	
3/16/2015	12:10	11.4	6.85	111	1.41	4.22	0.06	260	0.13	0.65	53.36	Empty flow-through cell
3/16/2015	12:15	11.54	6.9	107	1.41	5.16	0.06	258	0.13	0.65	54.2	
3/16/2015	12:20	11.51	6.9	113	1.31	4.55	0.06	258	0.21	1.05	55.9	
3/16/2015	12:25	11.43	6.85	324	1.49	4.83	0.07	262	0.21	1.05	57.53	
3/16/2015	12:30	11.46	6.77	606	1.64	5.11	0.08	266	0.2	1	58.66	
3/16/2015	12:35	11.69	6.88	1000	1.36	3.62	0.06	258	0.2	1	60.28	
3/16/2015	12:40	11.62	6.97	1000	1.12	2.44	0.05	248	0.2	1	62.02	
3/16/2015	12:45	11.52	7	677	1.15	1.74	0.05	245	0.2	1	64.15	
3/16/2015	12:48								0.32	0.96		Well cavitated
3/17/2015	9:40										33.34	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-165
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/9/2015
Pump ID: monsoon #82737
Purged By: Ryan Ulrich
Water Quality Inst: Horiba U-22
Purge Technique: Low Yield
Water Quality Inst ID: 16358
Purge Method: Positive Displacement
Total Purge Vol (gal) 11.1
Pump Set Depth (Ft BGS) : 70
Total Depth of Well (Ft BGS): 72.98
Initial Depth to Water (Ft BGS): 39.29

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Hand Bailer
Sample Date: 4/10/2015
Unit ID: Bailer
Sample Time: 8:40
Duplicate ID:
Sample ID: HD-MW-165-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
4/9/2015	9:40	13.06	6.41	148	1.47	6.44	0.07	270	0.76	3.8	57.61	
4/9/2015	9:45	13.25	6.63	1000	1.9	6.79	0.09	246	0.44	2.2	59.55	
4/9/2015	9:50	13.75	6.93	1000	1.7	4.14	0.08	227	0.58	2.9	65.73	
4/9/2015	9:54								0.55	2.2		well cavitated
4/10/2015	8:40										39.25	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-166
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/2/2015
Pump ID: Monsoon Pump 82951
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: Low Flow Parameter Stabilization
Water Quality Inst ID: 82551
Purge Method: Positive Displacement
Total Purge Vol (gal) 2.96
Pump Set Depth (Ft BGS) : 49
Total Depth of Well (Ft BGS): 51.5
Initial Depth to Water (Ft BGS): 45.6

Sample Information

Sampled By: Casey Littlefield
Sampled Method: Hand Bailer
Sample Date: 3/3/2015
Unit ID: Monsoon Pump 82951
Sample Time: 11:45
Duplicate ID:
Sample ID: HD-MW-166-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/2/2015	13:42	12	5.85	-5	0.412	8.61	0	329	0.23		46	
3/2/2015	13:47	13.8	5.75	660	0.322	6.06	0	323	0.19	1.5	47.1	
3/2/2015	13:52	14.2	5.52	220	0.302	5.89	0	312	0.17	0.95		Water Level below pump.
3/2/2015	13:55									0.51		Cavitated Well

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-166
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/24/2015
Pump ID: monsoon 82951
Purged By: Alan Miller
Water Quality Inst: Horiba U-22
Purge Technique: Low Yield
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 8
Pump Set Depth (Ft BGS) : 50
Total Depth of Well (Ft BGS): 51.5
Initial Depth to Water (Ft BGS): 39.25

Sample Information

Sampled By: Alan Miller
Sampled Method: Hand Bailer
Sample Date: 3/25/2015
Unit ID: Bailer
Sample Time: 12:58
Duplicate ID:
Sample ID: HD-MW-166-0/1-0
MS/MSD ID:

Notes: pump fluctuating need to keep adjusting pump. Purge volume is from actual bucket measurments recovery wl of 47.09' on 3/25/15 @ 1250

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/24/2015	13:40	10.32	6.1	-5	0.333	5.65	0.01	259				
3/24/2015	13:45	11.54	6.08	355	0.3	5.41	0.01	274	0.23	1.75	42.49	
3/24/2015	13:50	12.25	6.08	147	0.276	5.39	0.01	262	0.12		42.98	
3/24/2015	13:55	12.31	5.95	74.4	0.222	5.31	0.01	276	0.35	3.25	44.65	
3/24/2015	14:00	12.41	5.78	109	0.21	5.31	0.01	284			46.71	
3/24/2015	14:05	12.49	5.6	171	0.231	5.44	0.01	297				wl below top of pump.
3/24/2015	14:06									3		Well Cavitated

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-167
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/2/2015
Pump ID: Monsoon Pump
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: Low Flow Parameter Stabilization
Water Quality Inst ID: 82551
Purge Method: Positive Displacement
Total Purge Vol (gal) 6.9
Pump Set Depth (Ft BGS) : 48.5
Total Depth of Well (Ft BGS): 50.54
Initial Depth to Water (Ft BGS): 37.4

Sample Information

Sampled By: Casey Littlefield
Sampled Method: Hand Bailer
Sample Date: 3/3/2015
Unit ID: Monsoon Pump 82951
Sample Time: 12:00
Duplicate ID:
Sample ID: HD-MW-167-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/2/2015	14:25	10.5	6.09	152	0.242	11.24	0	301	0.17		39.8	
3/2/2015	14:30	13.2	5.86	248	0.244	9.39	0	293	0.14	0.85	41.29	
3/2/2015	14:35	13.8	5.8	439	0.246	9.1	0	278	0.17	0.7	42.06	
3/2/2015	14:40	14.2	5.75	299	0.221	8.76	0	274	0.2	0.85	43.5	
3/2/2015	14:45	14.4	5.58	146	0.212	8.58	0	280	0.15	1	45.3	
3/2/2015	14:50	14.2	5.6	151	0.219	8.54	0	278	0.17	0.75	45.97	Flush Flow Cell and Clean Turbitity Sensor.
3/2/2015	14:55	14.1	5.67	193	0.233	8.61	0	271	0.23	0.85		Water Level Below Pump
3/2/2015	15:00	14.6	5.73	391	0.255	8.16	0	268	0.2	1.5		Water Level Below Pump
3/2/2015	15:02								0.2	0.4		Cavitated well.

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-167
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/25/2015
Pump ID: monsoon 82951
Purged By: Alan Miller
Water Quality Inst: Horiba U-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 10
Pump Set Depth (Ft BGS) : 48.5
Total Depth of Well (Ft BGS): 50.54
Initial Depth to Water (Ft BGS): 27.22

Sample Information

Sampled By: Kaitlin Fleming
Sampled Method: Hand Bailer
Sample Date: 3/26/2015
Unit ID: Bailer
Sample Time: 10:10
Duplicate ID:
Sample ID: HD-MW-167-0/1-0
MS/MSD ID:

Notes: pump rate is fluctuating and need to keep adjusting pump rate. Purge volume is actual bucket measurments. Recovery water level on 3/25/15 47.39' @ 1337. Recovery wl on 3/26/15 @1010 = 45.68'

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/18/2015	9:45	11.21	6.09	-5	0.263	11.09	0.01	361				
3/25/2015	9:46								0.15		30.91	
3/25/2015	9:50	12.25	6.18	-5	0.268	11.46	0.01	335	0.34		34.45	
3/25/2015	9:55	12.67	6.13	680	0.262	11.65	0.01	328	0.2	3	39.55	
3/25/2015	10:00	12.86	6.13	247	0.264	11.13	0.01	321		2	42.45	
3/25/2015	10:05	12.8	5.92	266	0.211	10.83	0.01	324			44.2	
3/25/2015	10:10	12.76	6.04	195	0.243	10.68	0.01	324		4		water below top of pump.
3/25/2015	10:12									1		cavitation

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-168
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/3/2015
Pump ID: Monsoon Pump 82951
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: Low Flow Parameter Stabilization
Water Quality Inst ID: 82551
Purge Method: Positive Displacement
Total Purge Vol (gal) 9.5
Pump Set Depth (Ft BGS) : 38.5
Total Depth of Well (Ft BGS): 40.45
Initial Depth to Water (Ft BGS): 20.72

Sample Information

Sampled By: Kaitlin Fleming
Sampled Method: Hand Bailer
Sample Date: 3/4/2015
Unit ID: Monsoon Pump 82951
Sample Time: 9:10
Duplicate ID:
Sample ID: HD-MW-168-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/3/2015	8:42	13.8	5.74	137	1.86	8.99	0.1	324	0.28		23.84	
3/3/2015	8:47	15.1	6.27	894	1.24	7.6	0.1	265	0.3	1.4	27.2	
3/3/2015	8:52	14.9	6.21	465	1.12	7.35	0.1	191	0.19	1.5	30	
3/3/2015	8:57	15.4	6.22	856	1	7.1	0.1	202	0.19	0.95	31.42	
3/3/2015	9:02	15.7	6.16	-5	0.825	6.76	0.1	202	0.2	0.95	32.32	
3/3/2015	9:07	15.6	5.83	470	0.827	6.62	0.1	246	0.3	1	34	
3/3/2015	9:12	15.6	6.04	-5	1.34	6.43	0	249	0.2	1.5		Water level below pump.
3/3/2015	9:17	15.2	6.08	914	1.59	6.44	0.1	246	0.2	1		Water level below pump.
3/3/2015	9:22	15.5	6.16	787	1.77	6.42	0.1	246	0.2	1		Water level below pump.
3/3/2015	9:23									0.2		Cavitated Well

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-168
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/24/2015
Pump ID: Monsoon 82951
Purged By: Alan Miller
Water Quality Inst: Horiba U-22
Purge Technique: Low Yield
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 12.5
Pump Set Depth (Ft BGS) : 38.5
Total Depth of Well (Ft BGS): 40.45
Initial Depth to Water (Ft BGS): 14.33

Sample Information

Sampled By: Alan Miller
Sampled Method: Hand Bailer
Sample Date: 3/25/2015
Unit ID: Bailer
Sample Time: 12:18
Duplicate ID:
Sample ID: HD-MW-168-0/1-0
MS/MSD ID:

Notes: Have had to keep adjusting pump rate through whole purge. AGM Purge volume based on bucket measurments. Recovery wl on 3/25/15 14.94' @ 12:15

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/24/2015	10:45	11.9	6	345	0.241	7.84	0.01	342	0.28		17.33	
3/24/2015	10:50	11.63	5.96	274	0.241	7.54	0.01	342	0.34		20.65	
3/24/2015	10:55	12.59	5.85	400	0.221	7.98	0.01	318	0.24		22.65	
3/24/2015	11:00	12.37	5.78	385	0.218	7.96	0.01	306	0.1	2.5	23.01	
3/24/2015	11:05	12.87	5.78	270	0.205	7.86	0.01	304	0.25		24.39	
3/24/2015	11:08	12.93	5.76	104	0.202	7.82	0.01	313	0.32	2.5		
3/24/2015	11:11	13.04	5.84	53	0.205	7.8	0.01	309	0.16		27.35	
3/24/2015	11:15	13.14	5.81	440	0.202	7.74	0.01	314		2.5		
3/24/2015	11:20	13.24	5.77	892	0.198	7.62	0.01	308			31.72	
3/24/2015	11:25	13.42	5.61	-5	0.187	7.47	0.01	324		2.5	33.09	
3/24/2015	11:27											
3/24/2015	11:30	13.36	5.31	-5	0.165	7.37	0.01	343		2.5	34.02	
3/24/2015	11:35	13.58	5.61	-5	0.214	7.84	0.01	333			35.28	
3/24/2015	11:37									3.25		well cavitated

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-169
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/18/2015
Pump ID: monsoon #82951
Purged By: Ryan Ulrich
Water Quality Inst: Horiba W-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 16.2
Pump Set Depth (Ft BGS) : 45
Total Depth of Well (Ft BGS): 46.85
Initial Depth to Water (Ft BGS): 32.15

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Positive Displacement
Sample Date: 3/18/2015
Unit ID: 82951
Sample Time: 13:17
Duplicate ID:
Sample ID: HD-MW-169-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/18/2015	12:35								0.3	1.5	32.38	
3/18/2015	12:40								0.3	1.5	32.35	
3/18/2015	12:45	12.57	5.08	54.3	0.388	6.63	0.02	377	0.34	1.7	32.44	
3/18/2015	12:50	12.68	5.06	24.1	0.371	6.6	0.01	357	0.34	1.7	32.44	
3/18/2015	12:55	12.61	5.04	14.7	0.363	6.71	0.01	350	0.36	1.8	32.45	
3/18/2015	13:00	12.64	5.03	14.1	0.361	6.62	0.01	346	0.4	2	32.43	
3/18/2015	13:05	12.29	5.03	11.2	0.357	6.68	0.01	343	0.4	2	32.4	
3/18/2015	13:10	12.57	5.03	7.1	0.358	6.65	0.01	339	0.4	2	32.39	
3/18/2015	13:15	12.57	5.02	7.8	0.356	6.63	0.01	333	0.4	2	32.4	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-169
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 4/10/2015
Pump ID: monsoon # 82737
Purged By: Ryan Ulrich
Water Quality Inst: Horiba U-22
Purge Technique: Well Yield Matched Purge
Water Quality Inst ID: 16358
Purge Method: Positive Displacement
Total Purge Vol (gal) 17
Pump Set Depth (Ft BGS) : 45
Total Depth of Well (Ft BGS): 46.85
Initial Depth to Water (Ft BGS): 29.6

Sample Information

Sampled By: Ryan Ulrich
Sampled Method: Positive Displacement
Sample Date: 4/10/2015
Unit ID: 82737
Sample Time: 12:32
Duplicate ID:
Sample ID: HD-MW-169-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/29/2015	12:15	15.43	4.94	24.7	0.322	6.23	0.01	325	0.36	1.8	29.89	
4/10/2015	11:50								0.35	2.1	29.97	
4/10/2015	11:55	15.43	4.84	93.5	0.327	6.23	0.01	314	0.36	1.8	29.92	
4/10/2015	12:00	15.47	4.89	60.6	0.322	6.07	0.01	322	0.38	1.9	29.94	
4/10/2015	12:05	15.4	4.92	63.8	0.321	6	0.01	325	0.38	1.9	29.92	
4/10/2015	12:10	15.45	4.92	77.3	0.322	6.03	0.01	326	0.38	1.9	29.92	clean out flow-through cell
4/10/2015	12:20	15.52	4.94	23.9	0.321	6.19	0.01	329	0.37	1.85	29.93	
4/10/2015	12:25	15.53	4.93	23	0.32	6.16	0.01	330	0.38	1.9	29.9	
4/10/2015	12:30	15.56	4.93	22.6	0.321	6.17	0.01	329	0.37	1.85	29.91	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-170
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/3/2015
Pump ID: Bailer
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82551
Purge Method: Hand Bail
Total Purge Vol (gal) 0.2
Pump Set Depth (Ft BGS) :
Total Depth of Well (Ft BGS): 30.95
Initial Depth to Water (Ft BGS): 30.12

Sample Information

Sampled By: Kaitlin Fleming
Sampled Method: Hand Bailer
Sample Date: 3/4/2015
Unit ID: NA
Sample Time: 9:40
Duplicate ID:
Sample ID: HD-MW-170-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/3/2015	9:45	12.4	5.59	-5	0.547	10.12	0	293				Cavitated Well only enough water for one water quality reading.

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-170
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/24/2015
Pump ID: NA
Purged By: Alan Miller
Water Quality Inst: Horiba U-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82605
Purge Method: Hand Bail
Total Purge Vol (gal) 4
Pump Set Depth (Ft BGS) :
Total Depth of Well (Ft BGS): 30.95
Initial Depth to Water (Ft BGS): 24.84

Sample Information

Sampled By: Alan Miller
Sampled Method: Hand Bailer
Sample Date: 3/25/2015
Unit ID: Bailer
Sample Time: 9:18
Duplicate ID:
Sample ID: HD-MW-170-0/1-0
MS/MSD ID:

Notes: recovery wl @ 24.65' on 3/25/15 @0913

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/24/2015	9:55	9.82	6.96	36.2	0.625	7.57	0.03	345		0.25	24.84	
3/24/2015	9:59	11.09	6.4	160	0.593	8.18	0.02	347		1	25.97	
3/24/2015	10:04	11.32	6.09	126	0.567	7.86	0.02	343		1	26.88	
3/24/2015	10:12	12.32	5.86	655	0.577	7.31	0.02	349		1.75	28.72	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-171
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/3/2015
Pump ID: Monsoon Pump 82951
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: Low Flow Parameter Stabilization
Water Quality Inst ID: 82551
Purge Method: Positive Displacement
Total Purge Vol (gal) 9.1
Pump Set Depth (Ft BGS) : 40
Total Depth of Well (Ft BGS): 42.95
Initial Depth to Water (Ft BGS): 36.18

Sample Information

Sampled By: Casey Littlefield
Sampled Method: Hand Bailer
Sample Date: 3/3/2015
Unit ID: Monsoon Pump 82951
Sample Time: 13:30
Duplicate ID:
Sample ID: HD-MW-171-0/1-0
MS/MSD ID:

Notes: Strong Sulfur Odor to purge water.

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/3/2015	10:15	13.4	6.56	-5	2.41	3.23	0.1	-120	0.36		36.45	
3/3/2015	10:20	13.8	6.58	-5	2.3	1.15	0.1	-133	0.4	1.8	36.63	
3/3/2015	10:25	14	6.58	466	2.22	0.36	0.1	-143	0.17	2		Water Level below top of pump.
3/3/2015	10:30	13.3	6.59	484	2.19	0.52	0.1	-147	0.19	0.85		
3/3/2015	10:35	13.1	6.6	376	2.2	0.52	0.1	-148	0.19	0.95		
3/3/2015	10:40	13.2	6.59	328	2.12	0.46	0.1	-149	0.17	0.95		
3/3/2015	10:45	13.3	6.58	304	2.18	0.36	0.1	-150	0.17	0.85		
3/3/2015	10:50	14	6.57	268	2.16	0.32	0.1	-151	0.19	0.85		
3/3/2015	10:55									0.85		Cavitated Well

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-171
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/25/2015
Pump ID: monsoon 82951
Purged By: Alan Miller
Water Quality Inst: Horiba U-22
Purge Technique: Low Flow Parameter Stabilization
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 21.5
Pump Set Depth (Ft BGS) : 40.95
Total Depth of Well (Ft BGS): 42.95
Initial Depth to Water (Ft BGS): 32.64

Sample Information

Sampled By: Alan Miller
Sampled Method: Positive Displacement
Sample Date: 3/25/2015
Unit ID: Monsoon 82951
Sample Time: 11:50
Duplicate ID:
Sample ID: HD-MW-171-0/1-0
MS/MSD ID:

Notes: pump rate is fluctuating. Purge volume from actual bucket measurment. Stabilized purge parameters and sampled low flow technique.

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/25/2015	10:52	10.93	6.96	-5	2.07	0.42	0.09	-113				
3/25/2015	10:55	11.73	6.93	121	1.63	0	0.08	-141	0.26		33.48	
3/25/2015	11:00	12.16	6.91	56.3	1.65	0	0.08	-156			34.05	
3/25/2015	11:05	12.16	6.94	84	1.75	0	0.08	-208	0.42	5	35.98	
3/25/2015	11:10	12.16	6.97	126	1.85	0	0.09	-214		3.5	35.42	
3/25/2015	11:15	12.16	6.99	98.1	1.9	0	0.09	-218		1.5	35.78	
3/25/2015	11:20	12.19	6.99	217	1.95	0	0.09	-224		2.5	36.19	
3/25/2015	11:25	12.06	6.99	335	1.93	0	0.09	-228		2.5	36.46	
3/25/2015	11:30	12.09	7.01	50	1.94	0	0.09	-227		2	36.5	slowed pumping rate
3/25/2015	11:35	12.14	7.01	17.4	1.9	0	0.09	-227		3	36.69	
3/25/2015	11:40	11.79	7.03	6.4	1.86	0	0.09	-224			36.69	
3/25/2015	11:45	11.73	7.04	5.6	1.83	0	0.08	-221		1.5	36.69	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-172
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/2/2015
Pump ID: Monsoon Pump 82951
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: Low Flow Parameter Stabilization
Water Quality Inst ID: 82551
Purge Method: Positive Displacement
Total Purge Vol (gal) 2.21
Pump Set Depth (Ft BGS) : 35
Total Depth of Well (Ft BGS): 36.9
Initial Depth to Water (Ft BGS): 32

Sample Information

Sampled By: Jennifer Reese
Sampled Method: Hand Bailer
Sample Date: 3/2/2015
Unit ID: Monsoon Pump 82951
Sample Time: 15:40
Duplicate ID:
Sample ID: HD-MW-MW-172-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/2/2015	12:56	13.1	5.53	779	0.632	10.52	0	299	0.16		34	
3/2/2015	13:01	13.9	5.49	665	0.653	6.25	0	292	0.18	0.8	34.85	
3/2/2015	13:06	15.1	5.38	358	0.682	5.64	0	285	0.17	0.9		Water Level Below Pump
3/2/2015	13:09								0.18	0.51		Cavitated Well

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-172
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/25/2015
Pump ID: monsoon 82951
Purged By: Alan Miller
Water Quality Inst: Horiba U-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 7.25
Pump Set Depth (Ft BGS) : 35
Total Depth of Well (Ft BGS): 36.9
Initial Depth to Water (Ft BGS): 27.71

Sample Information

Sampled By: Alan Miller
Sampled Method: Hand Bailer
Sample Date: 3/25/2015
Unit ID: Bailer
Sample Time: 13:28
Duplicate ID:
Sample ID: HD-MW-172-0/1-0
MS/MSD ID:

Notes: recovery wl @ 27.98' on 3/25/15 @ 1323.

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/25/2015	7:48	11.28	5	256	0.814	7.59	0.03	374				
3/25/2015	7:51										29.69	
3/25/2015	7:53	12.08	5.05	18.5	0.779	7.32	0.03	325		2.5	31.85	
3/25/2015	7:56											stopped purge to fix flow cell
3/25/2015	7:58	11.65	5.39	36.7	0.806	8.08	0.03	308		2.5	32.85	
3/25/2015	8:03	12.62	5.35	86.9	0.813	7.58	0.03	303				
3/25/2015	8:06									2.25		cavitate

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-173
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/2/2015
Pump ID: Monsoon Pump
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: Low Flow Parameter Stabilization
Water Quality Inst ID: 82551
Purge Method: Positive Displacement
Total Purge Vol (gal) 7.8
Pump Set Depth (Ft BGS) : 29
Total Depth of Well (Ft BGS): 31.05
Initial Depth to Water (Ft BGS): 18.22

Sample Information

Sampled By: Casey Littlefield
Sampled Method: Hand Bailer
Sample Date: 3/3/2015
Unit ID: Monsoon Pump 82951
Sample Time: 11:00
Duplicate ID:
Sample ID: HD-MW-173-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/2/2015	11:50	13.7	5.18	-5	0.578	2.97	0	302	0.2		21.52	
3/2/2015	11:55	14.2	5.15	353	0.567	2.77	0	284	0.14	1	22.55	
3/2/2015	12:00	14.1	5.15	277	0.565	2.73	0	282	0.11	0.7	22.85	
3/2/2015	12:05	13.8	5.14	320	0.555	2.77	0	277	0.2	0.55	23.35	
3/2/2015	12:10	14.9	5.05	307	0.568	3.82	0	287	0.36	1	24.55	
3/2/2015	12:15	14.8	5.12	318	0.598	4.31	0	289	0.28	1.8	26.1	
3/2/2015	12:20	14.7	5.2	472	0.601	3.8	0	287	0.13	1.4	27.85	
3/2/2015	12:25	14.5	5.22	381	0.611	3.57	0	283	0.12	0.65		Water Level below pump
3/2/2015	12:30	14.7	5.28	258	0.613	3.46	0	280	0.12	0.6		Water Level below pump
3/2/2015	12:33								0.12	0.1		Cavitated Well

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-173
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/24/2015
Pump ID: monsoon 82951
Purged By: Alan Miller
Water Quality Inst: Horiba U-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82605
Purge Method: Positive Displacement
Total Purge Vol (gal) 11
Pump Set Depth (Ft BGS) : 29.05
Total Depth of Well (Ft BGS): 31.05
Initial Depth to Water (Ft BGS): 12.16

Sample Information

Sampled By: Alan Miller
Sampled Method: Hand Bailer
Sample Date: 3/25/2015
Unit ID: Bailer
Sample Time: 12:32
Duplicate ID:
Sample ID: HD-MW-173-0/1-0
MS/MSD ID:

Notes: had to adjust purge rate keeps dropping. Purge volume based on actual bucket measurments. Total of 11 gallons. Recovery wl 22.67' on 3/25/15 @ 1230.

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/24/2015	12:24	11.52	5.4	249	0.508	3.57	0.02	353				
3/24/2015	12:30	11.1	5.38	198	0.507	3.3	0.02				18.55	
3/24/2015	12:32								0.31			
3/24/2015	12:35	11.09	5.38	89.2	0.502	3.03	0.02	309			22.01	
3/24/2015	12:37										23.78	
3/24/2015	12:40	12.26	5.33	447	0.494	4.96	0.02	316	0.43		26.32	
3/24/2015	12:45	12.66	5.39	472	0.508	4.99	0.02	310				
3/24/2015	12:48											cavitation

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-174
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/2/2015
Pump ID: Bailer
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82551
Purge Method: Hand Bail
Total Purge Vol (gal) 1
Pump Set Depth (Ft BGS) :
Total Depth of Well (Ft BGS): 30.4
Initial Depth to Water (Ft BGS): 27.86

Sample Information

Sampled By: Casey Littlefield
Sampled Method: Hand Bailer
Sample Date: 3/3/2015
Unit ID: NA
Sample Time: 11:20
Duplicate ID:
Sample ID: HD-MW-174-0/1-0
MS/MSD ID:

Notes:

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/2/2015	11:00	11.7	6.36	339	1.11	10.25	0	294			28.15	Initial
3/2/2015	11:04	11.7	6.86	-5	1.09	10.71	0	292			28.74	1 well volume
3/2/2015	11:13	11.8	6.83	-5	1.06	5.9	0	297			29.6	2 Well volumes
3/2/2015	11:16										30.03	Cavitated well

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-174
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/24/2015
Pump ID: NA
Purged By: Alan Miller
Water Quality Inst: Horiba U-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82605
Purge Method: Hand Bail
Total Purge Vol (gal) 3.5
Pump Set Depth (Ft BGS) :
Total Depth of Well (Ft BGS): 30.4
Initial Depth to Water (Ft BGS): 24.12

Sample Information

Sampled By: Alan Miller
Sampled Method: Hand Bailer
Sample Date: 3/25/2015
Unit ID: Bailer
Sample Time: 8:58
Duplicate ID:
Sample ID: HD-MW-174-0/1-0
MS/MSD ID:

Notes: Recovery wl @ 27.19 om 3/25/15 @0849 as per JSR FSP says we need suficuent water in well to sample with 3' in the well we can sample.

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/24/2015	9:16	8.72	6.59	44.6	0.875	6.5	0.04	368				
3/24/2015	9:18	10.17	6.88	626	0.82	6.25	0.03	359		1.25		
3/24/2015	9:24	10.19	6.83	891	0.868	5.56	0.04	359		1.25	27.2	
3/24/2015	9:31	10.61	6.99	-5	0.981	6.98	0.04	354		1	28.93	

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 Initial SPBA New Well Sampling
Well ID: MW-175
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/2/2015
Pump ID: Bailer
Purged By: Casey Littlefield
Water Quality Inst: Horiba W-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82551
Purge Method: Hand Bail
Total Purge Vol (gal) 0.5
Pump Set Depth (Ft BGS) :
Total Depth of Well (Ft BGS): 28.55
Initial Depth to Water (Ft BGS): 27.07

Sample Information

Sampled By: Jennifer Reese
Sampled Method: Hand Bailer
Sample Date: 3/2/2015
Unit ID: NA
Sample Time: 15:25
Duplicate ID:
Sample ID: HD-MW-175-0/1-0
MS/MSD ID:

Notes: Not enough water for pump. Hand bail 3 well volumes. Collecting parameters Intialy and after each well volume. Sample ID: HD-MW-175-0/1-0

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/2/2015	10:30	13	5.29	-5	0.674	9.39	0	354				
3/2/2015	10:35	13.4	5.84	-5	0.593	7.2	0	338			27.7	One well volume
3/2/2015	10:45	13.5	5.91	-5	0.575	6.8	0	356			28.21	Second well volume. Cavitated well after .5 gallons

Harley-Davidson Groundwater Sample Purge Log

Sampling Event: 2015 2nd Rnd SPBA New Well Sampling
Well ID: MW-175
Project NO: 10012
Project Location York, Pa

Purge Information

Purge Date: 3/24/2015
Pump ID: NA
Purged By: Alan Miller
Water Quality Inst: Horiba U-22
Purge Technique: 3 Well Volumes
Water Quality Inst ID: 82605
Purge Method: Hand Bail
Total Purge Vol (gal) 3.25
Pump Set Depth (Ft BGS) :
Total Depth of Well (Ft BGS): 28.55
Initial Depth to Water (Ft BGS): 22.76

Sample Information

Sampled By: Alan Miller
Sampled Method: Hand Bailer
Sample Date: 3/25/2015
Unit ID: Bailer
Sample Time: 8:35
Duplicate ID:
Sample ID: HD-MW-175-0/1-0
MS/MSD ID:

Notes: Recovry wl 0829 @23.16'

Purge Parameter Information

Date	Time	Temp. °C	pH SU	Turb NTU	Con. mS/cm	DO mg/	Sal	ORP	Pr g/m	Pv gal.	DTW feet	Notes
3/24/2015	8:32	981	6.15	387	0.467	6.96	0.02	412		1.5	24.31	
3/24/2015	8:40	10.77	5.92	-5	0.484	7.27	0.02	405		1	26.19	
3/24/2015	8:46									0.75	27.28	

Appendix F

USDA Soil Texture Trilinear Diagrams

Sample Depth	% Sand	% Clay	% Silt	USDA Texture
12.4'-12.8'	26.5%	34.7%	38.9%	CLAY LOAM
17.4'-17.8'	40.8%	21.0%	38.2%	LOAM
22.0'-22.4'	26.6%	31.2%	42.2%	CLAY LOAM
26.6'-27.0'	35.4%	33.5%	31.1%	CLAY LOAM
31.6'-32.0'	21.2%	40.2%	38.7%	CLAY

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

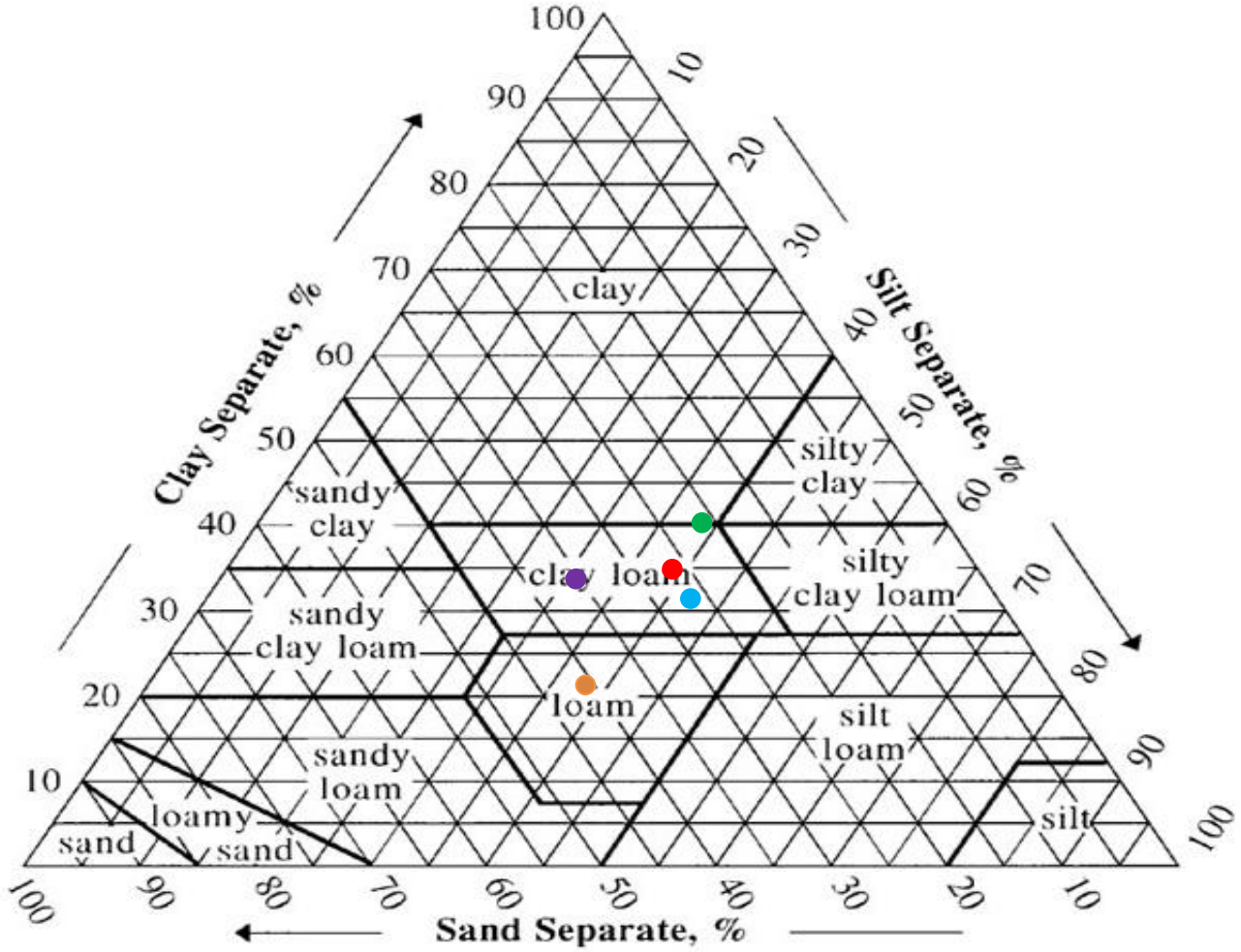
Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-161



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
8.0'-8.5'	52.7%	8.2%	39.2%	SANDY LOAM
16.0'-16.5'	29.6%	33.2%	37.2%	CLAY LOAM
23.0'-23.5'	24.0%	28.0%	48.0%	CLAY LOAM
30.5'-31.0'	13.9%	47.0%	39.0%	CLAY
38.0'-38.5'	18.7%	35.3%	46.0%	SILTY CLAY LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

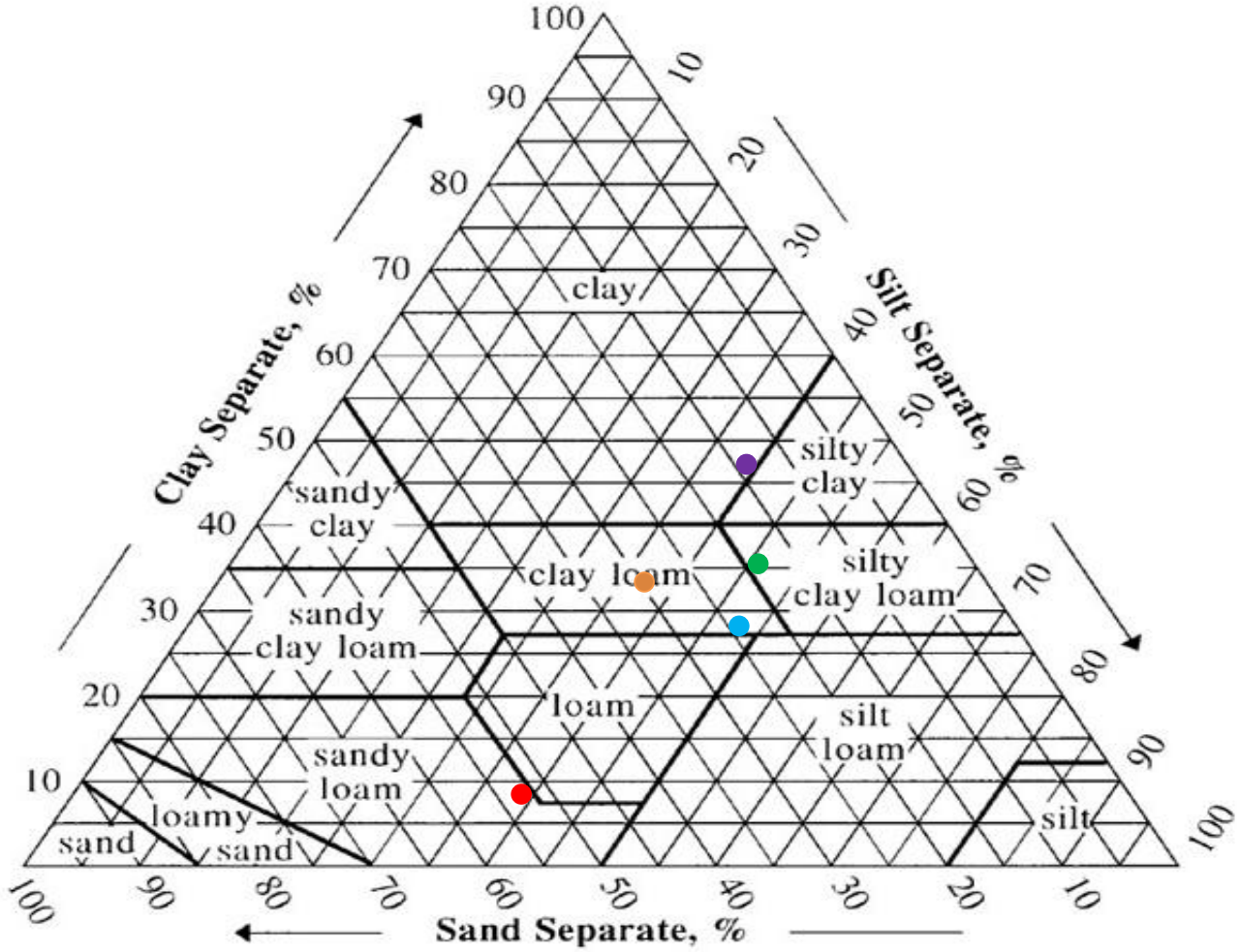
Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-162



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
8.3'-8.6'	27.3%	18.2%	54.5%	SILT LOAM
11.0'-11.4'	37.9%	10.5%	51.6%	SILT LOAM
19.4'-19.8'	46.8%	7.2%	46.0%	LOAM
24.6'-25.0'	30.7%	10.8%	58.5%	SILT LOAM
31.0'-31.4'	24.7%	40.4%	35.0%	CLAY

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

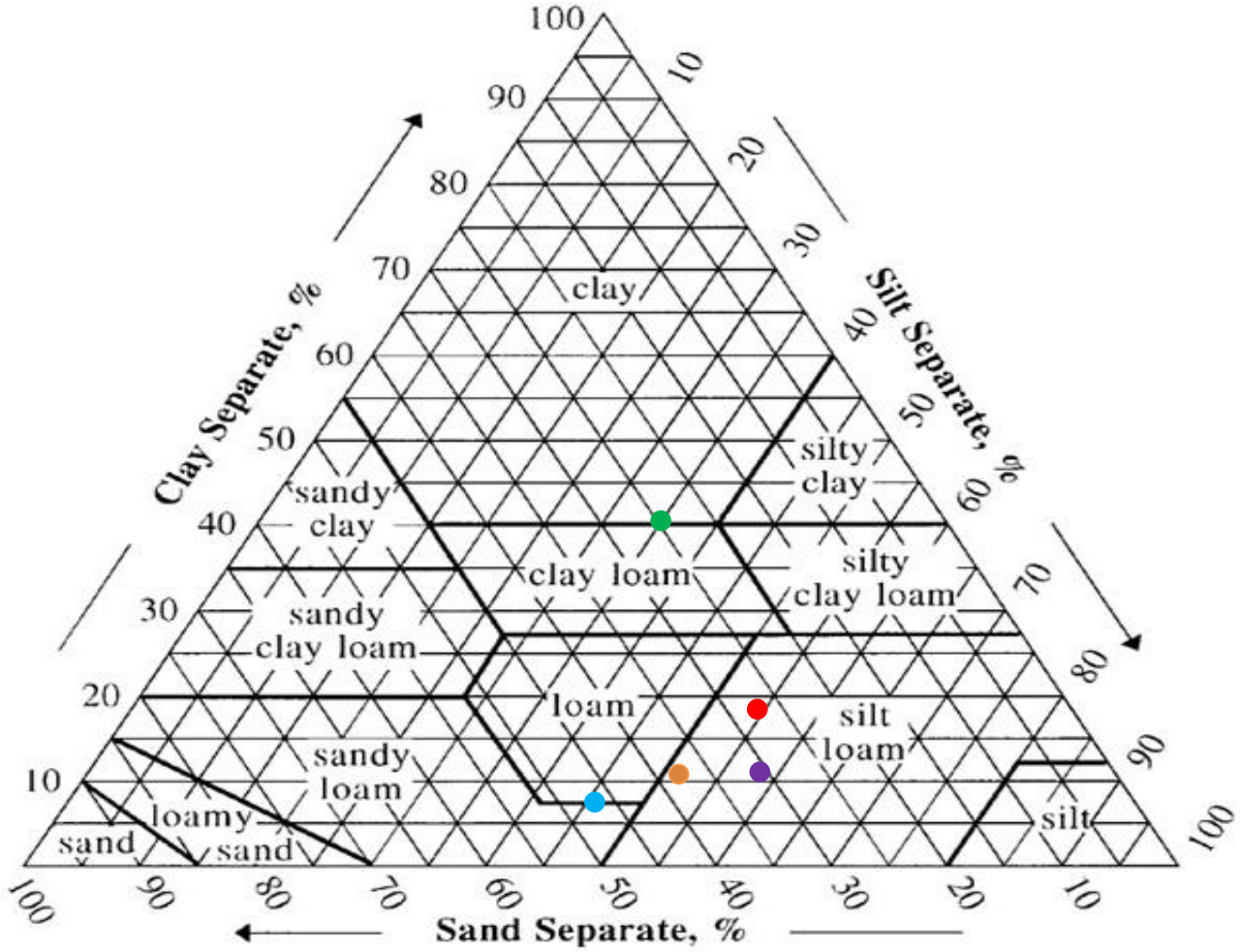
Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-163



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
11.8'-12.2'	28.7%	28.5%	42.8%	CLAY LOAM
19.0'-19.4'	34.4%	32.6%	33.1%	CLAY LOAM
25.4'-25.8'	30.3%	28.8%	40.9%	CLAY LOAM
31.0'-31.4'	50.2%	22.8%	27.0%	SANDY CLAY LOAM
42.5'-43.0'	36.3%	28.0%	35.7%	CLAY LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

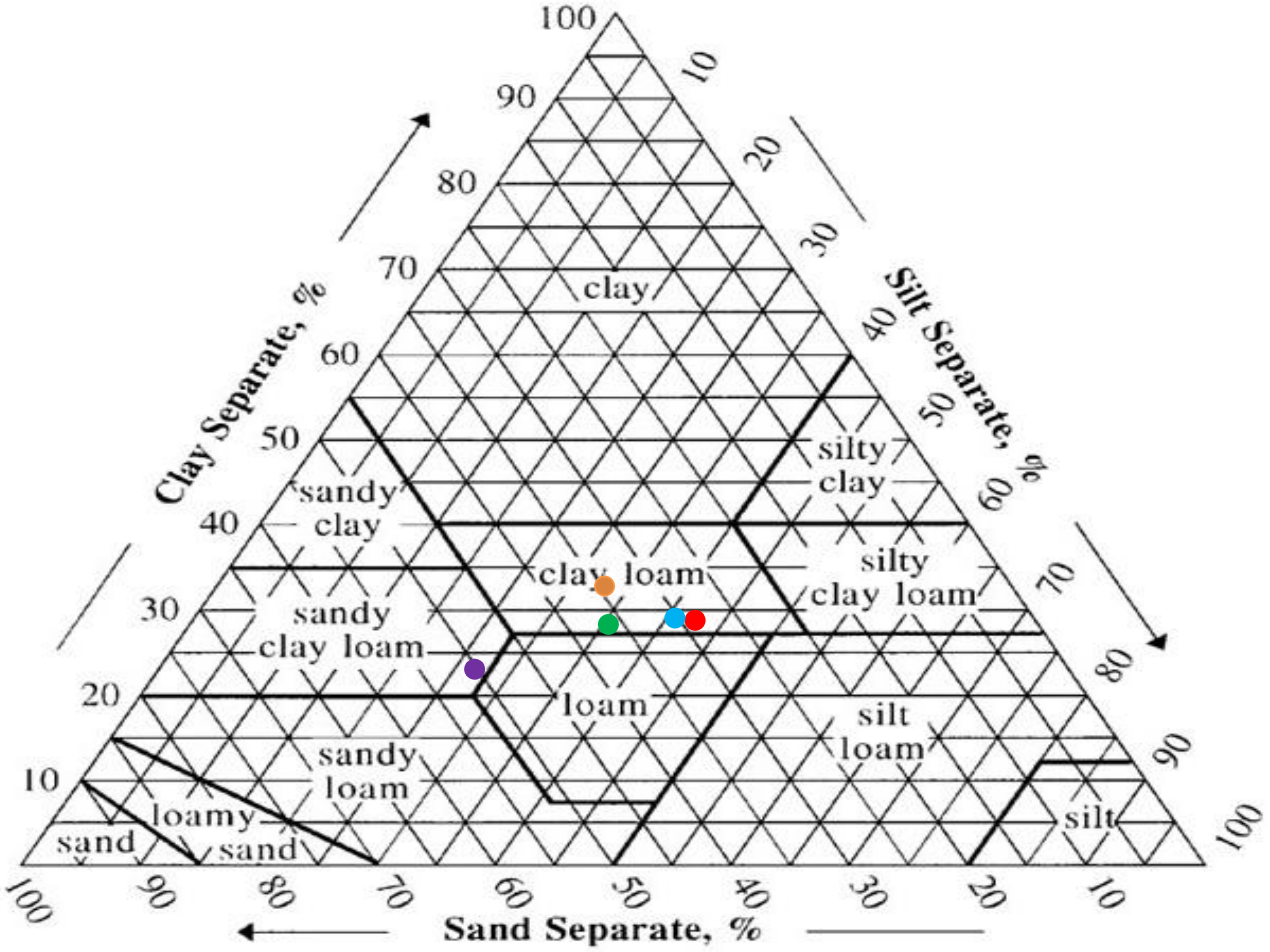
Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-166



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
8.4'-9.2'	26.9%	26.1%	47.1%	LOAM
16.2'-17.0'	48.4%	21.2%	30.4%	LOAM
28.2'-29.0'	18.0%	28.0%	54.0%	SILTY CLAY LOAM
38.2'-39.0'	25.5%	23.5%	51.0%	SILT LOAM
50.5'-51.2'	27.2%	28.3%	44.6%	CLAY LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
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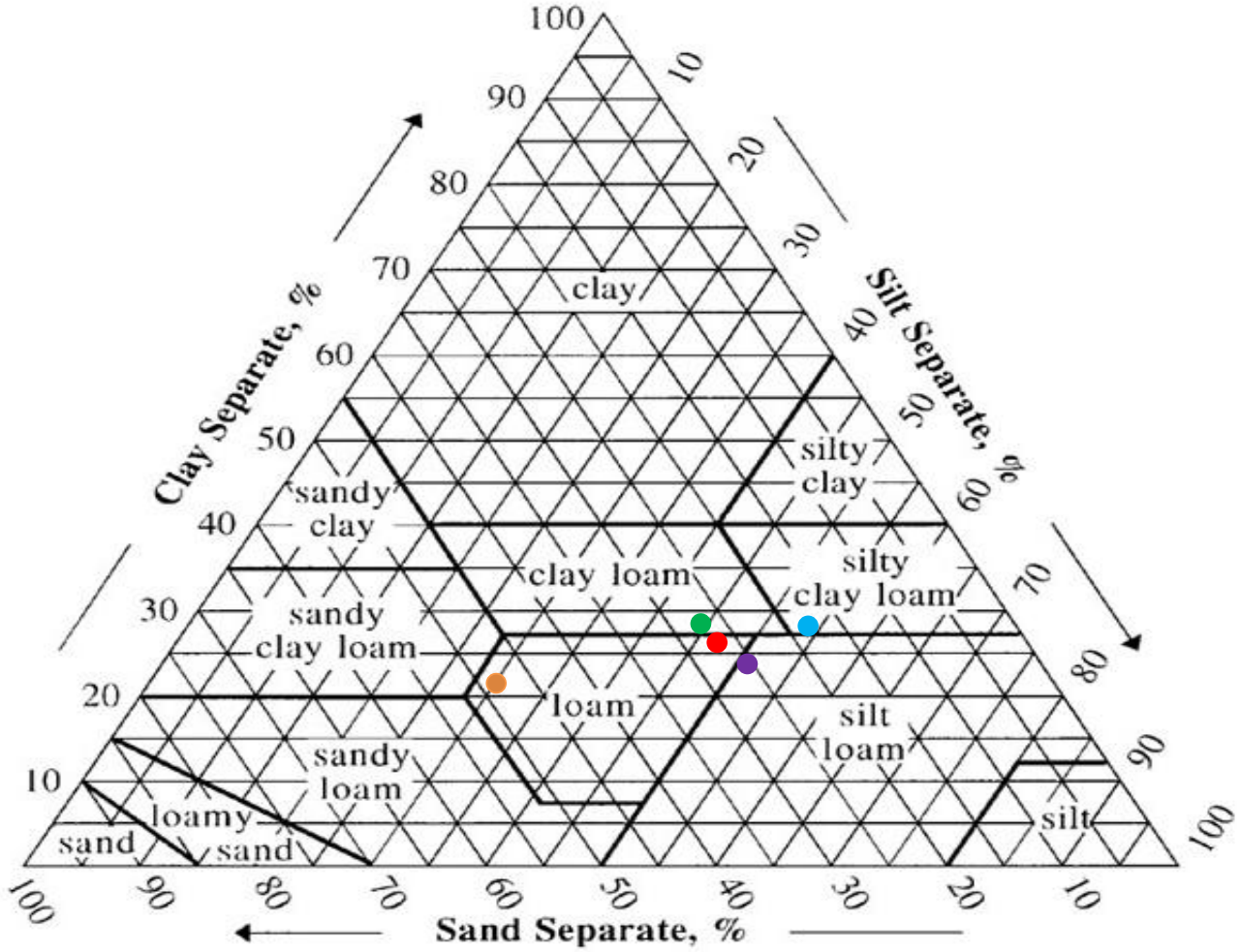
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-167



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
8.4'-8.8'	18.5%	35.0%	46.5%	SILTY CLAY LOAM
14.0'-14.4'	16.5%	35.5%	48.0%	SILTY CLAY LOAM
22.4'-22.8'	40.6%	24.6%	34.8%	LOAM
31.6'-32.0'	65.1%	9.6%	25.3%	SANDY LOAM
39.0'-39.4'	38.4%	28.7%	32.9%	CLAY LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
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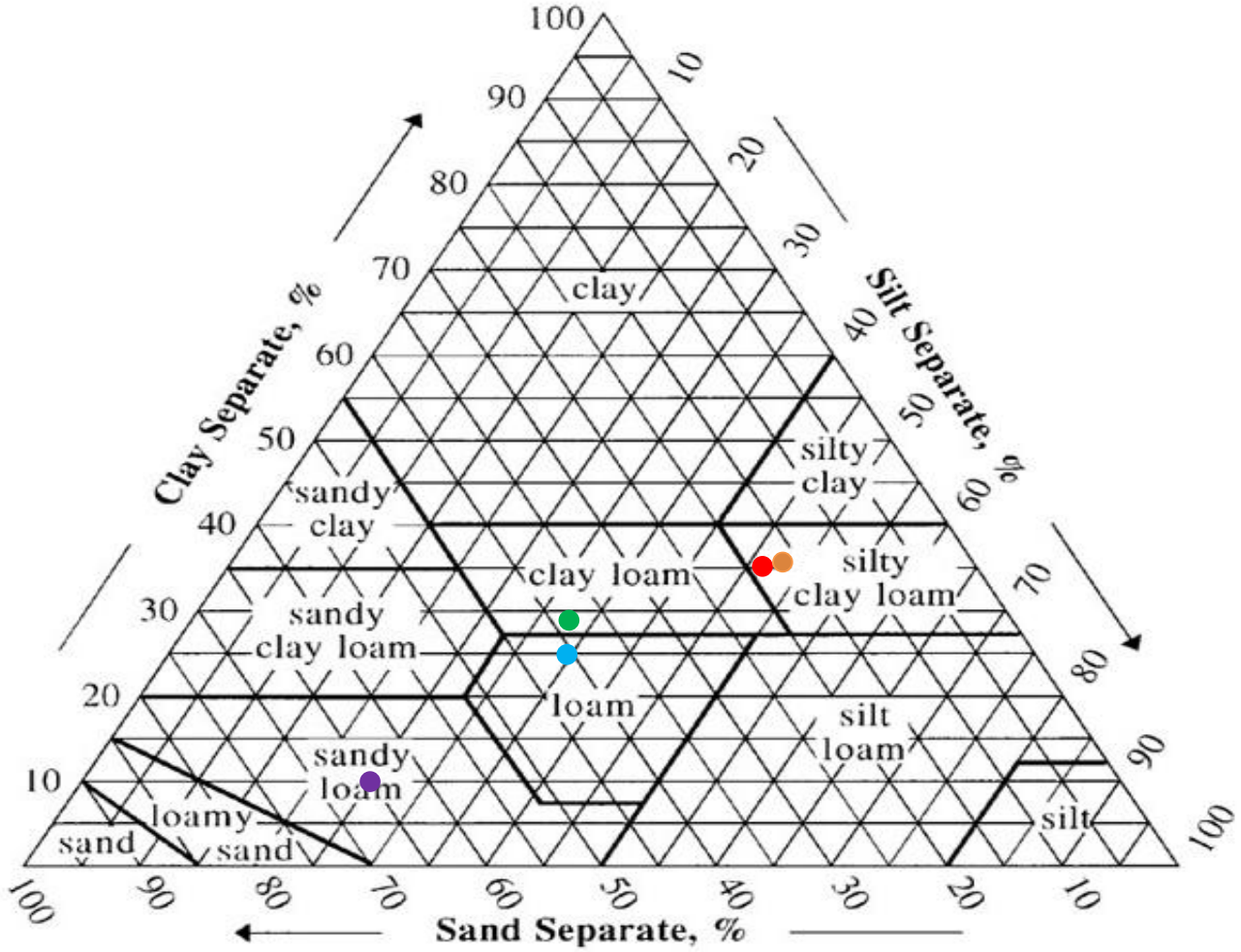
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-168



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
11.2'-11.6'	50.5%	9.3%	40.2%	LOAM
17.0'-17.4'	44.0%	16.0%	40.0%	LOAM
22.4'-22.8'	27.5%	24.0%	48.5%	LOAM
27.0'-27.4'	26.0%	20.5%	53.5%	SILT LOAM
28.6'-29.0'	51.4%	13.5%	35.1%	LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
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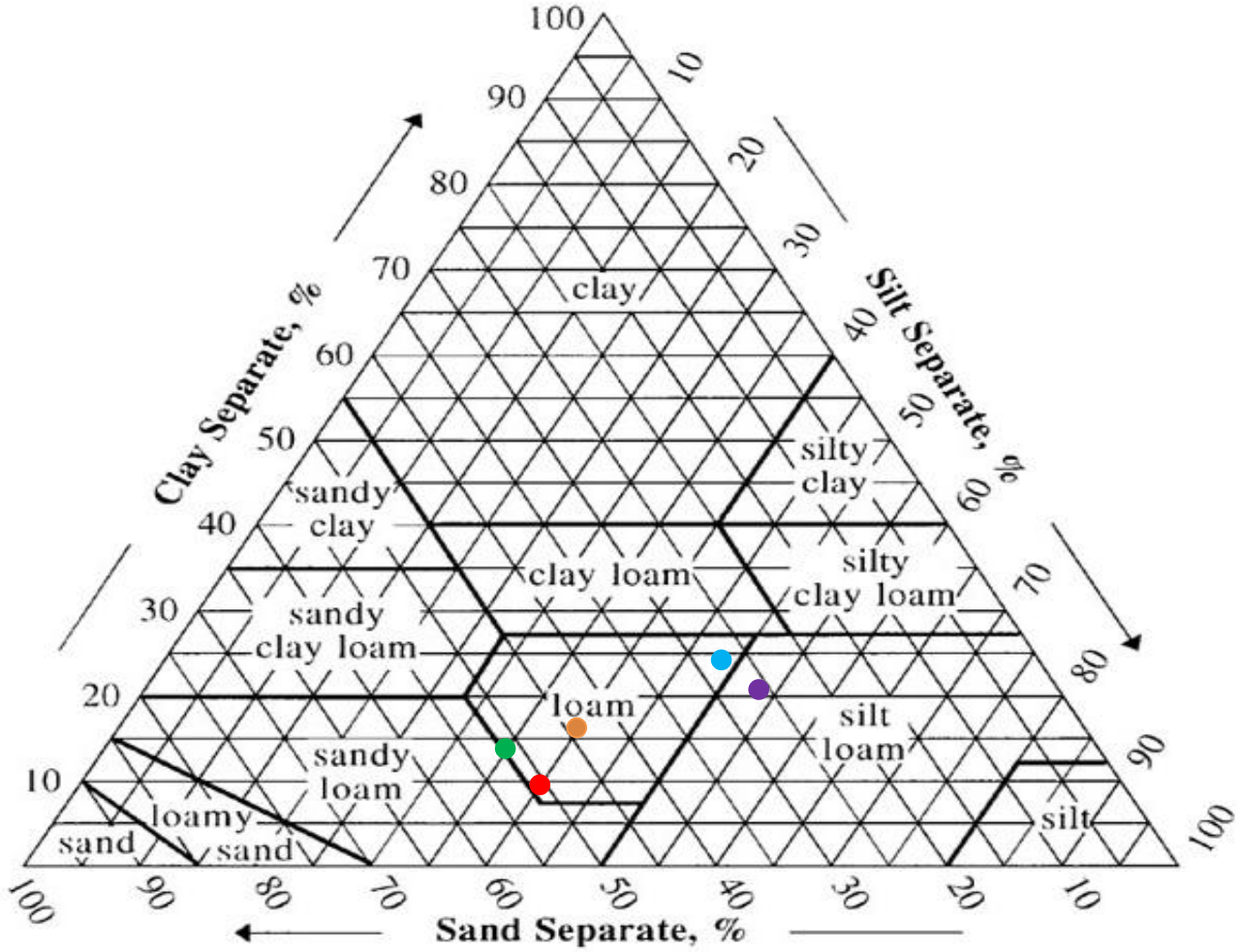
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-169



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
7.8'-8.2'	39.1%	23.0%	37.9%	LOAM
11.8'-12.2'	35.8%	16.7%	47.5%	LOAM
16.6'-17.0'	18.0%	31.0%	51.0%	SILTY CLAY LOAM
20.8'-21.2'	20.5%	31.5%	48.0%	CLAY LOAM
28.6'-29.0'	37.0%	19.7%	43.3%	LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
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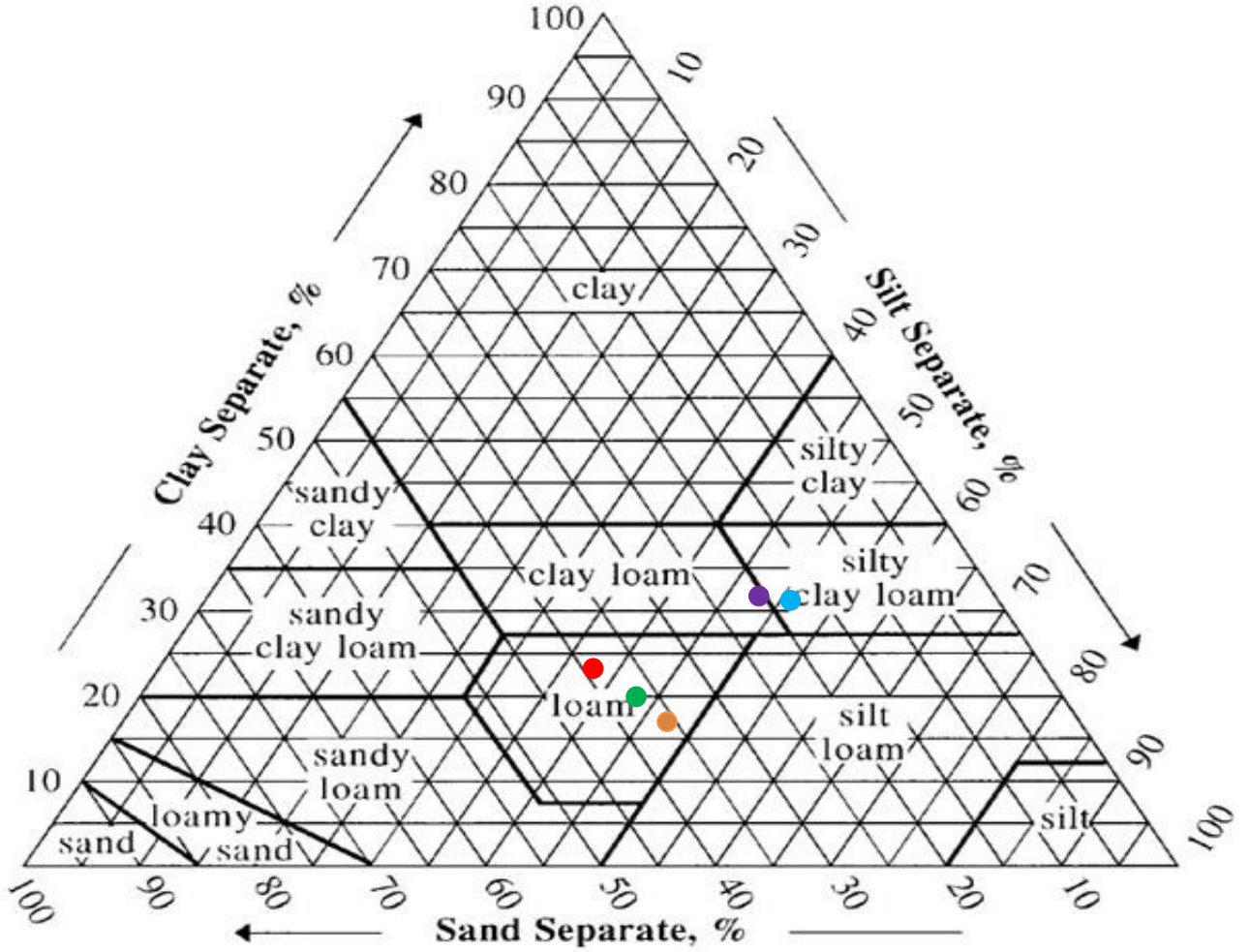
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-170



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
8.6'-9.0'	40.1%	25.7%	34.2%	LOAM
13.2'-13.6'	46.6%	14.3%	39.2%	LOAM
20.0'-20.4'	20.7%	22.4%	56.9%	SILT LOAM
22.4'-22.8'	24.7%	16.1%	59.2%	SILT LOAM
27.4'-27.8'	24.9%	5.0%	70.1%	SILT LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

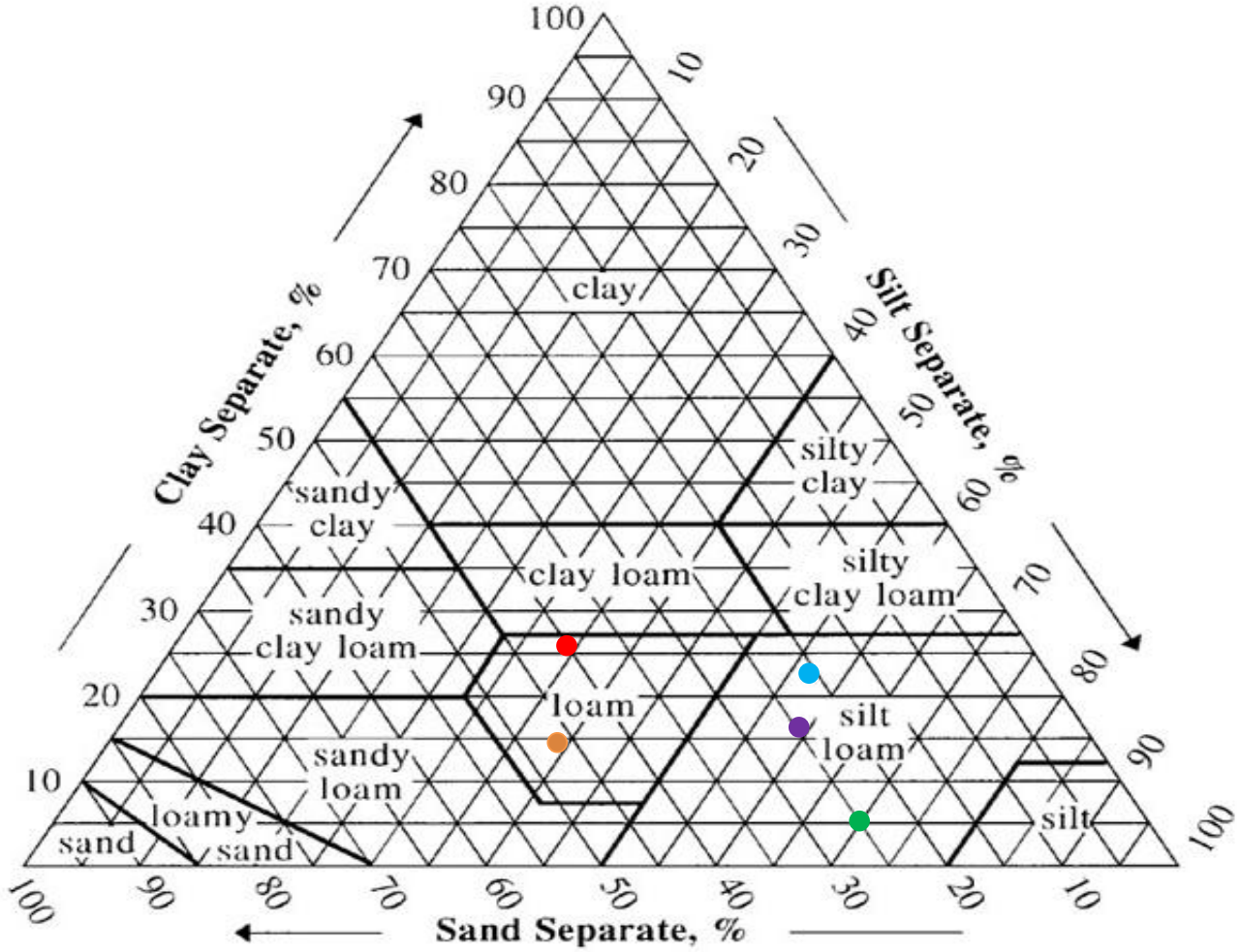
Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-171



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
10.2'-10.6'	56.6%	11.3%	32.1%	SANDY LOAM
13.0'-13.4'	22.6%	29.6%	47.7%	CLAY LOAM
16.0'-16.4'	13.0%	27.0%	60.0%	SILTY CLAY LOAM
23.0'-23.4'	53.3%	10.8%	35.9%	SANDY LOAM
30.8'-31.2'	51.5%	18.3%	30.2%	LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
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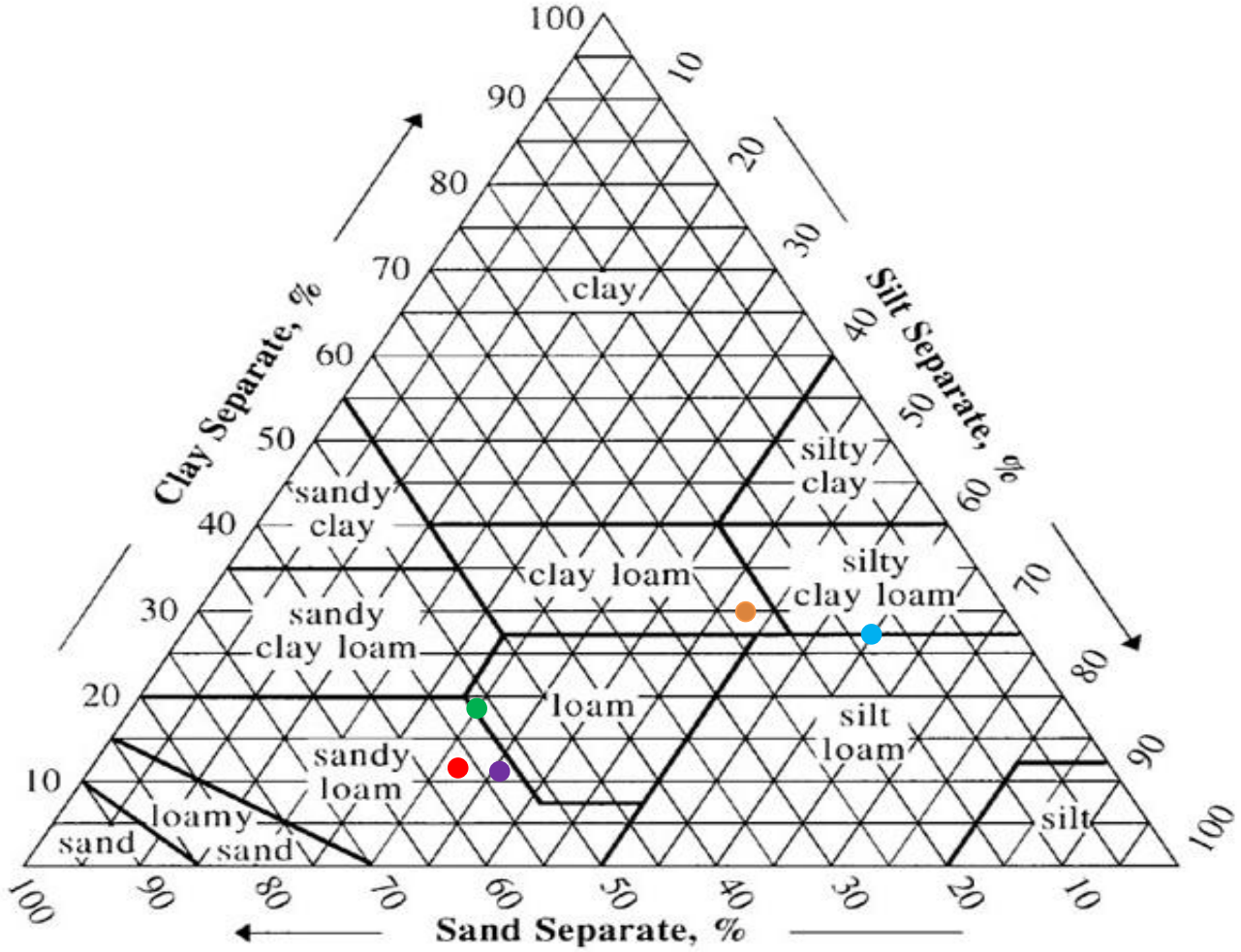
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-172



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
11.0'-11.4'	43.4%	17.4%	39.2%	LOAM
16.0'-16.4'	16.5%	22.5%	61.0%	SILT LOAM
21.4'-21.8'	24.4%	24.5%	51.1%	SILT LOAM
28.0'-28.4'	31.6%	22.6%	45.8%	LOAM
30.8'-31.2'	34.9%	18.1%	47.1%	LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

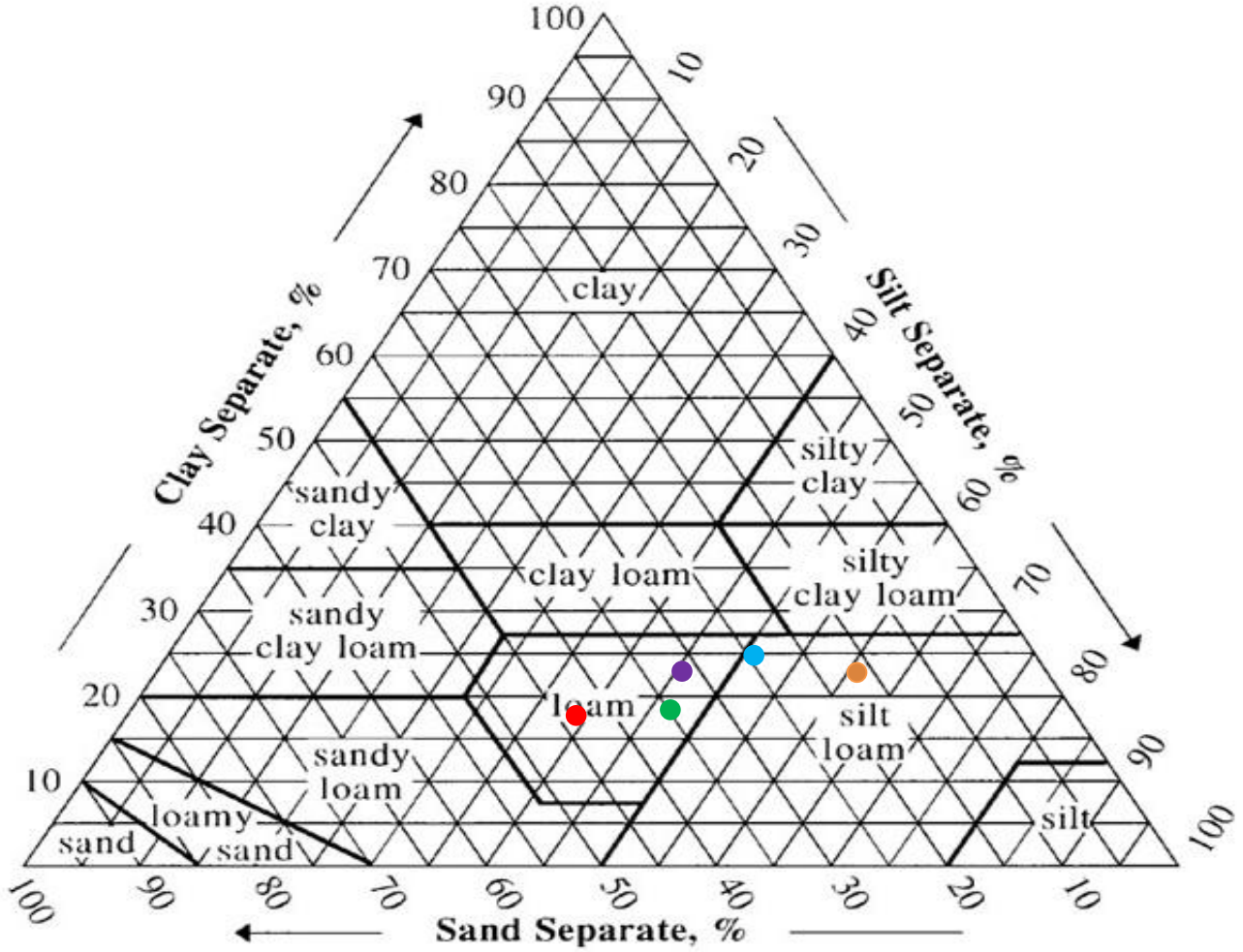
Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-173



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
8.0'-8.4'	39.2%	24.4%	36.4%	LOAM
13.4'-13.8'	42.4%	35.8%	21.8%	CLAY LOAM
22.2'-22.6'	18.1%	33.4%	48.5%	SILTY CLAY LOAM
28.0'-28.4'	27.4%	22.5%	50.1%	SILT LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
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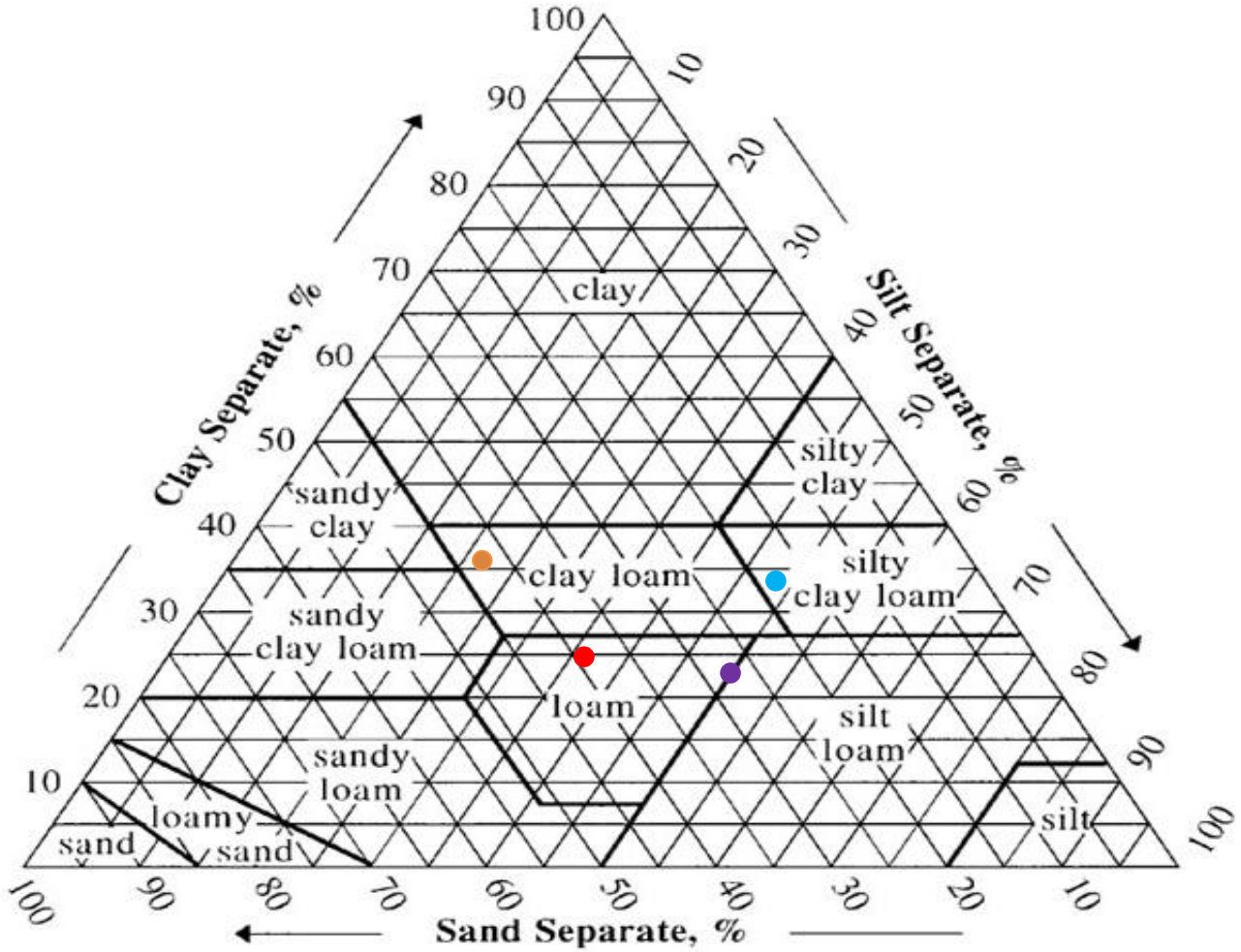
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-174



Sample Depth	% Sand	% Clay	% Silt	USDA Texture
8.2'-8.6'	34.2%	28.1%	37.7%	CLAY LOAM
13.8'-14.2'	69.9%	13.4%	16.6%	SANDY LOAM
18.4'-18.8'	59.3%	24.3%	16.4%	SANDY CLAY LOAM
21.4'-21.8'	32.9%	28.0%	39.2%	CLAY LOAM
22.6'-23.0'	65.1%	16.3%	18.6%	SANDY LOAM

Optional Sand 1	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 2	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 3	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 4	
% Very Coarse	0.0%
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

Optional Sand 5	
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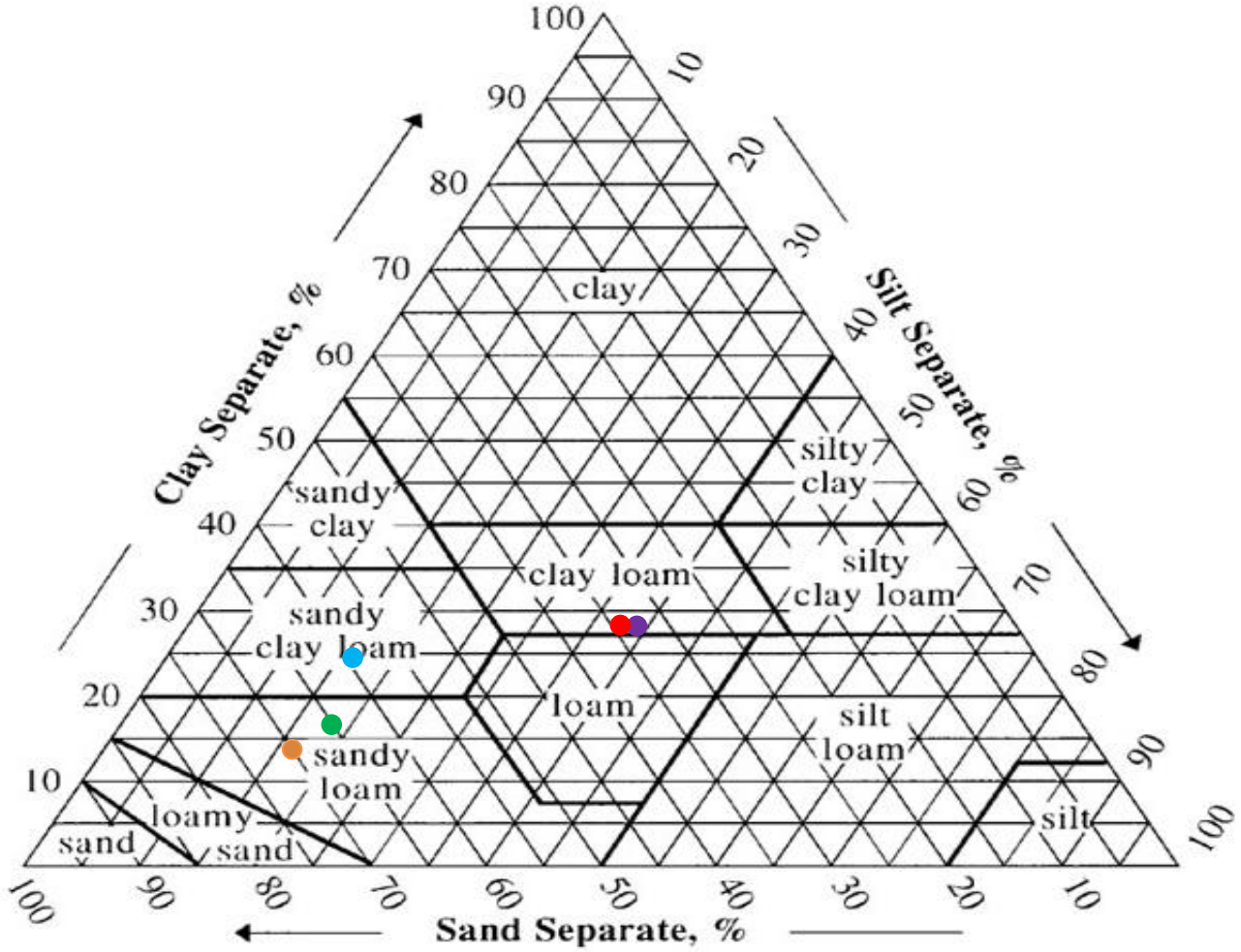
% Coarse	0.0%
% Medium	0.0%
% Fine	0.0%
% Very Fine	0.0%

MW-175



Appendix G

VISL Spreadsheet Calculations

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-161

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
67-66-3	Chloroform	3.7E-01	3.06E-02	2.5E-07	3.0E-04
127-18-4	Tetrachloroethylene	2.7E+02	9.21E+01	8.5E-06	**2.2E+00**
79-01-6	Trichloroethylene	1.0E+02	2.05E+01	8.3E-05	**9.8E+00**

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
2.30E-05	I	9.80E-02	A	
2.60E-07	I	4.00E-02	I	
4.10E-06	I	2.00E-03	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	R_GW	3.10E-06	C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
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Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
75-35-4	Dichloroethylene, 1,1-	1.2E+00	7.74E-01	No IUR	3.7E-03
75-09-2	Methylene Chloride	1.4E+00	1.07E-01	1.1E-09	1.7E-04
127-18-4	Tetrachloroethylene	7.0E+02	2.39E+02	2.2E-05	**5.7E+00**
79-01-6	Trichloroethylene	1.9E+02	3.90E+01	**1.6E-04**	**1.9E+01**

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
		2.00E-01	I	
1.00E-08	I	6.00E-01	I	Mut
2.60E-07	I	4.00E-02	I	
4.10E-06	I	2.00E-03	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
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Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($(ug/m^3)^{-1}$)	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
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Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
67-66-3	Chloroform	3.2E-01	2.65E-02	2.2E-07	2.6E-04
75-09-2	Methylene Chloride	2.3E-01	1.76E-02	1.7E-10	2.8E-05
127-18-4	Tetrachloroethylene	4.8E+01	1.64E+01	1.5E-06	3.9E-01
79-01-6	Trichloroethylene	2.7E+00	5.54E-01	2.2E-06	2.7E-01

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
2.30E-05	I	9.80E-02	A	
1.00E-08	I	6.00E-01	I	Mut
2.60E-07	I	4.00E-02	I	
4.10E-06	I	2.00E-03	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
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Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($(ug/m^3)^{-1}$)	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
										i

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
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Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
78-93-3	Methyl Ethyl Ketone (2-Butanone)	9.7E+01	1.16E-01	No IUR	2.2E-05
75-09-2	Methylene Chloride	3.1E-01	2.37E-02	2.3E-10	3.8E-05
127-18-4	Tetrachloroethylene	5.1E-01	1.74E-01	1.6E-08	4.2E-03
79-01-6	Trichloroethylene	7.6E-01	1.56E-01	6.3E-07	7.5E-02

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
		5.00E+00	I	
1.00E-08	I	6.00E-01	I	Mut
2.60E-07	I	4.00E-02	I	
4.10E-06	I	2.00E-03	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
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Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
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Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
75-09-2	Methylene Chloride	3.4E-01	2.60E-02	2.6E-10	4.1E-05
127-18-4	Tetrachloroethylene	7.6E+00	2.59E+00	2.4E-07	6.2E-02
79-01-6	Trichloroethylene	1.7E+01	3.49E+00	1.4E-05	**1.7E+00**

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
1.00E-08	I	6.00E-01	I	Mut
2.60E-07	I	4.00E-02	I	
4.10E-06	I	2.00E-03	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	R_GW	3.10E-06	C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
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Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
75-27-4	Bromodichloromethane	5.0E-01	2.19E-02	2.9E-07	No RfC
67-66-3	Chloroform	2.4E+00	1.99E-01	1.6E-06	1.9E-03
127-18-4	Tetrachloroethylene	8.5E-01	2.90E-01	2.7E-08	6.9E-03
79-01-6	Trichloroethylene	1.0E+00	2.05E-01	8.3E-07	9.8E-02

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
3.70E-05	CA			
2.30E-05	I	9.80E-02	A	
2.60E-07	I	4.00E-02	I	
4.10E-06	I	2.00E-03	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-166

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($(ug/m^3)^{-1}$)	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-167

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
75-27-4	Bromodichloromethane	8.4E-01	3.68E-02	4.8E-07	No RfC
67-66-3	Chloroform	3.0E+00	2.48E-01	2.0E-06	2.4E-03
127-18-4	Tetrachloroethylene	8.6E+00	2.93E+00	2.7E-07	7.0E-02
79-01-6	Trichloroethylene	2.6E+00	5.34E-01	2.2E-06	2.6E-01

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
3.70E-05	CA			
2.30E-05	I	9.80E-02	A	
2.60E-07	I	4.00E-02	I	
4.10E-06	I	2.00E-03	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-167

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($(ug/m^3)^{-1}$)	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-169

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
75-09-2	Methylene Chloride	2.2E-01	1.68E-02	1.7E-10	2.7E-05

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
1.00E-08	I	6.00E-01	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	mIURTCE_R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	IURTCE_R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
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Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
75-27-4	Bromodichloromethane	1.7E-01	7.45E-03	9.8E-08	No RfC
67-66-3	Chloroform	6.2E-01	5.13E-02	4.2E-07	5.0E-04

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
3.70E-05	CA			i
2.30E-05	I	9.80E-02	A	

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc R GW	26	ATnc C GW	25	Atnc GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF R GW	350	EF C GW	250	EF GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw R GW	0.001	AFgw C GW	0.001	AFgw GW	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss R GW	0.03	AFss C GW	0.03	AFss GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
m	IURTCE R GW	1.00E-06	IURTCE C GW	0.00E+00	mIURTCE GW	1.00E-06
	IURTCE R GW	3.10E-06	IURTCE C GW	4.10E-06	IURTCE GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-171

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
67-64-1	Acetone	1.4E+01	1.11E-02	No IUR	3.4E-07			3.10E+01	A	
107-13-1	Acrylonitrile	7.2E-01	2.02E-03	4.9E-08	9.7E-04	6.80E-05	I	2.00E-03	I	
71-43-2	Benzene	1.4E+00	1.68E-01	4.7E-07	5.4E-03	7.80E-06	I	3.00E-02	I	
75-15-0	Carbon Disulfide	3.1E-01	1.08E-01	No IUR	1.5E-04			7.00E-01	I	
591-78-6	Hexanone, 2-	5.8E-01	9.86E-04	No IUR	3.2E-05			3.00E-02	I	
78-93-3	Methyl Ethyl Ketone (2-Butanone)	5.7E+01	6.83E-02	No IUR	1.3E-05			5.00E+00	I	
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	1.6E+00	4.15E-03	No IUR	1.3E-06			3.00E+00	I	
100-42-5	Styrene	9.8E-02	4.84E-03	No IUR	4.6E-06			1.00E+00	I	
127-18-4	Tetrachloroethylene	2.4E+00	8.18E-01	7.6E-08	2.0E-02	2.60E-07	I	4.00E-02	I	
108-88-3	Toluene	1.1E+00	1.45E-01	No IUR	2.8E-05			5.00E+00	I	
79-01-6	Trichloroethylene	3.6E-01	7.39E-02	3.0E-07	3.5E-02	4.10E-06	I	2.00E-03	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc R GW	26	ATnc C GW	25	Atnc GW	26
Exposure duration	(yrs)	ED R GW	26	ED C GW	25	ED GW	26
Exposure frequency	(days/yr)	EF R GW	350	EF C GW	250	EF GW	350
Exposure time	(hr/day)	ET R GW	24	ET C GW	8	ET GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw R GW	0.001	AFgw C GW	0.001	AFgw GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss R GW	0.03	AFss C GW	0.03	AFss GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Trichloroethylene	mIURTCE_R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
	IURTCE R GW	3.10E-06	IURTCE C GW	4.10E-06	IURTCE GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:
I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-171

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR (ug/m^3)$^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i

S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-172

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
67-66-3	Chloroform	7.3E-01	6.04E-02	5.0E-07	5.9E-04

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
2.30E-05	I	9.80E-02	A	

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
	mIURTCE_R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
	IURTCE_R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-174

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
75-27-4	Bromodichloromethane	3.1E-01	1.36E-02	1.8E-07	No RfC
67-66-3	Chloroform	1.7E+00	1.41E-01	1.2E-06	1.4E-03
127-18-4	Tetrachloroethylene	5.6E+00	1.91E+00	1.8E-07	4.6E-02
79-01-6	Trichloroethylene	8.9E-01	1.83E-01	7.4E-07	8.8E-02

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator
3.70E-05	CA			
2.30E-05	I	9.80E-02	A	
2.60E-07	I	4.00E-02	I	
4.10E-06	I	2.00E-03	I	Mut

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-174

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($(ug/m^3)^{-1}$)	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

OSWER VAPOR INTRUSION ASSESSMENT
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.4, June 2015 RSLs
MW-175

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-04	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (^{o}C)	Tgw	11.7	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration Cgw (ug/L)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
75-27-4	Bromodichloromethane	4.2E-01	1.84E-02	2.4E-07	No RfC
67-66-3	Chloroform	1.9E+00	1.57E-01	1.3E-06	1.5E-03
124-48-1	Dibromochloromethane	1.5E-01	2.87E-03	2.8E-08	No RfC

Inhalation Unit Risk IUR ($ug/m^3)^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
3.70E-05	CA			
2.30E-05	I	9.80E-02	A	
2.70E-05	CA			

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	Atnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
mIURTCE	R_GW	1.00E-06	C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE	R_GW	3.10E-06	C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

Climate York - Pennsylvania

°C | °F

	Jan	Feb	Mar	Apr	May	Jun
Average high in °F:	39	43	53	65	75	83
Average low in °F:	21	23	31	39	49	58
Av. precipitation in inch:	3.43	2.76	3.66	3.5	4.25	4.29
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-

	Jul	Aug	Sep	Oct	Nov	Dec
Average high in °F:	87	85	78	67	54	43
Average low in °F:	63	61	54	42	34	26
Av. precipitation in inch:	3.74	3.35	4.09	3.15	3.46	3.23
Days with precipitation:	-	-	-	-	-	-
Hours of sunshine:	-	-	-	-	-	-

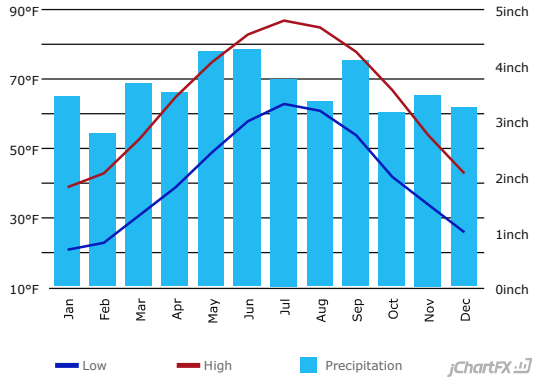
Climate data for York, PA - 17364 - 1961-1990 normals - weather

Jan: January, Feb: February, Mar: March, Apr: April, May: May, Jun: June, Jul: July, Aug: August, Sep: September, Oct: October, Nov: November, Dec: December

York weather averages

Annual high temperature:	64.3°F
Annual low temperature:	41.8°F
Average temperature:	53.05°F
Average annual precipitation - rainfall:	42.91 inch
Days per year with precipitation - rainfall:	-
Annual hours of sunshine:	-
Av. annual snowfall:	-

York Climate Graph - Pennsylvania Climate Chart



Climograph of York on your website