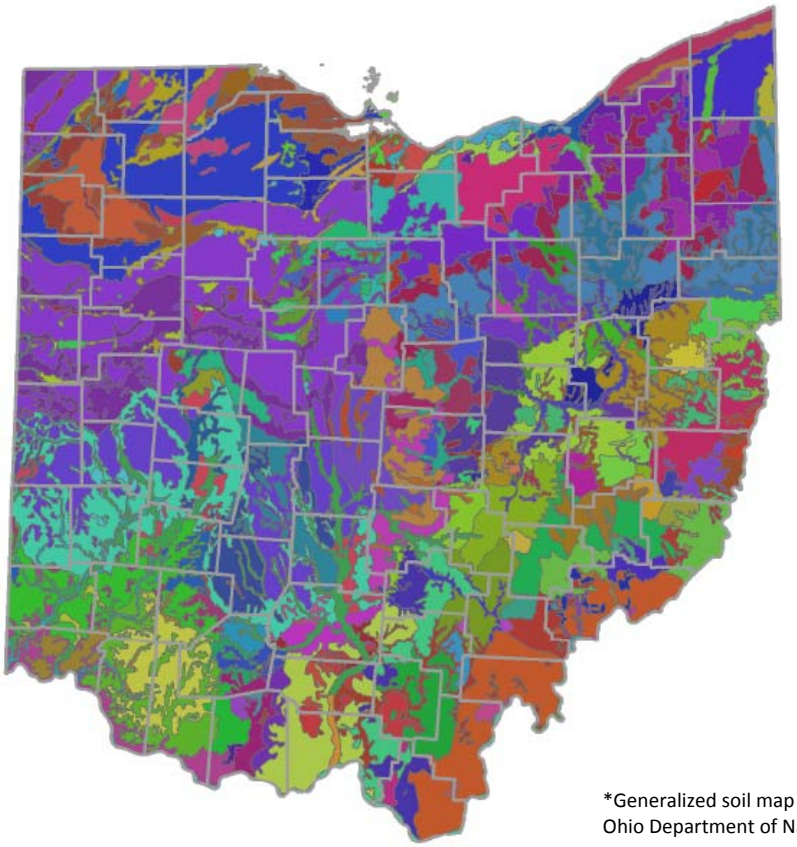
Evaluation of Background Metal Soil Concentrations in Cuyahoga County – Cleveland Area

Summary Report



*Generalized soil map for the State of Ohio, Ohio Department of Natural Resources

Division of Environmental Response and Revitalization
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Disclaimer

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The summary report serves as a tool in the aide of investigation and evaluation of environmentally impacted sites in Ohio. It is not meant as a regulatory document and any statements provided herein are not legally binding.

ACRONYMS

amsl	Above mean sea level
BCMP	Brecksville Cleveland Metroparks
bgs	Below ground surface
BHME	Bratenahl Mather Estate
BSR	Brookside Reservation, Cleveland Metropark (Cleveland)
CHFH	Cleveland Heights Forest Hills Park
C_v	Coefficient of variation
DERR	Division of Environmental Response and Revitalization
ECR	Euclid Creek Reservation, Cleveland Metropark (Euclid)
ft	Feet
FP-XRF	Field Portable X-ray Fluorescence
GOF	Goodness-of-fit
GPR	Garfield Park Reservation, Cleveland Metropark (Garfield Heights)
HSP	Holy Spirit Cemetery (Parma)
KM	Kaplan-Meier
mg/kg	Milligram per kilogram
n_b	Number of background observations
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation Recovery Act
RFP	Rockefeller Park (Cleveland)
RRN	Rocky River Reservation North (Lakewood)
RRS	Rocky River Reservation South (Lakewood)
SAP	Sampling and Analysis Plan
S_b	Standard deviation
SIFU	Site Investigation Field Unit
STG	St. Gregory Parish (Lakewood)
STN	St. Nicholas Parish (Cleveland)
TAL	Target Analyte List
TBA	Targeted Brownfields Assessment
TOC	Total Organic Carbon
UCL	Upper confidence level
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UPL	Upper prediction limit
UTL	Upper tolerance limit
VAP	Voluntary Action Program
VAP UL	Voluntary Action Program Upper Limit
WCR	West Creek Reservation, Cleveland Metropark (Parma)

EXECUTIVE SUMMARY

Ohio EPA Division of Environmental Response and Revitalization (DERR) sampled and analyzed surface soils at 10 Cleveland-area properties for background concentrations of Resource Conservation and Recovery Act (RCRA) metals (As, Ba, Cd, Cr, Pb, Hg, Se and Ag). Soil sample locations met the location restriction requirements of OAC 3745-300-07(H)(1)(b).

A reconnaissance was performed whereby one preliminary soil boring was installed at each property. The reconnaissance evaluated the shallow soil horizon (less than four feet deep) to ensure that areas of the property where samples were collected met location restrictions. Select soil samples from the preliminary borings were screened for metals concentrations using Ohio EPA's mobile laboratory field-portable X-ray fluorescence (FP-XRF) analyzer. Screening results were used to further evaluate the suitability of the sampling locations and depth intervals.

Ten soil samples per targeted soil horizon at each property were collected to provide a statistically representative data set as described by OAC 3745-300-07(H)(1)(d)(i). Ohio EPA collected all surficial soil samples between the ground surface and depth of two feet using a hand auger. Sample locations were within a 15-foot radius of the preliminary soil boring location. Upon sample collection completion all samples were sent to a fixed-base, VAP-certified laboratory for analyses of each soil sample.

Statistical evaluations were performed to determine the representative background concentrations. Additional metal data collected from a targeted brownfield assessment titled "Background Soil Determination for Three Locations in Cuyahoga County, Ohio" were included with the larger data set collected during this study. With the inclusion of these three additional locations, a total of 13 locations (and 151 total data points) were used in the statistical determination of Cuyahoga County background values. Data collected from all 13 property locations were incorporated into a single data set.

Background soil concentrations were calculated in accordance with the VAP rules effective April 23, 2012, found in OAC 3745-300-07(H)(1)(d)(ii). All statistical analyses, including outlier tests, were run using ProUCL version 4.1. A summary of the background determination results for Cuyahoga County are provided in tablular format as part of this report. Seven of the eight original RCRA metals are presented, however silver was removed from statistical analyses due to the high number of nondetects. Therefore, silver was determined not to be a significant contributor to elevated background concentrations across the Cuyahoga County region. Representative background soil concentrations of metals calculated for Cuyahoga County are as follows:

Arsenic	24.0 mg/kg
Barium	98.9 mg/kg
Cadmium	0.834 mg/kg
Chromium	21.1 mg/kg
Lead	51.7 mg/kg
Mercury	0.097 mg/kg
Selenium	0.943 mg/kg

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1.0 INTRODUCTION

Evaluation of metals in soils for the assessment and remediation of brownfield sites often requires that "background" concentrations be determined. Background metal concentrations are typically attributed to the natural composition of soil and not from the impact of hazardous substances or petroleum, hazardous or solid wastes, or wastewater. Background concentrations are assumed to be largely dependent on soil texture and composition (i.e., the percentages of sand, silt and clay; the specific mineral components present; and the naturally occurring organic matter present) and also the types of geologic material from which the soil has been derived (e.g., sand and gravel outwash, shale bedrock, till, etc.).

Background metal concentrations in urban soils are challenging to characterize. Urban soils often have been subjected to decades of various unregulated anthropogenic activities that can elevate background metal concentrations. For example aerial deposition of particulate matter from fuel combustion or industrial activities in urban areas may increase the concentrations of lead, arsenic, zinc and certain other metals in soils. Construction activities, demolition activities, and surface water runoff from roofs and paved areas may also increase soil metal concentrations.

This investigation evaluates background metal concentrations in urban surface soils to provide a dataset that may be used as a reference to help satisfy the requirements of, in part, Ohio Voluntary Action Program (VAP) rules (OAC Chapter 3745-300). Specifically, this summary report applies to Cuyahoga County and Cleveland-area brownfield properties being assessed and remediated under the Ohio VAP. For the purposes of this investigation, "Cuyahoga County – Cleveland area urban soils" means surficial soils within the City of Cleveland or adjacent municipalities, including suburban areas and metro parks within urban or suburban areas.

2.0 SCOPE

Under the direction of Ohio EPA – VAP Central Office, the Ohio EPA Site Investigation Field Unit (SIFU) sampled and analyzed surface soils at 10 Cleveland-area properties for background concentrations of Resource Conservation and Recovery Act (RCRA) metals (As, Ba, Cd, Cr, Pb, Hg, Se and Ag). The property locations are shown on Figure 1, and Tables 1A and 1B provide additional location information and property characteristics including setting (land use), topography and general soil data. The properties were selected based on the following criteria:

- The ability to obtain access from local governments or private property owners.

- Compliance with the VAP location restrictions for background soil sampling investigations [OAC 3745-300-07(H)(1)(b)].

- Design of an investigation that provided representative data for the major soil mapping units within Cuyahoga County as described on the "General Soil Map, Cuyahoga County, Ohio" of the *Soil Survey of Cuyahoga County, Ohio* (USDA Soil Conservation Service) to the extent possible given limitations imposed by the first two criteria.

In addition, at each property one representative sample of the targeted soil horizon was submitted to a contract soil laboratory for USCS and USDA soil texture classification based on sieve, hydrometer and Atterberg limits analyses.

Prior to performing sampling activities, SIFU performed a reconnaissance and collected one preliminary soil boring at each property. The objectives of the reconnaissance were to evaluate the shallow (less than four feet deep) soil horizons present and select a target sampling horizon, ensure that areas of the property where samples were collected met location restrictions, and select a general sampling area. Each preliminary soil boring (one per sampling area) was field logged in accordance with the Unified Soil Classification System (USCS) and the USDA soil classification system to evaluate the soil types present and screen the sampling location for fill or waste materials. In addition, selected soil samples from the preliminary borings were screened for metals concentrations using Ohio EPA's mobile laboratory field-portable X-ray fluorescence (FP-XRF) analyzer. The screening results were used to further evaluate the suitability of the sampling locations and depth intervals for background data.

Data quality objectives (DQOs) for this project included the following:

1. Soil samples from Cleveland-area urban properties meeting the location restriction requirements of OAC 3745-300-07(H)(1)(b)

2. USCS field classification of each preliminary soil boring per ASTM D2488, Standard Practice for Description and Identification of Soils (Visual–Manual Procedure)

3. USDA field classification of each preliminary soil boring using "texture-by-feel" analysis (Presley and Thien, 2008)

4. FP-XRF analyzer screening of each preliminary soil boring for selected metals (As, Cr, Cu, Pb, Mn, Mo, Ni, Sr and Zn) meeting the requirements of SW-846 Method 6200

5. Analysis of 10 soil samples per targeted soil horizon at each property to provide a statistically representative data set as described by OAC 3745-300-07(H)(1)(d)(i)

6. Fixed-base, VAP-certified laboratory analyses of each soil sample for RCRA metals (As, Ba, Cd, Cr, Pb, Hg, Se and Ag) meeting the requirements of Ohio EPA's Voluntary Action Program

7. USCS and USDA classification and textural composition of one selected soil sample per property based on soil laboratory testing in accordance with ASTM D422, Standard Test Method for Particle Size Analysis of Soils (modified to provide USDA soil particle size classes); ASTM D4318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; and ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

3.0 CLEVELAND-AREA SOIL TYPES

Figure 2 ("General Soil Map, Cuyahoga County, Ohio" from the Soil Survey of Cuyahoga County, Ohio) shows the general soil mapping units present in the Cleveland-area (USDA Soil Conservation Service, 1980). These include the following:

1. Deep soils on uplands and the higher parts of the lake plains
2. Moderately deep soils on uplands and lake plains
3. Deep soils on beach ridges, outwash terraces and lake plains
4. Deep soils on flood plains and low stream terraces
5. Urban land soils (level and gently sloping areas that are predominantly covered by buildings, pavement and other structures)

In summary, properties were selected to incorporate as many of these general soil mapping units as possible to provide a background metal data set that is representative with respect to the soils present in the Cleveland-area. Three properties underlain by "urban land soil" (Table 1B) were selected for sampling, as metal concentrations in these soils were the most representative of long-term background exposure to heavily urban-characteristic activities.

4.0 PROPERTY USE AND REGULATORY HISTORY

Properties evaluated for soil sampling included public parks and private properties (e.g., cemeteries or church properties) that were not underlain by engineered or structural fill [OAC 3745-300-01(A)(43)] or industrial fill [OAC 3745-300-01(A)(72)] and where industrial or waste disposal activities have not occurred (Tables 1A and 1B and Figure 1). Soil types where disposal has occurred must be excluded from background determinations by rule. The reconnaissance effort conducted prior to the actual sampling event prevented sampling of these prohibited soil types.

Properties underlain by native fill may be sampled [OAC 3745-300-01(A)(83)]. "Native fill" is soil material derived from the property and transferred from one area of the property to another area in such a manner that the original soil structure and physical properties may be altered from the initial pre-excavation conditions, but the chemical and physical properties remain consistent with other undisturbed native soils at the property. Native fill was encountered and sampled at two locations (St. Nicholas Church and St. Gregory Church).

5.0 SUMMARY OF SAMPLING STRATEGY AND FIELD ACTIVITIES

5.1 Property Reconnaissance and Preliminary Soil Boring Evaluation

SIFU performed a property reconnaissance to evaluate potential sampling areas and inspect the property soils. The results of the reconnaissance were used to select the general area where samples were ultimately collected as well as determine the soil horizon sampled for chemical (metals) and soil texture analysis (classification).

Prior to each property reconnaissance, a review of property soil descriptions provided by the Soil Survey of Cuyahoga County, Ohio was conducted. During site reconnaissance, field staff evaluated sampling location restrictions based on OAC 3745-300-07(H)(1)(b), which include:

(i) Areas underlain by engineered fill, structural fill or industrial fill
(ii) Areas where the management, treatment, handling, storage or disposal of hazardous substances or petroleum, solid or hazardous wastes, waste waters or material handling areas are known or are suspected to have occurred
(iii) Areas within three feet of a roadway
(iv) Parking lots or areas surrounding parking lots or other paved areas
(v) Railroad tracks or railway areas or other areas affected by their runoff
(vi) Areas of concentrated air pollution depositions or areas affected by their runoff
(vii) Storm drains or ditches presently or historically receiving industrial or urban runoff
(viii) Spill areas

The sampling locations were evaluated based on visual inspection of the property, interviews with the property owners or representatives, review of Sanborn Maps and other historical records, and sampling and inspection of property soils.

A hand auger was used to install a preliminary soil boring at each proposed sampling area to evaluate the upper two (2) to four (4) feet of surficial soils, which were field-classified in accordance the USCS (ASTM D2488) and the USDA soil classification system (Presley and Thien, 2008). Soil boring logs are included in Appendix A.

Ohio EPA analyzed selected soil samples from each preliminary soil boring for selected metals (As, Cr, Cu, Pb, Mn, Mo, Ni, Sr and Zn) using the FP – XRF analyzer in accordance with SW-846 Method 6200. The results were used to evaluate the influence of anthropogenic activities on the soil metal concentrations. Based on the screening results, the soil metal concentrations did not appear to be elevated by anthropogenic activities with the exception of lead (> 50 and < 230 mg/kg) at two urban properties (St. Nicholas Church and St. Gregory Church) and four parks (Brookside Reservation, Garfield Park

Reservation, Rockefeller Park, and West Creek Reservation). The elevated lead concentrations were generally detected in the upper 0.5 to 1.0 ft. of soil.

The FP-XRF results also were used to examine the vertical distributions of metal concentrations in the soil profile at each preliminary soil boring location. The results appear to indicate that some metal concentrations tend to increase with depth (e.g., arsenic) and other some metals tend to be concentrated near the surface of the soil horizon (e.g., lead). The trends were not tested for statistical significance. However, based on these results, a sampling interval of ground surface to two feet deep (or until refusal on shallow bedrock) was selected for all analytical samples to avoid introducing additional variation in the analytical data set due to potential variability associated with an inconsistent sampling depth interval.

The XP-XRF analytical results are considered 'screening' level data quality under the current VAP rules. As such, these results cannot be used as part of a background demonstration where comparison to soil applicable standards is required. However, the results are provided in Appendix B for general reference purposes.

5.2 Soil Sampling and Analysis

Based on the results of the preliminary field investigation, the team selected 10 soil sampling localities (properties) to collect soil samples for RCRA metal laboratory analysis. At each locality, Ohio EPA collected 10 surficial soil samples between the ground surface and depth of two feet using a hand auger. At a few locations auger refusal was encountered on shallow bedrock or cobbles before reaching the target depth of two feet, and the sampling interval was slightly smaller (e.g., ground surface to 1.5 feet), but was never less than one foot.

The sample locations were within a 15 ft. radius of the preliminary soil boring location (the sampling area circular with an approximate diameter of 30 ft. with the preliminary soil boring location in the center). Cleveland Metroparks required Ohio EPA to collect the geotechnical and 10 analytical samples within an area approximately 30 feet in diameter to minimize disturbance to native plant species. The Ohio EPA SIFU sampling team used this approach at all sampling localities for a consistent investigative approach across all properties sampled.

The first of the 10 samples at each locality (e.g., BSR-1, GPR-1, HSP-1, etc.) was collected adjacent to the preliminary soil boring location, and included analytical sample for RCRA metals and a soil sample for geotechnical analysis. The other nine analytical samples were collected at random locations within a radius of 15 ft. of the preliminary soil boring. Upon completion, each sampling location was backfilled with native soil.

Each soil sample was homogenized in a stainless steel mixing pan and split into three subsamples. One subsample was preserved on ice at 4° C and submitted to Ohio EPA's contract laboratory for RCRA metals analysis and the other two subsamples were retained

for future reference if required. Two ounces of soil were collected for each RCRA metal sample and four ounces of soil were collected for each of the retained samples. Approximately two (2) pounds of soil were collected for laboratory USCS and USDA classification and soil texture composition based on sieve, hydrometer, and Atterberg limits testing.

5.3 Field Sampling Equipment Decontamination

Hand augers, sampling spoons, mixing bowls, and other field equipment used to sample soils were decontaminated between properties by washing with a solution of non-phosphate detergent and potable water and rinsing with deionized water.

5.4 Laboratory Analyses

Ohio EPA's contract laboratory (TestAmerica Laboratories, Inc.) analyzed 100 soil samples (10 per site) for RCRA metals (As, Ba, Cd, Cr, Pb, Hg, Se and Ag) using Inductively Coupled Plasma (ICP) and/or Graphite Furnace Atomic Absorption Spectrophotometry (GFAAS) via U.S. EPA Method 6010 and Method 7471. Geotechnics, subcontracted by Test America, Inc. performed the USCS and USDA classification (see Table 2 and Appendix C) and soil texture composition in accordance with ASTM D422, Standard Test Method for Particle Size Analysis of Soils (modified to provide USDA soil particle size classes); ASTM D4318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; and ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). Data received from TestAmerica Laboratories are considered certified under the Ohio EPA VAP certified laboratory program.

6.0 Sampling Locations

6.1 Property Descriptions and Locations

Details for the 10 locations sampled for this investigation are included in Tables 1A and 1B. Information contained in Table 1A provides property information such as site location (latitude/longitude), generalized setting (e.g., urban or suburban), and the topography (e.g., level, gently sloping, etc.). Surveying the location of each sampling point was determined not to be practical; therefore the longitude and latitude coordinates represent the generalized property location. As noted in Section 5.0, samples were collected within a 15-foot radius of the original preliminary sample boring. Table 1B provides information relative to the soil survey for Cuyahoga County. Specific details on the table includes the mapping (soil type) unit at each property and the underlying parent material (e.g., bedrock, lake deposits, etc.) underlying each property. As noted in Section 2.0, all major soil types represented in Cuyahoga County were sampled.

6.2 Supplemental Locations

OEPA and US EPA Region 5 performed a targeted brownfield assessment project in July 2011 titled "Background Soil Determination for Three Locations in Cuyahoga County, Ohio." The assessment set out to address soil background concentrations of various metals and polynuclear aromatic hydrocarbons (PAHs) in three locations selected in Cuyahoga County. The study selected locations that were anticipated to be reliable and reasonably representative of background soil levels for metals and PAHs. OEPA and US EPA Region 5 relied on another study (Dike 14 CDF background study) to provide aerial photographs, historical maps, deed records, and associated site visits at each of the background sample sites. The following three Cuyahoga County Background Study Sites were identified for this background soil study:

- Cleveland Heights – Forest Hills Park (CHFH),
- Brecksville – Cleveland Metro Parks (BCMP), and
- Bratenahl – Mather Estate – Western Land Conservancy (BHME).

Details on these locations are included in Tables 1A and 1B.

6.3 Summary Results Combination

As with the 10 locations selected for this current study, the three background sampling locations, CHFH, BCMP, and BHME, were also selected in accordance with VAP siting criteria; such that each were areas that had not been directly impacted by development, filling, covering, roadways, or other alterations. There was no reason to suspect that hazardous substances or petroleum were regularly treated, stored, or disposed at these sampling locations, which would have biased the sampling results.

Sample collection protocol was nearly identical to that used in this study whereby shallow soil samples (e.g., 0-2 feet and 2-4 feet bgs) were selected and analyzed. One significant difference was that the targeted brownfield assessment study used a Geoprobe® for soil collection, while soil samples in this study were manually collected via hand auger. Remaining field logging, sample preservation, and decontamination procedures were identical. Data analyzed by the laboratory were certified under the VAP certified laboratory program.

Metal data (0-2 foot depth interval only) collected from the targeted brownfield assessment were included into the larger data set collected during this study. With the inclusion of these three additional locations, a total of 13 locations (and 151 total data points) were used in the statistical determination of Cuyahoga County background values. With the inclusion of the additional data, a more statistically robust data set has been generated.

7.0 METHOD OF BACKGROUND VALUE DETERMINATION

Upon receipt of all laboratory data, statistical evaluations were performed to determine the representative background concentrations. It was determined that data collected from all 13 property locations (10 from the current study and three from the supplemental study) would be incorporated into a single data set. Preliminary evaluations were perfomed whereby a comparison of properties was performed. Using this method statistically similar sites were combined into a single data set. Though statistically correct, this method was found to be cumbersome such that multiple background values were generated per metal. Therefore, the more direct approach was selected whereby all data points were combined into a single data set and outliers were removed as the entire data set was analyzed. The result was that a single, representative background number was generated for each metal.

Background values were determined for the 0-2 ft bgs interval from all 10 property locations. Only the 0-2 ft bgs interval data from the supplemental study "Background Soil Determination for Three Locations in Cuyahoga County, Ohio" were included into the larger data set. Samples collected from the 2-4 ft bgs interval as part of that study were excluded from incorporation into the larger data set.

7.1 Outlier test

The data set was evaluated for the presence of outliers in accordance with the VAP Rule OAC 3745-300-07(H)(1)(d)(ii)(d). The presence of outliers in the background data sets could yield higher or lower estimates of the upper limits. Statistical outlier tests give evidence that a value does not fit with the distribution of the remainder of the data and is, therefore, a statistical outlier. The outlier identification was performed by the Rosner outlier test utilizing ProUCL. All outliers were removed prior to completing background calculations.

7.2 Nondetect test

According to the ProUCL user's guide, when the percentage of nondetects in a data set is high (greater than 40 percent (%) to 50%) or when multiple detection limits are present, it is hard to reliably perform goodness-of-fit (GOF) tests to determine data distribution. In those cases, the uncertainty associated with the GOF tests is high, especially with smaller data sets (less than 10 to 20 samples). In those situations, the use of nonparametric methods such as the Kaplan-Meier (KM) method to compute statistics such as upper confidence limits, upper prediction limits (UPLs), and upper tolerance limits (UTLs) is preferred because nonparametric methods do not require any distributional assumptions about the data sets.

By example, Table 3 shows that cadmium results had approximately 32.8% non-detectable values (depending on the data set) and therefore the KM method was used by ProUCL to calculate the statistics associated with this data set, even though the data were

normally distributed. Further evaluation of the data set detailed below shows that this provides an acceptable representation of the data obtained.

7.3 Soil Background Mean

The background mean (X_b) for data sets without nondetects was calculated by ProUCL by dividing the sum of the total background values (X_n) by the total number of background readings (n_b):

$$X_b = \frac{X_1 + X_2 + X_3 \text{ (etc.)}}{n_b}$$

The background mean for data sets with nondetects was calculated by ProUCL using the appropriate method based on the distribution (e.g., the KM method for nonparametric data sets with multiple detection limits).

7.4 Standard Deviation

The standard deviation (S_b) for data sets without nondetects was calculated by ProUCL by taking the square root of the sum of the squares of each value (X_n) minus the mean (X_b), divided by the degrees of freedom (number of background soil samples minus one):

$$S_b = \left[\frac{(X_1 - X_b)^2 + (X_2 - X_b)^2 + (X_3 - X_b)^2 \text{ (etc.)}}{n_b - 1} \right]^{1/2}$$

For data sets with nondetects, the standard deviation was calculated by ProUCL using the appropriate method based on the distribution (e.g., the KM method for nonparametric data sets with multiple detection limits).

7.5 Coefficient of Variation

The C_v is the ratio of the standard deviation (S_b) to the mean (X_b) and describes the magnitude of sample values and the variation within them:

$$C_v = \frac{S_b}{X_b}$$

The C_v is used to evaluate the distribution of the data, where generally a C_v of less than 0.5 indicates a normal distribution. A C_v was calculated only for data sets without nondetects.

7.6 Distribution

The distribution of each data set was also evaluated using ProUCL to determine if the distributions were normal, lognormal, or gamma distributed. The upper limits for the data sets that were normal were then calculated as described below. Data sets that were not normally distributed were evaluated for the upper limits using nonparametric

methods. Nonparametric methods do not assume a particular population probability distribution, and are therefore valid for data from any population with any probability distribution, which can remain unknown.

7.7 VAP Upper Limit (UL)

In accordance with the VAP background soil determination requirements in OAC 3745-300-07(H)(1), the background mean plus two standard deviations is the maximum allowable limit or upper limit for normally distributed data. The background upper limit for normally distributed data sets was calculated by multiplying the standard deviation by two and adding the background mean such that:

$$\text{VAP UL} = X_b + (2 \times S_b)$$

If the data follows a lognormal, nonparametric, or gamma distribution, the upper limit was calculated using ProUCL to determine the 95% upper prediction limit (UPL) based on the best fit distribution. This is noted in Table 3.

8.0 CLEVELAND-AREA SOIL BACKGROUND VALUES

Background soil concentrations were calculated in accordance with the VAP rules effective March 1, 2009, found in OAC 3745-300-07(H)(1)(d)(ii). As noted in Section 7.7, for normally distributed data, the background mean plus two standard deviations is the maximum allowable limit, or UL, which was calculated by multiplying the standard deviation by two and then adding the mean concentration. Normally distributed data were only observed in the cadmium and chromium data sets. The remaining datasets were non-normal. The 95% upper prediction limit was used as the representative background concentrations for the remaining, non-normal data sets.

A summary of the background determination results for Cuyahoga County are provided in Table 3. Seven of the eight original RCRA metals are presented. Silver was removed from statistical analyses due to the high number of nondetects. Therefore, silver has been determined not to be a significant contributor to elevated background concentrations across the Cuyahoga County region.

The ProUCL output data sheets are provided in Appendix D. Analytical results for each metal are provided in Tables 4 through 10. Metal concentrations for each sample at each location are provided. Summary statistics including maximum, minimum, average, and standard deviation are also provided. The following sections are a narrative of the summary results.

8.1 Arsenic

Concentrations of arsenic ranged from 4.6 to 33.1 mg/kg with no nondetects. There were 150 valid data points, with only one outlier removed. The data set mean was calculated to be 14.06 mg/kg, with a standard deviation of 4.5 mg/kg. The VAP UL was determined to be 23.1 mg/kg, however the data set was not normally distributed. Therefore the VAP UL cannot be used as the representative concentration. The 95% UTL with 90% coverage was determined to be 22.3 mg/kg. The 95% UPL based on the best fit of the data distribution was calculated to be 24.0 mg/kg. This value is determined to be the representative soil background concentration.

8.2 Barium

Concentrations of barium ranged from 16.4 to 317.0 mg/kg with no nondetects. There were 143 valid data points, with eight outliers removed. Five of the outliers came from the WCR (West Creek Reservation – Cleveland Metropark) location. The data set mean was calculated to be 51.86 mg/kg, with a standard deviation of 19.8 mg/kg. The VAP UL was determined to be 91.5 mg/kg, however the data set was not normally distributed. Therefore the VAP UL cannot be used as the representative concentration. The 95% UTL with 90% coverage was determined to be 89.3 mg/kg. The 95% UPL based on the best fit of the data distribution was calculated to be 98.9 mg/kg. This value is determined to be the representative soil background concentration.

8.3 Cadmium

Detected concentrations of cadmium ranged from 0.223 to 1.36 mg/kg. There were 128 valid data points, with one outlier removed. Additionally, data from the BCMP and BHME sites were removed from the data set due to elevated reporting limits. There were 42 nondetects, or 32.8%, in the final data set. As noted in Table 3, the KM method was recommended by ProUCL due to multiple reporting limits in the data set. The data set mean was calculated to be 0.452 mg/kg, with a standard deviation of 0.191 mg/kg. The VAP UL was determined to be 0.834 mg/kg. The data were calculated to be normally distributed. The 95% UTL with 90% coverage was determined to be 0.737 mg/kg. The 95% UPL based on the best fit of the data distribution was calculated to be 0.770 mg/kg. The VAP UL is determined to be the representative soil background concentration.

8.4 Chromium

Detected concentrations of chromium ranged from 6.1 to 26.8 mg/kg. There were 151 valid data points, with no outliers removed. There were no nondetects in the entire data set. The data set mean was calculated to be 14.76 mg/kg, with a standard deviation of 3.151 mg/kg. The VAP UL was determined to be 21.1 mg/kg. The data were calculated to be normally distributed. The 95% UTL with 90% coverage was determined to be 19.4 mg/kg. The 95% UPL based on the best fit of the data distribution was calculated to be

20.0 mg/kg. The VAP UL is determined to be the representative soil background concentration.

8.5 Lead

Concentrations of lead ranged from 8.2 to 203.0 mg/kg with no nondetects. There were 132 valid data points, with 19 outliers removed. Nine of the outliers came from the STG (St. Gregory Church) location and another eight of the outliers came from the STN (St. Nicholas Church) location. The data set mean was calculated to be 23.81 mg/kg, with a standard deviation of 13.5 mg/kg. The VAP UL was determined to be 50.8 mg/kg, however the data set was not normally distributed. Therefore the VAP UL cannot be used as the representative concentration. The 95% UTL with 90% coverage was determined to be 49.7 mg/kg. The 95% UPL based on the best fit of the data distribution was calculated to be 51.7 mg/kg. This value is determined to be the representative soil background concentration.

8.6 Mercury

Detected concentrations of mercury ranged from 0.01 to 2.77 mg/kg. There were 115 valid data points, with 14 outliers removed. Eight of the outliers came from the STN (St. Nicholas Church) location and another four of the outliers came from the RFP (Rockefeller Park) location. Additionally, data from the BCMP and BHME sites were removed from the data set due to elevated reporting limits. There were two nondetects, or 1.7%, in the final data set. The data set mean was calculated to be 0.0483 mg/kg, with a standard deviation of 0.029 mg/kg. The VAP UL was determined to be 0.106 mg/kg, however the data set was not normally distributed. Therefore the VAP UL cannot be used as the representative concentration. The 95% UTL with 90% coverage was determined to be 0.092 mg/kg. The 95% UPL based on the best fit of the data distribution was calculated to be 0.097 mg/kg. This value is determined to be the representative soil background concentration.

8.7 Selenium

Detected concentrations of selenium ranged from 0.41 to 1.13 mg/kg. There were 100 valid data points, with no outliers removed. As noted in Table 3, data from the BCMP, BHME, and CHFH sites were removed from the data set due to elevated reporting limits. There were 32 nondetects, or 32.0%, in the final data set. The data set mean was calculated to be 0.647 mg/kg, with a standard deviation of 0.177 mg/kg. The VAP UL was determined to be 1.00 mg/kg. The data were calculated to be normally distributed. The 95% UTL with 90% coverage was determined to be 0.917 mg/kg. The 95% UPL based on the best fit of the data distribution was calculated to be 0.943 mg/kg. This value is determined to be the representative soil background concentration.

9.0 APPLICATION OF THIS REPORT AND SUMMARY OF BACKGROUND DETERMINATION

Background results generated in this report are specific to Cuyahoga County. Users of this report may elect to utilize the results presented in Section 8.0 and Table 3 for direct comparison purposes to other properties in Cuyahoga County in accordance with VAP soil background rule requirements (OAC 3745-300-07(H)(2)). It is generally inappropriate to apply these background values to properties located in non-adjacent or surrounding counties. Exceptions to this provision may be allowable if the user can demonstrate that the subject property has a similar soil provenance and type to one or more soil types listed for properties within this study. Geotechnical analysis of the subject property soil type is advisable to make the soil type comparison. Additionally, samples collected at the subject property must be representative of the zone (e.g., 0-2 ft. bgs.) assessed in this study.

The following results are the background upper limits for metal soil concentrations in Cuyahoga County – Cleveland Area:

Arsenic	24.0 mg/kg
Barium	98.9 mg/kg
Cadmium	0.834 mg/kg
Chromium	21.1 mg/kg
Lead	51.7 mg/kg
Mercury	0.097 mg/kg
Selenium	0.943 mg/kg

10.0 REFERENCES

ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D2488, Standard Practice for Description and Identification of Soils (Visual – Manual Procedure)

ASTM D422, Standard Test Method for Particle Size Analysis of Soils

ASTM D4318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

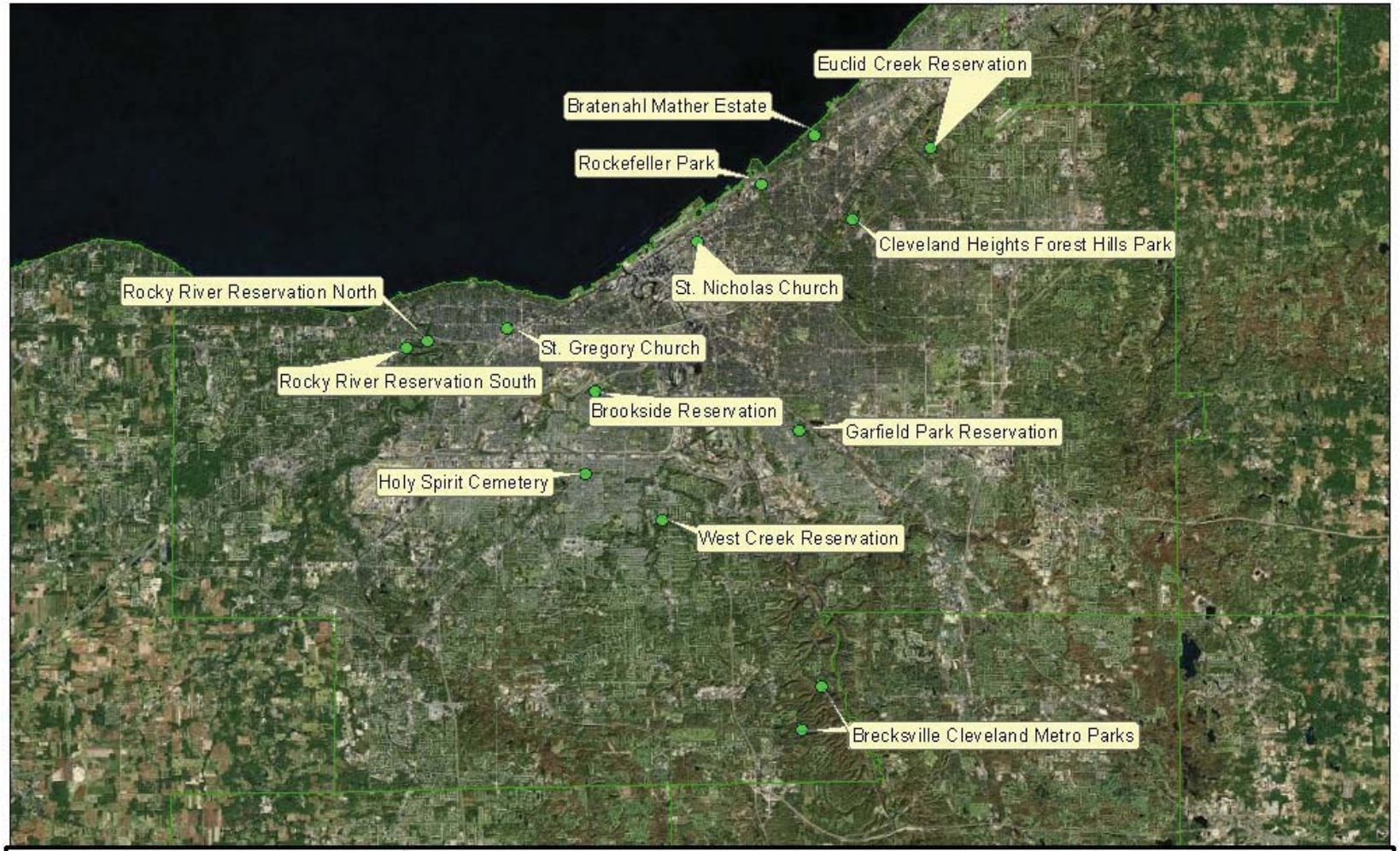
Background Soil Determination for Three Locations in Cuyahoga County, U.S. EPA Region V and Ohio EPA, December 2011

Presley, D., and S. Thien, September 2008, Estimating Soil Texture By Feel, Kansas State University Department of Agronomy, MF-2852

USDA Soil Conservation Service, December 1980, Soil Survey of Cuyahoga County, Ohio

U.S. EPA SW-846 Method 6200 (Revision 0, February 2007), Field Portable X-ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil or Sediment

U.S. EPA, U.S. EPA Statistical Software ProUCL 4.1 for Environmental Applications for Data Sets With and Without Non-detect Observations



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CLEVELAND AREA BACKGROUND SOIL STUDY
CUYAHOGA COUNTY, OHIO
BING AERIAL PHOTOGRAPH

FIGURE 1: LOCATIONS OF PROPERTIES EVALUATED FOR CUYAHOGA COUNTY BACKGROUND SOIL SAMPLING

Ohio Environmental Protection Agency

0 5,500 11,000 22,000 33,000 44,000 Feet

FIGURE 2: GENERAL SOIL MAP, CUYAHOGA COUNTY, OHIO

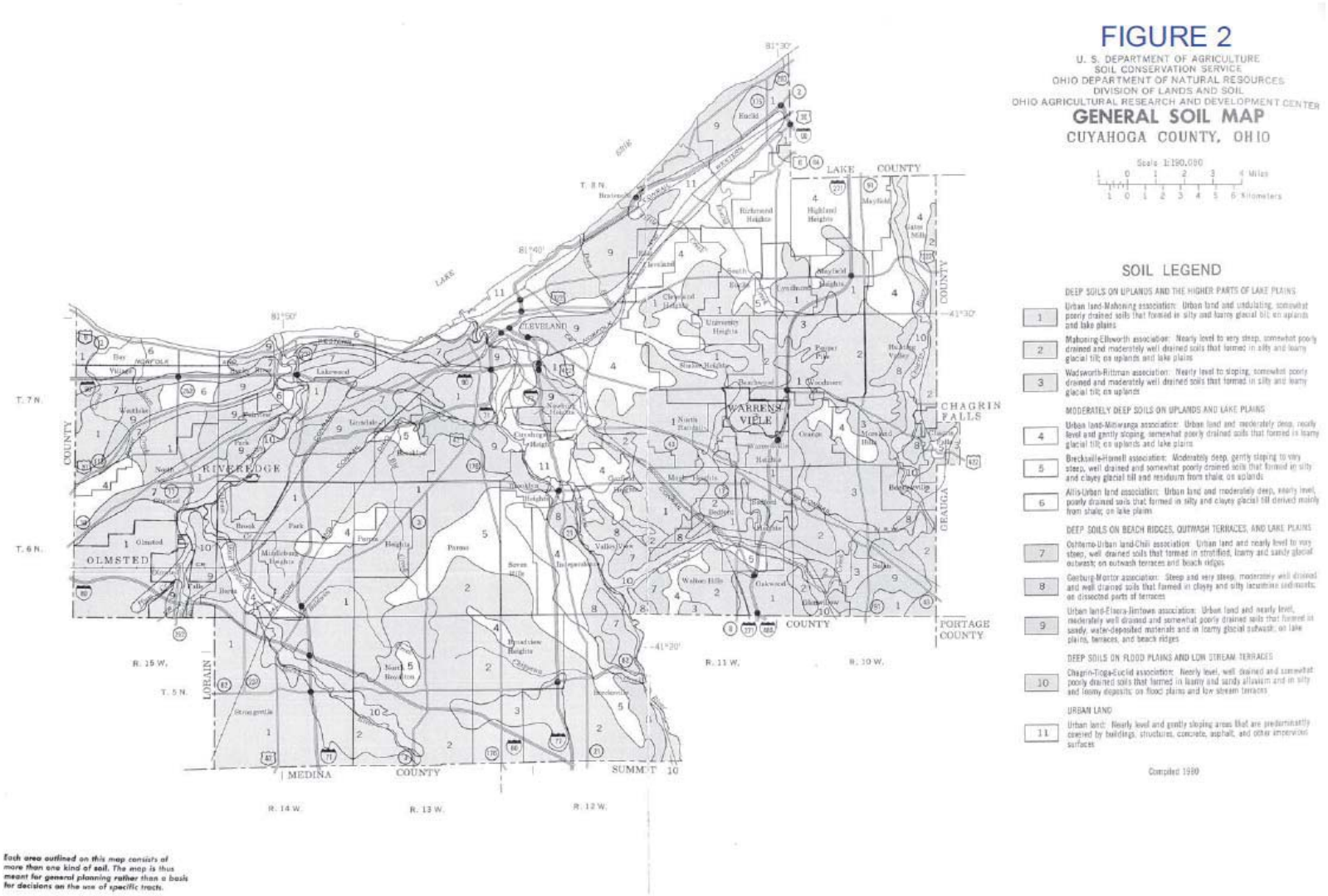

TABLE 1A

Soil Sampling Property Information Summary: Locations, Settings & Topography

Sampled Property	Location			Setting	Topography
	Address	Latitude[1]	Longitude		
Bratenahl Mather Estate	Lakeshore Blvd & Mather Ln, Cleveland	41.558631	-81.597778	urban residential	level to gently sloping lake plain
Brecksville Reservation (Cleveland Metropark)	Meadows Dr ,1500 ft S Valley Pkwy (stables)	41.300047	-81.610764	suburban park	gently sloping upland area
	Valley Pkwy, 1600 ft SW Riverview Rd (Ford Field)	41.318020	-81.597701		
Brookside Reservation (Cleveland Metropark)	Fulton Rd & Park Dr, Cleveland	41.447519	-81.726506	suburban park	lake plain terrace
Euclid Creek Reservation (Cleveland Metropark)	Euclid Park Rd (0.8 mi S of Highland Rd), Euclid	41.552044	-81.531611	suburban park	level area on hillside above Euclid Creek
Forest Hills Park (Cleveland Heights)	2370 Lee Rd, Cleveland Heights	41.523117	-81.577150	urban park	gently sloping upland area
Garfield Park Reservation (Cleveland Metropark)	Garfield Parkway S, Garfield Heights	41.429672	-81.608967	suburban park	gently sloping upland area
Holy Spirit Cemetery (East)	5500 W 54th St, Parma	41.412369	-81.726125	suburban residential	gently sloping upland area
Rockefeller Park (Cleveland)	Martin Luther King Jr Dr & E 88th St, Cleveland	41.536994	-81.629689	urban park	floodplain terrace above Doan Brook
Rocky River Reservation (North) (Cleveland Metropark)	Valley Parkway & I-90, Lakewood	41.470794	-81.824531	suburban park	Rocky River floodplain
Rocky River Reservation (South) (Cleveland Metropark)	Park Dr (1,500 ft due S of I-90), Lakewood	41.468197	-81.832142	suburban park	steep hillside above Rocky River floodplain
St. Gregory Church	2035 Quail Ave, Lakewood	41.475825	-81.776700	urban residential	level to gently sloping lake plain
St. Nicholas Church	3441 Superior Ave, Cleveland	41.512436	-81.666333	urban residential	level to gently sloping lake plain
West Creek Reservation (Cleveland Metropark)	Broadview Rd & E Ridgewood Dr, Parma	41.391414	-81.688061	suburban park	level to gently sloping lowland area

Note:

1 Latitude and longitude values (Google Earth) are for the approximate center of area from which soil samples were collected

TABLE 1B

Soil Sampling Property Information Summary: Soil Mapping Units, Parent Materials and Soil Types

Sampled Property	Preliminary Soil Boring[1] & Location			Soil Survey of Cuyahoga County Ohio		
	PSB	Latitude[2]	Longitude	Mapping Unit(s)	USDA Soil Types	Parent Material
Bratenahl Mather Estate	NA[3]	41.558631	-81.597778	Oshtemo sandy loam	loamy sand, sandy loam, sandy clay loam	lake plain/fluvial deposits (sand and gravel)
				Brecksville silt loam	silt loam, silty clay loam, silty clay	weathered shale bedrock
Brecksville Reservation (Cleveland Metropark)	NA	41.300047	-81.610764	Geeburg-Mentor & Mahoning silt loams	silt loam, silty clay loam, clay loam, silty clay, clay	clayey till (Hiram); ground, end, or hummocky moraine deposits
	NA	41.318020	-81.597701	Tioga & Chagrin silt loams	sand, loamy sand, sandy loam, loam, silt loam	alluvial/floodplain deposits
Brookside Reservation (Cleveland Metropark)	PSB-11	41.447519	-81.726506	Fitchville silt loam	loam, silt loam, silty clay loam	lake plain deposits (reworked till?)
Euclid Creek Reservation (Cleveland Metropark)	PSB-9	41.552044	-81.531611	Brecksville silt loam	silt loam, silty clay loam, silty clay	weathered shale bedrock
Forest Hills Park (Cleveland Heights)	NA	41.523117	-81.577150	Allis-Urban land & Mitiwanga silt loam	silt loam, silty clay loam, clay loam, silty clay	weathered shale bedrock
Garfield Park Reservation (Cleveland Metropark)	PSB-12	41.429672	-81.608967	Mahoning silt loam	silt loam, silty clay loam, clay loam, silty clay	clayey till (Hiram); ground moraine deposits
Holy Spirit Cemetery (East)	PSB-10	41.412369	-81.726125	Ellsworth-Urban land	silt loam, silty clay loam, clay loam, silty clay	clayey till (Hiram); ground moraine deposits on sandstone
Rockefeller Park (Cleveland)	PSB-8	41.536994	-81.629689	Tioga loam	loamy sand, sandy loam, loam, silt loam	alluvial deposits (mostly from weathered sandstone)
Rocky River Reservation (North) (Cleveland Metropark)	PSB-5	41.470794	-81.824531	Chagrin silt loam	fine sand, sandy loam, loam, silt loam	alluvial deposits (mostly from weathered shale)
Rocky River Reservation (South) (Cleveland Metropark)	PSB-4	41.468197	-81.832142	Brecksville silt loam	silt loam, silty clay loam, silty clay	weathered shale bedrock
St. Gregory Church	PSB-2	41.475825	-81.776700	Mahoning-Urban land	silt loam, silty clay loam, clay loam, silty clay	lacustrine silt (with sand & clay); lake plain deposits
St. Nicholas Church	PSB-3	41.512436	-81.666333	Elnora-Urban land	fine sand, loamy fine sand	lacustrine sand; lake plain deposits (deltaic)
West Creek Reservation (Cleveland Metropark)	PSB-7	41.391414	-81.688061	Loudonville silt loam (Allis silt loam?)	silt loam, silty clay loam, silty clay	clayey till (derived from shale)

Note:

1 One preliminary soil boring (PSB) was installed at each SIFU samplilng location to evaluate soil conditions prior to collecting analytical samples; PSB logs (with field soil descriptions) are included in Appendix A; PSB-1 [Holy Spirit Cemetery (West)] and PSB-6 [Huntington Reservation (Cleveland Metropark)] were installed at locations not selected for sampling and are not included in this report

2 Latitude and longitude values (Google Earth) are for the approximate center of area from which soil samples were collected

3 NA - preliminary soil borings were not installed at these locations (USCS field descriptions were recorded at each sampling location)

TABLE 2
Summary of Soil Geotechnical Testing Results

Soil Sample	Soil Parent Material	Unified Soil Classification System (USCS)								USDA Soil Classification System				
		USCS Soil Type	Particle Size Distribution				Atterberg Limits			USDA Soil Type	Particle Size Distribution			
			% Gravel (>4.76 mm)	% Sand (<=4.76 mm, >0.074 mm)	% Silt (<=0.074 mm, >0.002 mm)	% Clay (<=0.002 mm)	LL (%)	PL (%)	PI (%)		% Gravel (>2 mm)	% Sand (<=2 mm, >0.05 mm)	% Silt (<=0.05 mm, >0.002 mm)	% Clay (<=0.002 mm)
BSR-1	lake plain till (reworked?)	**Lean Clay (CL)**	0.51	8.60	47.30	43.59	47	22	25	**Silty Clay**	1.49	9.48	45.43	43.59
ECR-1	weathered shale bedrock	**Sandy Lean Clay (CL)**	0.47	37.85	43.56	18.12	35	23	12	**Loam**	1.37	39.93	40.59	18.12
GPR-1	clayey till (Hiram); ground moraine	**Lean Clay with Sand (CL)**	2.51	17.82	46.82	32.85	37	19	18	**Clay Loam**	4.60	19.40	43.16	32.85
HSP-1	clayey till (Hiram); ground moraine deposits on sandstone	**Lean Clay with Sand (CL)**	1.47	13.94	51.83	32.77	38	21	17	**Silty Clay Loam**	3.18	14.72	49.33	32.77
RFP-1	alluvial sediments	**Sandy Lean Clay (CL)**	0.61	36.81	45.07	17.51	29	17	12	**Loam**	1.13	39.38	41.99	17.51
RRN-1	alluvial sediments (derived mostly from weathered shale)	**Lean Clay (CL)**	1.05	11.94	68.23	18.78	49	28	21	**Silt Loam**	2.48	15.77	62.97	18.78
RRS-1	weathered shale bedrock	**Lean Clay with Sand (CL)**	4.51	17.64	46.03	31.82	49	24	25	**Silty Clay Loam**	9.68	13.40	45.10	31.82
STG-1	lacustrine silt (with sand & clay); lake plain deposits	**Lean Clay with Sand (CL)**	1.22	19.34	47.70	31.74	41	19	22	**Clay Loam**	2.76	21.04	44.46	31.74
STN-1	lacustrine sand; lake plain deposits (deltaic)	**Clayey Sand (SC)**	0.98	52.50	39.12	7.41	23	19	4	**Sandy Loam**	2.90	54.09	35.60	7.41
WCR-1	clayey till (derived from shale)	**Elastic Silt (MH)**	0.00	3.44	60.14	36.42	67	33	34	**Silty Clay Loam**	0.18	5.55	57.86	36.42

Table 3
Background Statistics for Cuyahoga County
Summary Results for Seven Metals

Metal	Number of Sites Included	Number of Outliers	% ND	Data points	Maximum	Mean	SD	Distribution	VAP UL	95% UTL with 90% Coverage	95% UPL	Units	Comments
Arsenic	13	1	0.0%	150	28.8	14.06	4.5	No defined distribution	{23.1}	22.3	**24.0**	mg/kg	
Barium	13	8	0.0%	143	118	51.86	19.8	No defined distribution	{91.5}	89.3	**98.9**	mg/kg	5 outliers from WCR
Cadmium	12(1)	1	32.8%	128	1.04	0.452	0.191	Normal	**0.834**	0.737	0.770	mg/kg	KM method (recommended due to multiple RLs)
Chromium	13	0	0.0%	151	26.8	14.76	3.151	Normal	**21.1**	19.4	20.0	mg/kg	
Lead	13	19	0.0%	132	70.1	23.81	13.5	No defined distribution	{50.8}	49.7	**51.67**	mg/kg	9 outliers from STG, 8 from STN
Mercury	12(1)	14	1.7%	115	0.146	0.0483	0.029	No defined distribution	{0.106}	0.092	**0.097**	mg/kg	8 outliers from STN, 4 from RFP
Selenium	10(2)	0	32.0%	100	1.13	0.647	0.177	No defined distribution	{1.00}	0.917	**0.943**	mg/kg	

(1) Does not include BCMP or BHME 2011 (all nondetects with elevated reporting limits). BHME 2008 data are included.
(2) Does not include BCME, BHME, or CHFH (elevated reporting limits).

KM method = Kaplan-Meier method

{ } = mean + 2SD calculated, but dataset is not normal or lognormal and value may not be appropriate for use as the MAL.

Bold Number = Representative background value for associated metal

Table 4

Property Abbreviation Key

Abbreviation	Property & General Location
BSR	Brookside Reservation, Cleveland Metropark (Cleveland)
ECR	Euclid Creek Reservation, Cleveland Metropark (Euclid)
GPR	Garfield Park Reservation, Cleveland Metropark (Garfield Heights)
HSP	Holy Spirit Cemetery (Parma)
RFP	Rockefeller Park (Cleveland)
RRN	Rocky River Reservation North (Lakewood)
RRS	Rocky River Reservation South (Lakewood)
STG	St. Gregory Parish (Lakewood)
STN	St. Nicholas Parish (Cleveland)
WCR	West Creek Reservation, Cleveland Metropark (Parma)
BHME	Bratenahl Mather Estate
CHFH	Cleveland Heights Forest Hills Park
BCMP	Brecksville Cleveland Metroparks

Table 5
Summary of Arsenic Data
Cuyahoga County Background Soils Summary Report

Sample	Location	BSR	ECR	GPR	HSP	RFP	RRN	RRS	STG	STN	WCR	BHME	CHFH	BCMP
	Units													
1	mg/kg	12.4	18.5	13.6	12.1	14.7	15.9	21.8	8.56	12.4	12.1	6.68	12.9	15.9
2	mg/kg	23.5	18.2	10.6	7.17	8.45	16	24.6	11.6	13.9	10.6	9.28	18.1	13.9
3	mg/kg	8.71	19.2	12	10.9	11.7	19.8	22.3	9.37	14.1	11.3	8.41	10.3	12.9
4	mg/kg	11.4	17.2	13.9	10.1	9.59	11.2	25.2	16.6	12.3	9.99	13.1	17.3	12.2
5	mg/kg	13.3	21.9	12.6	12	10.7	14.7	22.9	12.2	11.8	12.8	9.61	11.7	14.4
6	mg/kg	16.4	23	13.3	14.6	13	14.6	28.8	7.86	12	11.2	20.3	9.03	18.1
7	mg/kg	9.64	17.9	12.5	11.8	10.3	15.8	33.1	13.4	14.8	9.95	16.6	25.2	12.9
8	mg/kg	26.7	17.4	15.7	12.5	12.8	18.1	24.5	6.53	14.6	11.8	16.1	8.64	12.7
9	mg/kg	19.2	18.5	11.4	12.6	10.5	14.1	28.8	10.7	11.8	11.4	15.4	13.2	13.4
10	mg/kg	11.8	19	9.2	12.7	12	16	20.2	10.8	13	8.98	16.2	16.8	13.7
11	mg/kg											10.6	13	12.6
12	mg/kg											15.1	9.11	12.8
13	mg/kg											13.3	12.1	
14	mg/kg											8.5	14.7	
15	mg/kg											16.5	11.6	
16	mg/kg											17	18.7	
17	mg/kg											14.8	18.9	
18	mg/kg											10.8	9.3	
19	mg/kg											4.6	16.1	
20	mg/kg												10.9	

Notes:
mg/kg = milligrams per kilogram
BHME, CHFH, and BCMP from the "Background Soil Determination for Three Locations in Cuyahoga County, Ohio" study, Ohio EPA and USEPA (2011)

Table 6
Summary of Barium Data
Cuyahoga County Background Soils Summary Report

Sample	Location	BSR	ECR	GPR	HSP	RFP	RRN	RRS	STG	STN	WCR	BHME	CHFH	BCMP
	Units													
1	mg/kg	129	21.7	53.2	50.7	37.9	59.8	38.7	143	59.5	127	16.4	41.5	49.8
2	mg/kg	69.5	44.3	49.6	53.6	28	56.9	51.6	86.9	64.8	112	34.6	48.1	53.1
3	mg/kg	45.9	24.4	41.3	59.7	34.1	54.5	42	79.2	51.3	118	29	42.2	53.6
4	mg/kg	45.4	33.1	50.6	52.1	33	61.1	43.8	99.7	43.4	87.6	33.1	48.9	42.1
5	mg/kg	317	25.2	45.7	55.5	44.2	62	73.8	95.9	53.7	143	41.9	49.5	57
6	mg/kg	114	21.9	40.8	56.3	43.7	58.6	46.8	63.2	62.5	106	42	45.6	45.6
7	mg/kg	57.3	24.8	44.3	55	37	65.4	38.8	54.1	38.7	101	32.4	33.5	30.7
8	mg/kg	56.8	28.4	55.2	54.3	43	57.7	46.4	54.5	69	147	34.8	29.6	43.3
9	mg/kg	77.4	30.3	45.9	66.9	31.9	60.7	54.7	72.6	56.9	148	39.5	43.9	30.5
10	mg/kg	89.3	22.3	42.3	78.2	38.3	61	92.3	116	55.7	145	54.9	34.1	41.1
11	mg/kg											61.8	46	38.5
12	mg/kg											51.6	39.3	46.1
13	mg/kg											62.3	40.4	
14	mg/kg											80.1	45.6	
15	mg/kg											55.1	47.3	
16	mg/kg											40.4	28.1	
17	mg/kg											54.6	28.8	
18	mg/kg											55.2	49.7	
19	mg/kg											48.9	52.4	
20	mg/kg												41.3	

Notes:
mg/kg = milligrams per kilogram
BHME, CHFH, and BCMP from the "Background Soil Determination for Three Locations in Cuyahoga County, Ohio" study, Ohio EPA and USEPA (2011)

Table 7
Summary of Cadmium Data
Cuyahoga County Background Soils Summary Report

Sample	Location	BSR	ECR	GPR	HSP	RFP	RRN	RRS	STG	STN	WCR	BHME	CHFH	BCMP
	Units													
1	mg/kg	<0.453	0.278	<0.465	<0.445	0.463	0.517	<0.402	0.323	0.488	<0.483	0.335	0.596	<2.2
2	mg/kg	0.254	0.471	<0.463	<0.412	0.383	0.605	0.236	0.286	0.482	<0.487	0.495	0.617	<2.0
3	mg/kg	<0.445	0.356	<0.472	<0.435	0.503	0.474	<0.422	0.307	0.573	<0.495	0.421	0.497	<2.2
4	mg/kg	<0.413	0.364	<0.449	<0.429	0.623	0.331	0.23	0.613	0.469	<0.473	0.614	0.658	<2.3
5	mg/kg	<0.459	0.37	<0.442	<0.441	1.04	0.493	0.262	0.332	0.605	<0.510	0.562	0.512	<2.2
6	mg/kg	<0.411	0.314	<0.443	<0.406	0.843	0.572	<0.46	0.334	0.527	<0.515	0.912	0.701	<2.1
7	mg/kg	<0.428	0.309	<0.438	<0.443	0.952	0.764	0.243	<0.427	0.53	<0.505	0.755	1.01	<2.1
8	mg/kg	<0.456	0.388	<0.448	<0.447	1.36	0.589	0.344	0.236	0.802	<0.582	0.846	0.734	<2.2
9	mg/kg	<0.421	0.294	<0.448	<0.426	0.359	0.508	0.296	0.354	0.692	<0.485	0.881	0.618	<2.2
10	mg/kg	0.254	0.262	<0.420	<0.43	0.402	0.615	0.249	0.558	0.597	<0.448	<2.2	0.94	<2.3
11	mg/kg											<2.3	0.773	<2.2
12	mg/kg											<2.3	0.465	<2.2
13	mg/kg											<2.3	0.68	
14	mg/kg											<2.1	0.802	
15	mg/kg											<2.3	0.527	
16	mg/kg											<2.3	0.539	
17	mg/kg											<2.0	0.647	
18	mg/kg											<2.4	0.402	
19	mg/kg											<2.1	0.687	
20	mg/kg												0.487	

Notes:
mg/kg – milligrams per kilogram
BHME, CHFH, and BCMP from the "Background Soil Determination for Three Locations in Cuyahoga County, Ohio" study, Ohio EPA and USEPA (2011)

Table 8
Summary of Chromium Data
Cuyahoga County Background Soils Summary Report

Sample	Location	BSR	ECR	GPR	HSP	RFP	RRN	RRS	STG	STN	WCR	BHME	CHFH	BCMP
	Units													
1	mg/kg	18.5	13.2	14.8	15.9	11.5	14.2	10.4	15.1	11.5	15.4	6.11	20.2	19.3
2	mg/kg	14.1	14.1	9.69	14.3	8.19	13.3	11.3	10.5	11.1	20.2	11.4	18.9	16.7
3	mg/kg	17.2	13	12.1	13	10.2	13.2	13.5	10.5	14.1	15.6	12.1	20.1	14.9
4	mg/kg	16	12.4	14.3	12.4	11.5	13.2	11.7	12.6	10.7	13.3	15.4	26.8	18.3
5	mg/kg	18.1	14	15.4	16.5	18	14.7	8.73	12.9	13.1	17.1	15.7	15.1	20.2
6	mg/kg	17.6	14	12.1	14.9	14.4	14	13.3	14.2	11.8	13.3	17.8	17.9	20.9
7	mg/kg	17.8	13.1	12.2	16.2	14.2	14.7	12.4	12.2	10.8	22.3	15.2	17	12.1
8	mg/kg	14.1	11.6	10.6	16.4	19.6	12.6	14.1	12	15	16.7	15.9	15.1	15.2
9	mg/kg	16.7	13.7	12.4	15.5	9.56	13.3	11.9	11	13.3	19.3	14.8	19	14.3
10	mg/kg	15.4	14.2	10.2	18	10.1	14	9.23	12.8	12.7	18.6	16.1	17.3	14.8
11	mg/kg											14.1	17.4	14
12	mg/kg											17.1	16.8	11.8
13	mg/kg											17.7	17	
14	mg/kg											16.5	17.4	
15	mg/kg											15.5	18.9	
16	mg/kg											17.9	17.3	
17	mg/kg											16.8	19.2	
18	mg/kg											16.7	18.8	
19	mg/kg											14.3	20.8	
20	mg/kg												21.7	

Notes:
mg/kg – milligrams per kilogram
BHME, CHFH, and BCMP from the "Background Soil Determination for Three Locations in Cuyahoga County, Ohio" study, Ohio EPA and USEPA (2011)

Table 9
Summary of Lead Data
Cuyahoga County Background Soils Summary Report

Sample	Location	BSR	ECR	GPR	HSP	RFP	RRN	RRS	STG	STN	WCR	BHME	CHFH	BCMP
	Units													
1	mg/kg	25.2	21.8	18.4	16.9	38.3	33.2	14.8	134	176	52.9	48	11.6	14.6
2	mg/kg	35.3	16.1	19.9	15	37.7	30.2	18.5	95.2	170	43.3	26.2	11.8	17.2
3	mg/kg	22	19.6	18.4	19.6	44.1	22	14.9	74.2	86.5	49.3	12.0	13	19.5
4	mg/kg	27.4	19	32.5	14.2	40.2	30.6	16.6	186	59.5	47.4	15.8	14.4	13.5
5	mg/kg	14.3	28.1	18.3	14.1	48.2	36.7	25.1	155	103	54.3	10.2	11.1	14.4
6	mg/kg	41.7	22.7	18	12.5	41	32.4	14.7	86.8	112	49.7	21.8	9.66	17.7
7	mg/kg	26	18.5	26.6	15.2	51.8	36.4	13.2	63.9	48.8	76	13.1	10.2	13.1
8	mg/kg	23.5	20.5	23.7	14.2	48.5	24.9	21.5	79.6	170	70.1	16.8	11.4	13.1
9	mg/kg	36.5	17.5	20.4	15.3	25.6	29.7	18.6	114	138	81.5	19.0	10.3	14
10	mg/kg	25.7	21.2	20	13.9	51	31	20.5	203	134	51.6	10.0	18.3	14.2
11	mg/kg											8.2	22.5	13.5
12	mg/kg											14.5	14.5	12.3
13	mg/kg											11.8	14.3	
14	mg/kg											11.4	42.4	
15	mg/kg											26.2	12.6	
16	mg/kg											14.6	11.6	
17	mg/kg											14.9	11.6	
18	mg/kg											10.1	9.41	
19	mg/kg											21.9	13.8	
20	mg/kg												12.9	

Notes:
mg/kg – milligrams per kilogram
BHME, CHFH, and BCMP from the "Background Soil Determination for Three Locations in Cuyahoga County, Ohio" study, Ohio EPA and USEPA (2011)

Table 10
Summary of Mercury Data
Cuyahoga County Background Soils Summary Report

Sample	Location	BSR	ECR	GPR	HSP	RFP	RRN	RRS	STG	STN	WCR	BHME	CHFH	BCMP
	Units													
1	mg/kg	0.0432	0.0199	0.042	0.0314	0.0873	0.0693	0.0216	0.0885	0.275	0.0358	0.068	0.037	<0.41
2	mg/kg	0.0512	0.015	0.049	0.0178	0.128	0.0586	0.0338	0.0657	0.363	0.0254	0.065	0.0218	<0.38
3	mg/kg	0.0449	0.0321	0.0456	0.0342	0.113	0.0411	0.0218	0.0883	0.218	0.023	0.042	0.0363	<0.38
4	mg/kg	0.0619	0.0414	0.047	0.0314	0.135	0.0812	0.031	0.12	0.146	0.0682	0.04	0.0261	<0.37
5	mg/kg	0.0689	<0.303	0.0535	0.0222	0.237	0.0672	0.0319	0.0726	0.308	0.0435	0.035	0.0196	<0.4
6	mg/kg	0.0434	0.0372	0.0406	0.0303	0.231	0.0727	0.0227	0.115	2.77	0.0303	0.029	0.0199	<0.36
7	mg/kg	0.0468	0.0312	0.0453	0.0242	0.183	0.0698	0.0218	0.0777	0.112	0.0455	0.037	0.0333	<0.36
8	mg/kg	0.046	0.0295	0.058	0.0299	0.225	0.0618	0.0431	0.0823	0.515	0.0349	0.038	0.0244	<0.39
9	mg/kg	0.0433	0.0229	0.0409	0.0294	0.0829	0.0702	0.0295	0.105	0.375	0.0447	0.037	0.0219	<0.39
10	mg/kg	0.0584	0.0207	0.0412	0.0194	0.117	0.0814	0.0364	0.109	0.406	0.0392	<0.37	0.0337	<0.39
11	mg/kg											<0.38	0.0171	<0.42
12	mg/kg											<0.4	0.0059	<0.37
13	mg/kg											<0.39	0.00915	
14	mg/kg											<0.40	0.221	
15	mg/kg											<0.42	0.0058	
16	mg/kg											<0.42	0.0129	
17	mg/kg											<0.39	0.0131	
18	mg/kg											<0.38	0.0206	
19	mg/kg											<0.39	0.0366	
20	mg/kg												0.0298	

Notes:
mg/kg – milligrams per kilogram
BHME, CHFH, and BCMP from the "Background Soil Determination for Three Locations in Cuyahoga County, Ohio" study, Ohio EPA and USEPA (2011)

Table 11
Summary of Selenium Data
Cuyahoga County Background Soils Summary Report

Sample	Location	BSR	ECR	GPR	HSP	RFP	RRN	RRS	STG	STN	WCR	BHME	CHFH	BCMP
	Units													
1	mg/kg	0.478	0.5	<0.929	0.911	0.645	0.773	0.571	0.719	0.535	<0.965	<2.2	0.942	<2.2
2	mg/kg	0.451	0.672	0.650	<0.812	0.55	0.846	0.566	0.545	<0.819	0.456	<2.1	nd	<2.0
3	mg/kg	0.502	0.56	<0.944	0.491	<0.775	0.846	0.992	0.721	<0.773	<0.973	<2.3	nd	<2.2
4	mg/kg	0.499	0.451	0.707	0.598	0.505	0.516	0.884	0.533	<0.825	0.681	<2.0	nd	<2.3
5	mg/kg	<0.918	0.731	<0.844	0.657	0.411	0.875	<0.884	1.09	<0.776	0.793	<2.4	nd	<2.2
6	mg/kg	<0.821	0.488	<0.866	0.7	0.434	0.899	0.95	1.01	<0.808	<1.02	<2.1	nd	<2.1
7	mg/kg	<0.857	0.652	0.832	<0.894	0.471	0.938	0.838	0.808	0.413	0.85	<2.3	1.3	<2.1
8	mg/kg	<0.912	0.445	<0.896	0.447	<0.858	0.903	0.975	0.512	<0.835	<1.01	<2.0	nd	<2.1
9	mg/kg	<0.842	<0.816	0.551	<0.852	<0.807	0.876	1.13	0.721	0.418	0.593	<2.1	nd	<2.2
10	mg/kg	<0.827	0.467	0.531	<0.86	<0.836	0.9	0.525	0.764	<0.918	0.774	<2.0	nd	<2.2
11	mg/kg											<2.2	nd	<2.3
12	mg/kg											<2.3	nd	<2.0
13	mg/kg											<2.0	nd	
14	mg/kg											<2.1	nd	
15	mg/kg											<2.0	nd	
16	mg/kg											<2.2	nd	
17	mg/kg											<2.1	nd	
18	mg/kg											<2.0	nd	
19	mg/kg											<2.0	nd	
20	mg/kg												nd	

Notes:
mg/kg – milligrams per kilogram
BHME, CHFH, and BCMP from the "Background Soil Determination for Three Locations in Cuyahoga County, Ohio" study, Ohio EPA and USEPA (2011)
nd = nondetect, method detection limit values not reported in original report

APPENDIX A

BORING LOGS (PRELIMINARY SOIL BORINGS)

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

Holy Spirit Cemetery (West)
5500 West 54th Street
Parma, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-1
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.412308° / Long 81.731794°, west side of property in unused area of cemetery

GROUND ELEVATION: 840.0 ft | **TOC ELEVATION:** NA | **DRILLING SERVICES:** Ohio EPA SIFU

START DATE: 6/27/12 | **COMPLETION DATE:** 6/27/12 | **DRILLER:** Jeff Martin, Wendy Vorwerk

DRILLING & SAMPLING METHODS: Hand Auger | **LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 3 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): NA

NOTES: Sampling performed on a warm (T 70-80F), clear day. Soil samples were dry to slightly moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/27/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA			CL	**USDA Silty Clay (USCS Lean Clay):** pale brown (10YR 6/3), low to medium plasticity, no dilatancy, trace shale fragments, appears to be native soil fill
	HA	0.5-1.0 0.5	0.5 - 1.0						
1	HA	1.0-1.5 0.5	1.0 - 1.5			1	1'	CL	brown (10YR 5/3)
	HA	1.5-2.0 0.5	1.5 - 2.0				2'	CL	medium plasticity (increase in clay content)
2	HA	2.0-2.5 0.5	2.0 - 2.5				2.5'	CL	**USDA Silty Clay Loam (USCS Lean Clay):** brown (10YR 4/3), medium plasticity, no dilatancy, trace shale fragments, appears to be soil fill; appears to be the top (A horizon) of the buried Ellsworth soil
	HA	2.5-3.0 0.5	2.5 - 3.0				3'	CL	dark yellowish brown (10YR 4/4)
3	HA	3.0-3.5 0.5	3.0 - 3.5			2		CL	**USDA Silty Clay (USCS Lean Clay):** dark yellowish brown (10YR 4/4), medium plasticity, no dilatancy, trace shale fragments, trace to little sand
	HA	3.5-4.0 0.5	3.5 - 4.0				4'		
4									

REMARKS:

1. FP-XRF screening sampling HSPS 0.0-2.0 ft
2. FP-XRF screening sampling HSPS 2.0-4.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:27 - C:\PROGRAM FILES\GINTP\PROJECTS\CUYAHOGA COUNTY SOIL\HOLY SPIRIT CEMETERY WEST.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

St. Gregory Church
2035 Quail Avenue
Lakewood, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-2
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.475825° / Long 81.776700°, yard area between church and rectory

GROUND ELEVATION: 733.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 6/27/12	**COMPLETION DATE:** 6/27/12	**DRILLER:** Jeff Martin, Wendy Vorwerk
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 3 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): NA

NOTES: Sampling performed on a warm (T 70-80F), clear day. Soil samples were dry to slightly moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/27/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA		0.5'	CL	**USDA Sandy Clay (USCS Lean Clay):** dark grayish brown (2.5Y 4/2), low plasticity, no dilatancy, very sticky when wetted, trace red brick fragments
	HA	0.5-1.0 0.5	0.5 - 1.0						light yellowish brown (2.5Y 6/4), brick fragments not observed
1	HA	1.0-1.5 0.5	1.0 - 1.5			1	1.5'	CL	trace shale fragments
	HA	1.5-2.0 0.5	1.5 - 2.0				2'	CL	yellowish brown (10YR 5/4)
2	HA	2.0-2.5 0.5	2.0 - 2.5				2.5'	CL	**USDA Silty Clay (USCS Lean Clay):** yellowish brown (10YR 5/4), low to medium plasticity, no dilatancy, trace shale fragments
	HA	2.5-3.0 0.5	2.5 - 3.0						brown (10YR 5/3), black manganese oxide mineralization along fractures
3	HA	3.0-3.5 0.5	3.0 - 3.5					CL	
	HA	3.5-4.0 0.5	3.5 - 4.0			2	4'		
4									

REMARKS:

1. FP-XRF screening sample SGPS 0.0-2.0 ft
2. FP-XRF screening sample SGPS 3.5-4.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIOEPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 8/7/12 12:30 - C:\PROGRAM FILES\GNTP\PROJECTS\CUYAHOGA COUNTY SOIL\ST. GREGORY PARISH.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

St. Nicholas Church
3441 Superior Avenue
Cleveland, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-3
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.512436° / Long 81.666333°, garden area at west side (front) of rectory

GROUND ELEVATION: 647.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 6/27/12	**COMPLETION DATE:** 6/27/12	**DRILLER:** Jeff Martin, Wendy Vorwerk
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 3 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): NA

NOTES: Sampling performed on a warm (T 70-80F), clear day. Soil samples were dry to slightly moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/27/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA			ML-CL	**USDA Sandy Clay Loam (USCS Silt to Lean Clay):** dark grayish brown (10YR 4/2), nonplastic to low plasticity, slight dilatancy, red brick fragments, appears to be native soil fill
	HA	0.5-1.0 0.5	0.5 - 1.0			1	1'	ML	**USDA Sandy Loam (USCS Silt):** very dark grayish brown (10YR 3/2), nonplastic, slight to rapid dilatancy, appears to be native soil fill
1	HA	1.0-1.5 0.5	1.0 - 1.5				1.5'	ML	**USDA Sandy Loam (USCS Silt):** very dark brown (10YR 2/2), nonplastic, slight to rapid dilatancy, trace to little clay, possibly the top (A horizon) of the buried Elnora soil glass and ceramic pottery (china) fragments encountered between 1.5 and 2.0 ft
	HA	1.5-2.0 0.5	1.5 - 2.0				2'	ML	
2	HA	2.0-2.5 0.5	2.0 - 2.5			2	2.5'	ML	**USDA Loamy Sand (USCS Silt):** dark brown (10YR 3/3), nonplastic, slight to rapid dilatancy, trace to little gravel (quartz pebbles) and shale fragments
	HA	2.5-3.0 0.5	2.5 - 3.0				3'	ML	brown (10YR 4/3), finer grain size overall, trace gravel and shale fragments
3	HA	3.0-3.5 0.5	3.0 - 3.5				3.5'	ML	yellowish brown (10YR 5/4)
	HA	3.5-4.0 0.5	3.5 - 4.0				4'	ML	yellowish brown (10YR 5/6)
4									

REMARKS:

1. FP-XRF screening sample SNPS 0.0-1.5 ft
2. FP-XRF screening sample SNPS 1.5-3.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:54 - C:\PROGRAM FILES\GINTPROJECTS\CUYAHOGA COUNTY SOILS\ST NICHOLAS PARISH.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

Rocky River Reservation (South)
Cleveland Metropark
Lakewood, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-4
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.468197° / Long 81.832142°, approx. 1,000 ft south of I-90 bridge on steep hillside

GROUND ELEVATION: 632.0 ft | **TOC ELEVATION:** NA | **DRILLING SERVICES:** Ohio EPA SIFU

START DATE: 7/3/12 | **COMPLETION DATE:** 7/3/12 | **DRILLER:** Jeff Martin, Wendy Vorwerk

DRILLING & SAMPLING METHODS: Hand Auger | **LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 3 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): 3

NOTES: Sampling performed on a warm (T 75-85F), overcast day. Soil samples were dry to slightly moist. Heavy afternoon rain after sampling.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
07/03/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA		0.5'	CL	**USDA Silt Loam (USCS Lean Clay):** grayish brown (10YR 5/2), low to medium plasticity, no dilatancy, few to little shale fragments
	HA	0.5-1.0 0.5	0.5 - 1.0			1		CL	**USDA Silty Clay Loam (USCS Lean Clay):** pale yellowish brown (10YR 6/4), low to medium plasticity, no dilatancy, few to little shale fragments
1	HA	1.0-1.5 0.5	1.0 - 1.5				1.5'		trace to few shale fragments
	HA	1.5-2.0 0.5	1.5 - 2.0						**USDA Silty Clay (USCS Lean Clay):** yellowish brown (10YR 5/4), medium plasticity, no dilatancy
2	HA	2.0-2.5 0.5	2.0 - 2.5			2		CL	few to little shale fragments
	HA	2.5-3.0 0.5	2.5 - 3.0				3'		hand auger refusal on shale bedrock at 3.0 ft
3									
4									

REMARKS:

1. FP-XRF screening sampling RR1PS 0.0-1.5 ft
2. FP-XRF screening sampling RR1PS 1.5-3.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:39 - C:\PROGRAM FILES\GINTPROJECTS\CUYAHOGA COUNTY SOIL\ROCKY RIVER RESERVATION SOUTH.GPJ

Ohio Environmental Protection Agency	Rocky River Reservation (North)	DERR-SIFU
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	Cleveland Metropark Lakewood, OH Cuyahoga County, NA Project No./Type: NA/Urban Soil Background	**Soil Boring Log** **PSB-5** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.470794° / Long 81.824531°, approx. 250 ft south of I-90 bridge on floodplain (oxbow depression)

GROUND ELEVATION: 590.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 7/3/12	**COMPLETION DATE:** 7/3/12	**DRILLER:** Jeff Martin, Wendy Vorwerk
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin, Wendy Vorwerk
DIAMETER (in): 3	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): NA

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
07/03/12	00:00		not encountered

NOTES: Sampling performed on a warm (T 75-85F), overcast day. Soil samples were moist to very moist. Heavy afternoon rain after sampling.

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA			CL	**USDA Silty Clay Loam (USCS Lean Clay):** brown (10YR 5/3), medium plasticity, no dilatancy, trace to little sand, trace solid waste (aluminum bottle caps, broken glass, red clay drainage tile fragments)
	HA	0.5-1.0 0.5	0.5 - 1.0						
1	HA	1.0-1.5 0.5	1.0 - 1.5			1			
	HA	1.5-2.0 0.5	1.5 - 2.0						← trace shale fragments
2						2	2'		
	HA	2.0-2.5 0.5	2.0 - 2.5					CL	**USDA Clay (USCS Lean Clay):** dark grayish brown (10YR 4/2), medium to high plasticity, no dilatancy, little gravel- and sand-sized material (shale and other rock fragments)
	HA	2.5-3.0 0.5	2.5 - 3.0						
3	HA	3.0-3.5 0.5	3.0 - 3.5						
	HA	3.5-4.0 0.5	3.5 - 4.0						
4							4'		

REMARKS:

1. FP-XRF screening sampling RR2PS 0.0-2.0 ft
2. FP-XRF screening sampling RR2PS 2.0-4.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:39 - C:\PROGRAM FILES\GINTP\PROJECTS\CUYAHOGA COUNTY SOILS\ROCKY RIVER RESERVATION NORTH.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

Huntington Reservation
Cleveland Metropark
Bay Village, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-6
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.487211° / Long 81.935897°, approx. 80 ft NE of the intersection of Porter Creek Rd & Park Ln

GROUND ELEVATION: 606.0 ft | **TOC ELEVATION:** NA | **DRILLING SERVICES:** Ohio EPA SIFU

START DATE: 7/11/12 | **COMPLETION DATE:** 7/11/12 | **DRILLER:** Jeff Martin, Wendy Vorwerk

DRILLING & SAMPLING METHODS: Hand Auger | **LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 3 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): 3.0

NOTES: Sampling performed on a warm (T 70-80F), clear day. Soil samples were dry to slightly moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
07/11/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA	1	0.5'	CL	**USDA Silty Clay Loam (USCS Lean Clay):** brown (10YR 5/3), low to medium plasticity, no dilatancy
	HA	0.5-1.0 0.5	0.5 - 1.0				1'	CL	pale brown (10YR 6/3)
1	HA	1.0-1.5 0.5	1.0 - 1.5						**USDA Silty Clay (USCS Lean Clay):** pale brown (10YR 6/3), medium plasticity, trace to little weathered shale fragments
	HA	1.5-2.0 0.5	1.5 - 2.0					CL	little to some shale fragments
2	HA	2.0-2.5 0.5	2.0 - 2.5			2			
	HA	2.5-3.0 0.5	2.5 - 3.0				3'		hand auger refusal encountered on shale bedrock at 3.0 ft
3									
4									

REMARKS:

1. FP-XRF screening sample HNPS 0.0-1.0 ft
2. FP-XRF screening sample HNPS 2.0-3.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:28 - C:\PROGRAM FILES\GINTP\PROJECTS\CUYAHOGA COUNTY SOIL\HUNTINGTON RESERVATION.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

West Creek Reservation
Cleveland Metropark
Parma, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-7
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.391414° / Long 81.688061°, 570 ft W of Broadview & W Ridgewood, 180 ft S of W Ridgewood

GROUND ELEVATION: 932.0 ft | **TOC ELEVATION:** NA | **DRILLING SERVICES:** Ohio EPA SIFU

START DATE: 7/11/12 | **COMPLETION DATE:** 7/11/12 | **DRILLER:** Jeff Martin, Wendy Vorwerk

DRILLING & SAMPLING METHODS: Hand Auger | **LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 3 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): NA

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
07/11/12	00:00		not encountered

NOTES: Sampling performed on a warm (T 70-80F), clear day. Soil samples were slightly moist to moist.

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA		0.5'	CL	**USDA Silt Loam (USCS Lean Clay):** very dark grayish brown (10'YR 3/2), low to medium plasticity, no dilantancy
	HA	0.5-1.0 0.5	0.5 - 1.0			1	1'	CL	**USDA Silty Clay Loam (USCS Lean Clay):** dark grayish brown (10'YR 4/2), medium plasticity, no dilantancy
1	HA	1.0-1.5 0.5	1.0 - 1.5				1.5'	CL	**USDA Silty Clay (USCS Lean Clay):** very dark grayish brown (10'YR 3/2), medium to high plasticity, no dilantancy, weathered till
	HA	1.5-2.0 0.5	1.5 - 2.0						gray (10'YR 6/1) with yellowish brown (10'YR 5/8) mottling, high toughness (very stiff)
2	HA	2.0-2.5 0.5	2.0 - 2.5			2			
	HA	2.5-3.0 0.5	2.5 - 3.0					CL	
3	HA	3.0-3.5 0.5	3.0 - 3.5						
	HA	3.5-4.0 0.5	3.5 - 4.0				4'		
4									

REMARKS:

1. FP-XRF screening sample WCPS 0.0-1.5 ft
2. FP-XRF screening sample WCPS 1.5-3.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:38 - C:\PROGRAM FILES\GINTPROJECTS\CUYAHOGA COUNTY SOIL\WEST CREEK RESERVATION.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

Rockfeller Park
City of Cleveland Park
Cleveland, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-8
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.536994° / Long 81.629689°, 80 ft NE of the inter. of E88th St. & Martin Luther King Jr. Dr

GROUND ELEVATION: 628.0 ft | **TOC ELEVATION:** NA | **DRILLING SERVICES:** Ohio EPA SIFU

START DATE: 7/11/12 | **COMPLETION DATE:** 7/11/12 | **DRILLER:** Jeff Martin, Wendy Vorwerk

DRILLING & SAMPLING METHODS: Hand Auger | **LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 3 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): NA

NOTES: Sampling performed on a warm (T 70-80F), clear day. Soil samples were dry to slightly moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
07/11/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA	1	0.5'	ML	**USDA Sandy Loam (USCS Silt; "clayey silt"):**dark grayish brown (10YR 4/2), nonplastic to low plasticity, slight to rapid dilantancy
	HA	0.5-1.0 0.5	0.5 - 1.0				1'	ML	brown (10YR 4/3)
1	HA	1.0-1.5 0.5	1.0 - 1.5			2	1.5'	CL	**USDA Sandy Clay (USCS Lean Clay):**dark yellowish brown (10YR 4/4), low to medium plasticity, no dilantancy
	HA	1.5-2.0 0.5	1.5 - 2.0				2'	CL	**USDA Silty Clay (USCS Lean Clay):**yellowish brown (10YR 5/4), low to medium plasticity, no dilantancy
2	HA	2.0-2.5 0.5	2.0 - 2.5			3		CL	**USDA Sandy Clay Loam (USCS Lean Clay to Silt):**brown (10YR 5/3), low plasticity, no dilantancy
	HA	2.5-3.0 0.5	2.5 - 3.0						nonplastic to low plasticity, slight to rapid dilatancy
3	HA	3.0-3.5 0.5	3.0 - 3.5				3.5'		slight dilatancy
	HA	3.5-4.0 0.5	3.5 - 4.0				4'	ML	**USDA Sandy Loam (USCS Silt):**light brownish gray (10YR 6/2), nonplastic, rapid dilantancy, little to some fine sand
4									

REMARKS:

1. FP-XRF screening sample RFPS 0.0-1.0 ft
2. FP-XRF screening sample RFPS 1.0-2.0 ft
3. FP-XRF screening sample RFPS 2.0-3.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:28 - C:\PROGRAM FILES\GINTW\PROJECTS\CUYAHOGA COUNTY SOIL\ROCKEFELLER PARK.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

Euclid Creek Reservation
Cleveland Metropark
Euclid, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-9
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.552044° / Long 81.531611°, W of Metro Park Dr, 0.8 mi S of Metro Park Dr & Highland Rd

GROUND ELEVATION: 858.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 7/11/12	**COMPLETION DATE:** 7/11/12	**DRILLER:** Jeff Martin, Wendy Vorwerk
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 3 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): 2.5

NOTES: Sampling performed on a warm (T 85-90 F), cloudy day. Soil samples were dry to slightly moist. Heavy rain after sampling was completed.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
07/11/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA		0.5'	CL	**USDA Sandy Clay Loam (USCS Lean Clay):** dark grayish brown (10'YR 4/2), low plasticity, no dilantancy
	HA	0.5-1.0 0.5	0.5 - 1.0				1'	CL	brown (10'YR 5/3)
1	HA	1.0-1.5 0.5	1.0 - 1.5			1		CL	yellowish brown (10'YR 5/4), low to medium plasticity
	HA	1.5-2.0 0.5	1.5 - 2.0				2'		
2	HA	2.0-2.5 0.5	2.0 - 2.5				2.5'	CL	**USDA Silty Clay (USCS Lean Clay):** yellowish brown (10'YR 5/4), low to medium plasticity, no dilantancy hand auger refusal on shale bedrock at 2.5 ft
3									
4									

REMARKS:

1. FP-XRF screening sample EPSP 0.0-2.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:39 - C:\PROGRAM FILES\GINTPROJECTS\CUYAHOGA COUNTY SOIL\EUCLID CREEK RESERVATION.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

Holy Spirit Cemetery (East)
5500 West 54th Street
Parma, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-10
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.412369° / Long 81.726125°, lawn area between church parking lot and cemetery

GROUND ELEVATION: 847.0 ft | **TOC ELEVATION:** NA | **DRILLING SERVICES:** Ohio EPA SIFU

START DATE: 8/1/12 | **COMPLETION DATE:** 8/1/12 | **DRILLER:** Jeff Martin, Wendy Vorwerk

DRILLING & SAMPLING METHODS: Hand Auger | **LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 4 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): 2.5

NOTES: Sampling performed on a warm (T 70-80F), partly cloudy day. Soil samples were dry to slightly moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
08/01/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA	1	0.5'	CL	**USDA Clay Loam (USCS Lean Clay):** yellowish brown (10YR 5/4), low to medium plasticity, no dilatancy
	HA	0.5-1.0 0.5	0.5 - 1.0				1'	CL	**USDA Silty Clay (USCS Lean Clay):** yellowish brown (10YR 5/4), medium plasticity, no dilatancy
1	HA	1.0-1.5 0.5	1.0 - 1.5						**USDA Silty Clay (USCS Lean Clay):** dark yellowish brown (10YR 4/6), medium to high plasticity, no dilantancy, trace rock fragments (mostly shale)
	HA	1.5-2.0 0.5	1.5 - 2.0			2		CL	
2	HA	2.0-2.5 0.5	2.0 - 2.5				2.5'		increase in rock fragments, hand auger refusal at 2.5 ft on bedrock
3									
4									

REMARKS:

1. FP-XRF screening sampling HSPSa 0.0-1.0 ft
2. FP-XRF screening sampling HSPSa 1.0-2.5 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:26 - C:\PROGRAM FILES\GINTA\PROJECTS\CUYAHOGA COUNTY SOIL\HOLY SPIRIT CEMETERY EAST.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

Brookside Reservation
Cleveland Metropark
Cleveland, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-11
Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 41.447519° / Long 81.726506°, approx 1200 ft NW of Fulton Rd & Park Dr

GROUND ELEVATION: 672.0 ft | **TOC ELEVATION:** NA | **DRILLING SERVICES:** Ohio EPA SIFU

START DATE: 8/1/12 | **COMPLETION DATE:** 8/1/12 | **DRILLER:** Jeff Martin, Wendy Vorwerk

DRILLING & SAMPLING METHODS: Hand Auger | **LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 4 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): 3.5

NOTES: Sampling performed on a warm (T 70-80F), clear to partly cloudy day. Soil samples were slightly moist to moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
08/01/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA	1	0.5'	CL	**USDA Silty Clay (USCS Lean Clay):** very dark grayish brown (10YR 3/2), low to medium plasticity, no dilantancy, trace to some cinders, trace broken glass
	HA	0.5-1.0 0.5	0.5 - 1.0			2, 3		CL	yellowish brown (10YR 5/4), trace rock fragments (subangular to subrounded pebbles), trace broken glass
1	HA	1.0-1.5 0.5	1.0 - 1.5				1.5'		
	HA	1.5-2.0 0.5	1.5 - 2.0						dark yellowish brown (10YR 4/4), trace rock fragments (subangular to subrounded pebbles)
2	HA	2.0-2.5 0.5	2.0 - 2.5					CL	
	HA	2.5-3.0 0.5	2.5 - 3.0			4			calcite precipitation along fracture planes
3	HA	3.0-3.5 0.5	3.0 - 3.5				3.5'		hand auger refusal at 3.5 ft
4									

REMARKS:

1. Coal cinders & fire bricks present at ground surface; these materials are weathered and appear to be very old (>50-70 years?)
2. FP-XRF screening sample BSPS 0.0-0.5 ft
3. FP-XRF screening sample BSPS 0.5-1.5 ft
4. FP-XRF screening sample BSPS 2.5-3.5 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:25 - C:\PROGRAM FILES\GINTW\PROJECTS\CUYAHOGA COUNTY SOLS\BROOKSIDE RESERVATION.GPJ

Ohio Environmental Protection Agency

4675 Homer-Ohio Lane
Groveport, OH 43215
Telephone: (614) 836-8820, Fax: (614) 836-8795

Garfield Park Reservation
Cleveland Metropark
Garfield Heights, OH
Cuyahoga County, NA

Project No./Type: NA/Urban Soil Background

DERR-SIFU
Soil Boring Log

PSB-12

LAT/LONG and/or LOCATION DESCRIPTION: Lat 41.429672° / Long 81.608967°, 470 ft SW Garfield Pkwy & Garfield Pkwy S, 180 NE Garfield Pkwy S

GROUND ELEVATION: 823.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 8/1/12	**COMPLETION DATE:** 8/1/12	**DRILLER:** Jeff Martin, Wendy Vorwerk
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin, Wendy Vorwerk

DIAMETER (in): 4 | **TOTAL DEPTH** (ft): 4 | **REFUSAL** (ft): 3.0

NOTES: Sampling performed on a warm (T 70-80F), clear to partly cloudy day. Soil samples were slightly moist to moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
08/01/12	00:00		not encountered

DEPTH (ft)	CORING: Core Type	CORING: Core Interval/ Recovery (ft)	SAMPLING: Sample Interval (ft)	SAMPLING: Sample Purpose/ID	SAMPLING: PID (ppmv)	REMARKS	GRAPHIC LOG	USCS	MATERIAL DESCRIPTION
	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA	1	0.5'	CL	**USDA Silty Clay (USCS Lean Clay):** black (10YR 2/1), low plasticity, no dilantancy
	HA	0.5-1.0 0.5	0.5 - 1.0			2	1'	CL	dark yellowish brown (10YR 4/4), low to medium plasticity, trace to little fine sand
1	HA	1.0-1.5 0.5	1.0 - 1.5			3	1.5'	CL	yellowish brown (10YR 5/6) with gray mottling (10YR 5/1), medium plasticity, trace sand
	HA	1.5-2.0 0.5	1.5 - 2.0			4	2'	CL	dark yellowish brown (10YR 4/6) with grayish brown mottling (10YR 5/2)
2	HA	2.0-2.5 0.5	2.0 - 2.5			5	2.5'	CL	dark yellowish brown (10YR 4/6), trace to little shale fragments
	HA	2.5-3.0 0.5	2.5 - 3.0			6	3'	CL	brown (10YR 4/3), calcite precipitate along fracture planes
3									hand auger refusal at 3.0 ft
4									

REMARKS:

1. FP-XRF screening sample GRPS 0.0-0.5 ft
2. FP-XRF screening sample GRPS 0.5-1.0 ft
3. FP-XRF screening sample GRPS 1.0-1.5 ft
4. FP-XRF screening sample GRPS 1.5-2.0 ft
5. FP-XRF screening sample GRPS 2.0-2.5 ft
6. FP-XRF screening sample GRPS 2.5-3.0 ft

SURVEY BENCHMARK & DATUM: Google Earth

OHIO EPA BACKGROUND SOIL LOG - OHIO EPA GEOPROBE LOG.GDT - 9/7/12 12:25 - C:\PROGRAM FILES\GINT\PROJECTS\CUYAHOGA COUNTY SOIL\GARFIELD PARK RESERVATION.GPJ

APPENDIX B

FP-XRF SOIL ANALYTICAL SCREENING RESULTS

Sample Location	Sample Identification	Sampling Date	Screening (Analysis) Date	Reading Number	Titanium, ppm (LOD 10-100 ppm)		Chromium, ppm (LOD 10-100 ppm)		Manganese, ppm (LOD 10-100 ppm)		Iron, ppm (LOD 10-100 ppm)		Cobalt, ppm (LOD 10-100 ppm)	
					Ti	Ti +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-
QA/QC	Pass Internal Standardization	N/A	7/17/12	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QA/QC	SiO_2 Blank	N/A	7/17/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	High Cal Standard	N/A	7/17/12	1	2,724.61	462.34	<LOD	<LOD	10,145.58	209.85	39,745.84	568.68	<LOD	<LOD
QA/QC	Low Cal Standard	N/A	7/17/12	1	2,679.44	360.79	<LOD	<LOD	403.51	45.93	33,532.33	432.16	<LOD	<LOD
QA/QC	SiO_2 Blank	N/A	7/17/12	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Holy Spirit Cemetery West, PSB-1	HSPS/W 0.0-2.0 ft	6/27/12	7/17/12	1	**5,553.58**	**422.28**	**172.46**	**52.53**	**176.60**	**38.71**	**29,927.85**	**380.05**	<LOD	<LOD
				2	**5,533.37**	**426.32**	<LOD	<LOD	**202.80**	**38.61**	**30,322.88**	**379.60**	**198.63**	**60.12**
	HSPS/W 2.0-4.0 ft	6/27/12	7/17/12	1	**5,063.46**	**429.14**	<LOD	<LOD	**367.15**	**45.26**	**35,439.70**	**443.91**	**236.19**	**66.30**
				2	**5,091.15**	**407.58**	<LOD	<LOD	**343.32**	**42.82**	**33,932.37**	**413.95**	<LOD	<LOD
St. Gregory Church, PSB-2	SGPS 0.0-2.0 ft	6/27/12	7/17/12	1	**4,759.39**	**396.37**	<LOD	<LOD	**123.07**	**36.94**	**30,442.95**	**380.72**	<LOD	<LOD
				2	**4,525.73**	**401.21**	<LOD	<LOD	**142.34**	**38.00**	**30,064.99**	**384.80**	<LOD	<LOD
	SGPS 3.5-4.0 ft	6/27/12	7/17/12	1	**5,559.43**	**442.08**	<LOD	<LOD	**310.07**	**46.49**	**42,968.44**	**531.95**	<LOD	<LOD
				2	**5,797.79**	**452.30**	<LOD	<LOD	**283.24**	**46.60**	**42,271.69**	**533.05**	**229.90**	**73.85**
St. Nicholas Church, PSB-3	SNPS 0.0-1.5 ft	6/27/12	7/17/12	1	**4,438.17**	**372.57**	<LOD	<LOD	**327.30**	**39.90**	**27,695.74**	**342.68**	<LOD	<LOD
				2	**4,149.19**	**374.57**	**164.02**	**50.24**	**460.95**	**43.79**	**27,950.85**	**351.35**	<LOD	<LOD
	SNPS 1.5-3.0 ft	6/27/12	7/17/12	1	**2,993.00**	**352.52**	<LOD	<LOD	**301.01**	**38.45**	**24,522.85**	**308.41**	<LOD	<LOD
				2	**2,881.35**	**349.90**	<LOD	<LOD	**176.52**	**35.01**	**22,490.96**	**292.34**	<LOD	<LOD
QA/QC	SiO_2 Blank	N/A	7/17/12	3	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	Pass Internal Standardization	N/A	7/27/12	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QA/QC	SiO_2 Blank	N/A	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Sample Location	Sample Identification	Sampling Date	Screening (Analysis) Date	Reading Number	Titanium, ppm (LOD 10-100 ppm)		Chromium, ppm (LOD 10-100 ppm)		Manganese, ppm (LOD 10-100 ppm)		Iron, ppm (LOD 10-100 ppm)		Cobalt, ppm (LOD 10-100 ppm)	
					Ti	Ti +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-
Euclid Creek Reservation, PSB-9	ECPS 0.0-2.0 ft	7/11/12	7/27/12	1	4,063.44	396.04	<LOD	<LOD	233.41	40.53	33,672.79	414.99	<LOD	<LOD
				2	3,913.44	388.04	<LOD	<LOD	237.57	40.28	33,666.17	409.07	230.57	62.43
Huntington Reservation, PSB-6	HNPS 0.0-1.0 ft	7/11/12	7/27/12	1	6,151.70	441.90	<LOD	<LOD	<LOD	<LOD	32,966.52	412.52	257.63	63.63
				2	5,856.06	442.95	<LOD	<LOD	<LOD	<LOD	33,766.56	420.63	246.28	64.15
	HNPS 2.0-3.0 ft	7/11/12	7/27/12	1	5,496.72	462.64	<LOD	<LOD	<LOD	<LOD	41,822.93	528.64	297.38	74.03
				2	4,877.92	456.46	218.17	60.06	<LOD	<LOD	39,253.22	499.70	<LOD	<LOD
Rockefeller Park, PSB-8	RFPS 0.0-1.0 ft	7/11/12	7/27/12	1	4,195.37	368.41	<LOD	<LOD	259.88	39.34	29,156.67	362.47	<LOD	<LOD
				2	3,868.76	363.85	<LOD	<LOD	203.91	36.33	24,336.02	311.99	<LOD	<LOD
	RFPS 1.0-2.0 ft	7/11/12	7/27/12	1	4,768.43	399.46	<LOD	<LOD	130.25	37.36	31,210.84	392.39	<LOD	<LOD
				2	4,568.52	385.12	<LOD	<LOD	171.82	37.55	30,146.56	373.26	<LOD	<LOD
	RFPS 2.0-3.0 ft	7/11/12	7/27/12	1	3,565.62	332.86	<LOD	<LOD	141.87	29.80	16,290.89	211.66	<LOD	<LOD
				2	3,337.16	328.47	<LOD	<LOD	117.76	29.59	16,322.03	216.57	<LOD	<LOD
Rocky River Reservation (South), PSB-4	RR1PS 0.0-1.5 ft	7/3/12	7/27/12	1	7,546.70	499.07	<LOD	<LOD	193.11	43.52	37,931.29	487.77	247.92	70.79
				2	6,753.46	472.94	<LOD	<LOD	271.17	44.74	39,203.45	491.90	<LOD	<LOD
	RR1PS 1.5-3.0 ft	7/3/12	7/27/12	1	5,291.81	482.04	<LOD	<LOD	<LOD	<LOD	48,313.57	614.50	261.30	80.59
				2	5,566.18	482.70	<LOD	<LOD	<LOD	<LOD	48,157.93	605.64	306.82	79.86
Rocky River Reservation (North), PSB-5	RR2PS 0.0-2.0 ft	7/3/12	7/27/12	1	4,686.08	420.62	<LOD	<LOD	364.10	44.86	35,105.10	441.22	<LOD	<LOD
				2	5,151.89	412.70	<LOD	<LOD	396.83	44.56	34,167.15	422.96	<LOD	<LOD
	RR2PS 2.0-4.0 ft	7/3/12	7/27/12	1	4,110.21	418.73	<LOD	<LOD	195.73	42.02	38,266.59	472.24	<LOD	<LOD
				2	4,948.21	427.13	<LOD	<LOD	279.49	43.88	37,506.04	467.38	<LOD	<LOD
West Creek Reservation, PSB-7	WCPS 0.0-1.5 ft	7/11/12	7/27/12	1	4,614.82	398.13	<LOD	<LOD	438.05	43.95	30,525.34	378.51	<LOD	<LOD
				2	5,000.10	414.65	<LOD	<LOD	828.24	52.18	31,747.13	392.68	<LOD	<LOD
	WCPS 1.5-3.0 ft	7/11/12	7/27/12	1	6,113.82	443.31	<LOD	<LOD	133.24	41.13	40,292.91	495.39	215.59	70.02
				2	5,632.34	444.28	169.02	56.13	<LOD	<LOD	39,195.97	483.55	<LOD	<LOD
QA/QC	SiO_2 Blank	N/A	7/27/12	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	Pass Internal Standardization	N/A	8/13/12	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QA/QC	SiO_2 Blank	N/A	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Sample Location	Sample Identification	Sampling Date	Screening (Analysis) Date	Reading Number	Titanium, ppm (LOD 10-100 ppm)		Chromium, ppm (LOD 10-100 ppm)		Manganese, ppm (LOD 10-100 ppm)		Iron, ppm (LOD 10-100 ppm)		Cobalt, ppm (LOD 10-100 ppm)	
					Ti	Ti +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-
Brookside Reservation, PSB-11	BSPS 0.0-0.5 ft	8/1/12	8/13/12	1	3,534.42	362.48	<LOD	<LOD	265.32	38.70	30,638.02	367.96	<LOD	<LOD
				2	3,744.00	364.64	<LOD	<LOD	342.46	41.11	32,758.82	390.10	<LOD	<LOD
	BSPS 0.5-1.5 ft	8/1/12	8/13/12	1	4,498.33	416.28	<LOD	<LOD	159.35	41.28	38,985.43	482.57	296.84	69.72
				2	4,321.98	422.08	<LOD	<LOD	306.77	45.01	39,889.22	489.95	215.25	69.56
	BSPS 2.5-3.5 ft	8/1/12	8/13/12	1	4,408.04	416.99	<LOD	<LOD	303.58	44.56	38,764.81	478.64	<LOD	<LOD
				2	4,340.84	433.79	<LOD	<LOD	461.77	49.80	40,493.42	511.76	<LOD	<LOD
Holy Spirit Cemetery East, PSB-10	HSPS/E 0.0-1.0 ft	8/1/12	8/13/12	1	4,213.54	384.44	<LOD	<LOD	473.96	43.48	27,512.19	345.09	<LOD	<LOD
				2	4,796.65	391.19	<LOD	<LOD	431.65	41.75	25,834.62	322.81	<LOD	<LOD
	HSPS/E 1.0-2.5 ft	8/1/12	8/13/12	1	3,821.63	401.43	<LOD	<LOD	242.90	42.77	38,606.90	471.08	<LOD	<LOD
				2	4,885.60	421.70	<LOD	<LOD	357.73	45.88	39,633.16	485.46	277.95	69.58
Garfield Park Reservation, PSB-12	GRPS 0.0-0.5 ft	8/1/12	8/13/12	1	4,404.64	376.94	<LOD	<LOD	646.11	46.00	22,584.27	291.65	<LOD	<LOD
				2	4,397.32	377.83	<LOD	<LOD	760.51	47.95	22,845.60	292.19	<LOD	<LOD
	GRPS 0.5-1.0 ft	8/1/12	8/13/12	1	5,324.98	393.03	<LOD	<LOD	166.68	36.22	26,781.91	336.41	<LOD	<LOD
				2	4,432.97	395.79	<LOD	<LOD	130.43	35.43	27,278.26	340.59	<LOD	<LOD
	GRPS 1.0-1.5 ft	8/1/12	8/13/12	1	4,937.14	423.66	<LOD	<LOD	<LOD	<LOD	39,507.30	487.77	239.25	69.69
				2	4,492.39	417.85	<LOD	<LOD	143.94	40.93	40,724.16	491.88	<LOD	<LOD
	GRPS 1.5-2.0 ft	8/1/12	8/13/12	1	5,086.73	439.92	<LOD	<LOD	299.13	46.16	41,884.66	522.51	232.05	72.75
				2	5,418.41	432.18	<LOD	<LOD	302.28	45.23	39,820.39	493.39	<LOD	<LOD
	GRPS 2.0-2.5 ft	8/1/12	8/13/12	1	5,095.54	439.14	<LOD	<LOD	320.04	47.00	41,739.66	525.72	<LOD	<LOD
				2	5,532.38	436.52	<LOD	<LOD	318.65	46.32	40,972.86	511.28	299.46	72.31
	GRPS 2.5-3.0 ft	8/1/12	8/13/12	1	5,376.69	444.99	<LOD	<LOD	405.64	48.33	41,089.26	511.99	<LOD	<LOD
				2	4,993.19	427.11	<LOD	<LOD	424.96	48.26	41,631.31	513.04	258.19	71.83
QA/QC	SiO_2 Blank	N/A	8/13/12	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Sample Location	Sample Identification	Sampling Date	Screening (Analysis) Date	Reading Number	Nickel, ppm (LOD 10-100 ppm)		Copper, ppm (LOD 10-100 ppm)		Zinc, ppm (LOD 10-100 ppm)		Arsenic, ppm (LOD 10-100 ppm)		Selenium, ppm (LOD 10-100 ppm)		Rubidium, ppm (LOD 10-100 ppm)		Strontium, ppm (LOD 10-100 ppm)		Zirconium, ppm (LOD 10-100 ppm)	
					Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Rb	Rb +/-	Sr	Sr +/-	Zr	Zr +/-
QA/QC	Pass Internal Standardization	N/A	7/17/12	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QA/QC	SiO_2 Blank	N/A	7/17/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	High Cal Standard	N/A	7/17/12	1	<LOD	<LOD	3,055.69	59.44	7,138.94	106.77	802.10	33.58	<LOD	<LOD	120.17	4.19	324.82	6.99	97.29	4.17
QA/QC	Low Cal Standard	N/A	7/17/12	1	<LOD	<LOD	<LOD	<LOD	110.43	7.32	15.87	2.84	<LOD	<LOD	96.54	3.08	232.76	4.97	131.92	3.83
QA/QC	SiO_2 Blank	N/A	7/17/12	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Holy Spirit Cemetery West, PSB-1	HSPS/W 0.0-2.0 ft	6/27/12	7/17/12	1	<LOD	<LOD	**39.97**	**9.36**	**64.79**	**5.91**	**10.02**	**3.06**	<LOD	<LOD	**162.00**	**3.92**	**76.12**	**2.72**	**222.47**	**4.53**
				2	<LOD	<LOD	<LOD	<LOD	**69.01**	**5.94**	**13.89**	**2.94**	<LOD	<LOD	**151.27**	**3.73**	**80.48**	**2.75**	**205.50**	**4.30**
	HSPS/W 2.0-4.0 ft	6/27/12	7/17/12	1	<LOD	<LOD	<LOD	<LOD	**93.56**	**6.79**	**14.88**	**2.91**	<LOD	<LOD	**122.43**	**3.40**	**98.11**	**3.07**	**253.79**	**4.93**
				2	<LOD	<LOD	<LOD	<LOD	**87.61**	**6.41**	**19.50**	**2.86**	<LOD	<LOD	**112.52**	**3.15**	**95.36**	**2.94**	**230.30**	**4.53**
St. Gregory Church, PSB-2	SGPS 0.0-2.0 ft	6/27/12	7/17/12	1	<LOD	<LOD	<LOD	<LOD	**105.53**	**6.96**	**11.35**	**3.35**	<LOD	<LOD	**97.75**	**2.96**	**113.56**	**3.23**	**276.61**	**5.08**
				2	<LOD	<LOD	<LOD	<LOD	**102.29**	**7.00**	**12.74**	**3.48**	<LOD	<LOD	**96.81**	**3.01**	**100.87**	**3.11**	**276.98**	**5.18**
	SGPS 3.5-4.0 ft	6/27/12	7/17/12	1	**64.78**	**19.15**	**32.04**	**9.61**	**110.79**	**7.35**	**17.76**	**3.05**	<LOD	<LOD	**132.33**	**3.58**	**121.98**	**3.45**	**213.68**	**4.56**
				2	<LOD	<LOD	<LOD	<LOD	**86.92**	**6.79**	**20.48**	**3.10**	<LOD	<LOD	**139.51**	**3.74**	**123.84**	**3.53**	**213.46**	**4.64**
St. Nicholas Church, PSB-3	SNPS 0.0-1.5 ft	6/27/12	7/17/12	1	<LOD	<LOD	**43.30**	**9.15**	**165.42**	**8.20**	**11.98**	**3.51**	<LOD	<LOD	**63.88**	**2.36**	**108.54**	**3.08**	**263.46**	**4.81**
				2	<LOD	<LOD	**37.87**	**9.13**	**178.46**	**8.61**	**14.17**	**3.71**	<LOD	<LOD	**64.70**	**2.42**	**96.70**	**2.96**	**276.24**	**5.02**
	SNPS 1.5-3.0 ft	6/27/12	7/17/12	1	<LOD	<LOD	**47.83**	**9.24**	**164.76**	**8.18**	**20.90**	**5.56**	<LOD	<LOD	**54.67**	**2.22**	**131.45**	**3.38**	**246.55**	**4.65**
				2	<LOD	<LOD	**55.72**	**9.57**	**167.03**	**8.38**	**25.40**	**5.71**	<LOD	<LOD	**53.19**	**2.23**	**121.42**	**3.31**	**222.14**	**4.47**
QA/QC	SiO_2 Blank	N/A	7/17/12	3	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	Pass Internal Standardization	N/A	7/27/12	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QA/QC	SiO_2 Blank	N/A	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Sample Location	Sample Identification	Sampling Date	Screening (Analysis) Date	Reading Number	Nickel, ppm (LOD 10-100 ppm)		Copper, ppm (LOD 10-100 ppm)		Zinc, ppm (LOD 10-100 ppm)		Arsenic, ppm (LOD 10-100 ppm)		Selenium, ppm (LOD 10-100 ppm)		Rubidium, ppm (LOD 10-100 ppm)		Strontium, ppm (LOD 10-100 ppm)		Zirconium, ppm (LOD 10-100 ppm)	
					Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Rb	Rb +/-	Sr	Sr +/-	Zr	Zr +/-
Euclid Creek Reservation, PSB-9	FCPS 0.0-2.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	93.27	6.60	17.89	3.02	<LOD	<LOD	120.66	3.30	71.75	2.62	207.08	4.30
				2	<LOD	<LOD	<LOD	<LOD	91.60	6.47	18.89	3.08	<LOD	<LOD	122.89	3.28	61.16	2.41	192.05	4.07
Huntington Reservation, PSB-6	HNPS 0.0-1.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	52.12	5.50	26.49	3.45	<LOD	<LOD	175.09	4.10	69.65	2.62	188.97	4.16
				2	<LOD	<LOD	<LOD	<LOD	56.76	5.63	24.15	3.25	<LOD	<LOD	175.49	4.09	64.73	2.54	177.12	4.02
	HNPS 2.0-3.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	33.01	9.65	42.09	5.40	22.69	3.32	<LOD	<LOD	211.59	4.75	78.15	2.86	166.99	4.08
				2	<LOD	<LOD	32.36	9.66	42.22	5.40	18.51	3.15	<LOD	<LOD	212.56	4.76	72.72	2.78	169.53	4.11
Rockefeller Park, PSB-8	RFPS 0.0-1.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	110.34	7.00	12.93	3.51	<LOD	<LOD	68.20	2.47	111.88	3.16	281.86	5.07
				2	<LOD	<LOD	<LOD	<LOD	87.45	6.39	15.54	3.32	<LOD	<LOD	60.87	2.35	108.57	3.13	273.62	4.99
	RFPS 1.0-2.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	86.08	6.48	18.25	2.99	<LOD	<LOD	84.43	2.78	93.19	2.96	275.78	5.09
				2	<LOD	<LOD	<LOD	<LOD	89.72	6.43	17.47	2.86	<LOD	<LOD	86.21	2.75	91.18	2.87	269.39	4.93
	RFPS 2.0-3.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	58.79	5.19	9.13	2.20	<LOD	<LOD	64.06	2.25	105.29	2.89	262.17	4.58
				2	<LOD	<LOD	<LOD	<LOD	58.58	5.29	<LOD	<LOD	<LOD	<LOD	60.11	2.24	101.48	2.90	266.65	4.72
Rocky River Reservation (South), PSB-4	RR1PS 0.0-1.5 ft	7/3/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	105.81	7.35	28.26	3.44	<LOD	<LOD	150.67	3.93	78.26	2.87	207.63	4.56
				2	<LOD	<LOD	<LOD	<LOD	102.29	7.10	26.26	3.30	<LOD	<LOD	147.85	3.81	83.25	2.89	209.84	4.50
	RR1PS 1.5-3.0 ft	7/3/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	97.54	7.25	20.59	3.18	<LOD	<LOD	189.05	4.54	81.95	2.98	185.59	4.38
				2	<LOD	<LOD	<LOD	<LOD	89.65	6.95	25.96	3.23	<LOD	<LOD	173.62	4.27	75.75	2.84	168.07	4.13
Rocky River Reservation (North), PSB-5	RR2PS 0.0-2.0 ft	7/3/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	122.35	7.56	17.76	3.38	<LOD	<LOD	130.56	3.52	89.79	2.96	235.68	4.73
				2	<LOD	<LOD	<LOD	<LOD	125.32	7.49	16.30	3.27	<LOD	<LOD	123.67	3.36	84.87	2.83	257.97	4.88
	RR2PS 2.0-4.0 ft	7/3/12	7/27/12	1	<LOD	<LOD	28.20	9.15	94.85	6.79	22.82	3.43	<LOD	<LOD	140.89	3.65	96.96	3.04	184.11	4.15
				2	66.28	18.47	<LOD	<LOD	102.72	7.06	20.00	3.42	<LOD	<LOD	137.23	3.62	96.35	3.05	202.77	4.38
West Creek Reservation, PSB-7	WCPS 0.0-1.5 ft	7/11/12	7/27/12	1	<LOD	<LOD	40.01	9.14	88.32	6.45	<LOD	<LOD	<LOD	<LOD	182.40	4.11	66.96	2.53	172.66	3.90
				2	<LOD	<LOD	27.01	8.91	85.58	6.38	<LOD	<LOD	<LOD	<LOD	184.85	4.16	65.12	2.51	171.26	3.90
	WCPS 1.5-3.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	63.79	5.90	15.11	2.97	<LOD	<LOD	171.41	4.07	64.83	2.56	217.35	4.49
				2	<LOD	<LOD	<LOD	<LOD	83.75	6.50	17.82	3.07	<LOD	<LOD	171.75	4.08	67.57	2.61	224.12	4.57
QA/QC	SiO_2 Blank	N/A	7/27/12	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	Pass Internal Standardization	N/A	8/13/12	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QA/QC	SiO_2 Blank	N/A	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Sample Location	Sample Identification	Sampling Date	Screening (Analysis) Date	Reading Number	Nickel, ppm (LOD 10-100 ppm)		Copper, ppm (LOD 10-100 ppm)		Zinc, ppm (LOD 10-100 ppm)		Arsenic, ppm (LOD 10-100 ppm)		Selenium, ppm (LOD 10-100 ppm)		Rubidium, ppm (LOD 10-100 ppm)		Strontium, ppm (LOD 10-100 ppm)		Zirconium, ppm (LOD 10-100 ppm)	
					Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Rb	Rb +/-	Sr	Sr +/-	Zr	Zr +/-
	BSPS 0.0-0.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	105.58	6.67	25.82	3.64	<LOD	<LOD	106.98	2.98	89.08	2.77	158.72	3.66
				2	51.05	16.61	<LOD	<LOD	105.99	6.70	17.03	3.68	<LOD	<LOD	112.27	3.06	97.59	2.89	166.83	3.76
Brookside Reservation, PSB-11	BSPS 0.5-1.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	75.32	6.26	12.08	2.63	<LOD	<LOD	143.33	3.70	103.69	3.16	223.18	4.60
				2	<LOD	<LOD	<LOD	<LOD	72.98	6.17	10.31	2.70	<LOD	<LOD	143.35	3.68	100.78	3.10	189.35	4.21
	BSPS 2.5-3.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	75.79	6.25	17.59	2.81	<LOD	<LOD	134.02	3.55	118.36	3.35	185.71	4.20
				2	<LOD	<LOD	38.28	9.82	85.49	6.75	10.23	2.93	<LOD	<LOD	140.92	3.75	117.92	3.44	193.43	4.40
Holy Spirit Cemetery East, PSB-10	HSPS/E 0.0-1.0 ft	8/1/12	8/13/12	1	<LOD	<LOD	29.00	8.82	63.52	5.71	9.01	2.71	<LOD	<LOD	102.54	3.00	94.37	2.92	254.01	4.76
				2	53.78	16.25	37.53	9.00	71.16	5.88	11.82	2.63	<LOD	<LOD	101.63	2.94	94.38	2.88	255.77	4.72
	HSPS/E 1.0-2.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	86.39	6.49	17.00	2.75	<LOD	<LOD	124.67	3.38	102.60	3.09	211.98	4.41
				2	<LOD	<LOD	30.89	9.30	78.84	6.34	12.98	2.68	<LOD	<LOD	126.53	3.43	109.54	3.21	197.93	4.30
Garfield Park Reservation, PSB-12	GRPS 0.0-0.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	34.92	9.01	93.44	6.57	<LOD	<LOD	<LOD	<LOD	72.85	2.53	99.89	2.99	461.25	6.92
				2	<LOD	<LOD	<LOD	<LOD	99.25	6.65	12.43	3.25	4.69	1.44	70.93	2.48	95.28	2.90	445.26	6.70
	GRPS 0.5-1.0 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	64.33	5.77	<LOD	<LOD	<LOD	<LOD	83.74	2.71	89.11	2.84	471.12	7.02
				2	<LOD	<LOD	<LOD	<LOD	72.59	5.96	11.80	2.53	<LOD	<LOD	81.01	2.65	96.08	2.93	471.19	7.00
	GRPS 1.0-1.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	73.26	6.22	17.02	2.81	<LOD	<LOD	109.30	3.20	89.85	2.95	283.46	5.23
				2	<LOD	<LOD	<LOD	<LOD	67.88	5.96	14.47	2.85	<LOD	<LOD	105.07	3.08	86.40	2.84	304.96	5.36
	GRPS 1.5-2.0 ft	8/1/12	8/13/12	1	<LOD	<LOD	43.59	9.87	98.29	7.06	13.20	2.87	<LOD	<LOD	138.33	3.68	102.35	3.18	216.75	4.60
				2	<LOD	<LOD	33.53	9.51	97.83	6.95	19.05	2.92	<LOD	<LOD	135.75	3.60	100.84	3.12	211.21	4.48
	GRPS 2.0-2.5 ft	8/1/12	8/13/12	1	63.58	19.16	32.57	9.72	81.60	6.64	17.07	2.85	<LOD	<LOD	140.14	3.74	110.22	3.33	190.87	4.36
				2	<LOD	<LOD	41.44	9.75	91.31	6.84	19.31	2.91	<LOD	<LOD	147.66	3.81	106.36	3.24	204.69	4.46
	GRPS 2.5-3.0 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	102.86	7.14	15.55	2.84	<LOD	<LOD	138.13	3.67	104.64	3.21	227.29	4.70
				2	<LOD	<LOD	<LOD	<LOD	111.65	7.29	13.92	2.90	<LOD	<LOD	142.17	3.69	109.23	3.24	204.92	4.42
QA/QC	SiO_2 Blank	N/A	8/13/12	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Sample Location	Sample Identification	Sampling Date	Screening (Analysis) Date	Reading Number	Molybdenum, ppm (LOD 10-100 ppm)		Silver, ppm (LOD 50-150 ppm)		Cadmium, ppm (LOD 50-150 ppm)		Tin, ppm (LOD 50-150 ppm)		Antimony, ppm (LOD 50-150 ppm)		Mercury, ppm (LOD 10-100 ppm)		Lead, ppm (LOD 10-100 ppm)	
					Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sn	Sn +/-	Sb	Sb +/-	Hg	Hg +/-	Pb	Pb +/-
QA/QC	Pass Internal Standardization	N/A	7/17/12	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QA/QC	SiO_2 Blank	N/A	7/17/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	High Cal Standard	N/A	7/17/12	1	22.94	3.61	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	89.39	12.36	5,518.61	80.92
QA/QC	Low Cal Standard	N/A	7/17/12	1	10.69	3.10	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	18.22	3.65
QA/QC	SiO_2 Blank	N/A	7/17/12	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Holy Spirit Cemetery West, PSB-1	HSPS/W 0.0-2.0 ft	6/27/12	7/17/12	1	**11.71**	**3.08**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**39.15**	**4.21**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**30.80**	**3.89**
	HSPS/W 2.0-4.0 ft	6/27/12	7/17/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**24.52**	**3.77**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**20.81**	**3.56**
St. Gregory Church, PSB-2	SGPS 0.0-2.0 ft	6/27/12	7/17/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**56.15**	**4.62**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**58.46**	**4.75**
	SGPS 3.5-4.0 ft	6/27/12	7/17/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**25.18**	**3.89**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**21.99**	**3.86**
St. Nicholas Church, PSB-3	SNPS 0.0-1.5 ft	6/27/12	7/17/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**70.62**	**4.83**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**77.24**	**5.08**
	SNPS 1.5-3.0 ft	6/27/12	7/17/12	1	<LOD	<LOD	**49.76**	**14.47**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**230.70**	**7.95**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**230.60**	**8.10**
QA/QC	SiO_2 Blank	N/A	7/17/12	3	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	Pass Internal Standardization	N/A	7/27/12	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QA/QC	SiO_2 Blank	N/A	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Sample Location	Sample Identification	Sampling Date	Screening (Analysis) Date	Reading Number	Molybdenum, ppm (LOD 10-100 ppm)		Silver, ppm (LOD 50-150 ppm)		Cadmium, ppm (LOD 50-150 ppm)		Tin, ppm (LOD 50-150 ppm)		Antimony, ppm (LOD 50-150 ppm)		Mercury, ppm (LOD 10-100 ppm)		Lead, ppm (LOD 10-100 ppm)	
					Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sn	Sn +/-	Sb	Sb +/-	Hg	Hg +/-	Pb	Pb +/-
Euclid Creek Reservation, PSB-9	ECPS 0.0-2.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	29.88	3.87
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	34.32	3.94
Huntington Reservation, PSB-6	HNPS 0.0-1.0 ft	7/11/12	7/27/12	1	52.43	3.35	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	40.26	4.25
				2	48.57	3.31	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	32.36	4.03
	HNPS 2.0-3.0 ft	7/11/12	7/27/12	1	34.32	3.33	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	14.54	4.49	29.58	4.14
				2	34.94	3.33	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	13.41	4.43	26.40	4.04
Rockefeller Park, PSB-8	RFPS 0.0-1.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	66.74	4.81
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	51.80	4.41
	RFPS 1.0-2.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	26.91	3.78
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	24.35	3.62
	RFPS 2.0-3.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	11.97	2.96
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	13.29	3.06
Rocky River Reservation (South), PSB-4	RR1PS 0.0-1.5 ft	7/3/12	7/27/12	1	13.02	3.22	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	28.80	4.09
				2	15.06	3.17	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	27.23	3.98
	RR1PS 1.5-3.0 ft	7/3/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	20.94	3.98
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	18.91	3.83
Rocky River Reservation (North), PSB-5	RR2PS 0.0-2.0 ft	7/3/12	7/27/12	1	15.36	3.15	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	45.40	4.42
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	44.24	4.31
	RR2PS 2.0-4.0 ft	7/3/12	7/27/12	1	13.47	3.08	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	42.95	4.34
				2	14.03	3.12	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	43.92	4.41
West Creek Reservation, PSB-7	WCPS 0.0-1.5 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	71.78	4.99
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	81.32	5.23
	WCPS 1.5-3.0 ft	7/11/12	7/27/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	27.03	3.90
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	28.28	3.96
QA/QC	SiO_2 Blank	N/A	7/27/12	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	Pass Internal Standardization	N/A	8/13/12	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
QA/QC	SiO_2 Blank	N/A	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Sample Location	Sample Identification	Sampling Date	Screening (Analysis) Date	Reading Number	Molybdenum, ppm (LOD 10-100 ppm)		Silver, ppm (LOD 50-150 ppm)		Cadmium, ppm (LOD 50-150 ppm)		Tin, ppm (LOD 50-150 ppm)		Antimony, ppm (LOD 50-150 ppm)		Mercury, ppm (LOD 10-100 ppm)		Lead, ppm (LOD 10-100 ppm)	
					Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sn	Sn +/-	Sb	Sb +/-	Hg	Hg +/-	Pb	Pb +/-
	BSPS 0.0-0.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**65.41**	**4.65**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**78.88**	**4.97**
Brookside Reservation, PSB-11	BSPS 0.5-1.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**14.67**	**3.46**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**20.41**	**3.65**
	BSPS 2.5-3.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**16.71**	**3.53**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**27.06**	**3.99**
Holy Spirit Cemetery East, PSB-10	HSPS/E 0.0-1.0 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**27.43**	**3.73**
				2	<LOD	<LOD	**44.91**	**14.48**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**21.95**	**3.49**
	HSPS/E 1.0-2.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**15.92**	**3.47**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**16.66**	**3.52**
Garfield Park Reservation, PSB-12	GRPS 0.0-0.5 ft	8/1/12	8/13/12	1	**11.35**	**3.16**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**49.24**	**4.35**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**53.03**	**4.43**
	GRPS 0.5-1.0 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**26.35**	**3.69**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**15.72**	**3.35**
	GRPS 1.0-1.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**16.44**	**3.54**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**23.89**	**3.71**
	GRPS 1.5-2.0 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**21.29**	**3.79**
				2	<LOD	<LOD	**47.16**	**15.25**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**18.67**	**3.63**
	GRPS 2.0-2.5 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**14.81**	**3.61**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**16.60**	**3.61**
	GRPS 2.5-3.0 ft	8/1/12	8/13/12	1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**17.85**	**3.65**
				2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**23.66**	**3.81**
QA/QC	SiO_2 Blank	N/A	8/13/12	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

APPENDIX C

USCS AND USDA SOIL CLASSIFICATION
AND TEXTURAL COMPOSITION ANALYSES

SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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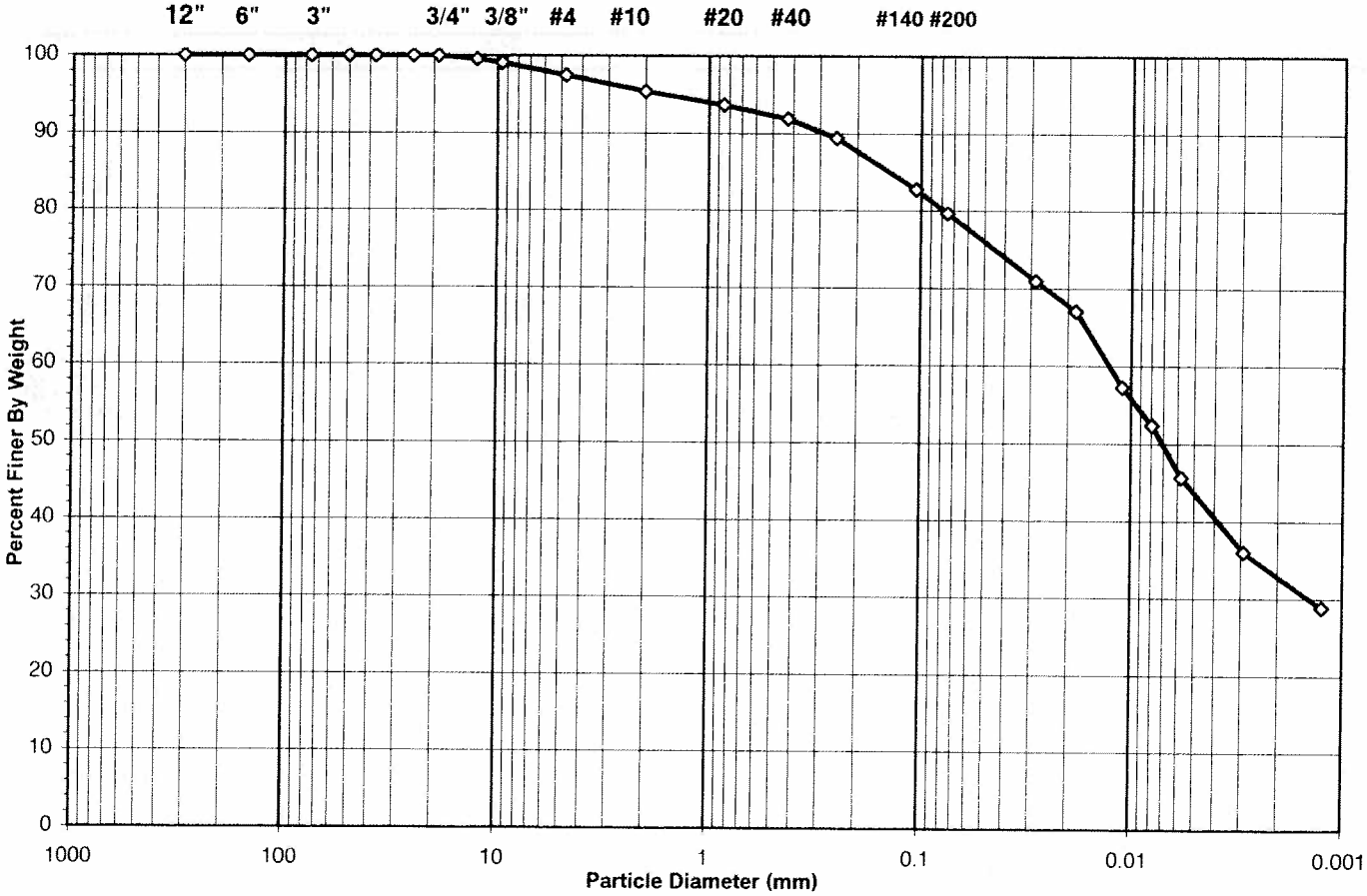
Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	GPR-1
Lab ID	2012-433-01-01	Soil Color	**BROWN**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



USCS Summary		
Sieve Sizes (mm)		**Percentage**
Greater Than #4	*Gravel*	2.51
#4 To #200	*Sand*	17.82
Finer Than #200	*Silt & Clay*	79.67

USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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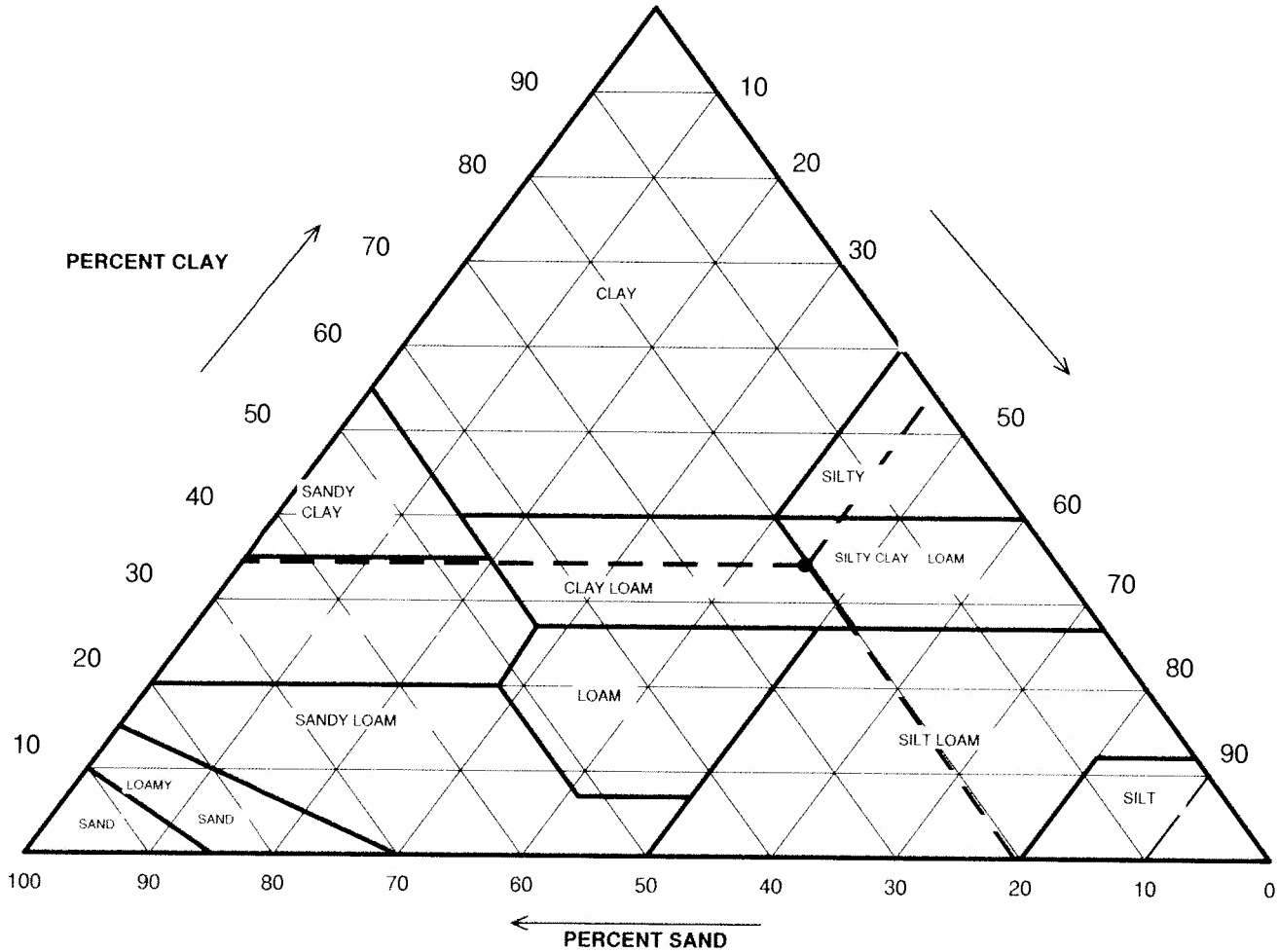
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	GPR-1
Lab ID	2012-433-01-01	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	4.60	**0.00**
2	95.40	*Sand*	19.40	**20.33**
0.05	76.01	*Silt*	43.16	**45.24**
0.002	32.85	*Clay*	32.85	**34.43**

USDA Classification: ***CLAY LOAM***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	GPR-1
Lab ID	2012-433-01-01	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1432	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	985.82	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	829.30	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.46	Weight of Tare (gm)	NA
Weight of Water (gm)	156.52	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	683.84	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**22.9**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	683.84
Dry Weight - 3/4" Sample (gm)	139.04	Weight of minus #200 material (gm)	544.80
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	139.04
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	3.15	0.46	0.46	99.54	**99.54**
3/8"	9.50	3.03	0.44	0.90	99.10	**99.10**
#4	4.75	10.99	1.61	2.51	97.49	**97.49**
#10	2.00	14.26	2.09	4.60	95.40	**95.40**
#20	0.85	11.81	1.73	6.32	93.68	**93.68**
#40	0.425	12.15	1.78	8.10	91.90	**91.90**
#60	0.250	17.10	2.50	10.60	89.40	**89.40**
#140	0.106	45.43	6.64	17.24	82.76	**82.76**
#200	0.075	21.12	3.09	20.33	79.67	**79.67**
Pan	-	544.80	79.67	100.00	-	-

Tested By PC Date 9/14/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	GPR-1
Lab ID	2012-433-01-01	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	41.0	22.6	4.64	36.4	89.0	0.01303	0.0285	**70.9**
5	39.0	22.6	4.64	34.4	84.1	0.01303	0.0183	**67.0**
15	34.0	22.6	4.64	29.4	71.9	0.01303	0.0110	**57.3**
30	31.5	22.6	4.64	26.9	65.8	0.01303	0.0079	**52.4**
60	28.0	22.7	4.61	23.4	57.3	0.01302	0.0058	**45.6**
250	23.0	22.9	4.55	18.4	45.2	0.01299	0.0029	**36.0**
1440	19.5	22.4	4.71	14.8	36.2	0.01307	0.0012	**28.9**

Soil Specimen Data		**Other Corrections**	
Tare No.	679		
Tare + Dry Material (gm)	143.9	a - Factor	0.99
Weight of Tare (gm)	98.48		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	79.67
Weight of Dry Material (gm)	40.42		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	GPR-1
Lab ID	2012-433-01-01	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

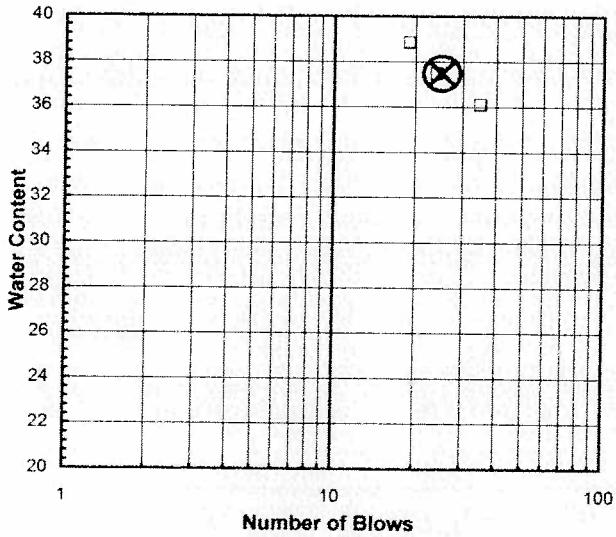
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	412	383	409	M
Wt. of Tare & WS (gm)	40.64	41.32	39.48	U
Wt. of Tare & DS (gm)	35.01	35.12	32.60	L
Wt. of Tare (gm)	19.41	18.57	14.88	T
Wt. of Water (gm)	5.6	6.2	6.9	I
Wt. of DS (gm)	15.6	16.6	17.7	P
				O
Moisture Content (%)	**36.1**	**37.5**	**38.8**	I
Number of Blows	**35**	**24**	**19**	N
				T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	182	320	
Wt. of Tare & WS (gm)	24.97	26.59	
Wt. of Tare & DS (gm)	23.95	25.50	
Wt. of Tare (gm)	18.56	19.91	
Wt. of Water (gm)	1.0	1.1	
Wt. of DS (gm)	5.4	5.6	
Moisture Content (%)	**18.9**	**19.5**	**-0.6**

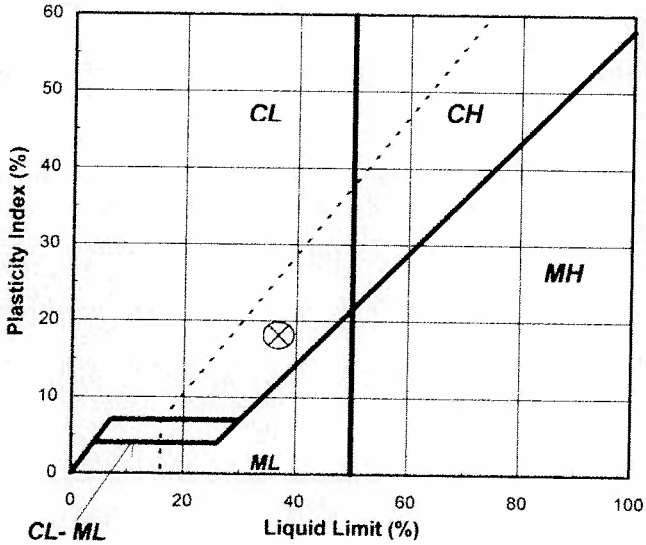
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**37**
Plastic Limit (%)	**19**
Plasticity Index (%)	**18**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By TO *Date* 9/19/12 *Checked By* KC *Date* 9-21-12

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SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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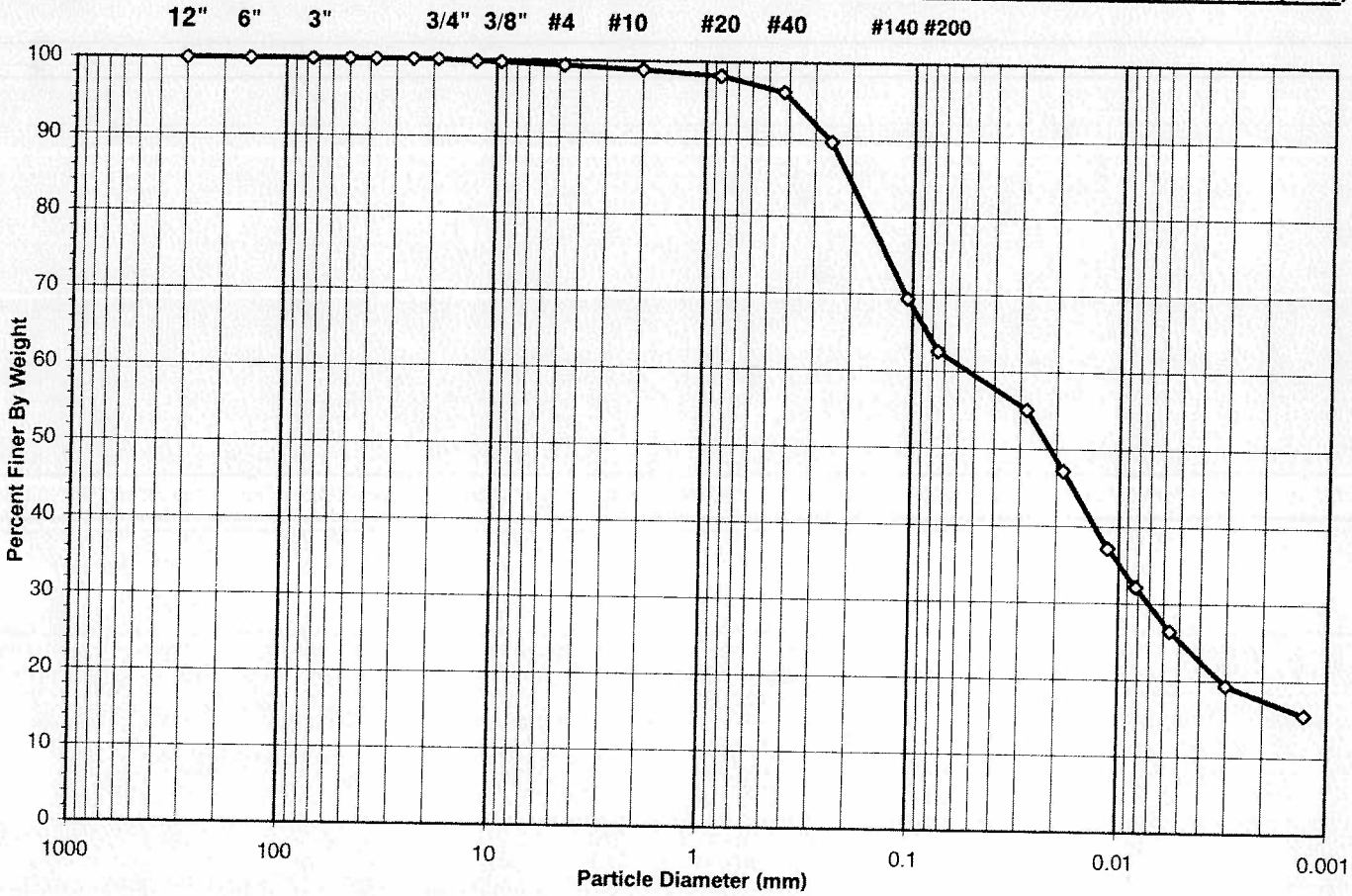
Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RFP-1
Lab ID	2012-433-01-02	Soil Color	**BROWN**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	0.61
#4 To #200	*Sand*	36.81
Finer Than #200	*Silt & Clay*	62.58

USCS Symbol ***CL, TESTED***

USCS Classification ***SANDY LEAN CLAY***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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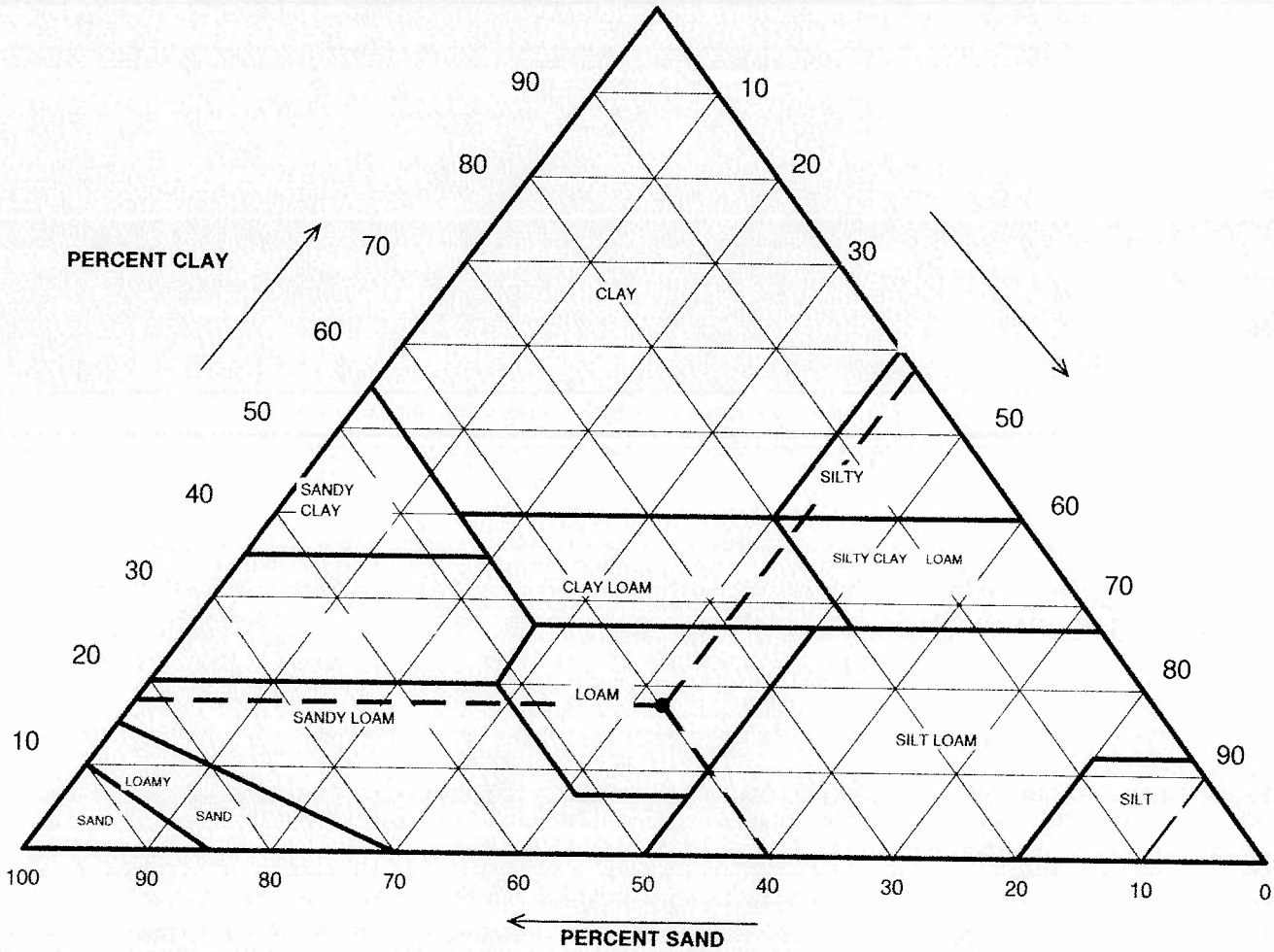
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RFP-1
Lab ID	2012-433-01-02	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	1.13	**0.00**
2	98.87	*Sand*	39.38	**39.83**
0.05	59.49	*Silt*	41.99	**42.47**
0.002	17.51	*Clay*	17.51	**17.71**

USDA Classification: ***LOAM***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RFP-1
Lab ID	2012-433-01-02	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1436	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	937.54	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	849.20	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	144.26	Weight of Tare (gm)	NA
Weight of Water (gm)	88.34	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	704.94	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**12.5**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	704.94
Dry Weight - 3/4" Sample (gm)	263.81	Weight of minus #200 material (gm)	441.13
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	263.81
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	1.85	0.26	0.26	99.74	**99.74**
3/8"	9.50	0.24	0.03	0.30	99.70	**99.70**
#4	4.75	2.24	0.32	0.61	99.39	**99.39**
#10	2.00	3.62	0.51	1.13	98.87	**98.87**
#20	0.85	4.95	0.70	1.83	98.17	**98.17**
#40	0.425	14.38	2.04	3.87	96.13	**96.13**
#60	0.250	45.17	6.41	10.28	89.72	**89.72**
#140	0.106	143.05	20.29	30.57	69.43	**69.43**
#200	0.075	48.31	6.85	37.42	62.58	**62.58**
Pan	-	441.13	62.58	100.00	-	-

Tested By PC Date 9/14/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RFP-1
Lab ID	2012-433-01-02	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	43.0	22.6	4.64	38.4	88.0	0.01303	0.0280	**55.1**
5	37.5	22.6	4.64	32.9	75.4	0.01303	0.0186	**47.2**
15	30.5	22.6	4.64	25.9	59.3	0.01303	0.0113	**37.1**
30	27.0	22.6	4.64	22.4	51.3	0.01303	0.0082	**32.1**
68	23.0	22.7	4.61	18.4	42.2	0.01302	0.0056	**26.4**
250	18.0	22.9	4.55	13.4	30.9	0.01299	0.0030	**19.3**
1440	15.5	22.4	4.71	10.8	24.8	0.01307	0.0013	**15.5**

Soil Specimen Data		**Other Corrections**	
Tare No.	2326		
Tare + Dry Material (gm)	146.22	a - Factor	0.99
Weight of Tare (gm)	98.09		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	62.58
Weight of Dry Material (gm)	43.13		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RFP-1
Lab ID	2012-433-01-02	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

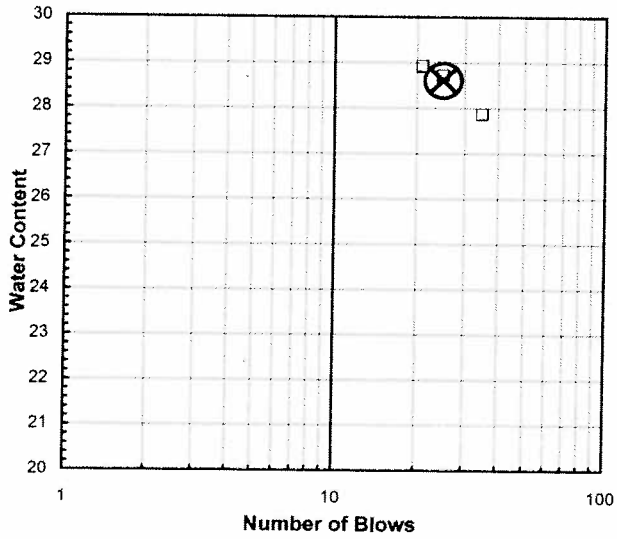
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	53	289	354	MULTIPOINT
Wt. of Tare & WS (gm)	49.35	46.54	43.15	
Wt. of Tare & DS (gm)	42.50	40.50	37.77	
Wt. of Tare (gm)	18.81	19.46	18.46	
Wt. of Water (gm)	6.9	6.0	5.4	
Wt. of DS (gm)	23.7	21.0	19.3	
Moisture Content (%)	**28.9**	**28.7**	**27.9**	
Number of Blows	**21**	**25**	**35**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	325	386	
Wt. of Tare & WS (gm)	26.94	26.73	
Wt. of Tare & DS (gm)	25.77	25.82	
Wt. of Tare (gm)	18.82	20.62	
Wt. of Water (gm)	1.2	0.9	
Wt. of DS (gm)	7.0	5.2	
Moisture Content (%)	**16.8**	**17.5**	**-0.7**

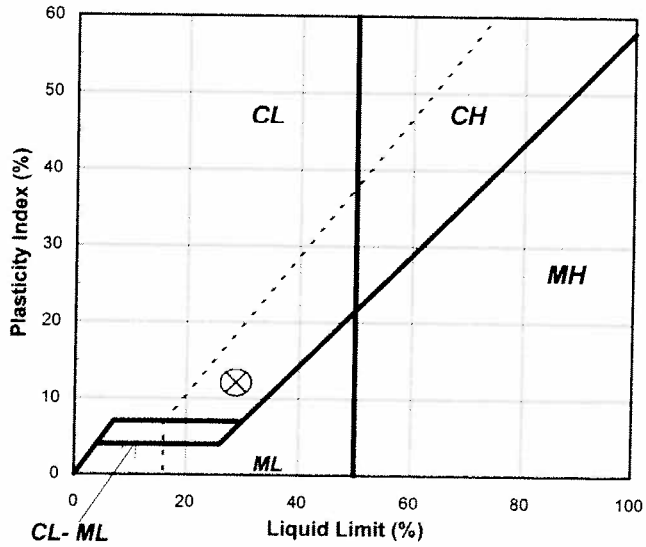
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**29**
Plastic Limit (%)	**17**
Plasticity Index (%)	**12**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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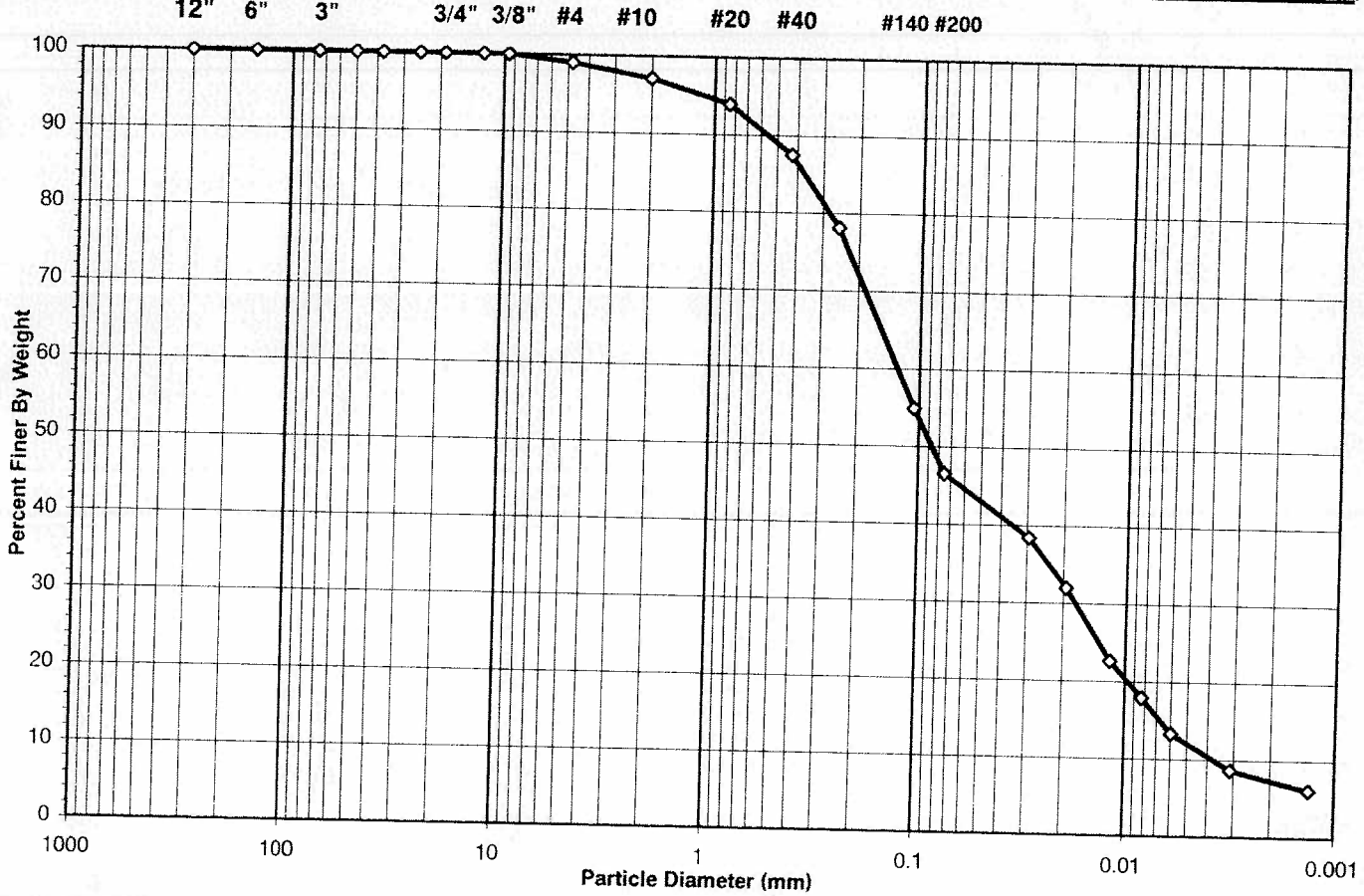
Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STN-1
Lab ID	2012-433-01-03	Soil Color	**BROWN**

	SIEVE ANALYSIS				HYDROMETER	
USCS	cobbles	gravel	sand		silt and clay fraction	
USDA	cobbles	gravel	sand		silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	0.98
#4 To #200	*Sand*	52.50
Finer Than #200	*Silt & Clay*	46.53

USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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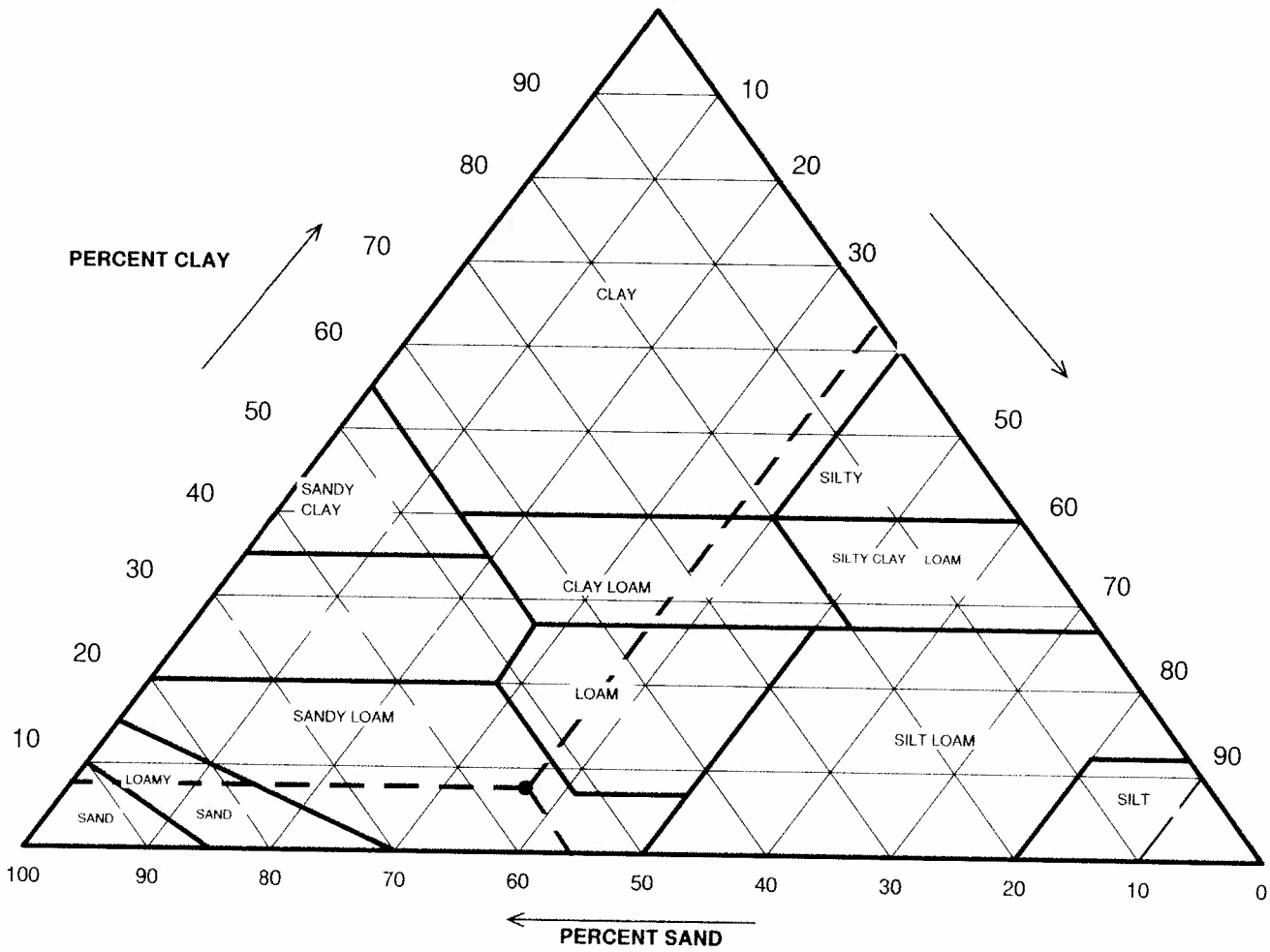
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STN-1
Lab ID	2012-433-01-03	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	2.90	**0.00**
2	97.10	*Sand*	54.09	**55.70**
0.05	43.02	*Silt*	35.60	**36.67**
0.002	7.41	*Clay*	7.41	**7.63**

USDA Classification: ***SANDY LOAM***

DCN: CT-53A DATE:01/27/12 REVISION: 10

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STN-1
Lab ID	2012-433-01-03	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1441	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	982.98	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	921.50	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	143.83	Weight of Tare (gm)	NA
Weight of Water (gm)	61.48	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	777.67	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**7.9**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	777.67
Dry Weight - 3/4" Sample (gm)	415.85	Weight of minus #200 material (gm)	361.82
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	415.85
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	7.60	0.98	0.98	99.02	**99.02**
#10	2.00	14.92	1.92	2.90	97.10	**97.10**
#20	0.85	24.37	3.13	6.03	93.97	**93.97**
#40	0.425	50.38	6.48	12.51	87.49	**87.49**
#60	0.250	72.77	9.36	21.87	78.13	**78.13**
#140	0.106	180.60	23.22	45.09	54.91	**54.91**
#200	0.075	65.21	8.39	53.47	46.53	**46.53**
Pan	-	361.82	46.53	100.00	-	**-**

Tested By PC Date 9/14/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STN-1
Lab ID	2012-433-01-03	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	37.5	22.6	4.64	32.9	82.6	0.01303	0.0294	**38.4**
5	32.0	22.6	4.64	27.4	68.7	0.01303	0.0194	**32.0**
15	24.0	22.6	4.64	19.4	48.6	0.01303	0.0118	**22.6**
32	20.0	22.6	4.64	15.4	38.6	0.01303	0.0083	**18.0**
65	16.0	22.7	4.61	11.4	28.6	0.01302	0.0060	**13.3**
250	12.0	22.9	4.55	7.4	18.7	0.01299	0.0031	**8.7**
1440	10.0	22.4	4.71	5.3	13.3	0.01307	0.0013	**6.2**

Soil Specimen Data		**Other Corrections**	
Tare No.	2487		
Tare + Dry Material (gm)	137.27	a - Factor	0.99
Weight of Tare (gm)	92.87		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	46.53
Weight of Dry Material (gm)	39.4		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STN-1
Lab ID	2012-433-01-03	Soil Description	**BROWN SILTY CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

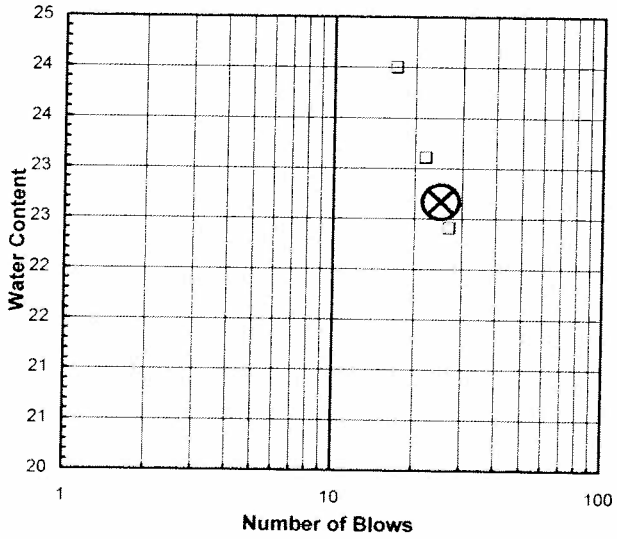
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	407	332	31	**MULTIPOINT**
Wt. of Tare & WS (gm)	40.42	45.70	46.32	
Wt. of Tare & DS (gm)	36.32	40.76	41.12	
Wt. of Tare (gm)	18.02	19.38	19.45	
Wt. of Water (gm)	4.1	4.9	5.2	
Wt. of DS (gm)	18.3	21.4	21.7	
Moisture Content (%)	**22.4**	**23.1**	**24.0**	
Number of Blows	**27**	**22**	**17**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	321	109	
Wt. of Tare & WS (gm)	26.20	21.93	
Wt. of Tare & DS (gm)	25.14	20.94	
Wt. of Tare (gm)	19.47	15.54	
Wt. of Water (gm)	1.1	1.0	
Wt. of DS (gm)	5.7	5.4	
Moisture Content (%)	**18.7**	**18.3**	**0.4**

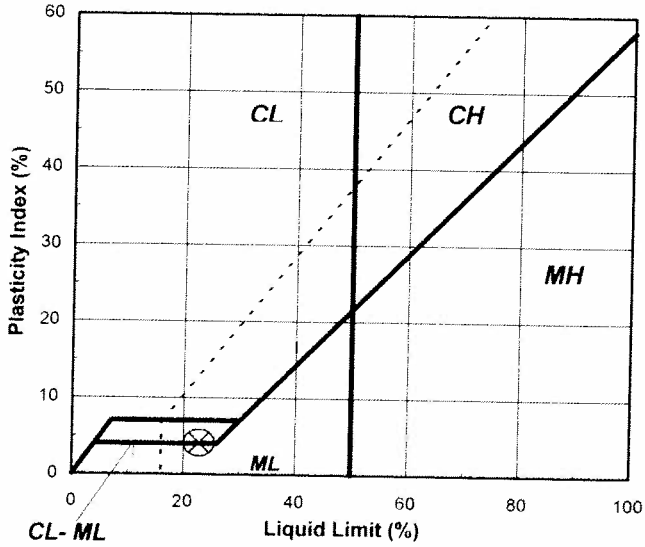
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**23**
Plastic Limit (%)	**19**
Plasticity Index (%)	**4**
USCS Symbol	**CL-ML**

Flow Curve



Plasticity Chart



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SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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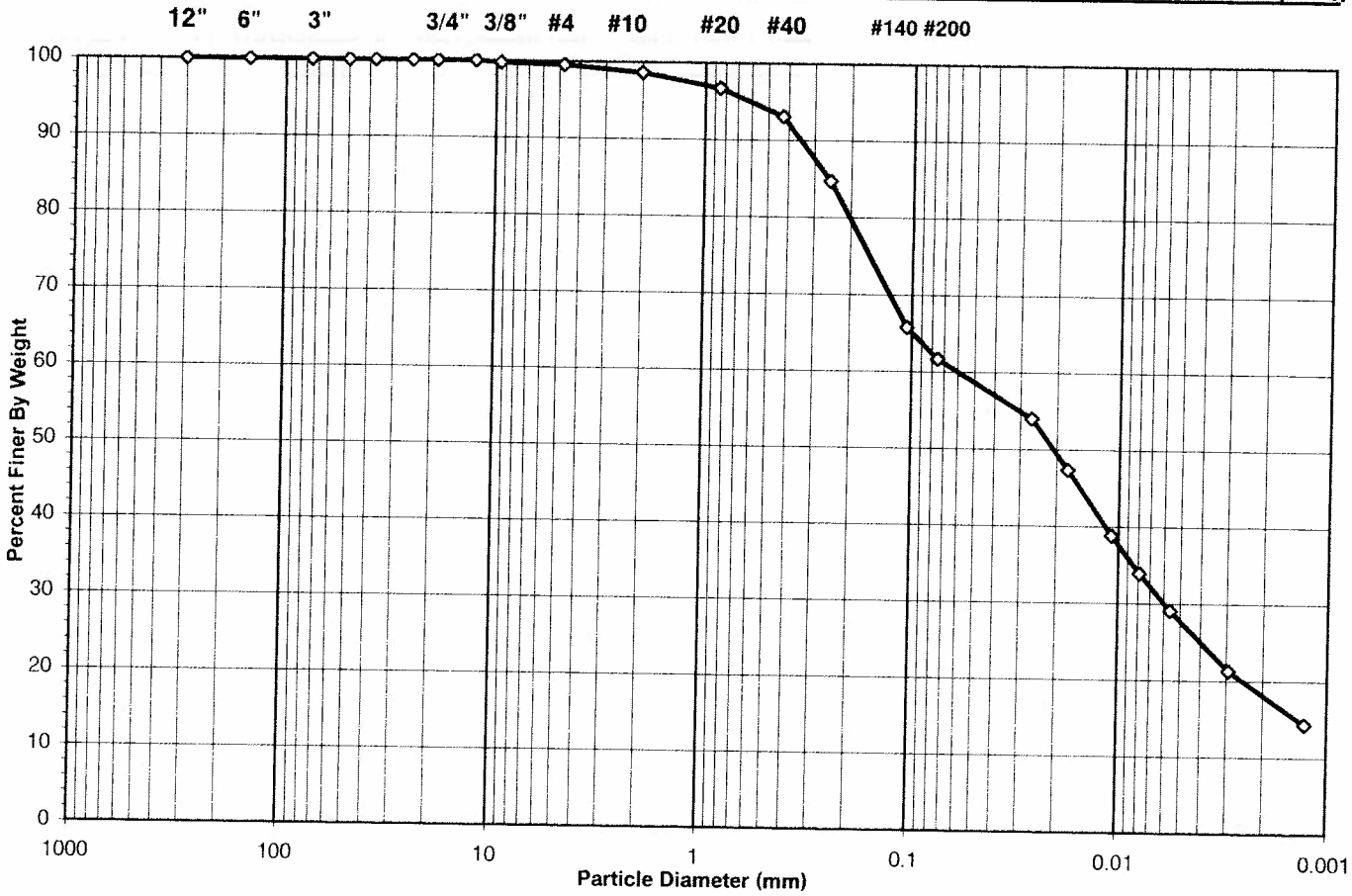
Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	ECR-1
Lab ID	2012-433-01-04	Soil Color	**BROWN**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	0.47
#4 To #200	*Sand*	37.85
Finer Than #200	*Silt & Clay*	61.68

USCS Symbol ***CL, TESTED***

USCS Classification ***SANDY LEAN CLAY***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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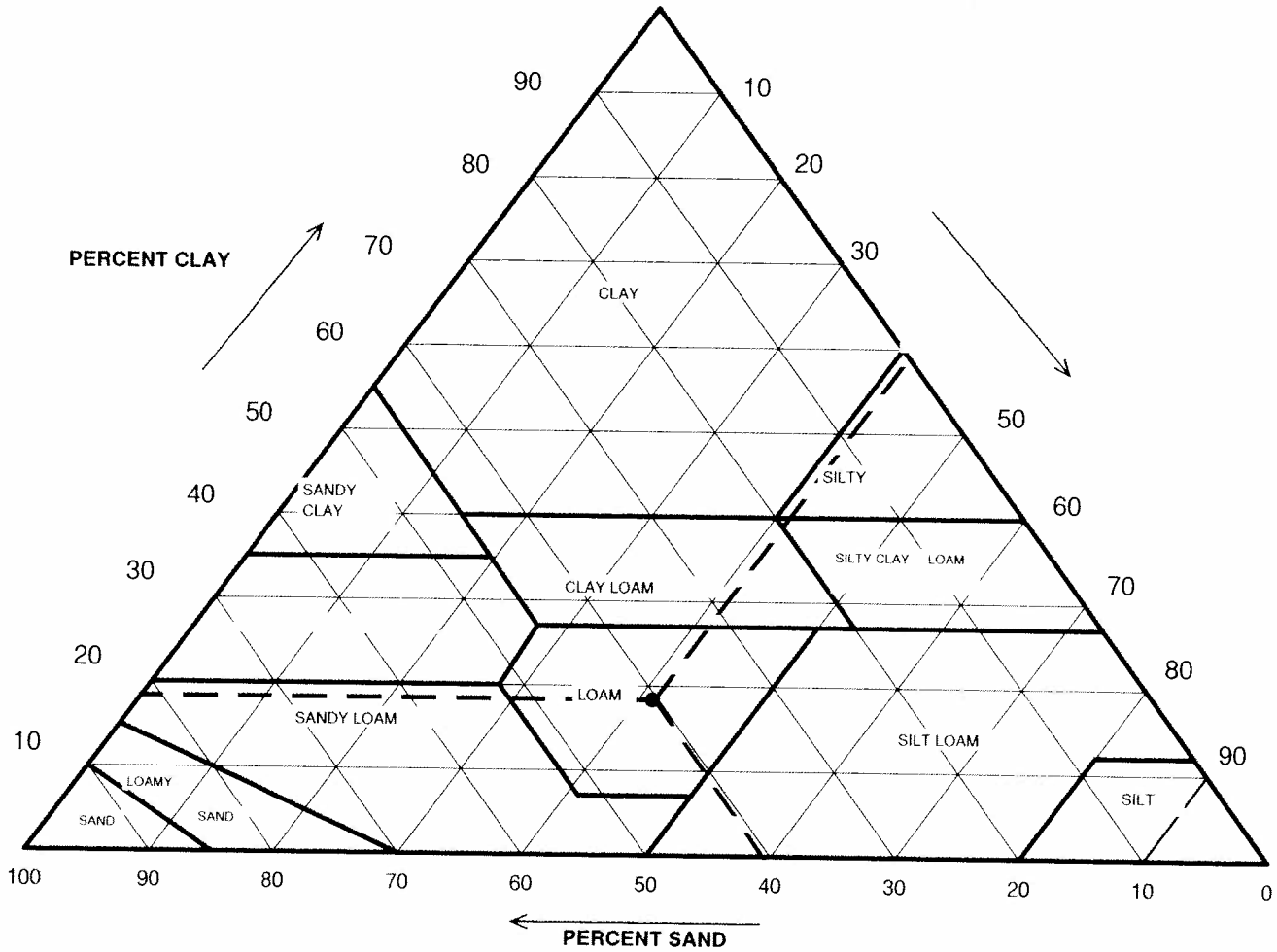
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	ECR-1
Lab ID	2012-433-01-04	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	1.37	**0.00**
2	98.63	*Sand*	39.93	**40.48**
0.05	58.70	*Silt*	40.59	**41.15**
0.002	18.12	*Clay*	18.12	**18.37**

USDA Classification: ***LOAM***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	ECR-1
Lab ID	2012-433-01-04	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1430	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	926.66	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	841.50	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.41	Weight of Tare (gm)	NA
Weight of Water (gm)	85.16	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	696.09	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**12.2**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	696.09
Dry Weight - 3/4" Sample (gm)	266.72	Weight of minus #200 material (gm)	429.37
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	266.72
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	1.38	0.20	0.20	99.80	**99.80**
#4	4.75	1.88	0.27	0.47	99.53	**99.53**
#10	2.00	6.29	0.90	1.37	98.63	**98.63**
#20	0.85	13.54	1.95	3.32	96.68	**96.68**
#40	0.425	24.90	3.58	6.89	93.11	**93.11**
#60	0.250	58.27	8.37	15.27	84.73	**84.73**
#140	0.106	131.99	18.96	34.23	65.77	**65.77**
#200	0.075	28.47	4.09	38.32	61.68	**61.68**
Pan	-	429.37	61.68	100.00	-	**-**

Tested By PC Date 9/14/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	ECR-1
Lab ID	2012-433-01-04	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (° C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	49.0	22.6	4.64	44.4	87.6	0.01303	0.0265	**54.0**
5	43.5	22.6	4.64	38.9	76.7	0.01303	0.0176	**47.3**
15	36.5	22.6	4.64	31.9	62.9	0.01303	0.0108	**38.8**
30	32.5	22.6	4.64	27.9	55.0	0.01303	0.0079	**33.9**
63	28.5	22.7	4.61	23.9	47.2	0.01302	0.0056	**29.1**
250	22.0	22.9	4.55	17.4	34.5	0.01299	0.0029	**21.3**
1440	16.5	22.4	4.71	11.8	23.3	0.01307	0.0013	**14.4**

Soil Specimen Data		**Other Corrections**	
Tare No.	659		
Tare + Dry Material (gm)	151.3	a - Factor	0.99
Weight of Tare (gm)	96.17		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	61.68
Weight of Dry Material (gm)	50.13		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	ECR-1
Lab ID	2012-433-01-04	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description

(Minus No. 40 sieve material, Airdried)

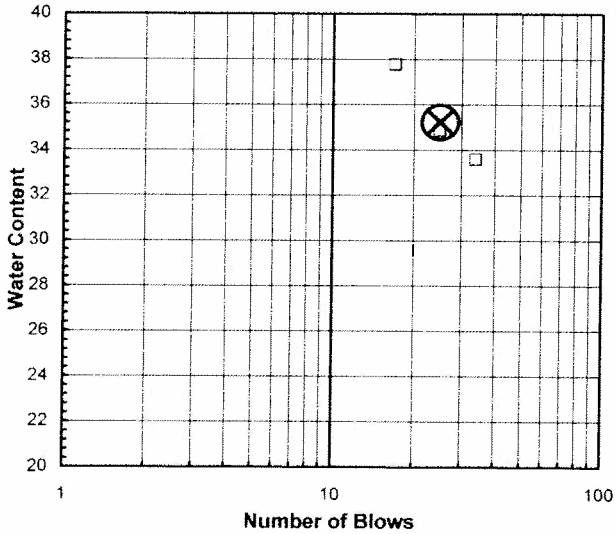
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	429	3166	310	M
Wt. of Tare & WS (gm)	36.56	40.18	44.15	U
Wt. of Tare & DS (gm)	30.08	34.48	37.38	L
Wt. of Tare (gm)	10.78	18.12	19.45	T
Wt. of Water (gm)	6.5	5.7	6.8	I
Wt. of DS (gm)	19.3	16.4	17.9	P
				O
Moisture Content (%)	**33.6**	**34.8**	**37.8**	I
Number of Blows	**34**	**25**	**17**	N T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	375	398	
Wt. of Tare & WS (gm)	19.19	21.95	
Wt. of Tare & DS (gm)	18.08	20.78	
Wt. of Tare (gm)	13.19	15.70	
Wt. of Water (gm)	1.1	1.2	
Wt. of DS (gm)	4.9	5.1	
Moisture Content (%)	**22.7**	**23.0**	**-0.3**

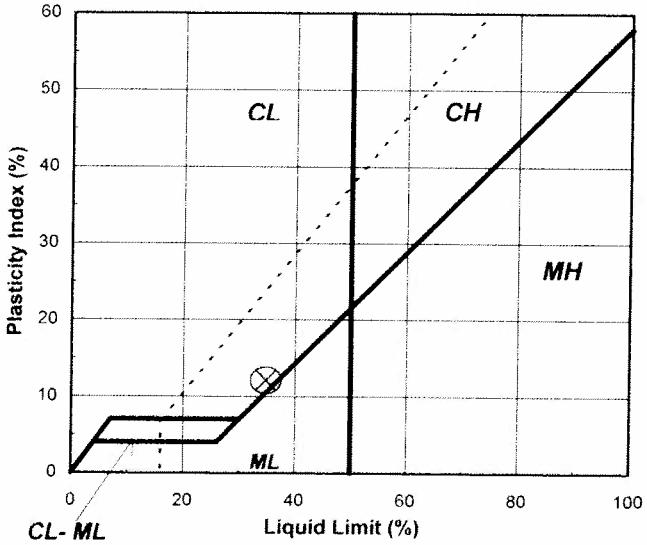
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**35**
Plastic Limit (%)	**23**
Plasticity Index (%)	**12**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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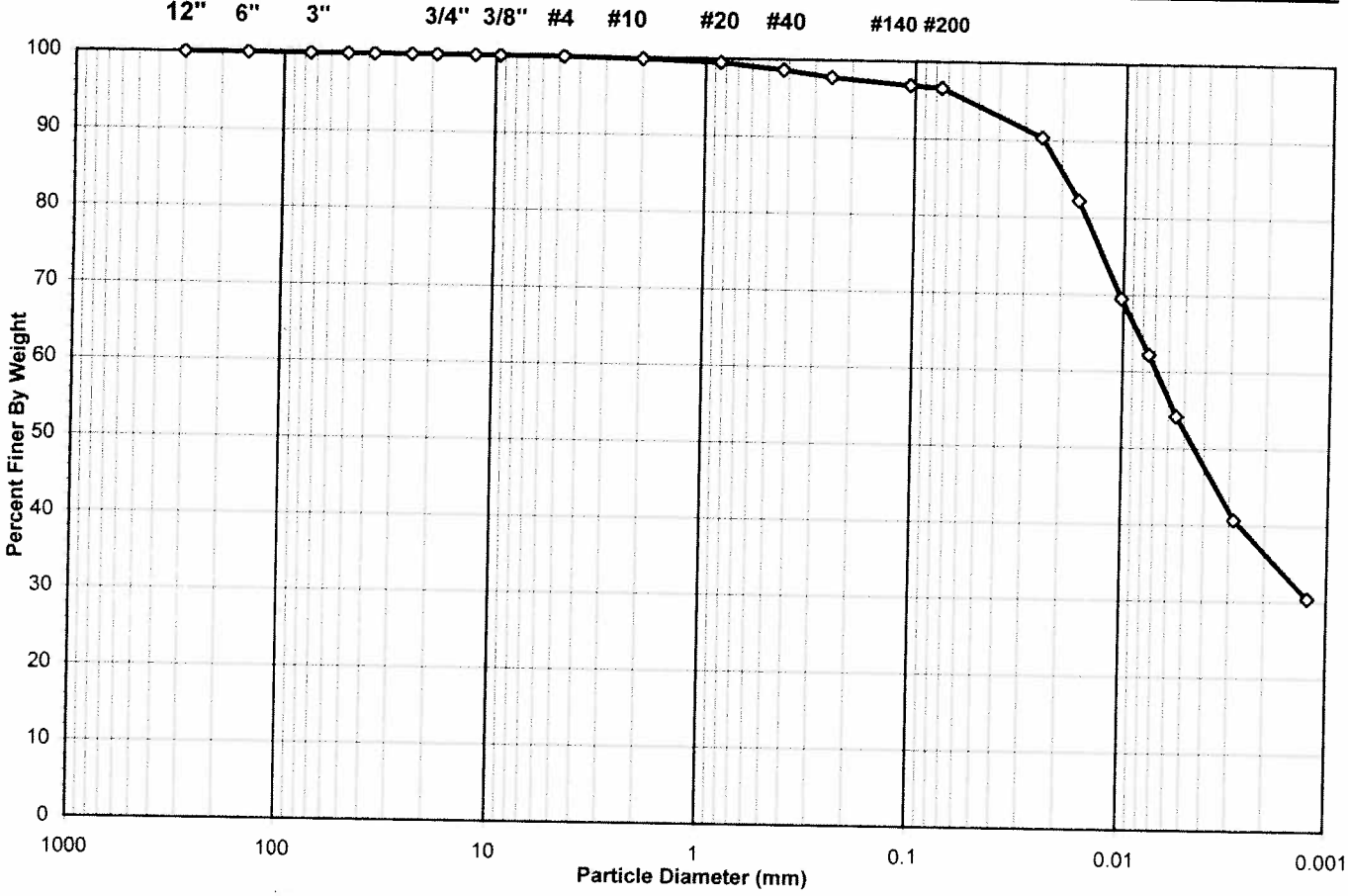
Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	WCR-1
Lab ID	2012-433-01-05	Soil Color	**BROWN**

	SIEVE ANALYSIS					HYDROMETER	
USCS	cobbles	gravel		sand		silt and clay fraction	
USDA	cobbles	gravel		sand		silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	0.00
#4 To #200	*Sand*	3.44
Finer Than #200	*Silt & Clay*	96.56

USCS Symbol ***MH, TESTED***

USCS Classification ***ELASTIC SILT***

DCN: CT-S3A DATE:01/27/12 REVISION: 10 *\\Geojackconcrete\users\Geojack\Documents\PRINT Q (LOCAL)\MICROBAC, 433-01\[SieveHyd 5.XLS]Sheet1*

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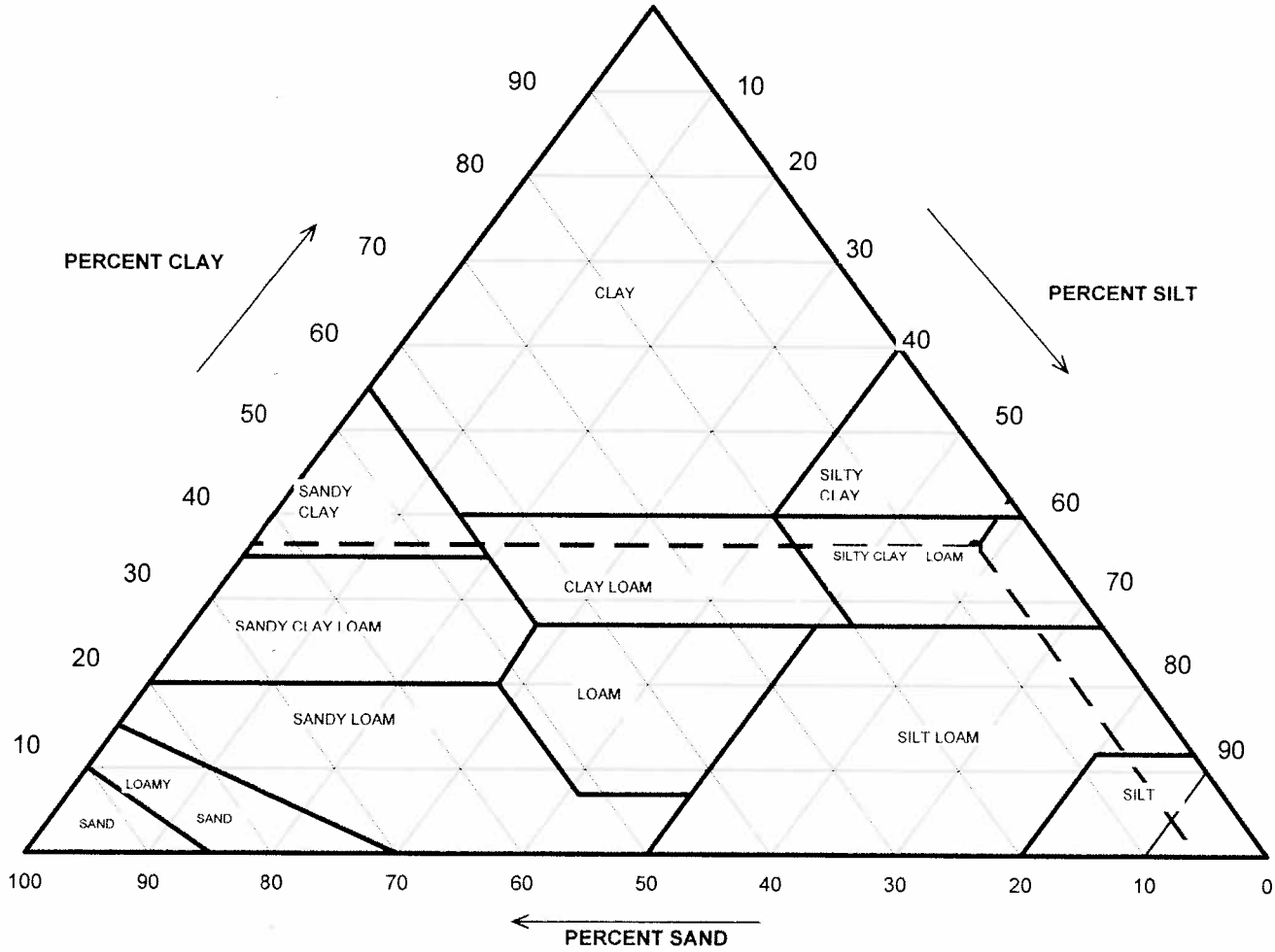
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	WCR-1
Lab ID	2012-433-01-05	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	0.18	**0.00**
2	99.82	*Sand*	5.55	**5.56**
0.05	94.27	*Silt*	57.86	**57.96**
0.002	36.42	*Clay*	36.42	**36.48**

USDA Classification: ***SILTY CLAY LOAM***

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	WCR-1
Lab ID	2012-433-01-05	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1446	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	842.39	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	679.00	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.22	Weight of Tare (gm)	NA
Weight of Water (gm)	163.39	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	533.78	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**30.6**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	533.78
Dry Weight - 3/4" Sample (gm)	18.36	Weight of minus #200 material (gm)	515.42
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	18.36
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.96	0.18	0.18	99.82	**99.82**
#20	0.85	1.70	0.32	0.50	99.50	**99.50**
#40	0.425	4.64	0.87	1.37	98.63	**98.63**
#60	0.250	4.66	0.87	2.24	97.76	**97.76**
#140	0.106	4.82	0.90	3.14	96.86	**96.86**
#200	0.075	1.58	0.30	3.44	96.56	**96.56**
Pan	-	515.42	96.56	100.00	-	-

Tested By PC Date 9/14/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10 \\Geojackconcrete\users\Geojack\Documents\PRINT Q (LOCAL)\MICROBAC, 433-01\[SieveHyd 5.XLS]Sheet1

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	WCR-1
Lab ID	2012-433-01-05	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (° C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	54.5	22.6	4.64	49.9	93.6	0.01303	0.0250	**90.4**
5	50.0	22.6	4.64	45.4	85.1	0.01303	0.0166	**82.2**
15	43.0	22.6	4.64	38.4	72.0	0.01303	0.0102	**69.5**
30	39.0	22.6	4.64	34.4	64.5	0.01303	0.0075	**62.3**
60	34.5	22.7	4.61	29.9	56.1	0.01302	0.0055	**54.2**
250	27.0	22.9	4.55	22.4	42.1	0.01299	0.0028	**40.7**
1440	21.5	22.4	4.71	16.8	31.5	0.01307	0.0012	**30.4**

Soil Specimen Data		**Other Corrections**	
Tare No.	961		
Tare + Dry Material (gm)	159.96	a - Factor	0.99
Weight of Tare (gm)	102.22		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	96.56
Weight of Dry Material (gm)	52.74		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10 *\\Geojackconcrete\users\Geojack\Documents\PRINT Q (LOCAL)\MICROBAC, 433-01\[SieveHyd 5.XLS]Sheet1*

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	WCR-1
Lab ID	2012-433-01-05	Soil Description	**BROWN ELASTIC SILT**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

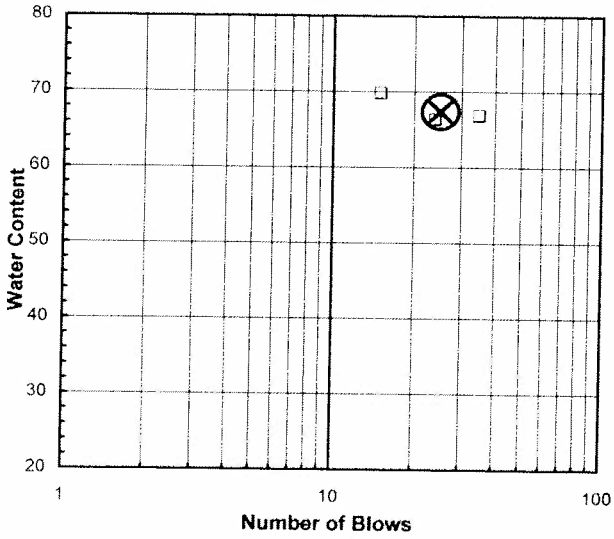
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	423	293	317	**M**
Wt. of Tare & WS (gm)	37.52	41.69	42.40	**U**
Wt. of Tare & DS (gm)	28.50	32.38	32.68	**L**
Wt. of Tare (gm)	15.00	18.34	18.74	**T**
Wt. of Water (gm)	9.0	9.3	9.7	**I**
Wt. of DS (gm)	13.5	14.0	13.9	**P**
				O
Moisture Content (%)	**66.8**	**66.3**	**69.7**	**I**
Number of Blows	**35**	**24**	**15**	**N**
				T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	268	343	
Wt. of Tare & WS (gm)	22.42	25.53	
Wt. of Tare & DS (gm)	20.93	23.98	
Wt. of Tare (gm)	16.40	19.31	
Wt. of Water (gm)	1.5	1.6	
Wt. of DS (gm)	4.5	4.7	
Moisture Content (%)	**32.9**	**33.2**	**-0.3**

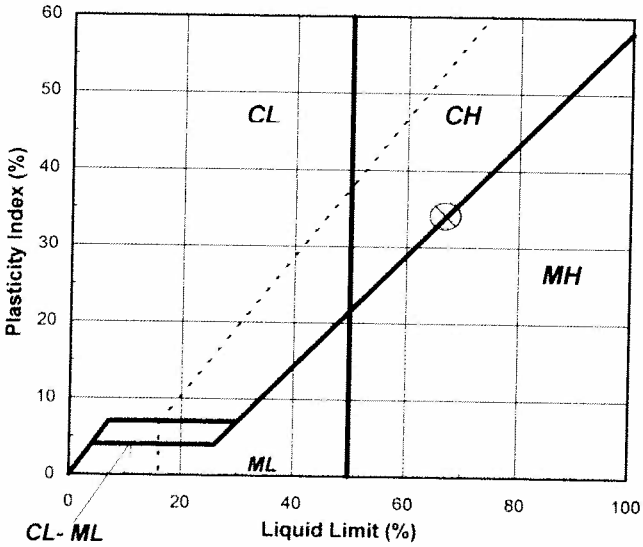
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**67**
Plastic Limit (%)	**33**
Plasticity Index (%)	**34**
USCS Symbol	**MH**

Flow Curve



Plasticity Chart



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SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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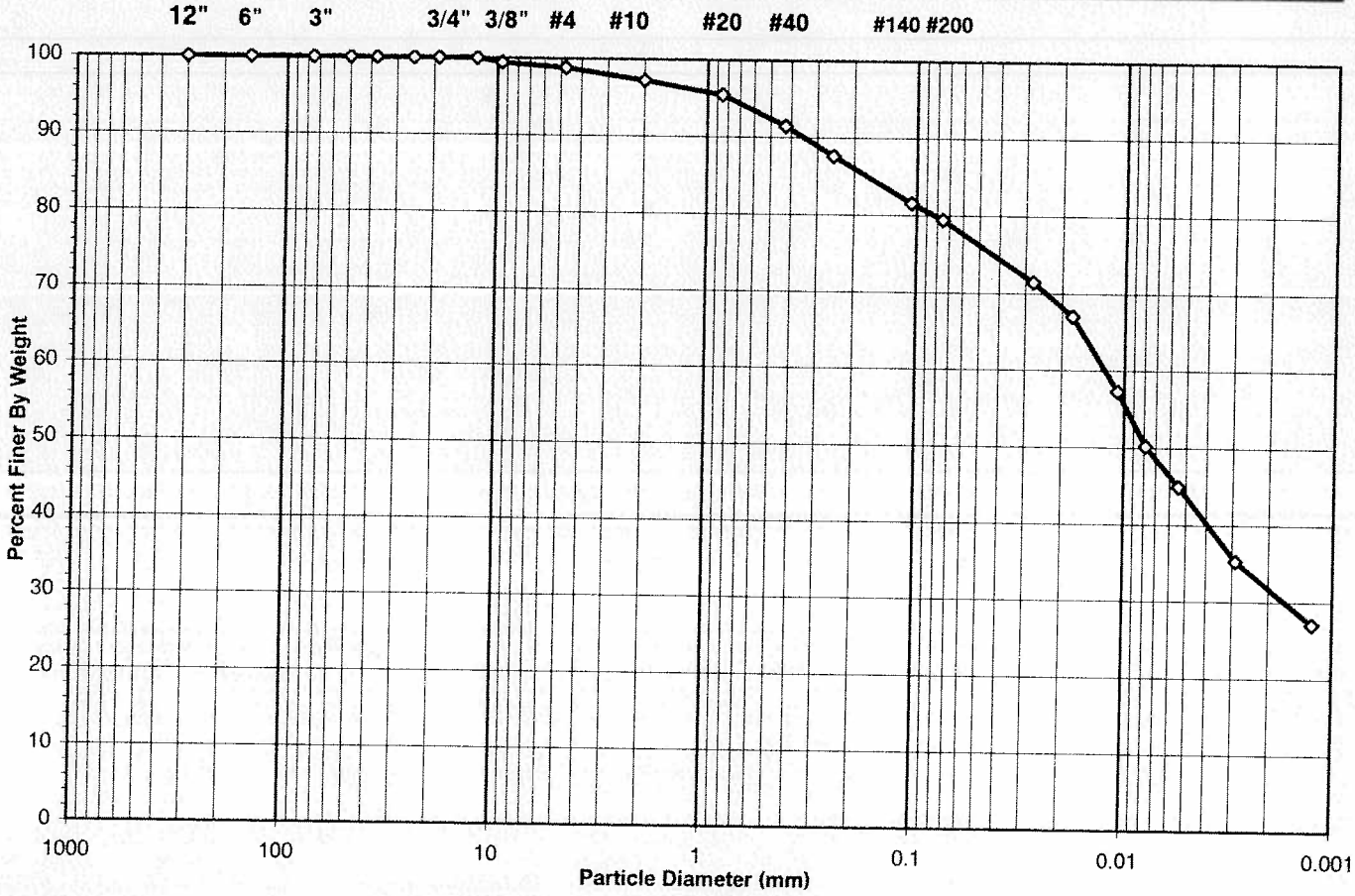
Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STG-1
Lab ID	2012-433-01-06	Soil Color	**BROWN**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	1.22
#4 To #200	*Sand*	19.34
Finer Than #200	*Silt & Clay*	79.44

USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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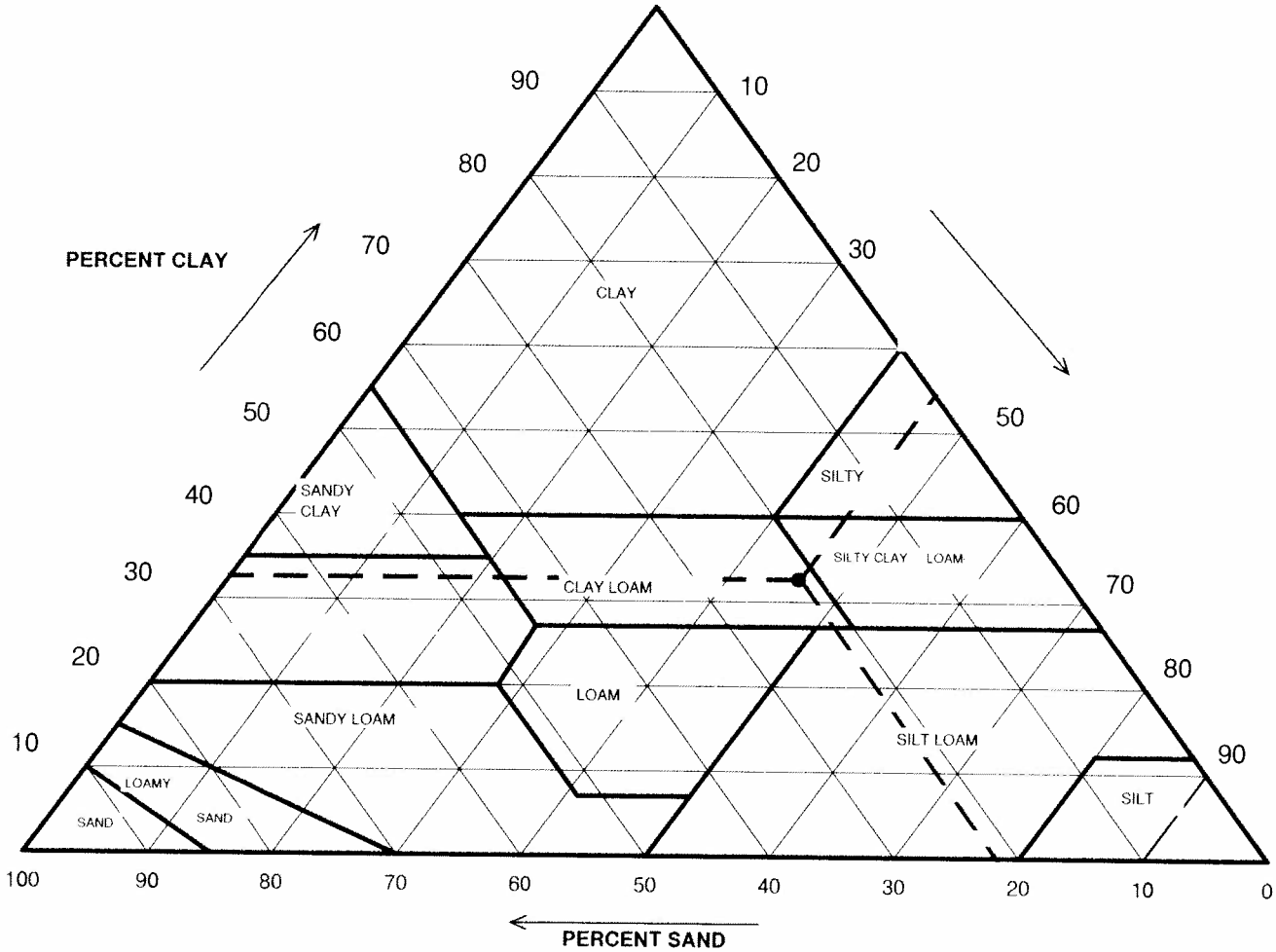
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STG-1
Lab ID	2012-433-01-06	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	2.76	**0.00**
2	97.24	*Sand*	21.04	**21.63**
0.05	76.20	*Silt*	44.46	**45.72**
0.002	31.74	*Clay*	31.74	**32.64**

USDA Classification: ***CLAY LOAM***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STG-1
Lab ID	2012-433-01-06	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1456	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	974.86	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	847.50	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.23	Weight of Tare (gm)	NA
Weight of Water (gm)	127.36	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	702.27	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**18.1**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	702.27
Dry Weight - 3/4" Sample (gm)	144.37	Weight of minus #200 material (gm)	557.90
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	144.37
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	4.06	0.58	0.58	99.42	**99.42**
#4	4.75	4.48	0.64	1.22	98.78	**98.78**
#10	2.00	10.85	1.54	2.76	97.24	**97.24**
#20	0.85	12.51	1.78	4.54	95.46	**95.46**
#40	0.425	28.36	4.04	8.58	91.42	**91.42**
#60	0.250	26.92	3.83	12.41	87.59	**87.59**
#140	0.106	42.41	6.04	18.45	81.55	**81.55**
#200	0.075	14.78	2.10	20.56	79.44	**79.44**
Pan	-	557.90	79.44	100.00	-	-

Tested By PC Date 9/14/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STG-1
Lab ID	2012-433-01-06	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	45.0	22.6	4.64	40.4	89.9	0.01303	0.0275	**71.4**
5	42.5	22.6	4.64	37.9	84.3	0.01303	0.0178	**67.0**
15	37.0	22.6	4.64	32.4	72.1	0.01303	0.0108	**57.3**
30	33.0	22.6	4.64	28.4	63.2	0.01303	0.0079	**50.2**
65	30.0	22.7	4.61	25.4	56.6	0.01302	0.0054	**44.9**
250	24.5	22.9	4.55	19.9	44.5	0.01299	0.0029	**35.3**
1440	20.0	22.4	4.71	15.3	34.1	0.01307	0.0012	**27.1**

Soil Specimen Data		Other Corrections	
Tare No.	694		
Tare + Dry Material (gm)	147.28	a - Factor	0.99
Weight of Tare (gm)	97.85		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	79.44
Weight of Dry Material (gm)	44.43		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	STG-1
Lab ID	2012-433-01-06	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

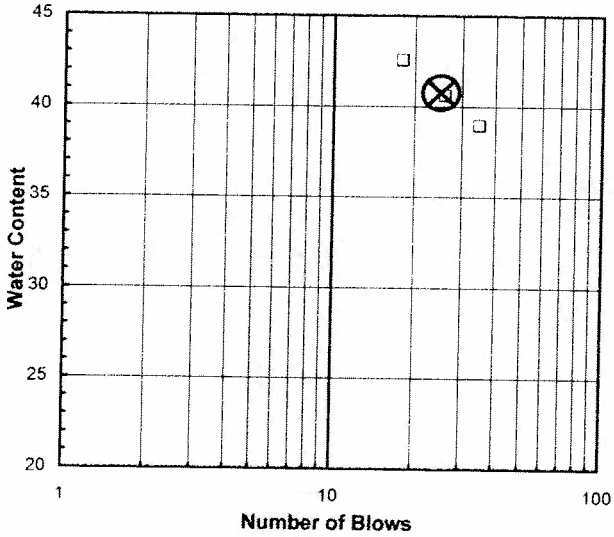
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	418	117	351	M
Wt. of Tare & WS (gm)	41.62	44.17	42.86	U
Wt. of Tare & DS (gm)	35.97	37.25	35.47	L
Wt. of Tare (gm)	21.45	20.21	18.10	T
Wt. of Water (gm)	5.7	6.9	7.4	I
Wt. of DS (gm)	14.5	17.0	17.4	P
				O
Moisture Content (%)	**38.9**	**40.6**	**42.5**	I
Number of Blows	**35**	**26**	**18**	N
				T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	1882	2045	
Wt. of Tare & WS (gm)	25.79	25.29	
Wt. of Tare & DS (gm)	24.72	24.27	
Wt. of Tare (gm)	19.23	19.02	
Wt. of Water (gm)	1.1	1.0	
Wt. of DS (gm)	5.5	5.3	
Moisture Content (%)	**19.5**	**19.4**	**0.1**

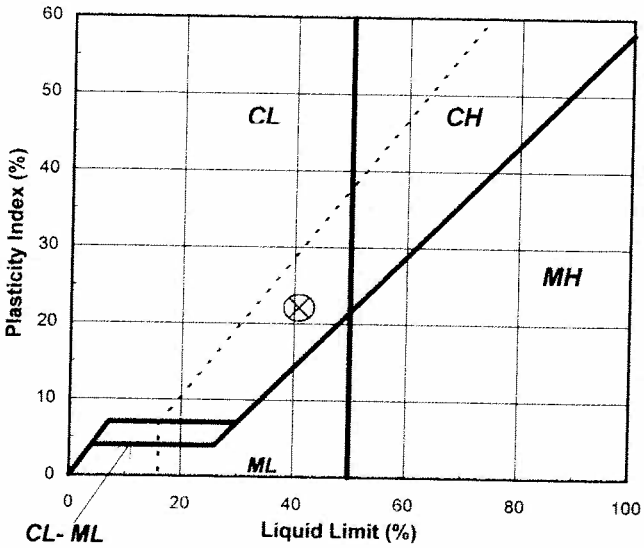
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**41**
Plastic Limit (%)	**19**
Plasticity Index (%)	**22**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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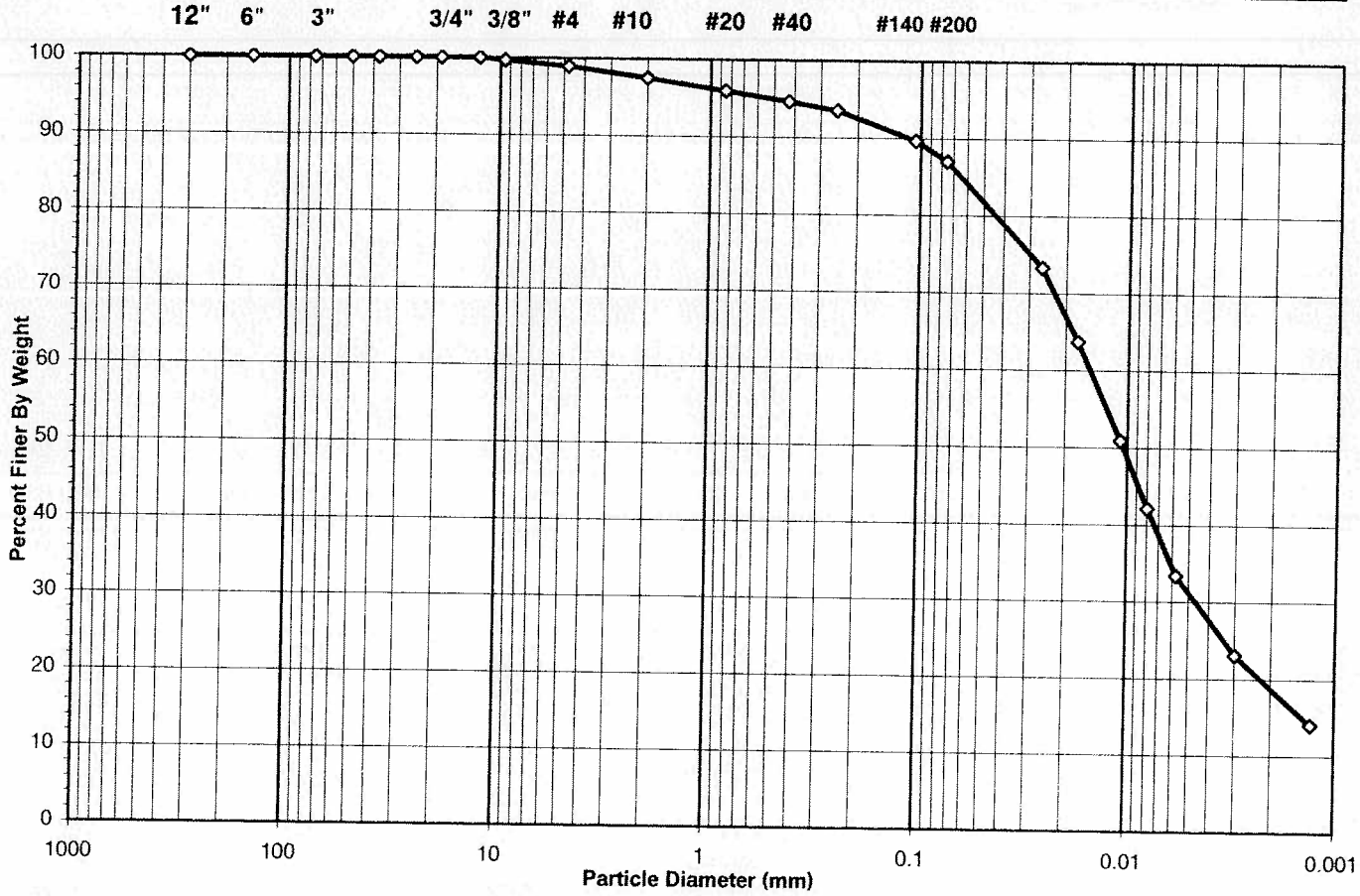
INTEGRITY IN TESTING

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRN-1
Lab ID	2012-433-01-07	Soil Color	**BROWN**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



USCS Summary

Sieve Sizes (mm)		Percentage
Greater Than #4	*Gravel*	1.05
#4 To #200	*Sand*	11.94
Finer Than #200	*Silt & Clay*	87.01

USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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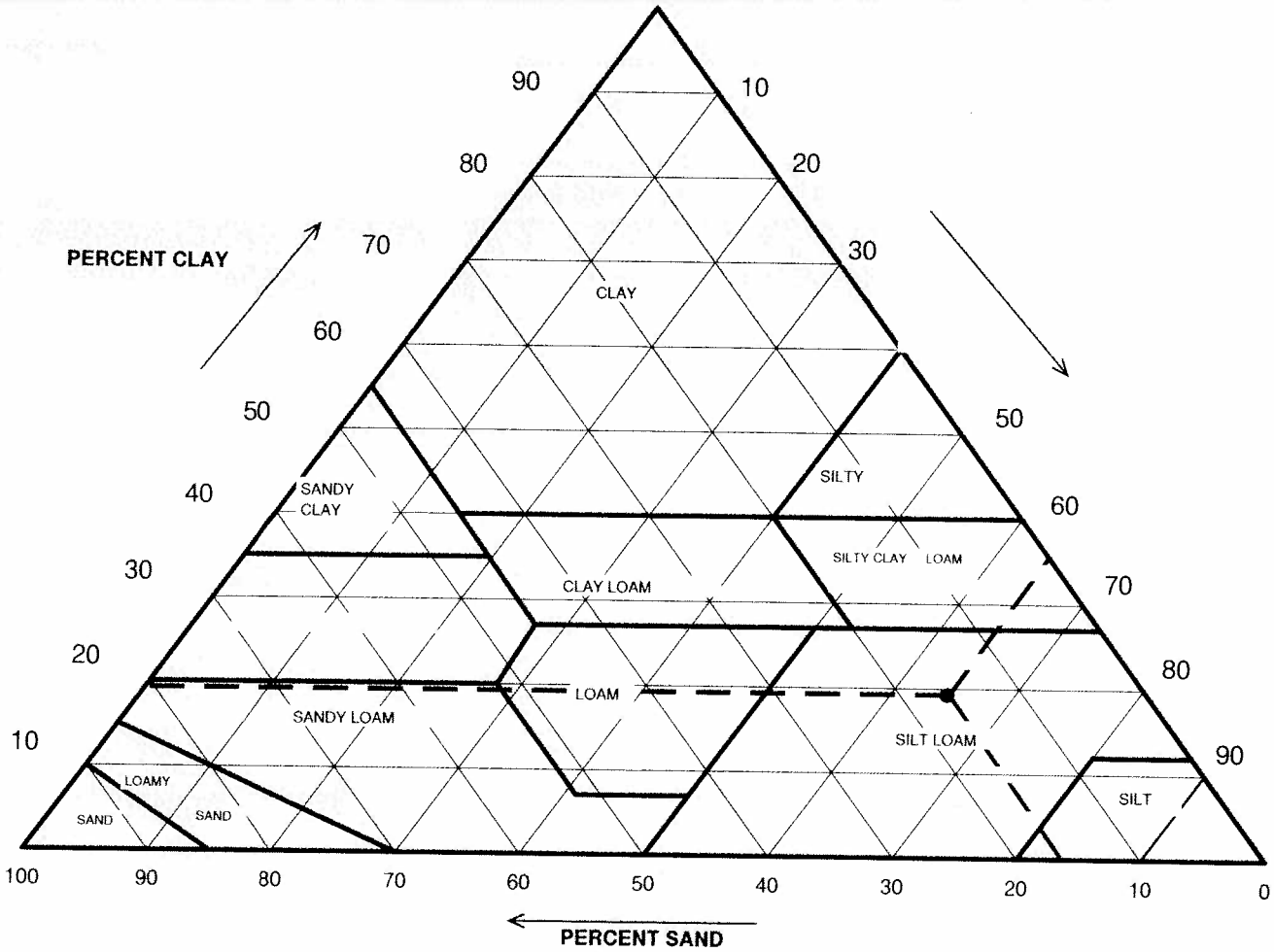
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRN-1
Lab ID	2012-433-01-07	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	2.48	**0.00**
2	97.52	*Sand*	15.77	**16.17**
0.05	81.75	*Silt*	62.97	**64.57**
0.002	18.78	*Clay*	18.78	**19.26**

USDA Classification: ***SILT LOAM***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRN-1
Lab ID	2012-433-01-07	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1420	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	924.17	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	768.50	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	144.65	Weight of Tare (gm)	NA
Weight of Water (gm)	155.67	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	623.85	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**25.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	623.85
Dry Weight - 3/4" Sample (gm)	81.04	Weight of minus #200 material (gm)	542.81
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	81.04
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	1.77	0.28	0.28	99.72	**99.72**
#4	4.75	4.78	0.77	1.05	98.95	**98.95**
#10	2.00	8.91	1.43	2.48	97.52	**97.52**
#20	0.85	9.79	1.57	4.05	95.95	**95.95**
#40	0.425	8.35	1.34	5.39	94.61	**94.61**
#60	0.250	7.03	1.13	6.51	93.49	**93.49**
#140	0.106	23.95	3.84	10.35	89.65	**89.65**
#200	0.075	16.46	2.64	12.99	87.01	**87.01**
Pan	-	542.81	87.01	100.00	-	-

Tested By PC Date 9/14/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRN-1
Lab ID	2012-433-01-07	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	50.5	22.6	4.64	45.9	84.3	0.01303	0.0261	**73.3**
5	44.5	22.6	4.64	39.9	73.2	0.01303	0.0175	**63.7**
15	36.5	22.6	4.64	31.9	58.5	0.01303	0.0108	**50.9**
30	31.0	22.6	4.64	26.4	48.4	0.01303	0.0080	**42.1**
62	25.5	22.7	4.61	20.9	38.4	0.01302	0.0058	**33.4**
250	19.0	22.9	4.55	14.4	26.5	0.01299	0.0030	**23.1**
1440	13.5	22.4	4.71	8.8	16.2	0.01307	0.0013	**14.1**

Soil Specimen Data		**Other Corrections**	
Tare No.	1463		
Tare + Dry Material (gm)	168.64	a - Factor	0.99
Weight of Tare (gm)	109.76		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	87.01
Weight of Dry Material (gm)	53.88		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRN-1
Lab ID	2012-433-01-07	Soil Description	**BROWN SILT**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.

(Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**
Tare Number	312	399	405
Wt. of Tare & WS (gm)	39.91	35.31	40.09
Wt. of Tare & DS (gm)	33.25	28.18	32.58
Wt. of Tare (gm)	19.31	13.63	17.44
Wt. of Water (gm)	6.7	7.1	7.5
Wt. of DS (gm)	13.9	14.6	15.1
Moisture Content (%)	**47.8**	**49.0**	**49.6**
Number of Blows	**32**	**26**	**21**

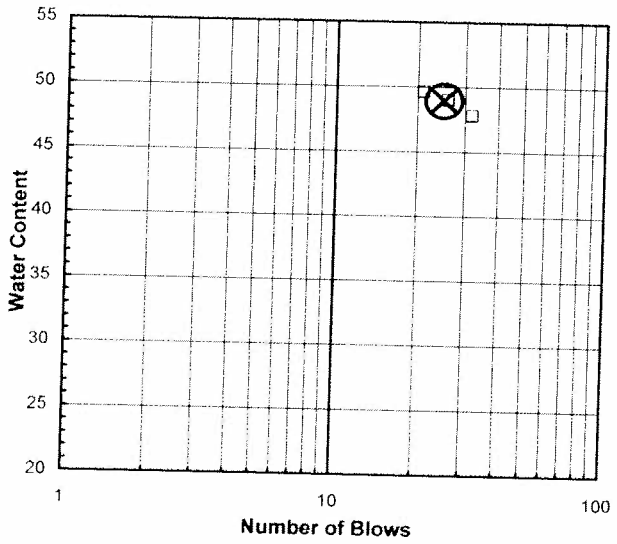
MULTIPOINT

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	189	216	
Wt. of Tare & WS (gm)	26.05	25.94	
Wt. of Tare & DS (gm)	24.63	24.63	
Wt. of Tare (gm)	19.65	19.78	
Wt. of Water (gm)	1.4	1.3	
Wt. of DS (gm)	5.0	4.9	
Moisture Content (%)	**28.5**	**27.0**	**1.5**

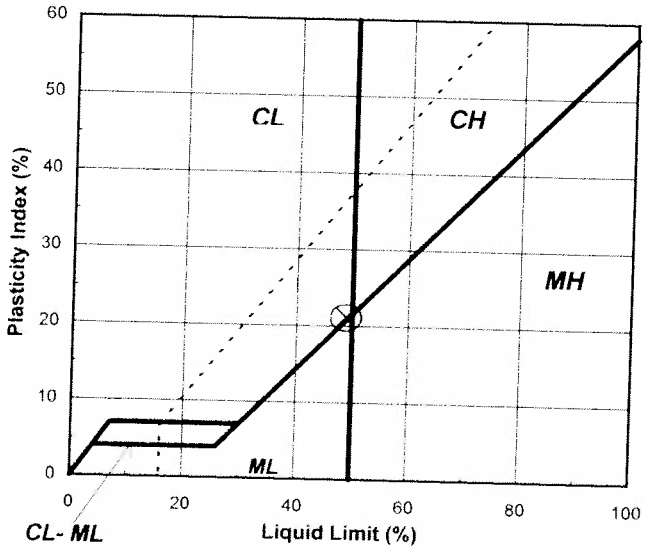
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**49**
Plastic Limit (%)	**28**
Plasticity Index (%)	**21**
USCS Symbol	**ML**

Flow Curve



Plasticity Chart



Tested By JP *Date* 9/18/12 *Checked By* KC *Date* 9-21-12

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SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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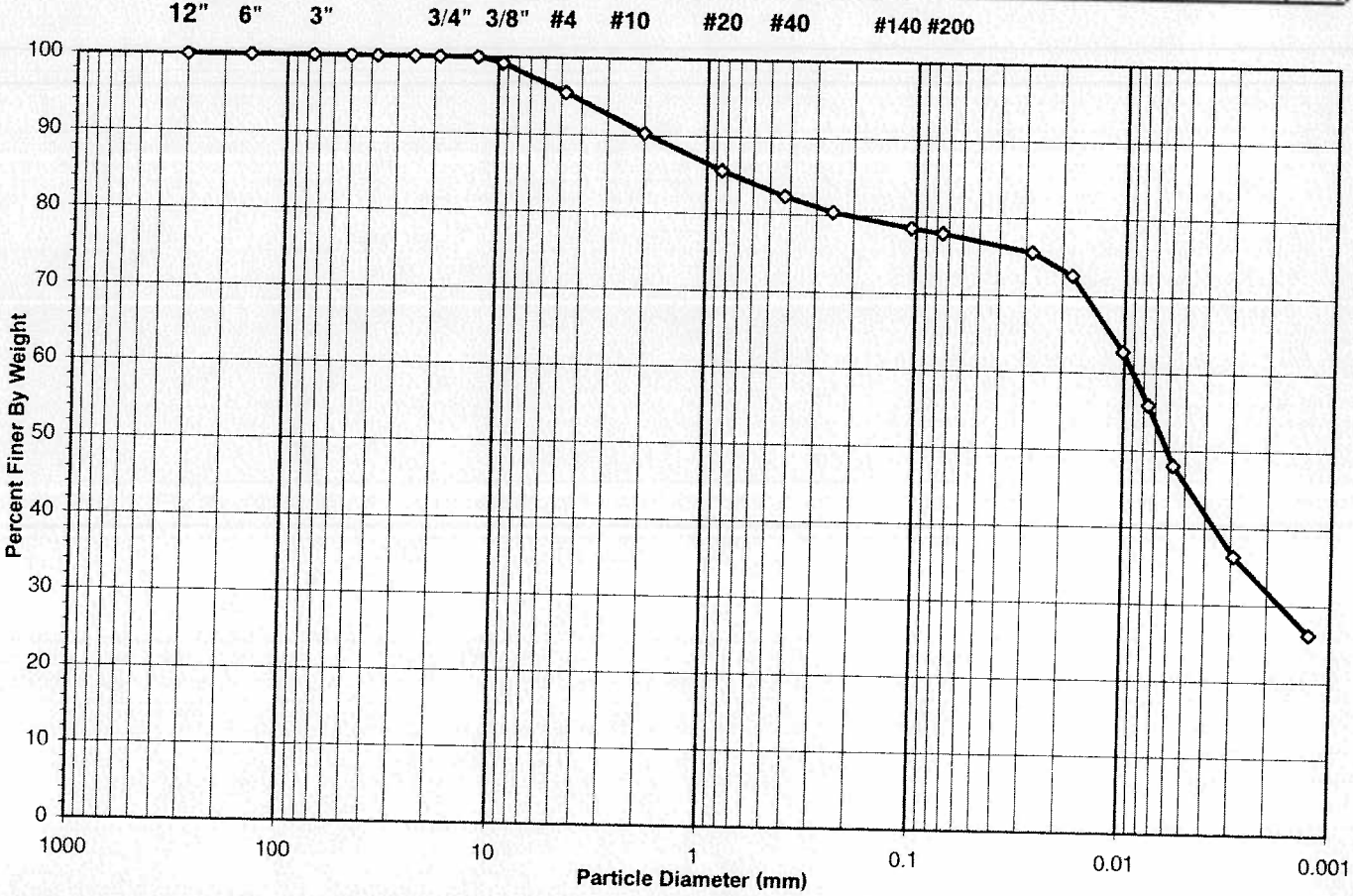
Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRS-1
Lab ID	2012-433-01-08	Soil Color	**BROWN**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	4.51
#4 To #200	*Sand*	17.64
Finer Than #200	*Silt & Clay*	77.85

USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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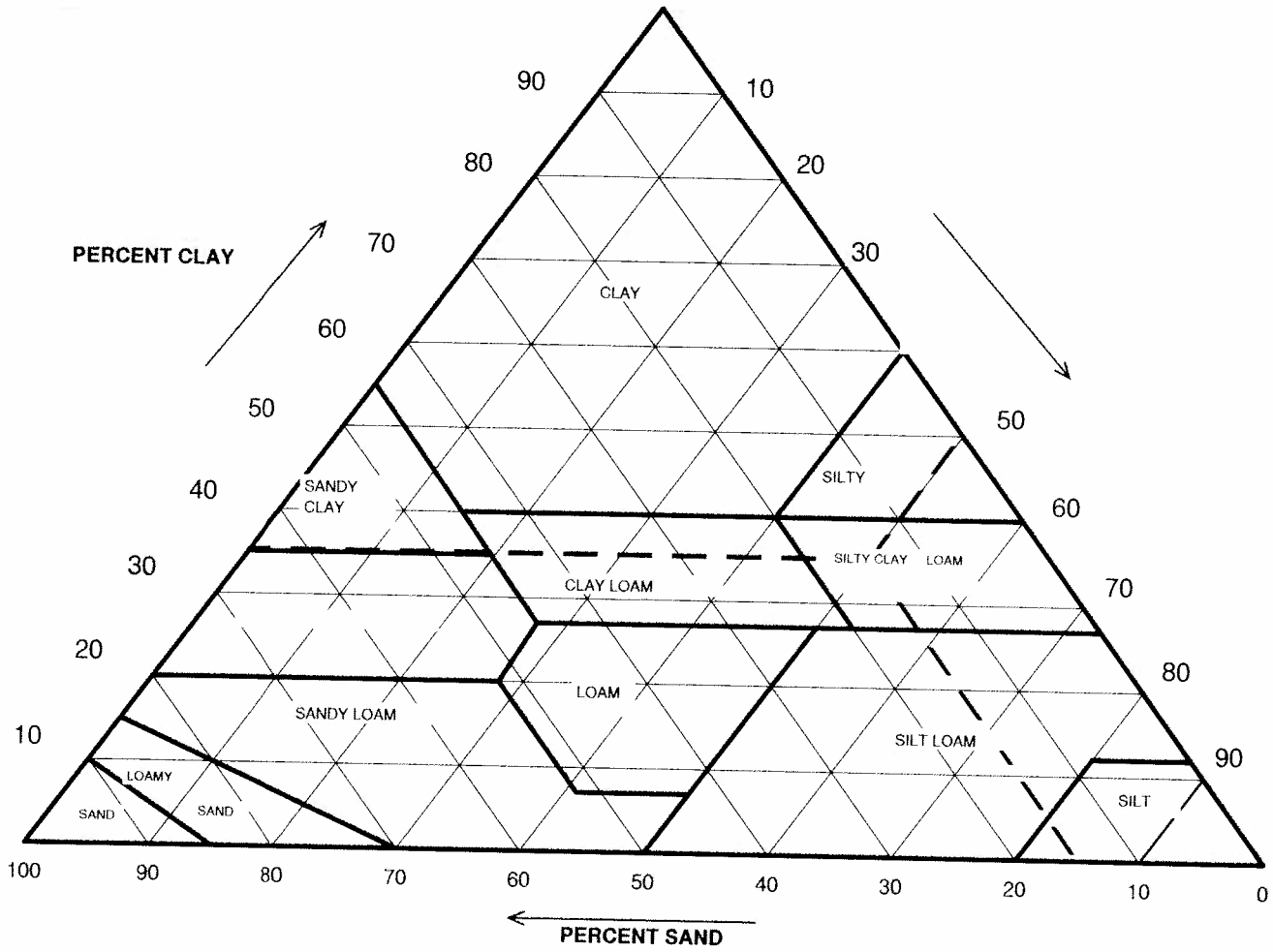
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRS-1
Lab ID	2012-433-01-08	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	9.68	**0.00**
2	90.32	*Sand*	13.40	**14.84**
0.05	76.92	*Silt*	45.10	**49.93**
0.002	31.82	*Clay*	31.82	**35.23**

USDA Classification: ***SILTY CLAY LOAM***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRS-1
Lab ID	2012-433-01-08	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1429	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	897.70	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	787.70	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	144.88	Weight of Tare (gm)	NA
Weight of Water (gm)	110.00	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	642.82	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**17.1**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	642.82
Dry Weight - 3/4" Sample (gm)	142.39	Weight of minus #200 material (gm)	500.43
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	142.39
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	5.01	0.78	0.78	99.22	**99.22**
#4	4.75	23.98	3.73	4.51	95.49	**95.49**
#10	2.00	33.25	5.17	9.68	90.32	**90.32**
#20	0.85	30.27	4.71	14.39	85.61	**85.61**
#40	0.425	20.76	3.23	17.62	82.38	**82.38**
#60	0.250	12.84	2.00	19.62	80.38	**80.38**
#140	0.106	12.35	1.92	21.54	78.46	**78.46**
#200	0.075	3.93	0.61	22.15	77.85	**77.85**
Pan	-	500.43	77.85	100.00	-	-

Tested By PC Date 9/14/12 Checked By HC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRS-1
Lab ID	2012-433-01-08	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (° C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	43.0	22.6	4.64	38.4	97.1	0.01303	0.0280	**75.6**
5	41.5	22.6	4.64	36.9	93.3	0.01303	0.0180	**72.6**
17	36.5	22.6	4.64	31.9	80.6	0.01303	0.0102	**62.8**
32	33.0	22.6	4.64	28.4	71.8	0.01303	0.0076	**55.9**
60	29.0	22.7	4.61	24.4	61.7	0.01302	0.0057	**48.1**
250	23.0	22.9	4.55	18.4	46.7	0.01299	0.0029	**36.4**
1440	18.0	22.4	4.71	13.3	33.6	0.01307	0.0013	**26.2**

Soil Specimen Data		Other Corrections	
Tare No.	975		
Tare + Dry Material (gm)	142.68	a - Factor	0.99
Weight of Tare (gm)	98.57		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	77.85
Weight of Dry Material (gm)	39.11		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By RC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	RRS-1
Lab ID	2012-433-01-08	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.

(Minus No. 40 sieve material, Airdried)

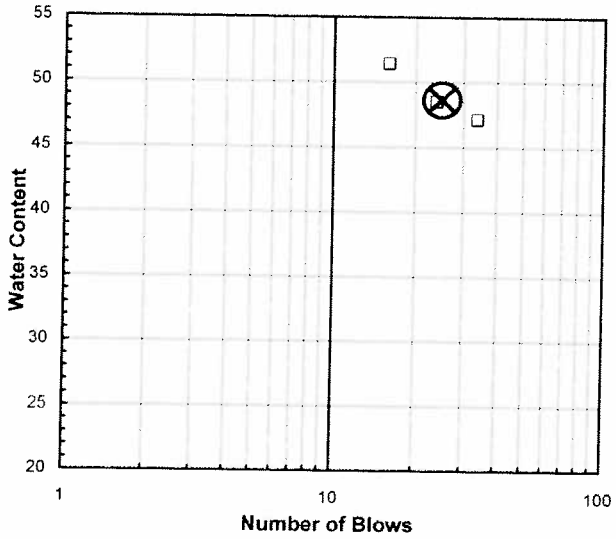
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	427	2234	274	MULTIPOINT
Wt. of Tare & WS (gm)	43.21	41.01	46.53	
Wt. of Tare & DS (gm)	34.33	32.88	37.51	
Wt. of Tare (gm)	15.47	16.11	19.96	
Wt. of Water (gm)	8.9	8.1	9.0	
Wt. of DS (gm)	18.9	16.8	17.6	
Moisture Content (%)	**47.1**	**48.5**	**51.4**	
Number of Blows	**34**	**24**	**16**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	240	180	
Wt. of Tare & WS (gm)	25.95	24.72	
Wt. of Tare & DS (gm)	24.77	23.50	
Wt. of Tare (gm)	19.88	18.56	
Wt. of Water (gm)	1.2	1.2	
Wt. of DS (gm)	4.9	4.9	
Moisture Content (%)	**24.1**	**24.7**	**-0.6**

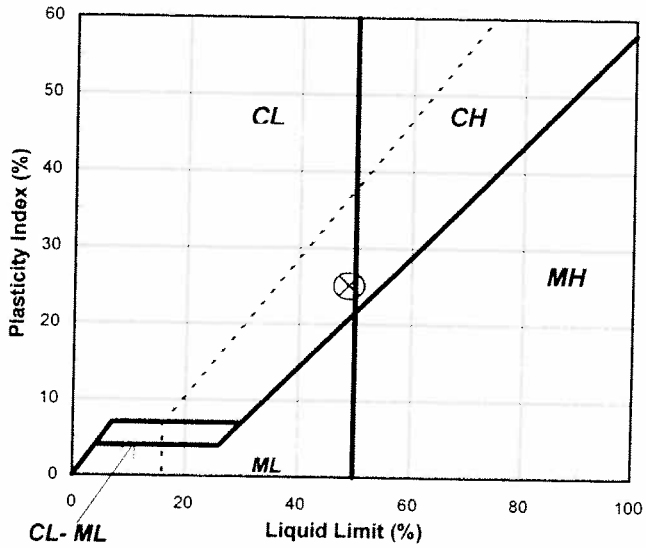
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**49**
Plastic Limit (%)	**24**
Plasticity Index (%)	**25**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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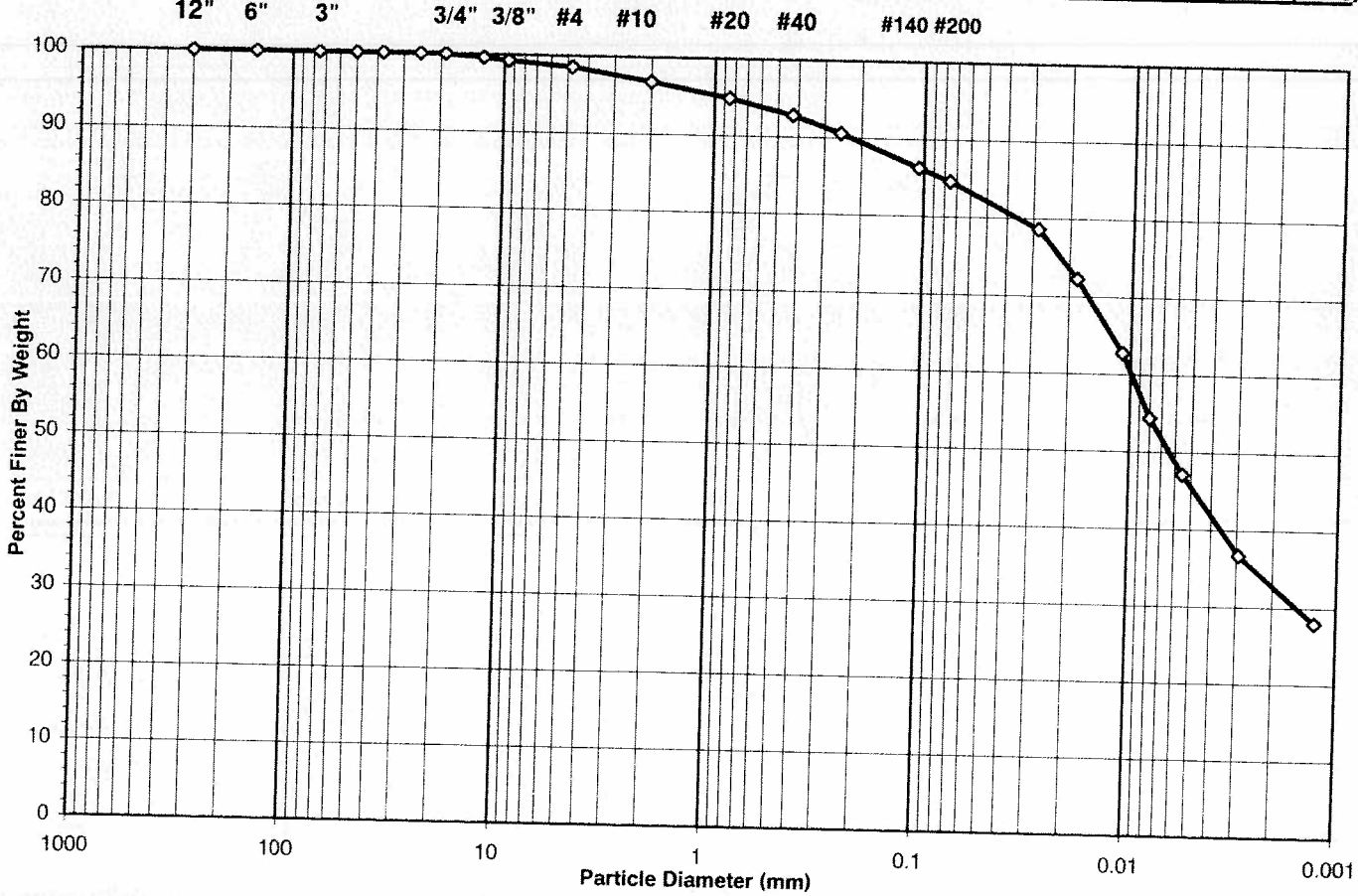
Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	HSP-1
Lab ID	2012-433-01-09	Soil Color	**BROWN**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	1.47
#4 To #200	*Sand*	13.94
Finer Than #200	*Silt & Clay*	84.60

USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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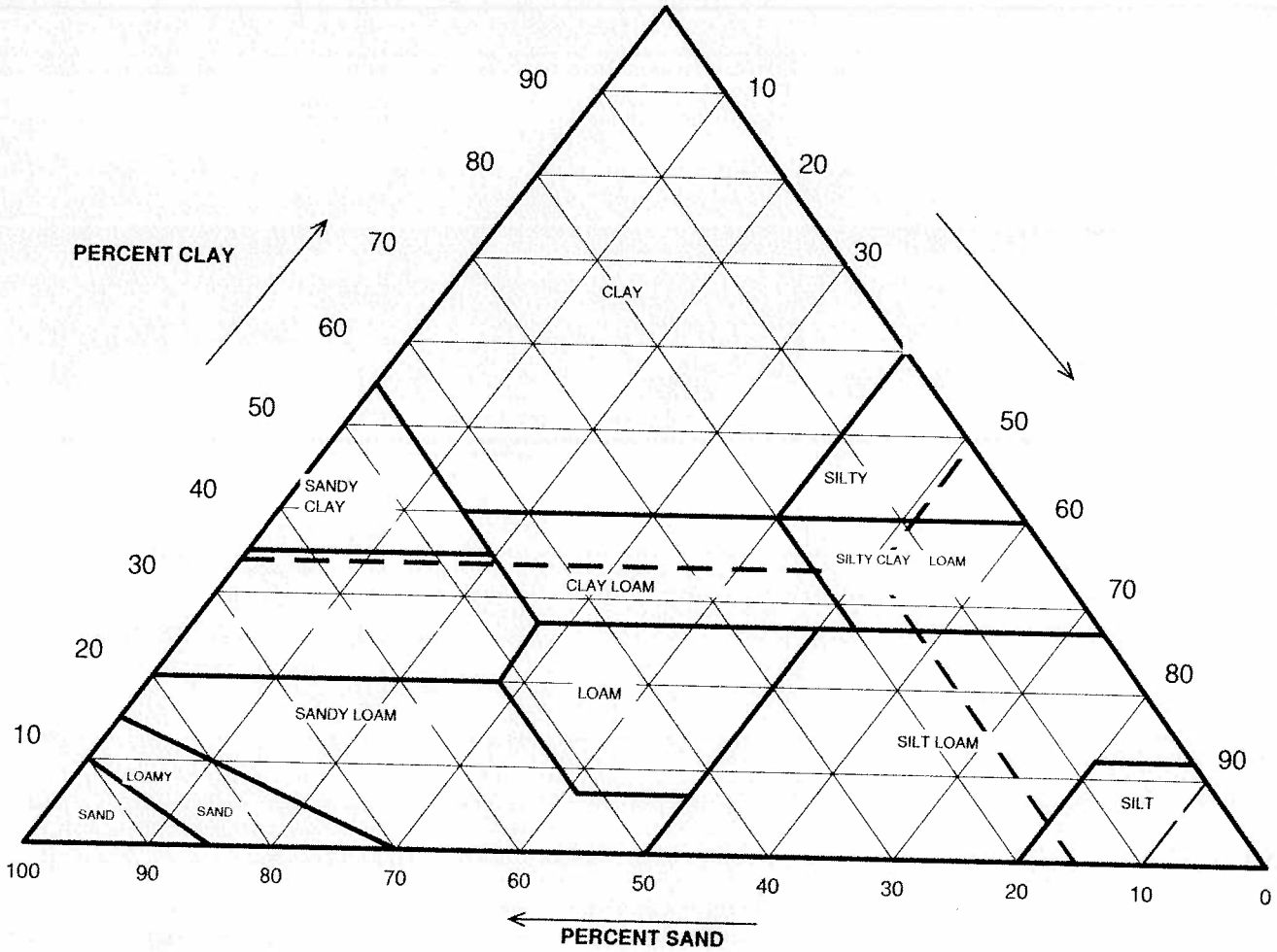
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	HSP-1
Lab ID	2012-433-01-09	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	3.18	**0.00**
2	96.82	*Sand*	14.72	**15.20**
0.05	82.10	*Silt*	49.33	**50.95**
0.002	32.77	*Clay*	32.77	**33.84**

USDA Classification: ***SILTY CLAY LOAM***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	HSP-1
Lab ID	2012-433-01-09	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1439	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	903.72	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	797.30	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.60	Weight of Tare (gm)	NA
Weight of Water (gm)	106.42	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	651.70	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**16.3**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	651.70
Dry Weight - 3/4" Sample (gm)	100.39	Weight of minus #200 material (gm)	551.31
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	100.39
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	2.81	0.43	0.43	99.57	**99.57**
3/8"	9.50	1.99	0.31	0.74	99.26	**99.26**
#4	4.75	4.75	0.73	1.47	98.53	**98.53**
#10	2.00	11.20	1.72	3.18	96.82	**96.82**
#20	0.85	12.78	1.96	5.15	94.85	**94.85**
#40	0.425	13.46	2.07	7.21	92.79	**92.79**
#60	0.250	14.44	2.22	9.43	90.57	**90.57**
#140	0.106	27.99	4.29	13.72	86.28	**86.28**
#200	0.075	10.97	1.68	15.40	84.60	**84.60**
Pan	-	551.31	84.60	100.00	-	-

Tested By PC Date 9/14/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	HSP-1
Lab ID	2012-433-01-09	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	42.0	22.6	4.64	37.4	92.9	0.01303	0.0283	**78.6**
5	39.0	22.6	4.64	34.4	85.4	0.01303	0.0183	**72.3**
15	34.5	22.6	4.64	29.9	74.2	0.01303	0.0110	**62.8**
30	30.5	22.6	4.64	25.9	64.3	0.01303	0.0080	**54.4**
66	27.0	22.7	4.61	22.4	55.7	0.01302	0.0055	**47.1**
250	22.0	22.9	4.55	17.4	43.4	0.01299	0.0029	**36.7**
1440	18.0	22.4	4.71	13.3	33.1	0.01307	0.0013	**28.0**

Soil Specimen Data		Other Corrections	
Tare No.	1139		
Tare + Dry Material (gm)	143.78	a - Factor	0.99
Weight of Tare (gm)	98.97		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	84.60
Weight of Dry Material (gm)	39.81		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	HSP-1
Lab ID	2012-433-01-09	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.

(Minus No. 40 sieve material, Airdried)

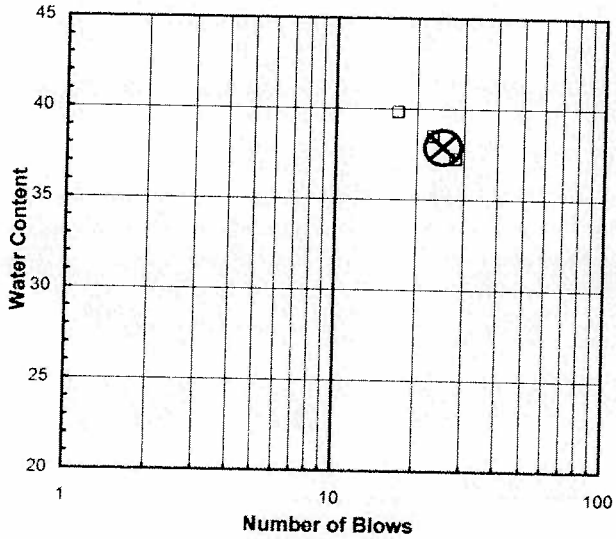
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	290	403	318	MULTIPOINT
Wt. of Tare & WS (gm)	42.70	39.00	41.87	
Wt. of Tare & DS (gm)	36.61	33.33	35.23	
Wt. of Tare (gm)	20.25	18.60	18.55	
Wt. of Water (gm)	6.1	5.7	6.6	
Wt. of DS (gm)	16.4	14.7	16.7	
Moisture Content (%)	**37.2**	**38.5**	**39.8**	
Number of Blows	**28**	**23**	**17**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	296	2234	
Wt. of Tare & WS (gm)	25.58	22.81	
Wt. of Tare & DS (gm)	24.40	21.66	
Wt. of Tare (gm)	18.78	16.12	
Wt. of Water (gm)	1.2	1.2	
Wt. of DS (gm)	5.6	5.5	
Moisture Content (%)	**21.0**	**20.8**	**0.2**

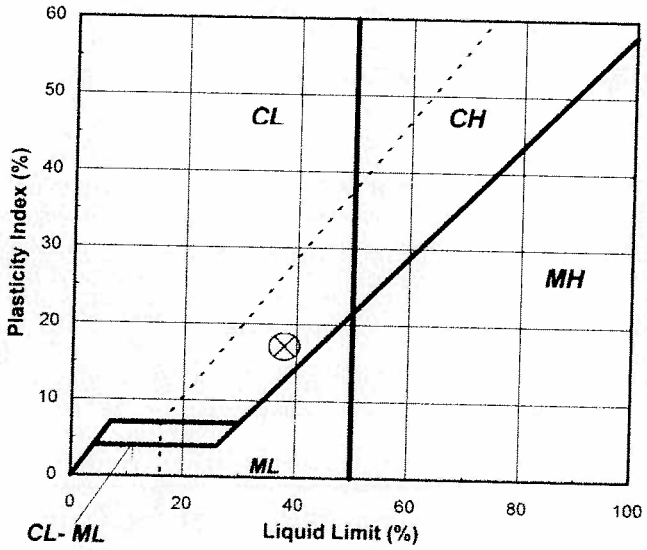
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**38**
Plastic Limit (%)	**21**
Plasticity Index (%)	**17**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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page 1 of 1 **DCN:** CT-S4B **DATE:** 12/20/06 **REVISION:** 3

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SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

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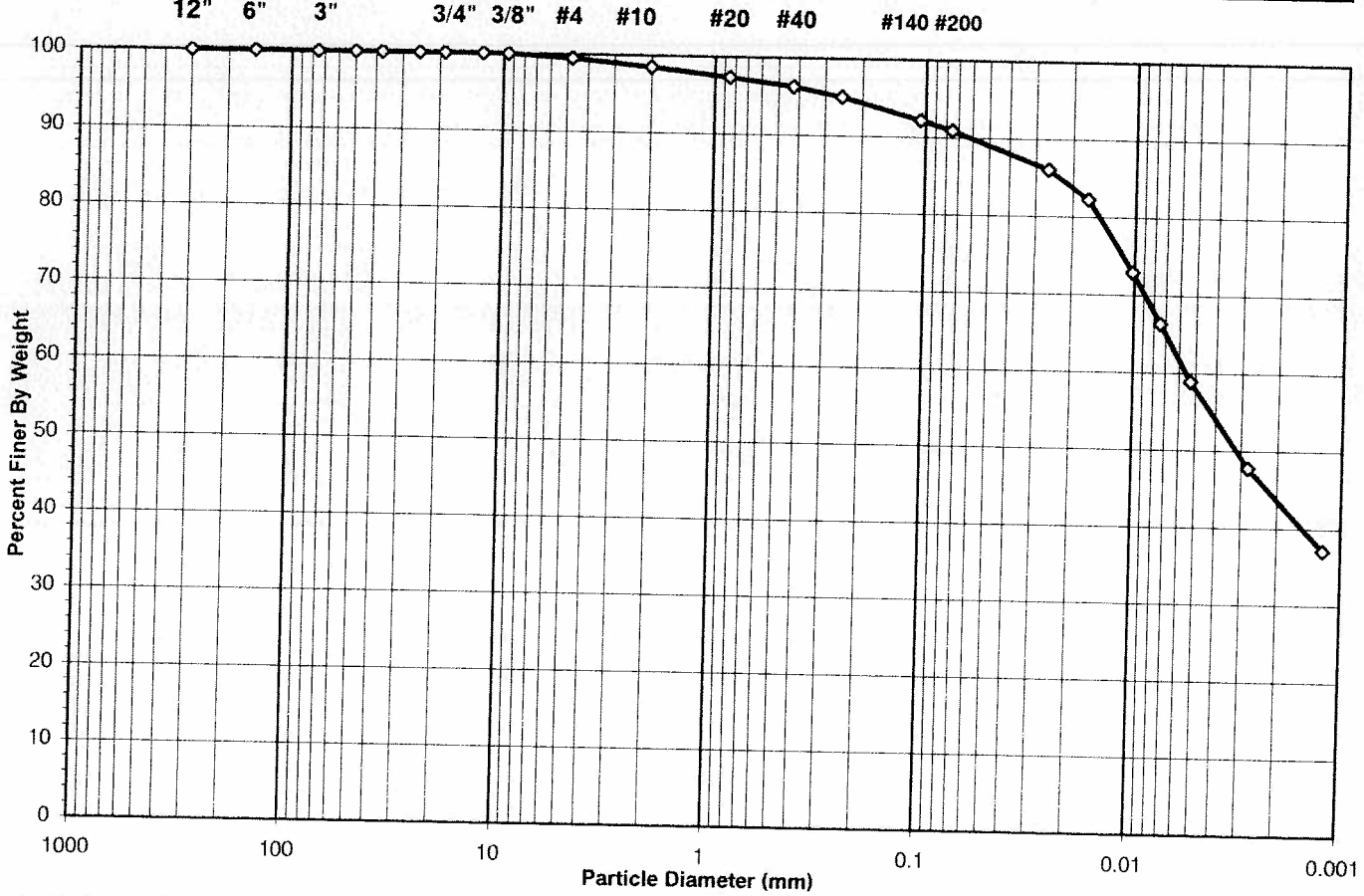
Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	BSR-1
Lab ID	2012-433-01-10	Soil Color	**BROWN**

	SIEVE ANALYSIS				HYDROMETER	
USCS	cobbles	gravel	sand		silt and clay fraction	
USDA	cobbles	gravel	sand		silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	0.51
#4 To #200	*Sand*	8.60
Finer Than #200	*Silt & Clay*	90.89

USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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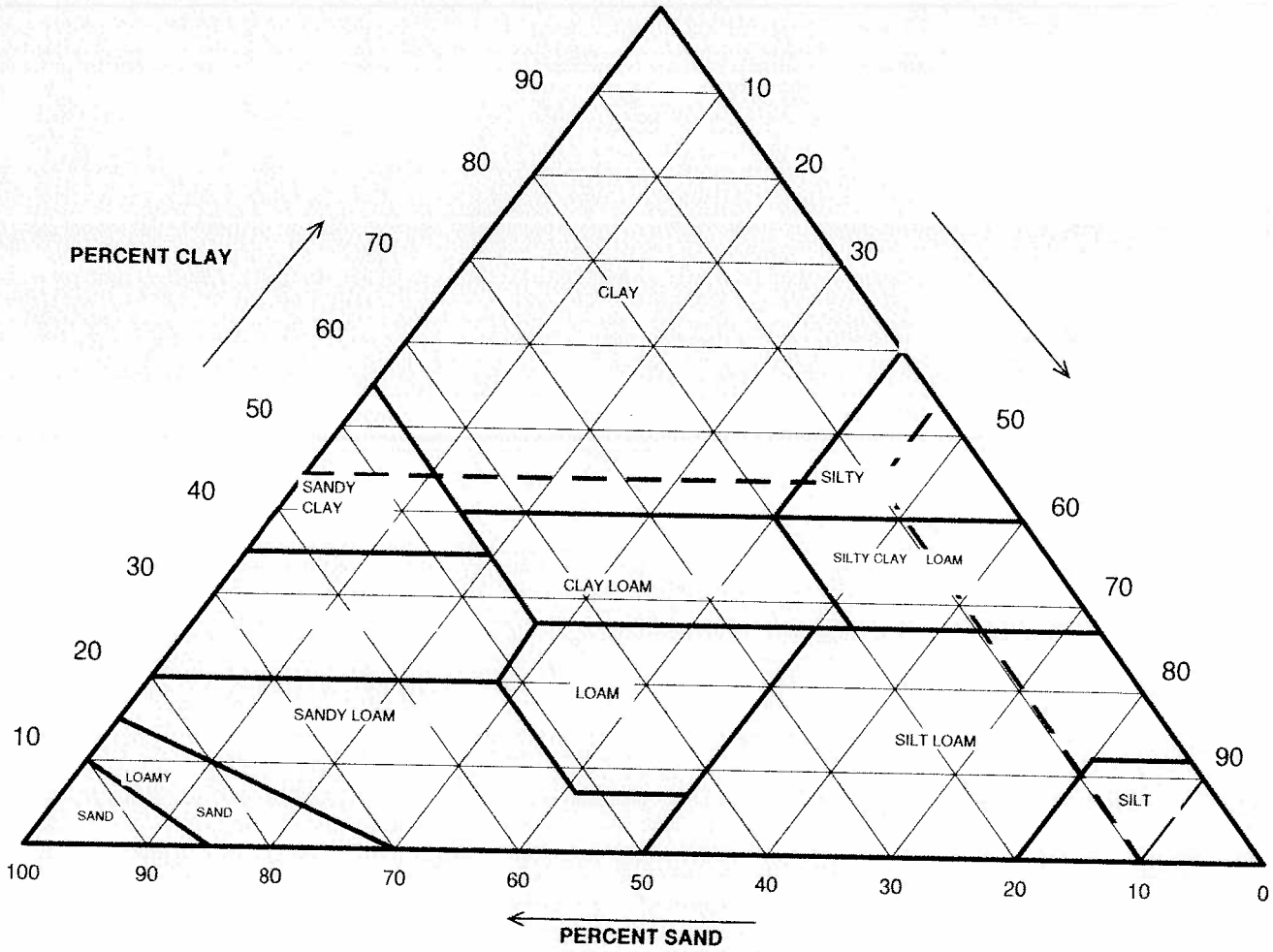
USDA CLASSIFICATION CHART

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	BSR-1
Lab ID	2012-433-01-10	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	1.49	**0.00**
2	98.51	*Sand*	9.48	**9.63**
0.05	89.03	*Silt*	45.43	**46.12**
0.002	43.59	*Clay*	43.59	**44.25**

USDA Classification: ***SILTY CLAY***

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	BSR-1
Lab ID	2012-433-01-10	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1454	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	897.30	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	760.70	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	144.98	Weight of Tare (gm)	NA
Weight of Water (gm)	136.60	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	615.72	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**22.2**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	615.72
Dry Weight - 3/4" Sample (gm)	56.12	Weight of minus #200 material (gm)	559.60
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	56.12
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	3.16	0.51	0.51	99.49	**99.49**
#10	2.00	6.01	0.98	1.49	98.51	**98.51**
#20	0.85	7.20	1.17	2.66	97.34	**97.34**
#40	0.425	6.61	1.07	3.73	96.27	**96.27**
#60	0.250	7.54	1.22	4.96	95.04	**95.04**
#140	0.106	17.68	2.87	7.83	92.17	**92.17**
#200	0.075	7.92	1.29	9.11	90.89	**90.89**
Pan	-	559.60	90.89	100.00	-	-

Tested By PC Date 9/14/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)/AASHTO T88-00 (SOP-S3)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soils L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	BSR-1
Lab ID	2012-433-01-10	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (° C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	50.5	22.6	4.64	45.9	94.7	0.01303	0.0261	**86.0**
5	48.5	22.6	4.64	43.9	90.5	0.01303	0.0168	**82.3**
15	43.5	22.6	4.64	38.9	80.2	0.01303	0.0102	**72.9**
30	40.0	22.6	4.64	35.4	73.0	0.01303	0.0074	**66.3**
63	36.0	22.7	4.61	31.4	64.8	0.01302	0.0053	**58.9**
250	30.0	22.9	4.55	25.4	52.5	0.01299	0.0028	**47.8**
1440	24.5	22.4	4.71	19.8	40.9	0.01307	0.0012	**37.1**

Soil Specimen Data		Other Corrections	
Tare No.	506		
Tare + Dry Material (gm)	153.11	a - Factor	0.99
Weight of Tare (gm)	100.16		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	90.89
Weight of Dry Material (gm)	47.95		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date 9/17/12 Checked By KC Date 9-21-12

DCN: CT-S3A DATE:01/27/12 REVISION: 10

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	MICROBAC	Boring No.	NA
Client Reference	Cleveland Background Soil L12090032	Depth (ft)	NA
Project No.	2012-433-01	Sample No.	BSR-1
Lab ID	2012-433-01-10	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.

(Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**
Tare Number	43	117	427
Wt. of Tare & WS (gm)	39.83	44.96	40.17
Wt. of Tare & DS (gm)	33.30	37.05	32.08
Wt. of Tare (gm)	19.02	20.20	15.47
Wt. of Water (gm)	6.5	7.9	8.1
Wt. of DS (gm)	14.3	16.9	16.6
Moisture Content (%)	**45.7**	**46.9**	**48.7**
Number of Blows	**34**	**25**	**19**

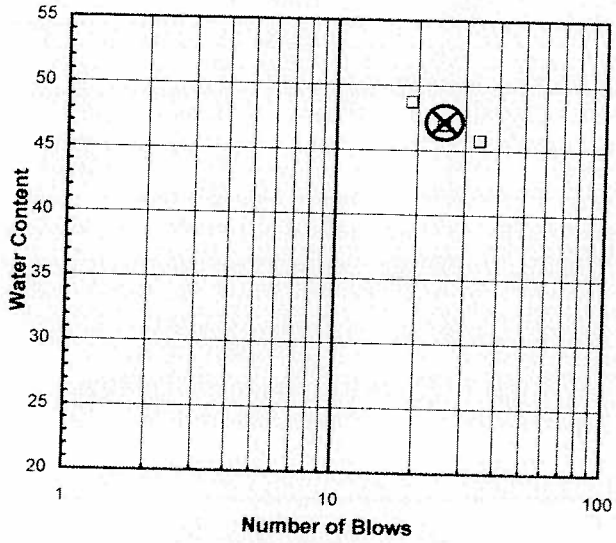
MULTIPOINT

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	2045	354	
Wt. of Tare & WS (gm)	25.16	24.61	
Wt. of Tare & DS (gm)	24.05	23.52	
Wt. of Tare (gm)	19.01	18.45	
Wt. of Water (gm)	1.1	1.1	
Wt. of DS (gm)	5.0	5.1	
Moisture Content (%)	**22.0**	**21.5**	**0.5**

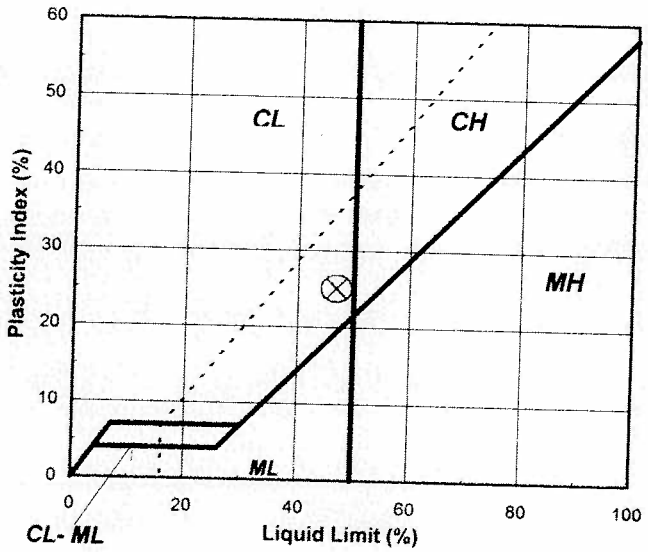
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**47**
Plastic Limit (%)	**22**
Plasticity Index (%)	**25**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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APPENDIX D

PROUCL DATASET RUNS

Background Statistics for 7 Metals

(Cuyahoga County multiple sites)

Metal	Number of Sites Included	Number of Outliers	% ND	Datapoints	Maximum	Mean	SD	Distribution	VAP MAL	95% UTL with 90% Coverage	95% UPL	Units	Comments
Arsenic	13	1	0.0%	150	28.8	14.06	4.5	No defined distribution	{23.1}	22.3	24.0	mg/kg	
Barium	13	8	0.0%	143	118	51.86	19.8	No defined distribution	{91.5}	89.3	98.9	mg/kg	5 outliers from WCR
Cadmium	12(1)	1	32.8%	128	1.04	0.452	0.191	Normal	0.834	0.737	0.770	mg/kg	KM method (recommended due to multiple RLs)
Chromium	13	0	0.0%	151	26.8	14.76	3.151	Normal	21.1	19.4	20.0	mg/kg	
Lead	13	19	0.0%	132	70.1	23.81	13.5	No defined distribution	{50.8}	49.7	51.7	mg/kg	9 outliers from STG, 8 from STN
Mercury	12(1)	14	1.7%	115	0.146	0.0483	0.029	No defined distribution	{0.106}	0.092	0.097	mg/kg	8 outliers from STN, 4 from RFP
Selenium	10(2)	0	32.0%	100	1.13	0.647	0.177	No defined distribution	{1.00}	0.917	0.943	mg/kg	

(1) Does not include BCMP or BHME 2011 (all nondetects with elevated reporting limits). BHME 2008 data are included.

(2) Does not include BCME, BHME, or CHFH (elevated reporting limits).

{ } = mean + 2SD calculated, but dataset is not normal or lognormal and value may not be appropriate for use as the MAL.

Outlier Tests for Selected Variables

User Selected Options

From File	0-2 for ProUCL - 13 SITES.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers with Rosner test	10

Rosner's Outlier Test for Arsenic

Mean	**14.18**
Standard Deviation	**4.745**
Number of data	**151**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	14.18	4.729	33.1	117	4	3.522	3.892
2	14.06	4.5	28.8	116	3.276	3.512	3.892
3	13.96	4.348	28.8	119	3.413	3.512	3.892
4	13.86	4.187	26.7	58	3.068	3.512	3.882
5	13.77	4.063	25.2	7	2.813	3.512	3.882
6	13.69	3.964	25.2	114	2.903	3.51	3.88
7	13.61	3.86	24.6	121	2.846	3.508	3.878
8	13.54	3.762	24.5	118	2.914	3.506	3.876
9	13.46	3.661	23.5	61	2.743	3.504	3.874
10	13.39	3.574	23	66	2.689	3.502	3.872

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 33.1 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation 33.1 is a Potential Statistical Outlier

Outlier Tests for Selected Variables

User Selected Options

From File	All Data - 13 Sites.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers with Rosner test	10

Rosner's Outlier Test for Barium

Mean	**57.71**
Standard Deviation	**34.25**
Number of data	**151**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	57.71	34.14	317	4	7.595	3.522	3.892
2	55.98	26.96	148	98	3.413	3.512	3.892
3	55.37	25.96	147	97	3.529	3.512	3.892
4	54.75	24.92	145	99	3.621	3.512	3.882
5	54.13	23.86	143	71	3.725	3.512	3.882
6	53.52	22.77	143	94	3.93	3.51	3.88
7	52.91	21.59	129	1	3.525	3.508	3.878
8	52.38	20.7	127	91	3.605	3.506	3.876
9	51.86	19.8	118	92	3.341	3.504	3.874
10	51.39	19.07	116	79	3.388	3.502	3.872

For 5% significance level, there are 8 Potential Outliers

Therefore, Potential Statistical Outliers are

317, 148, 147, 145, 143, 143, 129, 127

For 1% Significance Level, there are 6 Potential Outliers

Therefore, Potential Statistical Outliers are

317, 148, 147, 145, 143, 143

Outlier Tests for Selected Variables

User Selected Options

From File	All Data - 13 Sites.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers for Rosner test	10

Rosner's Outlier Test for Cadmium

Mean	**0.528**
Standard Deviation	**0.218**
Number of data	**87**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.528	0.217	1.36	19	3.844	3.338	3.705
2	0.518	0.199	1.04	16	2.618	3.328	3.698
3	0.512	0.192	1.01	79	2.592	3.328	3.695
4	0.506	0.185	0.952	18	2.407	3.325	3.688
5	0.501	0.18	0.912	64	2.289	3.318	3.685
6	0.496	0.175	0.881	67	2.204	3.319	3.687
7	0.491	0.171	0.846	66	2.082	3.32	3.688
8	0.486	0.167	0.843	17	2.137	3.321	3.69
9	0.482	0.163	0.831	69	2.143	3.322	3.691
10	0.477	0.159	0.802	55	2.041	3.323	3.693

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 1.36 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation 1.36 is a Potential Statistical Outlier

Outlier Tests for Selected Variables

User Selected Options

From File	0-2 for ProUCL - 13 Sites Indiv.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers with Rosner test	10

Rosner's Outlier Test for Chromium

Mean	**14.74**
Standard Deviation	**2.929**
Number of data	**149**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	14.74	2.919	22.3	145	2.591	3.517	3.887
2	14.69	2.872	21.7	19	2.443	3.507	3.887
3	14.64	2.822	8.19	99	2.285	3.507	3.887
4	14.68	2.78	20.9	33	2.236	3.507	3.877
5	14.64	2.741	20.8	18	2.248	3.507	3.877
6	14.6	2.702	8.73	113	2.172	3.505	3.875
7	14.64	2.666	20.2	1	2.087	3.503	3.873
8	14.6	2.634	20.2	32	2.127	3.501	3.871
9	14.56	2.6	20.2	149	2.17	3.499	3.869
10	14.52	2.565	20.1	3	2.176	3.497	3.867

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Outlier Tests for Selected Variables

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers with Rosner test	10

Rosner's Outlier Test for Lead

Run 1

Mean	**36.54**
Standard Deviation	**38.74**
Number of data	**151**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	36.54	38.62	203	130	4.311	3.522	3.892
2	35.43	36.39	186	124	4.138	3.512	3.892
3	34.42	34.33	176	132	4.124	3.512	3.892
4	33.46	32.39	170	138	4.215	3.512	3.882
5	32.53	30.46	170	141	4.513	3.512	3.882
6	31.59	28.34	155	125	4.355	3.51	3.88
7	30.74	26.5	138	139	4.048	3.508	3.878
8	29.99	25.02	134	122	4.156	3.506	3.876
9	29.27	23.53	134	140	4.45	3.504	3.874
10	28.53	21.9	114	129	3.903	3.502	3.872

For 5% significance level, there are 10 Potential Outliers

Therefore, Potential Statistical Outliers are

203, 186, 176, 170, 170, 155, 138, 134, 134, 114

For 1% Significance Level, there are 10 Potential Outliers

Therefore, Potential Statistical Outliers are

203, 186, 176, 170, 170, 155, 138, 134, 134, 114

Outlier Tests for Selected Variables

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers with Rosner test	10

Rosner's Outlier Test for Lead

Run 2 (10 outliers already removed)

Mean	**27.92**
Standard Deviation	**20.74**
Number of data	**141**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	27.92	20.67	112	130	4.068	3.495	3.865
2	27.32	19.55	103	129	3.871	3.487	3.865
3	26.78	18.52	95.2	126	3.694	3.487	3.865
4	26.28	17.64	86.8	123	3.43	3.485	3.855
5	25.84	16.92	86.5	127	3.584	3.485	3.855
6	25.39	16.16	81.5	139	3.472	3.482	3.852
7	24.98	15.47	79.6	125	3.531	3.48	3.85
8	24.57	14.78	76	137	3.479	3.478	3.848
9	24.18	14.14	74.2	122	3.536	3.475	3.845
10	23.81	13.5	70.1	138	3.429	3.473	3.843

For 5% significance level, there are 9 Potential Outliers

Therefore, Potential Statistical Outliers are

112, 103, 95.2, 86.8, 86.5, 81.5, 79.6, 76, 74.2

For 1% Significance Level, there are 2 Potential Outliers

Therefore, Potential Statistical Outliers are

112, 103

Outlier Tests for Selected Variables

User Selected Options

From File	All Data - 13 Sites.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers for Rosner test	10

Rosner's Outlier Test for Mercury

Run 1

Mean	**0.0941**
Standard Deviation	**0.254**
Number of data	**126**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.0941	0.253	2.77	84	10.56	3.453	3.823
2	0.0727	0.0836	0.515	86	5.288	3.448	3.823
3	0.0691	0.0738	0.406	88	4.564	3.448	3.823
4	0.0664	0.0675	0.375	87	4.572	3.443	3.813
5	0.0639	0.0616	0.363	89	4.853	3.443	3.813
6	0.0614	0.0555	0.308	83	4.444	3.44	3.81
7	0.0593	0.0509	0.275	80	4.238	3.437	3.807
8	0.0575	0.0471	0.237	43	3.814	3.434	3.804
9	0.056	0.0442	0.231	44	3.957	3.431	3.801
10	0.0545	0.0413	0.225	46	4.127	3.428	3.798

For 5% significance level, there are 10 Potential Outliers

Therefore, Potential Statistical Outliers are

2.77, 0.515, 0.406, 0.375, 0.363, 0.308, 0.275, 0.237, 0.231, 0.225

For 1% Significance Level, there are 10 Potential Outliers

Therefore, Potential Statistical Outliers are

2.77, 0.515, 0.406, 0.375, 0.363, 0.308, 0.275, 0.237, 0.231, 0.225

Outlier Tests for Selected Variables

User Selected Options

From File	All Data - 13 Sites.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers for Rosner test	10

Rosner's Outlier Test for Mercury

Run 2 (10 outliers already removed)

Mean	**0.053**
Standard Deviation	**0.0383**
Number of data	**116**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.053	0.0381	0.221	103	4.405	3.425	3.795
2	0.0516	0.0351	0.218	77	4.746	3.422	3.795
3	0.0501	0.0315	0.183	43	4.217	3.422	3.795
4	0.0489	0.029	0.146	78	3.343	3.415	3.785
5	0.0481	0.0277	0.135	42	3.143	3.415	3.785
6	0.0473	0.0265	0.128	46	3.045	3.411	3.781
7	0.0466	0.0255	0.12	69	2.884	3.408	3.778
8	0.0459	0.0246	0.117	45	2.893	3.405	3.775
9	0.0452	0.0237	0.115	71	2.943	3.401	3.771
10	0.0446	0.0228	0.113	41	2.997	3.398	3.768

For 5% significance level, there are 3 Potential Outliers

Therefore, Potential Statistical Outliers are

0.221, 0.218, 0.183

For 1% Significance Level, there are 3 Potential Outliers

Therefore, Potential Statistical Outliers are

0.221, 0.218, 0.183

Outlier Tests for Selected Variables

User Selected Options

From File	All Data - 13 Sites.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers for Rosner test	10

Rosner's Outlier Test for Selenium

Mean	**0.596**
Standard Deviation	**0.193**
Number of data	**100**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.596	0.192	1.13	68	2.775	3.38	3.75
2	0.591	0.187	1.09	74	2.675	3.38	3.75
3	0.586	0.181	1.01	75	2.35	3.38	3.75
4	0.581	0.176	0.992	62	2.331	3.37	3.74
5	0.577	0.172	0.975	67	2.314	3.37	3.74
6	0.573	0.168	0.95	65	2.246	3.366	3.736
7	0.569	0.164	0.938	56	2.249	3.362	3.732
8	0.565	0.16	0.911	31	2.158	3.358	3.728
9	0.561	0.157	0.903	57	2.176	3.354	3.724
10	0.557	0.154	0.9	59	2.228	3.35	3.72

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

General Background Statistics for Full Data Sets

User Selected Options

From File	0-2 for ProUCL - 13 SITES.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	150	Number of Distinct Observations	97
Tolerance Factor	1.476	Number of Missing Values	1

Raw Statistics

Minimum	4.6
Maximum	28.8
Second Largest	28.8
First Quartile	11.23
Median	12.9
Third Quartile	16.18
Mean	14.06
SD	4.5
Coefficient of Variation	0.32
Skewness	1.041

Log-Transformed Statistics

Minimum	1.526
Maximum	3.36
Second Largest	3.36
First Quartile	2.418
Median	2.557
Third Quartile	2.783
Mean	2.595
SD	0.309

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.131
Lilliefors Critical Value	0.0723

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0736
Lilliefors Critical Value	0.0723

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	20.7
95% UPL (t)	21.53
90% Percentile (z)	19.82
95% Percentile (z)	21.46
99% Percentile (z)	24.53

Assuming Lognormal Distribution

95% UTL with 90% Coverage	21.14
95% UPL (t)	22.38
90% Percentile (z)	19.91
95% Percentile (z)	22.27
99% Percentile (z)	27.48

Gamma Distribution Test

k star	10.45
Theta Star	1.345
MLE of Mean	14.06
MLE of Standard Deviation	4.348
nu star	3135

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic	1.177
5% A-D Critical Value	0.752
K-S Test Statistic	0.0942
5% K-S Critical Value	0.0765

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile	19.84
95% Percentile	23.28
99% Percentile	27.77

Assuming Gamma Distribution

90% Percentile	19.84
95% Percentile	21.89
99% Percentile	26.09
95% WH Approx. Gamma UPL	21.91
95% HW Approx. Gamma UPL	22.01
95% WH Approx. Gamma UTL with 90% Coverage	20.86
95% HW Approx. Gamma UTL with 90% Coverage	20.91

95% UTL with 90% Coverage	22.3
95% Percentile Bootstrap UTL with 90% Coverage	22.37
95% BCA Bootstrap UTL with 90% Coverage	22.9
95% UPL	23.95
95% Chebyshev UPL	33.74
Upper Threshold Limit Based upon IQR	23.6

General Background Statistics for Full Data Sets

User Selected Options

From File	All Data - 13 Sites.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	143	Number of Distinct Observations	129
Tolerance Factor	1.481	Number of Missing Values	8

Raw Statistics

Minimum	16.4
Maximum	118
Second Largest	116
First Quartile	40.4
Median	48.9
Third Quartile	57.5
Mean	51.86
SD	19.8
Coefficient of Variation	0.382
Skewness	1.308

Log-Transformed Statistics

Minimum	2.797
Maximum	4.771
Second Largest	4.754
First Quartile	3.699
Median	3.89
Third Quartile	4.052
Mean	3.883
SD	0.362

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.14
Lilliefors Critical Value	0.0741

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0748
Lilliefors Critical Value	0.0741

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	81.18
95% UPL (t)	84.75
90% Percentile (z)	77.23
95% Percentile (z)	84.42
99% Percentile (z)	97.92

Assuming Lognormal Distribution

95% UTL with 90% Coverage	82.96
95% UPL (t)	88.55
90% Percentile (z)	77.19
95% Percentile (z)	88.02
99% Percentile (z)	112.6

Gamma Distribution Test

k star	7.625
Theta Star	6.801
MLE of Mean	51.86
MLE of Standard Deviation	18.78
nu star	2181

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic	1.402
5% A-D Critical Value	0.753
K-S Test Statistic	0.0921
5% K-S Critical Value	0.0784

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile	78.04
95% Percentile	95.54
99% Percentile	115.2

Assuming Gamma Distribution

90% Percentile	76.91
95% Percentile	86.11
99% Percentile	105.2
95% WH Approx. Gamma UPL	86.18
95% HW Approx. Gamma UPL	86.63
95% WH Approx. Gamma UTL with 90% Coverage	81.55
95% HW Approx. Gamma UTL with 90% Coverage	81.8

95% UTL with 90% Coverage	89.3
95% Percentile Bootstrap UTL with 90% Coverage	88.96
95% BCA Bootstrap UTL with 90% Coverage	88.82
95% UPL	98.94
95% Chebyshev UPL	138.5
Upper Threshold Limit Based upon IQR	83.15

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	All Data - 13 Sites.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Number of Valid Data	128	Number of Detected Data	86
Number of Distinct Detected Data	81	Number of Non-Detect Data	42
Tolerance Factor	1.493	Percent Non-Detects	32.81%
Number of Missing Values	1		

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.223	Minimum Detected	-1.501
Maximum Detected	1.04	Maximum Detected	0.0392
Mean of Detected	0.518	Mean of Detected	-0.733
SD of Detected	0.199	SD of Detected	0.396
Minimum Non-Detect	0.402	Minimum Non-Detect	-0.911
Maximum Non-Detect	0.582	Maximum Non-Detect	-0.541

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommended

For all methods (except KM, DL/2, and ROS Methods),

Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	97
Number treated as Detected with Single DL	31
Single DL Non-Detect Percentage	75.78%

Background Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.085	Lilliefors Test Statistic	0.102
5% Lilliefors Critical Value	0.0955	5% Lilliefors Critical Value	0.0955
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.422	Mean (Log Scale)	-0.983
SD	0.214	SD (Log Scale)	0.485
95% UTL 90% Coverage	0.741	95% UTL 90% Coverage	0.773
95% UPL (t)	0.778	95% UPL (t)	0.839
90% Percentile (z)	0.696	90% Percentile (z)	0.697
95% Percentile (z)	0.774	95% Percentile (z)	0.832
99% Percentile (z)	0.919	99% Percentile (z)	1.158

Maximum Likelihood Estimate(MLE) Method

Log ROS Method

Mean	0.401
SD	0.258
95% UTL with 90% Coverage	0.786
95% UPL (t)	0.83
90% Percentile (z)	0.732
95% Percentile (z)	0.825
99% Percentile (z)	1.001

Mean in Original Scale	0.457
SD in Original Scale	0.185
95% UTL with 90% Coverage	0.739
95% BCA UTL with 90% Coverage	0.811
95% Bootstrap (%) UTL with 90% Coverage	0.811
95% UPL (t)	0.787
90% Percentile (z)	0.683
95% Percentile (z)	0.781
99% Percentile (z)	1.005

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	6.575
Theta Star	0.0788
nu star	1131
A-D Test Statistic	0.538
5% A-D Critical Value	0.753
K-S Test Statistic	0.0768
5% K-S Critical Value	0.0965

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.473
Median	0.404
SD	0.176
k star	8.061
Theta star	0.0587
Nu star	2064
95% Percentile of Chisquare (2k)	26.45
90% Percentile	0.695
95% Percentile	0.776
99% Percentile	0.944

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.452
SD	0.191
SE of Mean	0.0175
95% KM UTL with 90% Coverage	0.737
95% KM Chebyshev UPL	1.289
95% KM UPL (t)	0.77
90% Percentile (z)	0.697
95% Percentile (z)	0.766
99% Percentile (z)	0.897

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.777
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.78
95% WH Approx. Gamma UTL with 90% Coverage	0.739
95% HW Approx. Gamma UTL with 90% Coverage	0.74

Note: DL/2 is not a recommended method.

General Background Statistics for Full Data Sets

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

Chromium

General Statistics

Total Number of Observations	151	Number of Distinct Observations	86
Tolerance Factor	1.475		

Raw Statistics

Minimum	6.11
Maximum	26.8
Second Largest	22.3
First Quartile	12.5
Median	14.3
Third Quartile	16.9
Mean	14.76
SD	3.151
Coefficient of Variation	0.214
Skewness	0.405

Log-Transformed Statistics

Minimum	1.81
Maximum	3.288
Second Largest	3.105
First Quartile	2.526
Median	2.66
Third Quartile	2.827
Mean	2.669
SD	0.219

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.0679
Lilliefors Critical Value	0.0721

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0619
Lilliefors Critical Value	0.0721

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	19.41
95% UPL (t)	19.99
90% Percentile (z)	18.8
95% Percentile (z)	19.94
99% Percentile (z)	22.09

Assuming Lognormal Distribution

95% UTL with 90% Coverage	19.92
95% UPL (t)	20.74
90% Percentile (z)	19.09
95% Percentile (z)	20.67
99% Percentile (z)	23.99

Gamma Distribution Test

k star	21.34
Theta Star	0.692
MLE of Mean	14.76
MLE of Standard Deviation	3.195
nu star	6446

Data Distribution Test

Data appear Normal at 5% Significance Level

A-D Test Statistic	0.184
5% A-D Critical Value	0.75
K-S Test Statistic	0.0474
5% K-S Critical Value	0.0761

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile	18.9
95% Percentile	20.15
99% Percentile	22

Assuming Gamma Distribution

90% Percentile	18.97
95% Percentile	20.38
99% Percentile	23.19
95% WH Approx. Gamma UPL	20.4
95% HW Approx. Gamma UPL	20.47
95% WH Approx. Gamma UTL with 90% Coverage	19.68
95% HW Approx. Gamma UTL with 90% Coverage	19.73

95% UTL with 90% Coverage	19.3
95% Percentile Bootstrap UTL with 90% Coverage	19.3
95% BCA Bootstrap UTL with 90% Coverage	19.3
95% UPL	20.2
95% Chebyshev UPL	28.54
Upper Threshold Limit Based upon IQR	23.5

General Background Statistics for Full Data Sets

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	132	Number of Distinct Observations	109
Tolerance Factor	1.49	Number of Missing Values	19

Raw Statistics		Log-Transformed Statistics	
Minimum	8.2	Minimum	2.104
Maximum	70.1	Maximum	4.25
Second Largest	63.9	Second Largest	4.157
First Quartile	14.19	First Quartile	2.652
Median	18.8	Median	2.934
Third Quartile	29.83	Third Quartile	3.395
Mean	23.81	Mean	3.034
SD	13.5	SD	0.506
Coefficient of Variation	0.567		
Skewness	1.294		

Background Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.182	Lilliefors Test Statistic	0.114
Lilliefors Critical Value	0.0771	Lilliefors Critical Value	0.0771
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	43.92	95% UTL with 90% Coverage	44.18
95% UPL (t)	46.26	95% UPL (t)	48.22
90% Percentile (z)	41.11	90% Percentile (z)	39.76
95% Percentile (z)	46.01	95% Percentile (z)	47.78
99% Percentile (z)	55.22	99% Percentile (z)	67.46

Gamma Distribution Test		Data Distribution Test
k star	3.766	Data do not follow a Discernable Distribution (0.05)
Theta Star	6.32	
MLE of Mean	23.81	
MLE of Standard Deviation	12.27	
nu star	994.3	

A-D Test Statistic	3.705
5% A-D Critical Value	0.757
K-S Test Statistic	0.122
5% K-S Critical Value	0.0815

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile	47.94
95% Percentile	51.27
99% Percentile	62.54

Assuming Gamma Distribution

90% Percentile	40.25
95% Percentile	46.89
99% Percentile	61.12
95% WH Approx. Gamma UPL	46.9
95% HW Approx. Gamma UPL	47.14
95% WH Approx. Gamma UTL with 90% Coverage	43.66
95% HW Approx. Gamma UTL with 90% Coverage	43.73

95% UTL with 90% Coverage	49.7
95% Percentile Bootstrap UTL with 90% Coverage	49.66
95% BCA Bootstrap UTL with 90% Coverage	49.66
95% UPL	51.67
95% Chebyshev UPL	82.88
Upper Threshold Limit Based upon IQR	53.28

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	All Data - 13 Sites.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

Mercury

General Statistics

Number of Valid Data	115	Number of Detected Data	113
Number of Distinct Detected Data	104	Number of Non-Detect Data	2
Tolerance Factor	1.506	Percent Non-Detects	1.74%
Number of Missing Values	14		

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0131	Minimum Detected	-4.335
Maximum Detected	0.146	Maximum Detected	-1.924
Mean of Detected	0.0489	Mean of Detected	-3.168
SD of Detected	0.029	SD of Detected	0.542
Minimum Non-Detect	0.0116	Minimum Non-Detect	-4.457
Maximum Non-Detect	0.0118	Maximum Non-Detect	-4.44

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommended

For all methods (except KM, DL/2, and ROS Methods),

Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	2
Number treated as Detected with Single DL	113
Single DL Non-Detect Percentage	1.74%

Background Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.199	Lilliefors Test Statistic	0.0917
5% Lilliefors Critical Value	0.0833	5% Lilliefors Critical Value	0.0833
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0482	Mean (Log Scale)	-3.203
SD	0.0293	SD (Log Scale)	0.597
95% UTL 90% Coverage	0.0924	95% UTL 90% Coverage	0.0999
95% UPL (t)	0.097	95% UPL (t)	0.11
90% Percentile (z)	0.0858	90% Percentile (z)	0.0873
95% Percentile (z)	0.0964	95% Percentile (z)	0.108
99% Percentile (z)	0.116	99% Percentile (z)	0.163

Maximum Likelihood Estimate(MLE) Method

Log ROS Method

Mean	0.048
SD	0.0295
95% UTL with 90% Coverage	0.0924
95% UPL (t)	0.0971
90% Percentile (z)	0.0858
95% Percentile (z)	0.0965
99% Percentile (z)	0.117

Mean in Original Scale	0.0483
SD in Original Scale	0.0292
95% UTL with 90% Coverage	0.0966
95% BCA UTL with 90% Coverage	0.112
95% Bootstrap (%) UTL with 90% Coverage	0.113
95% UPL (t)	0.106
90% Percentile (z)	0.0851
95% Percentile (z)	0.105
99% Percentile (z)	0.154

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	3.379
Theta Star	0.0145
nu star	763.8
A-D Test Statistic	1.735
5% A-D Critical Value	0.758
K-S Test Statistic	0.13
5% K-S Critical Value	0.0866

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.0483
SD	0.029
SE of Mean	0.00272
95% KM UTL with 90% Coverage	0.092
95% KM Chebyshev UPL	0.175
95% KM UPL (t)	0.0967
90% Percentile (z)	0.0855
95% Percentile (z)	0.0961
99% Percentile (z)	0.116

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.0481
Median	0.0406
SD	0.0295
k star	1.677
Theta star	0.0287
Nu star	385.8
95% Percentile of Chisquare (2k)	8.421
90% Percentile	0.0975
95% Percentile	0.121
99% Percentile	0.173

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.11
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.121
95% WH Approx. Gamma UTL with 90% Coverage	0.102
95% HW Approx. Gamma UTL with 90% Coverage	0.11

Note: DL/2 is not a recommended method.

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	All Data - 13 Sites.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

Selenium

General Statistics

Number of Valid Data	100	Number of Detected Data	68
Number of Distinct Detected Data	65	Number of Non-Detect Data	32
Tolerance Factor	1.524	Percent Non-Detects	32.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.411	Minimum Detected	-0.889
Maximum Detected	1.13	Maximum Detected	0.122
Mean of Detected	0.672	Mean of Detected	-0.436
SD of Detected	0.191	SD of Detected	0.281
Minimum Non-Detect	0.773	Minimum Non-Detect	-0.257
Maximum Non-Detect	1.02	Maximum Non-Detect	0.0198

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommended

For all methods (except KM, DL/2, and ROS Methods),

Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	98
Number treated as Detected with Single DL	2
Single DL Non-Detect Percentage	98.00%

Background Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.144	Lilliefors Test Statistic	0.113
5% Lilliefors Critical Value	0.107	5% Lilliefors Critical Value	0.107
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.596	Mean (Log Scale)	-0.564
SD	0.193	SD (Log Scale)	0.301
95% UTL 90% Coverage	0.891	95% UTL 90% Coverage	0.9
95% UPL (t)	0.919	95% UPL (t)	0.94
90% Percentile (z)	0.844	90% Percentile (z)	0.836
95% Percentile (z)	0.914	95% Percentile (z)	0.933
99% Percentile (z)	1.046	99% Percentile (z)	1.145
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
		Mean in Original Scale	0.647

SD in Original Scale	0.162
Mean in Log Scale	-0.464
SD in Log Scale	0.236
95% UTL 90% Coverage	0.9
95% UPL (t)	0.932
90% Percentile (z)	0.85
95% Percentile (z)	0.926
99% Percentile (z)	1.088

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	12.42
Theta Star	0.0541
nu star	1690
A-D Test Statistic	1.259
5% A-D Critical Value	0.75
K-S Test Statistic	0.125
5% K-S Critical Value	0.108

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.67
Median	0.657
SD	0.157
k star	18.3
Theta star	0.0366
Nu star	3660
95% Percentile of Chisquare (2k)	51.72
90% Percentile	0.877
95% Percentile	0.946
99% Percentile	1.087

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.647
SD	0.177
SE of Mean	0.02
95% KM UTL with 90% Coverage	0.917
95% KM Chebyshev UPL	1.423
95% KM UPL (t)	0.943
90% Percentile (z)	0.874
95% Percentile (z)	0.938
99% Percentile (z)	1.059

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.948
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.951
95% WH Approx. Gamma UTL with 90% Coverage	0.92
95% HW Approx. Gamma UTL with 90% Coverage	0.922

Note: DL/2 is not a recommended method.