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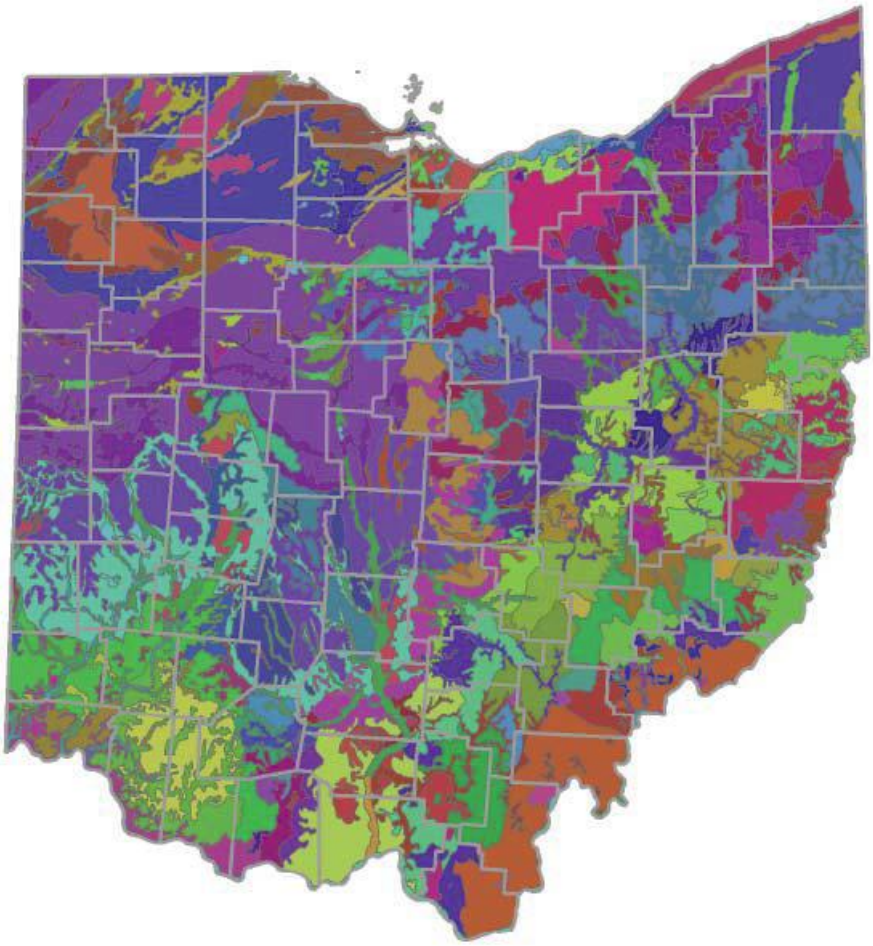
Evaluation of Background Metal Soil Concentrations in Franklin County – Columbus Area

DEVELOPED IN SUPPORT OF
THE OHIO VOLUNTARY ACTION PROGRAM

Summary Report



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

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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
BDC	Battelle Darby Creek Metro Park
bgs	Below ground surface
BW	Blendon Woods Metro Park
C_v	Coefficient of variation
DERR	Division of Environmental Response and Revitalization
ft	Feet
FP-XRF	Field Portable X-ray Fluorescence
GDL	Goodale Park
GOF	Goodness-of-fit
GRG	Griggs Reservoir Park
HB	Highbanks Metro Park
KM	Kaplan-Meier
MAY	Maybury Park
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
SAP	Sampling and Analysis Plan
S_b	Standard deviation
SCH	Schiller Park
SIFU	Site Investigation Field Unit
SS	Scioto South Metro Park
SCW	Scioto Woods Park
TAL	Target Analyte List
TBA	Targeted Brownfields Assessment
TC	Three Creeks Metro Park
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
WEX	Wexford Green Park

EXECUTIVE SUMMARY

Ohio EPA Division of Environmental Response and Revitalization (DERR) sampled and analyzed surface soils at 11 Columbus-area properties for background concentrations of Resource Conservation and Recovery Act (RCRA) metals (As, Ba, Cd, Cr, Pb, Hg, and Se) in addition to nickel (Ni) and thallium (Tl). Silver was removed from the RCRA analytical suite due to repeated non-detections found in other counties. 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 ft. 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 for each metal. 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 Franklin County are provided in tablular format as part of this report. Seven RCRA metals are presented in addition to nickel and thallium. Final and representative background concentrtions of metals in Franklin County are as follows:

Arsenic	20.7 mg/kg
Barium	163 mg/kg
Cadmium	0.789 mg/kg
Chromium	16.4 mg/kg
Lead	41.5 mg/kg
Mercury	0.081 mg/kg
Nickel	36.4 mg/kg
Selenium	1.07 mg/kg
Thallium	0.743 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 particularly challenging to characterize as opposed to background concentrations in suburban or rural areas. 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, suburban and rural 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 Franklin County and Columbus-area brownfield properties being assessed and remediated under the Ohio VAP. For the purposes of this investigation, "Franklin County – Columbus area urban soils" means surficial soils within the City of Columbus or adjacent municipalities, including suburban areas and metro parks within suburban or rural 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 11 Columbus-area properties for background concentrations of Resource Conservation and Recovery Act (RCRA) metals (As, Ba, Cd, Cr, Pb, Hg, and Se) in addition to nickel and thallium. Silver was removed from the RCRA metals analytical suite due to repeated non-detections found in collected from other counties. 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 Franklin County as described on the "General Soil Map, Franklin County, Ohio" of the *Soil Survey of Franklin 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 Columbus-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), nickel, and thallium 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 COLUMBUS-AREA SOIL TYPES

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

1. Well drained, moderately well drained, and very poorly drained soils on flood plains, terraces and outwash plains

2. Well drained, moderately well drained, and somewhat poorly drained soils on uplands

3. Moderately well drained, somewhat poorly drained, and very poorly drained soils on uplands

The majority of the soils in Franklin County are formed on silt- and clay-rich glacial till.

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 Columbus-area. Two properties within the downtown Columbus area (Schiller Park and Goodale Park) 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 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.

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 Franklin 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 (Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Rb, Sr, Zr, Mo, Ag, Cd, Sn, Sb, Hg, and Pb) 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 at any of the selected properties.

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 (excluding silver), including nickel and thallium. An eleventh location was selected (Highbanks Park) after samples collected at Goodale Park revealed the potential for soils to be derived from non-native fill. There was some concern that non-native fill could have elevated metals concentrations derived from anthropogenic sources. Highbanks Park was selected as an alternate location in the event that XRF screening results revealed anomalously high concentrations which would facilitate removal of the Goodale location. XRF results indicated metals concentrations within an acceptable range, therefore both the Goodale and Highbanks Parks were included as part of the final soil sampling regimen.

At each locality, Ohio EPA collected 10 surficial soil samples between the ground surface and depth of two feet using a hand auger. At the Griggs Reservoir Park location the depth to bedrock varies between 0.7 and 1.5 ft, and Ohio EPA encountered auger refusal between those depths. At a few other locations auger refusal was encountered on 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). Ohio EPA collected the geotechnical and 10 analytical samples within an area approximately 30 feet in diameter to ensure that the soil samples were similar in texture and composition (i.e., from the same population). 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., BDC-1, BW-1, GDL-1, etc.) was collected adjacent to the preliminary soil boring location, and included analytical sample for metals analyses 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 (approximately three to four pounds) was homogenized in a stainless steel mixing pan. A two-ounce subsample was collected and preserved on ice at 4° C and submitted to Ohio EPA's contract laboratory for RCRA metals, nickel and thallium analysis. 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 (one per sampling area).

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 (Microbac Laboratories, Inc.) analyzed 110 soil samples (10 per site) for RCRA metals (As, Ba, Cd, Cr, Pb, Hg and Se), nickel (Ni), and thallium (Tl) using Inductively Coupled Plasma (ICP) and/or Graphite Furnace Atomic Absorption Spectrophotometry (GFAAS) via U.S. EPA Method 6020 and Method 7471. Geotechnics, subcontracted by Microbac, 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 Microbac are considered certified under the Ohio EPA VAP certified laboratory program.

6.0 Sampling Locations

6.1 Property Descriptions and Locations

Details for the 11 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, suburban or rural), 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 are presented for the approximate location of the preliminary soil boring. 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 Franklin 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 Franklin County were sampled.

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 11 property locations 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 11 property locations.

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 28.18% 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 COLUMBUS-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 Franklin County are provided in Table 3. Seven of the eight original RCRA metals are presented. As previously discussed, silver was not included in this study due to the characteristically high number of nondetects found for other county-wide soil background studies completed in the State. Therefore, silver has been determined not to be a significant contributor to elevated background concentrations across the Franklin County region. As a replacement both nickel and thallium were added to the suite of metals analyses.

The ProUCL output data sheets are provided in Appendix D. Analytical results for each metal are provided in Tables 5 through 13. 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 2.72 to 38.0 mg/kg with no nondetects. There were 110 valid data points, with only one outlier removed. The data set mean was calculated to be 12.96 mg/kg, with a standard deviation of 4.93 mg/kg. The VAP UL was determined to be 22.8 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 19.8 mg/kg. The 95% UPL is 20.7 mg/kg. This value is determined to be the representative soil background concentration.

8.2 Barium

Concentrations of barium ranged from 48.9 to 163 mg/kg with no nondetects. There were 110 valid data points with no outliers removed. The data set mean was calculated to be 103.7 mg/kg, with a standard deviation of 31.43 mg/kg. The VAP UL was determined to be 167 mg/kg; however the data set was not normally distributed. Therefore the VAP UL cannot be used as the representative concentration. The 95% WH Gamma UTL with 90% Coverage was determined to be 156 mg/kg. The 95% Gamma UPL based on the best fit of the data distribution was calculated to be 163 mg/kg. This value is determined to be the representative soil background concentration.

8.3 Cadmium

Detected concentrations of cadmium ranged from 0.232 to 1 mg/kg. There were 110 valid data points with no outliers removed. There were 31 nondetects, or 28.18%, of 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 0.478 mg/kg, with a standard deviation of 0.236 mg/kg. The VAP UL was determined to be 0.87 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 0.756 mg/kg. the 95% UPL based on the best fit of the data distribution was calculated to be 0.789 mg/kg. This value is determined to be the representative soil background concentration.

8.4 Chromium (Kaplan-Meier Method)

Detected concentrations of chromium ranged from an estimated value of 0.764 to 19.8 mg/kg. There were 110 valid data points, with no outliers removed. There were two nondetects in the data set, or 1.8%, in the final dataset. 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 8.97 mg/kg, with a standard deviation of 3.72 mg/kg. The VAP UL was determined to be 16.41 mg/kg. The data were calculated to be normally distributed. The 95% UTL with 90% coverage was determined to be 14.59 mg/kg. The 95% UPL is 15.16 mg/kg. The VAP UL was determined to the representative soil background concentration.

8.5 Lead

Detected concentrations of lead ranged from 12.7 to 51.1 mg/kg. There were 110 valid data points, with no outliers removed. There were no nondetects in the data set. The data set mean was calculated to be 22.48 mg/kg, with a standard deviation of 8.5 mg/kg. The VAP UL was determined to be 39.48 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 39.00 mg/kg. The 95% UPL is 41.50 mg/kg. This value was determined to be the representative soil background concentration.

8.6 Mercury

Concentrations of mercury ranged from 0.019 to 0.092 mg/kg. There were 97 valid data points after removal of 13 outliers. All samples from the Scioto South (SS) and three samples from the Schiller Park (SCH) site were identified as statistical outliers using Rosner's outlier test. The data set mean was calculated to be 0.041 mg/kg, with a standard deviation of 0.0167 mg/kg. The VAP UL was determined to be 0.081 mg/kg. The data were not normally distributed, however the data were able to be log-transformed therefore the mean and standard deviation are represented using the transformed data. The 95% UTL with 90% coverage was determined to be 0.068 mg/kg. The 95% UPL is 0.072 mg/kg. The VAP UL, using log-transformation, was determined to be the representative soil background concentration.

8.7 Nickel

Detected concentrations of lead ranged from 10.9 to 39.0 mg/kg. There were 110 valid data points, with no outliers removed. There were no nondetects in the data set. The data set mean was calculated to be 20.74 mg/kg, with a standard deviation of 7.3 mg/kg. The VAP UL was determined to be 35.34 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 35.9 mg/kg. The 95% UPL is 36.44 mg/kg and it was determined to be the representative background concentration.

8.8 Selenium

Detected concentrations of selenium ranged from 0.164 to 1.11 mg/kg. There were 110 valid data points, with no outliers removed. There were no nondetects in the data set. The data set mean was calculated to be 0.651 mg/kg, with a standard deviation of 0.211 mg/kg. The VAP UL was determined to be 1.07 mg/kg. The data set was normally distributed. The 95% UTL with 90% coverage was determined to be 0.971 mg/kg. The 95% UPL is 1.00 mg/kg. The VAP UL was determined to be the representative soil background concentration.

8.9 Thallium

Detected concentrations of selenium ranged from 0.131 to 0.956 mg/kg. There were 110 valid data points, with no outliers removed. There were no nondetects in the data set. The data set mean was calculated to be 0.429 mg/kg, with a standard deviation of 0.164 mg/kg. The VAP UL was determined to be 0.757 mg/kg; however the data set was not normally distributed. The 95% UTL with 90% coverage was determined to be 0.710 mg/kg. The 95% UPL is 0.743 mg/kg. This value was determined to 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 Franklin 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 Franklin 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 Franklin County – Columbus Area:

Arsenic	20.7 mg/kg
Barium	163 mg/kg
Cadmium	0.789 mg/kg
Chromium	16.4 mg/kg
Lead	41.5 mg/kg
Mercury	0.081 mg/kg
Nickel	36.4 mg/kg
Selenium	1.07 mg/kg
Thallium	0.743 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

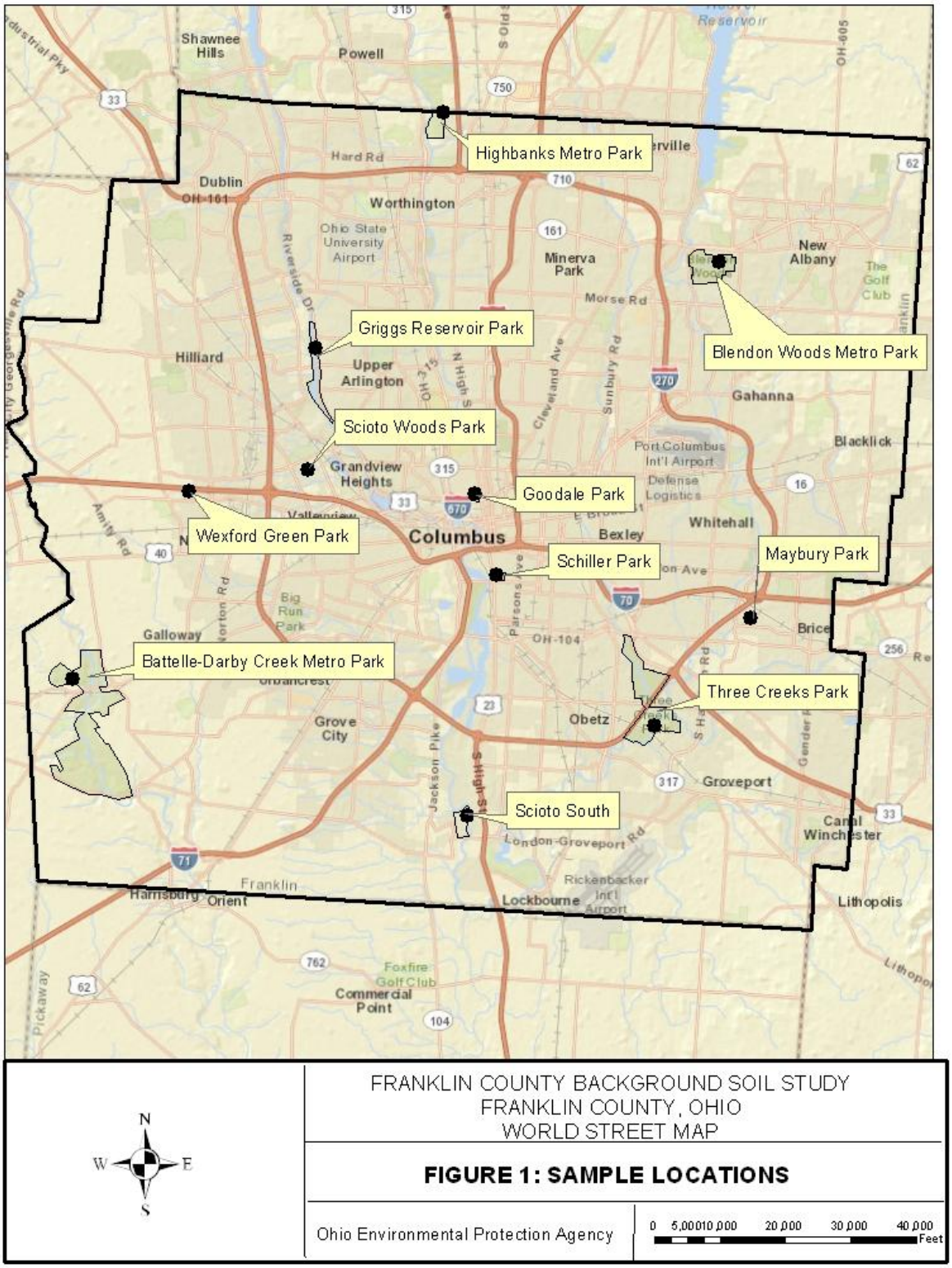
Presley, D., and S. Thien, September 2008, Estimating Soil Texture By Feel, Kansas State University Department of Agronomy, MF-2852

USDA Soil Conservation Service, December 1980, Soil Survey of Franklin 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

FIGURE 1: SAMPLE LOCATIONS, FRANKLIN COUNTY, OHIO



FRANKLIN COUNTY BACKGROUND SOIL STUDY
FRANKLIN COUNTY, OHIO
WORLD STREET MAP

FIGURE 1: SAMPLE LOCATIONS

Ohio Environmental Protection Agency

0 5,000 10,000 20,000 30,000 40,000 Feet

FIGURE 2: GENERAL SOIL MAP, FRANKLIN COUNTY, OHIO

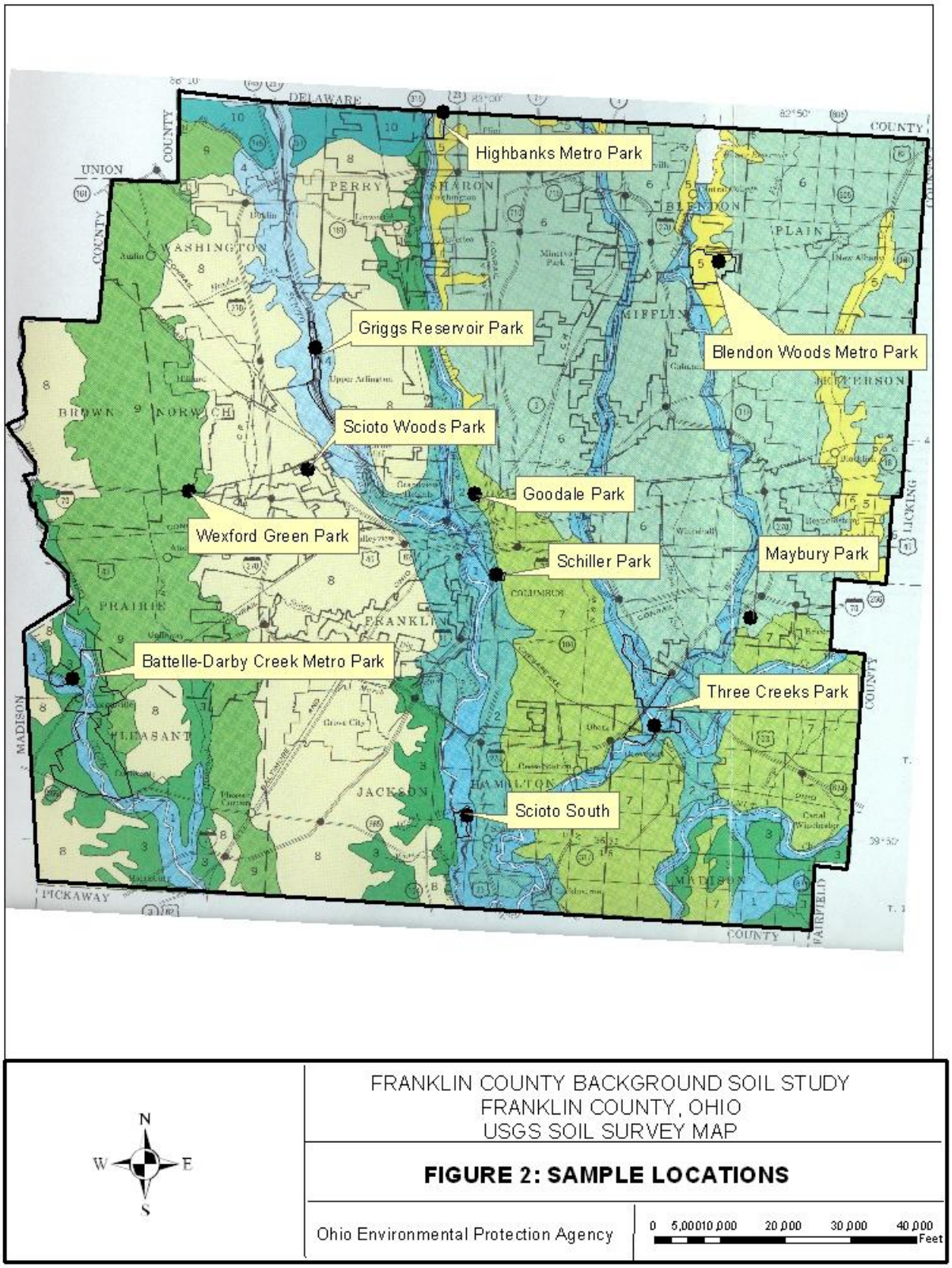


TABLE 1A

Soil Sampling Property Information Summary: Locations, Settings & Topography

Sampled Property	Property Abbreviation (Sample ID)	Location			Setting	Topography
		Address	Latitude[1]	Longitude[1]		
Battelle Darby Creek Metro Park	**BDC**	1775 Darby Creek Drive, Galloway, OH 43119	39.898044	-83.225097	rural park	level to very gently sloping upland area
Blendon Woods Metro Park	**BW**	4625 E Dublin-Granville Rd, Westerville, OH 43081	40.074058	-82.873897	suburban park	gently to moderately sloping upland area with ravines
Goodale Park	**GDL**	120 W Goodale Street, Columbus, OH 43215	39.976436	-83.007119	urban park	level to very gently sloping upland area
Griggs Reservoir Park	**GRG**	2933 Riverside Drive, Columbus, OH 43221	40.037281	-83.093942	suburban park	steep hillside adjacent to Scoto River
Highbanks Metro Park	**HB**	9466 U.S. Route 23 N, Lewis Center, OH 43035	40.136197	-83.025386	suburban to rural park	level upland area
Maybury Park	**MAY**	5026 Lindora Drive, Columbus, OH 43227	39.925272	-82.856383	suburban park	level (to very gently sloping?) upland area
Schiller Park	**SCH**	1069 Jaeger Street, Columbus, OH 43206	39.942836	-82.994728	urban park	level upland area
Scioto South ("Future") Metro Park	**SS**	Intersection of London-Groveport Rd & Hibbs Rd	39.842014	-83.010167	rural park	level floodplain area (Scioto River)
Scioto Woods Park	**SCW**	1605 Bendalow Drive, Columbus, OH 43228	39.986500	-83.097758	suburban park	level (to very gently sloping?) upland area
Three Creeks Metro Park	**TC**	3860 Bixby Road, Groveport, OH 43125	39.880092	-82.908467	suburban to rural park	level floodplain area (Alum, Big Walnut and Blacklick Creeks)
Wexford Green Park	**WEX**	6052 Wexford Park Drive, Columbus, OH 43119	39.976767	-83.162892	suburban park	level upland 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, Classification and Parent Materials

Sampled Property	Preliminary Soil Boring[1] & Location			Soil Mapping Units, Classification and Parent Material			
	PSB	Latitude[2]	Longitude[2]	Mapping Unit	USCS	USDA	Parent Material
Battelle Darby Creek Metro Park	BDC-PSB	39.898044	-83.225097	Miamian silt loam (MkB)	Lean Clay with Sand	Clay Loam	till (high lime)
Blendon Woods Metro Park	BW-PSB	40.074058	-82.873897	Cardington silt loam (CaB)	Lean Clay with Sand	Silt Loam	till (medium lime)
Goodale Park	GDL-PSB	39.976436	-83.007119	Celina-Urban land complex (CfB)	Lean Clay with Sand	Clay Loam	till (high lime)
Griggs Reservoir Park	GRG-PSB	40.037281	-83.093942	Ritchey silt loam (RhD2)	Lean Clay	Silty Clay Loam	limestone and shale bedrock
Highbanks Metro Park	HB-PSB	40.136197	-83.025386	Bennington silt loam (BaB)	Lean Clay	Silty Clay Loam	till (medium lime)
Maybury Park	MAY-PSB	39.925272	-82.856383	Benington-Urban land complex (BfA)	Lean Clay with Sand	Loam	till (medium lime)
Schiller Park	SCH-PSB	39.942836	-82.994728	Eldean-Urban land complex (EmB)	Lean Clay	Silt Loam	alluvium
Scioto South ("Future") Metro Park	SS-PSB	39.842014	-83.010167	Genessee silt loam (Gn)	Lean Clay	Silty Clay Loam	alluvium
Scioto Woods Park	SCW-PSB	39.986500	-83.097758	Crosby silt loam (CrA, CrB)	Lean Clay with Sand	Clay Loam	till (high lime)
Three Creeks Metro Park	TC-PSB	39.880092	-82.908467	Medway silt loam (Mh)	Fat Clay	Silty Clay Loam	alluvium
Wexford Green Park	WEX-PSB	39.976767	-83.162892	Lewisburg-Crosby complex (LeB)	Fat Clay	Silty Clay Loam	till (high lime)

Note:

1 One preliminary soil boring (PSB) was installed at each samplilng location to evaluate soil conditions prior to collecting analytical samples; PSB logs (with field soil descriptions) are included in Appendix A

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

TABLE 2
Summary of Geotechnical Testing Results for Franklin County Background Soils

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)
BDC-1	Till	Lean Clay With Sand	7.31	21.24	38.96	32.49	44	22	22	Clay Loam	11.07	20.63	35.80	32.49
BW-1	Till	Lean Clay With Sand	0.80	16.41	61.15	21.64	32	19	13	Silt Loam	3.27	18.55	56.54	21.64
GDL-1	Till	Lean Clay With Sand	5.10	18.80	49.28	26.82	48	24	24	Clay Loam	9.63	18.44	45.11	26.82
GRG-1	Weathered Limestone and Shale Bedrock	Lean Clay	2.91	10.79	55.04	31.26	47	25	22	Silty Clay Loam	4.73	12.79	51.23	31.26
HB-1	Till	Lean Clay	0.20	14.39	55.73	29.68	43	22	21	Silty Clay Loam	1.38	16.57	52.36	29.68
MAY-1	Till	Lean Clay With Sand	0.98	26.41	49.81	22.80	37	21	16	Loam	2.65	28.89	45.66	22.80
SCH-1	Till	Lean Clay	0.03	12.68	65.12	22.17	36	21	15	Silt Loam	0.46	18.77	58.60	22.17
SS-1	Alluvium (Floodplain)	Lean Clay	0.02	9.65	58.87	31.46	45	22	23	Silty Clay Loam	0.02	15.54	52.98	31.46
SCW-1	Till	Lean Clay With Sand	3.60	26.28	43.38	26.74	40	19	21	Clay Loam	7.95	26.00	39.31	26.74
TC-1	Alluvium (Floodplain)	Fat Clay	0.03	1.91	64.90	33.16	54	26	28	Silty Clay Loam	0.08	6.52	60.24	33.16
WEX-1	Till	Fat Clay	1.32	8.29	54.98	35.41	54	22	32	Silty Clay Loam	1.80	11.57	51.22	35.41

Table 3
Background Statistics for Franklin County
Summary Results for Nine 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	11	1	0.0%	110	38	12.96	4.931	No defined distribution	{22.8}	19.8	**20.7**	mg/kg	1 outlier (38 mg/kg) removed
Barium	11	0	0.0%	110	163	103.7	31.43	Gamma	{167}	156.1	**163**	mg/kg	No outliers
Cadmium	11	0	0.0%	110	1	0.478	0.236	No defined distribution	{0.87}	0.756	**0.789**	mg/kg	KM method recommended due to multiple RLs
Chromium	11	0	1.8%	110	19.8	8.99	3.72	Normal	**16.4**	14.6	15.2	mg/kg	Two non-detects replaced with RLs
Lead	11	0	0.0%	110	51.1	22.48	8.5	Non-normal distribution	{39.5}	39.0	**41.5**	mg/kg	No outliers
Mercury	11	13(1)	0.0%	97	0.092	0.041	0.017	Lognormal	**0.081**	0.068	0.072	mg/kg	MAL calculated using log-transformed mean and SD
Nickel	11	0	0.0%	110	39.0	20.74	7.3	Non-normal distribution	{35.3}	35.9	**36.4**	mg/kg	No outliers
Selenium	11	0	0.0%	110	1.11	0.651	0.211	Normal	**1.07**	0.971	1.00	mg/kg	
Thallium	11	0	0.0%	110	0.956	0.429	0.164	No defined distribution	{0.757}	0.710	**0.743**	mg/kg	Nonparametric UTL and UPL

(1) All samples from the Scioto South (SS) site and three samples from the Schiller Park (SCH) site were identified as statistical outliers using Rosner's test and were removed from the background data set.

RL = reporting limit

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
BDC	Battelle Darby Creek Metro Park
BW	Blendon Woods Metro Park
GDL	Goodale Park
GRG	Griggs Reservoir Park
HB	Highbanks Metro Park
MAY	Maybury Park
SCH	Schiller Park
SS	Scioto South (“Future”) Metro Park
SCW	Scioto Woods Park
TC	Three Creeks Metro Park
WEX	Wexford Green Park

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

Sample	Location	BDC	BW	GDL	GRG	HB	MAY	SCH	SS	SCW	TC	WEX
	Units											
1	mg/kg	11.8	9.41	38	13.9	12.6	11.5	9.71	9.2	25.4	17.1	8.76
2	mg/kg	12.6	4.04	19.8	11.4	16.2	11.6	10.2	12	10.7	16.7	11.3
3	mg/kg	10.5	3.35	25.2	15.6	13.5	12.9	9.14	10.5	15.8	16.6	12.8
4	mg/kg	9.47	10.3	15	13.6	12.4	11.1	10.8	10.1	16.2	18.5	11.1
5	mg/kg	13.9	9.27	15.4	11.9	9.78	11.9	8.78	12.3	10.1	16.9	12.2
6	mg/kg	3.55	3.78	19.8	11.7	15.9	11.9	11.4	11.5	13.8	16.5	11.9
7	mg/kg	15	13.8	15.7	14.8	11.3	11.9	10.8	12	18.2	16.9	9.54
8	mg/kg	4.76	2.72	24.5	12.2	11.3	16.5	11.2	13.2	13.7	16.5	7.71
9	mg/kg	11	7.32	19.3	21.7	21.5	12.8	14.4	12.2	16.8	17	10.6
10	mg/kg	3.35	4.42	14	13.6	12.2	9.68	11.1	12.3	14.7	17	11.4

Notes:
mg/kg = milligrams per kilogram

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

Sample	Location	BDC	BW	GDL	GRG	HB	MAY	SCH	SS	SCW	TC	WEX
	Units											
1	mg/kg	59.7	59.4	83.8	115	76.8	148	98.7	150	74.4	158	119
2	mg/kg	54	67.9	102	124	74.6	109	90	154	84.8	141	118
3	mg/kg	48.9	81.7	117	110	94.7	129	94.5	139	89.3	148	102
4	mg/kg	58.9	58	80.2	119	62.3	105	81.8	141	82.7	154	118
5	mg/kg	53.2	71.2	104	120	80.4	156	81.7	156	107	146	120
6	mg/kg	57.1	72.5	103	142	72.9	127	90.4	128	83.1	151	139
7	mg/kg	64.5	71.6	88.1	128	71.5	117	79.5	125	79.5	163	117
8	mg/kg	55.6	67.8	76.2	125	86.5	111	95.8	146	98.3	145	101
9	mg/kg	55.6	90.6	76.5	131	73.3	105	84.8	156	72.5	142	132
10	mg/kg	52.7	60.5	103	136	154	112	97.8	142	102	140	135

Notes:
mg/kg = milligrams per kilogram

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

Sample	Location	BDC	BW	GDL	GRG	HB	MAY	SCH	SS	SCW	TC	WEX
	Units											
1	mg/kg	0.335	0.241	0.472	<0.238	<0.228	0.393	0.352	0.739	0.307	0.896	<0.24
2	mg/kg	0.308	0.447	0.444	<0.209	<0.226	0.319	0.306	0.877	<0.241	0.913	<0.233
3	mg/kg	0.299	0.347	0.56	<0.244	<0.224	0.404	0.345	0.715	0.232	0.953	<0.22
4	mg/kg	0.344	0.411	0.293	<0.232	<0.237	0.318	0.299	0.834	0.32	0.903	<0.228
5	mg/kg	0.277	0.371	0.353	<0.218	<0.218	0.365	0.331	1	<0.227	0.927	<0.224
6	mg/kg	0.341	0.431	0.398	<0.222	<0.232	0.379	0.364	0.616	<0.207	0.823	0.329
7	mg/kg	0.357	0.377	0.401	<0.229	<0.222	0.403	0.304	0.552	0.253	0.938	<0.218
8	mg/kg	0.309	0.284	0.436	0.286	<0.24	0.309	0.398	0.87	0.233	0.936	<0.215
9	mg/kg	0.34	0.294	0.476	<0.226	0.271	0.405	0.457	1	0.276	0.936	<0.227
10	mg/kg	0.295	0.257	0.411	<0.219	<0.226	0.324	0.446	0.853	<0.222	0.805	<0.224

Notes:
mg/kg – milligrams per kilogram

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

Sample	Location	BDC	BW	GDL	GRG	HB	MAY	SCH	SS	SCW	TC	WEX
	Units											
1	mg/kg	9.88	10.2	9.29	6.01	10.9	<0.413	5.41	17.2	7.22	9.81	9.07
2	mg/kg	12.5	13.2	8.47	7.26	11.8	4.18	6.01	16.7	8.25	7.46	10.9
3	mg/kg	9.08	12.9	5.42	8.92	9.35	3.19	5.16	16.4	7.29	6.91	7.97
4	mg/kg	10.1	13	6.01	8.51	12.7	4.13	6.25	16.5	8.85	12	7.11
5	mg/kg	10	13.4	6.87	8.6	9.14	0.764	4.39	18.1	9.04	7.71	10.5
6	mg/kg	7.98	13.6	5.86	5.11	11.9	2.42	5.93	13.6	9	9.1	9.55
7	mg/kg	12.5	13.1	7	7.84	11.6	1.55	5.21	12.6	10.9	11.6	9.52
8	mg/kg	11.4	8.48	5.82	5.31	11.6	5.2	5.83	17.4	9.8	7.42	7.4
9	mg/kg	9.97	13.7	5.91	2.97	10.1	4.11	7.56	19.8	9.9	6.52	8.52
10	mg/kg	8.62	12.4	5.63	8.18	<4.55	5.02	6.02	15.6	10.5	7.11	10.2

Notes:
mg/kg – milligrams per kilogram

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

Sample	Location	BDC	BW	GDL	GRG	HB	MAY	SCH	SS	SCW	TC	WEX
	Units											
1	mg/kg	16.5	16.8	34.1	23.6	17.5	19.9	34	33.1	16.3	18.1	17.5
2	mg/kg	15.3	19.1	30.3	18.6	16.7	16.1	29.3	39	18.3	18.7	19.8
3	mg/kg	12.7	19.4	23.6	17.6	23.1	17.4	35.4	31.7	15.4	18.4	18.2
4	mg/kg	14.1	20	24	19.1	14.7	14.8	45.3	38.2	16.3	19.6	17.2
5	mg/kg	14.3	19.4	24.4	17.4	19.6	15.1	36.4	44.1	17.6	18.9	21.7
6	mg/kg	15.3	18.4	24.1	18.6	34.2	16.8	36.4	26.6	16.2	18.3	20.4
7	mg/kg	18.3	19.4	25.9	22.1	21.1	18.4	32.5	28.6	14.5	19.2	14.1
8	mg/kg	15.3	17.7	20.8	20.4	19.2	15.7	40.2	39.4	18.5	20.2	19.2
9	mg/kg	15.4	17.9	33.5	26	15.4	18.2	45	43.1	15	18.3	20
10	mg/kg	15	16.9	30.7	19	24.1	16.3	51.1	37	13.8	17.2	17.6

Notes:
mg/kg – milligrams per kilogram

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

Sample	Location	BDC	BW	GDL	GRG	HB	MAY	SCH	SS	SCW	TC	WEX
	Units											
1	mg/kg	0.0324	0.0441	0.092	0.0278	0.0399	0.0306	0.0719	0.173	0.0208	0.0486	0.0421
2	mg/kg	0.0212	0.0398	0.064	0.0389	0.0291	0.0283	0.0662	0.195	0.0229	0.0391	0.0454
3	mg/kg	0.0303	0.0348	0.044	0.0498	0.0288	0.0412	0.0832	0.147	0.0327	0.0461	0.0371
4	mg/kg	0.029	0.0375	0.0707	0.0446	0.0268	0.0267	0.102	0.184	0.0389	0.0414	0.0257
5	mg/kg	0.0252	0.0367	0.067	0.0424	0.022	0.0308	0.0857	0.184	0.0223	0.0507	0.0479
6	mg/kg	0.0311	0.0358	0.0536	0.0341	0.0388	0.0315	0.0778	0.159	0.0297	0.0398	0.059
7	mg/kg	0.0355	0.0484	0.0699	0.0502	0.0213	0.0288	0.0672	0.27	0.03	0.0495	0.0502
8	mg/kg	0.0272	0.0239	0.0425	0.0491	0.0257	0.0251	0.0737	0.214	0.0381	0.0493	0.04
9	mg/kg	0.0277	0.0234	0.0763	0.0449	0.0185	0.0264	0.244	0.189	0.0401	0.0581	0.0235
10	mg/kg	0.0279	0.0312	0.0682	0.0431	0.0265	0.0276	0.114	0.134	0.0188	0.0308	0.0431

Notes:
mg/kg – milligrams per kilogram

Table 11
Summary of Nickel Data
Franklin County Background Soils Summary Report

Sample	Location	BDC	BW	GDL	GRG	HB	MAY	SCH	SS	SCW	TC	WEX
	Units											
1	mg/kg	27.4	17.4	24.7	15.1	12.9	19.6	13.8	28	19.6	37.9	16.8
2	mg/kg	27.3	25.6	21.4	17.1	12.2	14	14.4	26.6	12.5	35	16.6
3	mg/kg	24.4	23.4	14.6	17.6	14	18.4	13.6	27.5	18.4	37.4	15.3
4	mg/kg	27.2	25.4	16.2	17.5	13.5	13.3	14.7	26.6	25.8	38	15.8
5	mg/kg	26.1	20.8	19.5	16.1	12	16	11.5	26	13.4	36.2	23.7
6	mg/kg	26.7	27.3	16.5	13.8	10.9	15.1	14.9	25.5	18.1	35.9	22.9
7	mg/kg	30.9	25.1	17.2	16.5	12.7	15.1	13.2	25.2	23.5	39	17.3
8	mg/kg	28	15.6	14.3	15.2	13	14.7	15.1	27.1	23.3	36.3	12.5
9	mg/kg	31.8	19	15.9	16.6	11.8	17.1	16.5	27.2	22.5	36.6	21.3
10	mg/kg	27.8	19.7	17.4	16.6	12.2	14.2	14.3	27.6	24.8	34.9	21.2

Notes:
mg/kg – milligrams per kilogram

Table 12
Summary of Selenium Data
Franklin County Background Soils Summary Report

Sample	Location	BDC	BW	GDL	GRG	HB	MAY	SCH	SS	SCW	TC	WEX
	Units											
1	mg/kg	0.464	0.343	1.11	0.796	0.689	0.421	0.773	0.558	0.695	0.9	0.597
2	mg/kg	0.395	0.253	0.804	0.578	0.959	0.545	0.764	0.809	0.606	0.907	0.891
3	mg/kg	0.454	0.251	0.692	1.06	0.596	0.507	0.818	0.643	0.583	0.819	0.721
4	mg/kg	0.441	0.213	0.87	0.927	0.527	0.448	0.727	0.645	0.647	0.877	0.699
5	mg/kg	0.436	0.344	0.839	0.728	0.516	0.432	0.917	0.828	0.537	1.01	0.747
6	mg/kg	0.38	0.199	0.651	0.757	0.668	0.525	0.783	0.722	0.516	0.696	0.762
7	mg/kg	0.512	0.381	0.718	0.683	0.689	0.514	0.894	0.709	0.55	0.814	0.722
8	mg/kg	0.363	0.164	0.689	0.706	0.563	0.57	1.07	0.871	0.612	0.937	0.77
9	mg/kg	0.35	0.198	0.925	0.748	0.847	0.401	1.01	0.821	0.546	0.838	0.568
10	mg/kg	0.308	0.2	0.788	0.604	0.678	0.487	0.695	0.834	0.573	0.753	0.768

Notes:
mg/kg – milligrams per kilogram

Table 13
Summary of Thallium Data
Franklin County Background Soils Summary Report

Sample	Location	BDC	BW	GDL	GRG	HB	MAY	SCH	SS	SCW	TC	WEX
	Units											
1	mg/kg	0.608	0.337	0.699	0.324	0.284	0.6	0.386	0.333	0.479	0.71	0.27
2	mg/kg	0.625	0.224	0.462	0.253	0.267	0.543	0.299	0.473	0.314	0.806	0.272
3	mg/kg	0.534	0.162	0.386	0.365	0.301	0.65	0.309	0.372	0.379	0.743	0.388
4	mg/kg	0.571	0.48	0.357	0.32	0.258	0.369	0.356	0.346	0.428	0.743	0.279
5	mg/kg	0.66	0.314	0.432	0.255	0.339	0.752	0.298	0.636	0.243	0.836	0.275
6	mg/kg	0.284	0.281	0.403	0.264	0.321	0.566	0.355	0.453	0.386	0.71	0.449
7	mg/kg	0.673	0.596	0.426	0.268	0.36	0.672	0.318	0.45	0.497	0.701	0.288
8	mg/kg	0.375	0.131	0.376	0.304	0.285	0.576	0.345	0.501	0.315	0.695	0.33
9	mg/kg	0.598	0.264	0.465	0.349	0.37	0.551	0.419	0.443	0.492	0.667	0.279
10	mg/kg	0.293	0.201	0.392	0.314	0.252	0.47	0.376	0.45	0.494	0.956	0.387

Notes:
mg/kg – milligrams per kilogram

APPENDIX A

BORING LOGS (PRELIMINARY SOIL BORINGS)

Ohio Environmental Protection Agency	Battelle-Darby Creek Metro Park	DERR-SIFU Soil Boring Log
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	1775 Darby Creek Drive Galloway, OH 43119 Franklin County, CDO Project No./Type: NA/County Soil Background	**BDC-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 39.898044° / Long -83.225097°, 1,200 ft N Ice Skating Pond along Dyer Mill/Ski Trails

GROUND ELEVATION: 899.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 4/17/13	**COMPLETION DATE:** 4/17/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin, Wendy Vorwerk
DIAMETER (in): 2	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): NR

NOTES: PSB sampling performed on a cool (55-65 F), cloudy day with light rain. Soil samples were moist to very moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
04/17/13	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	**USCS Lean Clay (USDA Silty Clay):** very dark brown; medium plasticity; trace to few sand
	HA	0.5-1.0 0.5	0.5 - 1.0			2		CL	**USCS Lean Clay (USDA Silty Clay):** very dark grayish brown with dark yellowish brown mottling; medium to high plasticity; trace gravel, trace to few sand; carbonate mineralization along fractures
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			3		CL	**USCS Lean Clay with Sand (USDA Silty Clay),** dark yellowish brown; medium to high plasticity; few to little sand; carbonate mineralization not present
2	HA	2.0-2.5 0.5	2.0 - 2.5				2.5'		
	HA	2.5-3.0 0.5	2.5 - 3.0					CL	**USCS Sandy Lean Clay (USDA Clay Loam to Sandy Clay):** dark yellowish brown, medium to high plasticity; trace to few gravel, little to some sand; weathered glacial till (becoming dense and gravelly with cobbles)
3	HA	3.0-3.5 0.5	3.0 - 3.5			4	3.5'		
4									

Soil analytical and geotechnical testing samples BDC-1 through BDC-10 were collected on 5-23-13. BDC-1 was collected adjacent to the BDC-PSB location, and BDC-2 through BDC-10 were collected at random locations within a 15 ft radius of BDC-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample BDC-1 was submitted to Geotechnics of Pittsburgh, PA for seive and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample BDC-PSB-A 0.0-0.5 ft
2. FP-XRF screening sample BDC-PSB-B 0.5-2.0 ft
3. Homogenized soil from 0.0-2.0 ft deep (sampling location BCD-1) consists of **USCS Lean Clay with Sand / USDA Clay Loam** based on laboratory analysis
4. FP-XRF screening sample BDC-PSB-C 3.0-3.5 ft

SURVEY BENCHMARK & DATUM: Google Earth

Ohio Environmental Protection Agency	Blendon Woods Metro Park	DERR-SIFU Soil Boring Log
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	4265 East Dublin-Granville Road Westerville, OH 43081 Franklin County, CDO Project No./Type: NA/County Soil Background	**BW-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 40.074058° / Long -82.873897°, W side Ripple Rock Trail, 500 ft N of Park Rd/trail intersection

GROUND ELEVATION: 946.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 4/17/13	**COMPLETION DATE:** 4/17/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin, Wendy Vorwerk
DIAMETER (in): 2	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): 3.5

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
04/17/13	00:00		not encountered

NOTES: PSB sampling performed on a cool (55-65 F), cloudy day with light rain. Soil samples were moist to very 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	1	0.5'	ML-CL	**USCS Silt to Lean Clay (USDA Silty Clay Loam):** dark brown with dark yellowish brown mottling; low plasticity; slight dilatancy; trace to few sand
	HA	0.5-1.0 0.5	0.5 - 1.0			2		CL	**USCS Lean Clay (USDA Silty Clay Loam):** dark yellowish brown; low to medium plasticity; trace to few sand
1	HA	1.0-1.5 0.5	1.0 - 1.5				1.5'		medium plasticity; trace to few sand
	HA	1.5-2.0 0.5	1.5 - 2.0				2'	CL	**USCS Lean Clay (USDA Silty Clay):** dark yellowish brown; medium to high plasticity; trace gravel, trace to few sand
2	HA	2.0-2.5 0.5	2.0 - 2.5			3		CL	**USCS Lean Clay (USDA Silty Clay):** dark yellowish brown with gray mottling; medium to high plasticity; trace gravel, few to little sand
	HA	2.5-3.0 0.5	2.5 - 3.0				3'		
3	HA	3.0-3.5 0.5	3.0 - 3.5			4	3.5'	CL	**USCS Lean Clay with Sand (USDA Silty Clay):** dark yellowish brown with gray mottling; medium to high plasticity; trace gravel, little sand; weathered till
4									

Soil analytical and geotechnical testing samples BW-1 through BW-10 were collected on 5-23-13. BW-1 was collected adjacent to the BW-PSB location, and BW-2 through BW-10 were collected at random locations within a 15 ft radius of BW-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample BW-1 was submitted to Geotechnics of Pittsburgh, PA for seive and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample BW-PSB-A 0.0-0.5 ft
2. FP-XRF screening sample BW-PSB-B 0.5-2.0 ft
3. Homogenized soil from 0.0-2.0 ft deep (sampling location BW-1) consists of **USCS Lean Clay with Sand / USDA Silt Loam** based on laboratory analysis
4. FP-XRF screening sample BW-PSB-C 3.0-3.5 ft

SURVEY BENCHMARK & DATUM: Google Earth

Ohio Environmental Protection Agency	Goodale Park	DERR-SIFU Soil Boring Log
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	120 West Goodale Street Columbus, OH 43125 Franklin County, CDO Project No./Type: NA/County Soil Background	**GDL-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 39.976436° / Long -83.007119°, N area of park, 530 ft E of Dennison Ave & 280 ft S of Buttles Ave

GROUND ELEVATION: 756.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 6/4/13	**COMPLETION DATE:** 6/4/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin
DIAMETER (in): 1.5	**TOTAL DEPTH** (ft): 2.5	**REFUSAL** (ft): 1.5

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/04/13	00:00		not encountered

NOTES: Sampling performed on a clear day, T approx 75-80 F. 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			CL	**USCS Lean Clay (USDA Silt Loam)** : black to very dark brown; low to medium plasticity; trace sand trace to few sand
	HA	0.5-1.0 0.5	0.5 - 1.0				1'		
1	HA	1.0-1.5 0.5	1.0 - 1.5			1	1.5'	CL	**USCS Lean Clay (USDA Silty Clay Loam)** : dark brown; medium plasticity; few sand
	HA	1.5-2.0 0.5	1.5 - 2.0					CL	**USCS Lean Clay to Lean Clay with Sand (USDA Silty Clay)** : dark brown with dark yellowish brown mottling; medium to high plasticity; few to little sand, trace gravel and cobbles; massive structure, fractures with gypsum (or carbonate?) mineralization; till (very dense, overcompacted)
2	HA	2.0-2.5 0.5	2.0 - 2.5			2	2.5'		auger refusal on cobble or dense till

Soil analytical and geotechnical testing samples GDL-1 through GDL-10 were collected on 6-26-13. GDL-1 was collected adjacent to the GDL-PSB location, and GDL-2 through GDL-10 were collected at random locations within a 15 ft radius of GDL-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample GDL-1 was submitted to Geotechnics of Pittsburgh, PA for seive and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample GDL 0.0-2.0 ft
2. Homogenized soil from 0.0-2.0 ft deep (sampling location GDL-1) consists of **USCS Lean Clay with Sand / USDA Clay Loam** based on laboratory analysis

SURVEY BENCHMARK & DATUM: Google Earth

Ohio Environmental Protection Agency	Griggs Reservoir Park	DERR-SIFU
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	Riverside Dr & Stratford Dr (south) Columbus, OH 43221 Franklin County, CDO Project No./Type: NA/County Soil Background	**Soil Boring Log** **GRG-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 40.037281° / Long -83.093942°, in picnic area approx 180 ft S of parking lot turn around

GROUND ELEVATION: 797.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 6/5/13	**COMPLETION DATE:** 6/5/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin
DIAMETER (in): 1.5	**TOTAL DEPTH** (ft): 1.5	**REFUSAL** (ft): 1.5

NOTES: PSB sampling performed on a cool (55-65 F), cloudy day with light rain. Soil samples were moist to very moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/05/13	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
1	HA	0.0-0.5 0.5	0.0 - 0.5	Field Classification & FP-XRF Screening (selected samples, see remarks)	NA			CL-ML	**USCS Lean Clay to Silt (USDA Silt Loam) :** brown; low plasticity and toughness, slight dilatancy, very sticky; trace to few sand few to little sand, trace gravel (limestone and shale fragments)
	HA	0.5-1.0 0.5	0.5 - 1.0			1	1'		
	HA	1.0-1.5 0.5	1.0 - 1.5					CL	**USCS Lean Clay (USDA Silty Clay) :** dark yellowish brown; medium plasticity; little sand, trace to few gravel (limestone and shale fragments); refusal on limestone/shale bedrock
	HA	1.5-2.0 0.5	1.5 - 2.0			2	1.5'		
	HA	2.0-2.5 0.5	2.0 - 2.5						

Soil analytical and geotechnical testing samples GRG-1 through GRG-10 were collected on 6-27-13. GRG-1 was collected adjacent to the GRG-PSB location, and GRG-2 through GRG-10 were collected at random locations within a 15 ft radius of GRG-PSB. Each sample was collected from ground surface to a depth of 0.7 to 1.5 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample GRG-1 was submitted to Geotechnics of Pittsburgh, PA for seive and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample GRG 0.0-1.5 ft
2. Homogenized soil from 0.0-1.5 ft deep (sampling location GRG-1) consists of **USCS Lean Clay / USDA Silty Clay Loam** based on laboratory analysis

SURVEY BENCHMARK & DATUM: Google Earth

Ohio Environmental Protection Agency	Highbanks Metro Park	DERR-SIFU Soil Boring Log
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	9466 U.S. Route 23 North Lewis Center, OH 43035 Franklin County, CDO Project No./Type: NA/County Soil Background	**HB-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 40.136197° / Long -83.025386°, 660 ft S of wetland area (west end), 90 ft W of road/trail

GROUND ELEVATION: 922.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 6/6/13	**COMPLETION DATE:** 6/6/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin
DIAMETER (in): 1.5	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): NR

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/06/13	00:00		not encountered

NOTES: PSB sampling performed on a rainy, overcast day, T = 80-85 F. Soil samples were moist to very moist. Location and elevation from Google Earth.

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	**USCS Lean Clay (USDA Silty Clay Loam) :** very dark grayish brown; low to medium plasticity; trace to few sand
	HA	0.5-1.0 0.5	0.5 - 1.0			2		CL	**USCS Lean Clay (USDA Silty Clay Loam) :** dark yellowish brown with dark grayish brown mottling; medium plasticity; few sand
1	HA	1.0-1.5 0.5	1.0 - 1.5			3			dark yellowish brown with dark grayish brown and brownish yellow mottling; high plasticity; few to little sand
	HA	1.5-2.0 0.5	1.5 - 2.0			4			
2						5			
	HA	2.0-2.5 0.5	2.0 - 2.5			6			
	HA	2.5-3.0 0.5	2.5 - 3.0			7	3'		
3	HA	3.0-3.5 0.5	3.0 - 3.5			8		CL	**USCS Lean Clay with Sand (USDA Silty Clay to Silty Clay Loam) :** mottled yellowish brown and dark yellowish brown; medium to high plasticity; little sand, trace gravel and cobbles; massive structure; oxidized till
	HA	3.5-4.0 0.5	3.5 - 4.0			9	4'		
4									

Soil analytical and geotechnical testing samples HB-1 through HB-10 were collected on 6-25-13. HB-1 was collected adjacent to the HB-PSB location, and HB-2 through HB-10 were collected at random locations within a 15 ft radius of HB-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample HB-1 was submitted to Geotechnics of Pittsburgh, PA for seive and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample HB 0.0-0.5 ft
2. FP-XRF screening sample HB 0.5-1.0 ft
3. FP-XRF screening sample HB 1.0-1.5 ft
4. FP-XRF screening sample HB 1.5-2.0 ft
5. Homogenized soil from 0.0-2.0 ft deep (sampling location HB-1) consists of **USCS Lean Clay / USDA Silty Clay Loam** based on laboratory analysis
6. FP-XRF screening sample HB 2.0-2.5 ft
7. FP-XRF screening sample HB 2.5-3.0 ft
8. FP-XRF screening sample HB 3.0-3.5 ft
9. FP-XRF screening sample HB 3.5-4.0 ft

Ohio Environmental Protection Agency

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

Maybury Park
5026 Lindora Drive
Columbus, OH 43227
Franklin County, CDO

Project No./Type: NA/County Soil Background

DERR-SIFU
Soil Boring Log

MAY-PSB

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 39.925272° / Long -82.856383°, Central area of park (open field)

GROUND ELEVATION: 761.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 6/4/13	**COMPLETION DATE:** 6/4/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin

DIAMETER (in): 1.5	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): NR

NOTES: PSB sampling performed on a clear day with a slight SW-W wind, T approx. 75-80 F; soil samples were slightly most to moist.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/04/13	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	**USCS Lean Clay (USDA Silt Loam to Silty Clay Loam) :** dark yellowish brown; low to medium plasticity; few sand
	HA	0.5-1.0 0.5	0.5 - 1.0						**USCS Lean Clay (USDA Silty Clay Loam) :** dark yellowish brown; low to medium plasticity; few to little sand
1	HA	1.0-1.5 0.5	1.0 - 1.5			1		CL	
	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			**USCS Lean Clay (USDA Silty Clay) :** dark yellowish brown with gray mottling; medium plasticity; little sand; fractures with Fe-Mn mineralization
	HA	2.5-3.0 0.5	2.5 - 3.0						fewer gray mottles
3	HA	3.0-3.5 0.5	3.0 - 3.5					CL	mottled dark yellowish brown and yellowish brown; trace gravel; massive structure; weathered, oxidized till
	HA	3.5-4.0 0.5	3.5 - 4.0				4'		
4									

Soil analytical and geotechnical testing samples MAY-1 through MAY-10 were collected on 6-27-13. MAY-1 was collected adjacent to the MAY-PSB location, and MAY-2 through MAY-10 were collected at random locations within a 15 ft radius of MAY-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample MAY-1 was submitted to Geotechnics of Pittsburgh, PA for seive and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample MAY 0.0-2.0 ft
2. Homogenized soil from 0.0-2.0 ft deep (sampling location MAY-1) consists of **USCS Lean Clay with Sand / USDA Loam** based on laboratory analysis

SURVEY BENCHMARK & DATUM: Google Earth

Ohio Environmental Protection Agency	Schiller Park	DERR-SIFU
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	1069 Jaeger Street Columbus, OH 43206 Franklin County, CDO Project No./Type: NA/County Soil Background	Soil Boring Log **SCH-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 39.942836° / Long -82.994728°, 90 ft E of City Park Ave and 60 ft S of Reinhard Ave

GROUND ELEVATION: 758.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 6/4/13	**COMPLETION DATE:** 6/4/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin
DIAMETER (in): 1.5	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): NR

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/04/13	00:00		not encountered

NOTES: Sampling performed on a clear day, T approx 72-75 F. Soil samples were slightly moist to moist. Location and elevation data from Google Earth.

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		CL-ML	**USCS Lean Clay to Silt (USDA Silt Loam) :** very dark brown; low plasticity and toughness, slight dilatancy, very sticky; trace sand
	HA	0.5-1.0 0.5	0.5 - 1.0			2			
1	HA	1.0-1.5 0.5	1.0 - 1.5			3	1.5'		
	HA	1.5-2.0 0.5	1.5 - 2.0			4		CL	**USCS Lean Clay (USDA Silt Loam to Silty Clay Loam) :** dark yellowish brown; medium plasticity, low to medium toughness, no dilatancy; trace sand, increase in clay content and decrease in silt content with depth
2						5			
	HA	2.0-2.5 0.5	2.0 - 2.5			6			← trace to few sand
	HA	2.5-3.0 0.5	2.5 - 3.0			7	3'		
3	HA	3.0-3.5 0.5	3.0 - 3.5			8		CL	**USCS Lean Clay with Sand (USDA Silty Clay Loam) :** dark yellowish brown; medium plasticity and toughness; little sand, trace gravel; appears to be loess (windblown sediment)
	HA	3.5-4.0 0.5	3.5 - 4.0			9	4'		
4									

Soil analytical and geotechnical testing samples SCH-1 through SCH-10 were collected on 6-26-13. SCH-1 was collected adjacent to the SCH-PSB location, and SCH-2 through SCH-10 were collected at random locations within a 15 ft radius of SCH-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample SCH-1 was submitted to Geotechnics of Pittsburgh, PA for seive and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample SCH 0.0-0.5 ft
2. FP-XRF screening sample SCH 0.5-1.0 ft
3. FP-XRF screening sample SCH 1.0-1.5 ft
4. FP-XRF screening sample SCH 1.5-2.0 ft
5. Homogenized soil from 0.0-2.0 ft deep (sampling location SCH-1) consists of **USCS Lean Clay / USDA Silt Loam** based on laboratory analysis
6. FP-XRF screening sample SCH 2.0-2.5 ft
7. FP-XRF screening sample SCH 2.5-3.0 ft
8. FP-XRF screening sample SCH 3.0-3.5 ft
9. FP-XRF screening sample SCH 3.5-4.0 ft

Ohio Environmental Protection Agency	Scioto South (Future) Metro Park	DERR-SIFU
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	London-Groveport Rd (665) & Hibbs Rd Grove City, OH 43123 Franklin County, CDO Project No./Type: NA/County Soil Background	Soil Boring Log **SS-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 39.842014° / Long -83.010167°, 0.75 NE of 665/Hibbs Rd intersection, 140 ft W of river

GROUND ELEVATION: 684.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 4/17/13	**COMPLETION DATE:** 4/17/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin, Wendy Vorwerk
DIAMETER (in): 2	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): NR

NOTES: PSB sampled on a cloudy day with light rain, T 55-65 F. Soil samples were moist to very moist. Location and elevation data from Google Earth.

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
04/17/13	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	**USCS Lean Clay (USDA Silty Clay)** : very dark gray; medium plasticity; trace to few sand
	HA	0.5-1.0 0.5	0.5 - 1.0			2			very dark grayish brown
1	HA	1.0-1.5 0.5	1.0 - 1.5			3 4	1.5'	CL	
	HA	1.5-2.0 0.5	1.5 - 2.0			5	2'	CL	dark brown
2	HA	2.0-2.5 0.5	2.0 - 2.5			6 7	2.5'	CL	very dark grayish brown
	HA	2.5-3.0 0.5	2.5 - 3.0			8			dark brown
3	HA	3.0-3.5 0.5	3.0 - 3.5			9		CL	
	HA	3.5-4.0 0.5	3.5 - 4.0			10	4'		
4									

Soil analytical and geotechnical testing samples SS-1 through SS-10 were collected on 5-23-13. SS-1 was collected adjacent to the SS-PSB location, and SS-2 through SS-10 were collected at random locations within a 15 ft radius of SS-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample SS-1 was submitted to Geotechnics of Pittsburgh, PA for selve and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample SS-PSB-A 0.0-0.5 ft
2. FP-XRF screening sample SS 0.5-1.0 ft
3. FP-XRF screening sample SS-PSB-B 0.5-2.0 ft
4. FP-XRF screening sample SS 1.0-1.5 ft
5. FP-XRF screening sample SS 1.5-2.0 ft
6. Homogenized soil from 0.0-2.0 ft deep (sampling location SS-1) consists of **USCS Lean Clay / USDA Silty Clay Loam** based on lab analysis
7. FP-XRF screening sample SS 2.0-2.5 ft
8. FP-XRF screening sample SS 2.5-3.0 ft
9. FP-XRF screening sample SS-PSB-C 3.0-3.5 ft
10. FP-XRF screening sample SS 3.5-4.0 ft

Ohio Environmental Protection Agency	Scioto Woods Park	DERR-SIFU Soil Boring Log
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	1605 Bendalow Drive Columbus, OH 43228 Franklin County, CDO Project No./Type: NA/County Soil Background	**SCW-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 39.986500° / Long -83.097758°, South-central area of park in field (inside paved walking path)

GROUND ELEVATION: 839.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 6/5/13	**COMPLETION DATE:** 6/5/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin
DIAMETER (in): 1.5	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): 2.5

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/05/13	00:00		not encountered

NOTES: Sampling performed on a clear day, T approx 80 F, slight W wind. Soil samples were 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	**USCS Lean Clay (USDA Silt Loam to Silty Clay Loam) :** brown; low to medium plasticity; few to little sand
	HA	0.5-1.0 0.5	0.5 - 1.0				1'	CL	**USCS Lean Clay (USDA Silty Clay Loam) :** brown; medium plasticity; few to little sand (sand content increasing)
1	HA	1.0-1.5 0.5	1.0 - 1.5			1	1.5'	CL	**USCS Lean Clay with Sand (USDA Silty Clay) :** brown with dark yellowish brown mottling; medium plasticity; little sand, trace gravel; fractures with carbonate mineralization
	HA	1.5-2.0 0.5	1.5 - 2.0					CL	**USCS Sandy Lean Clay (USDA Clay Loam) :** yellowish brown; medium plasticity; little to some sand, trace to few gravel and cobbles; oxidized till (dense)
2	HA	2.0-2.5 0.5	2.0 - 2.5			2	2.5'		refusal at 2.5 ft on cobble or dense till
3									
4									

Soil analytical and geotechnical testing samples SCW-1 through SCW-10 were collected on 6-27-13. SCW-1 was collected adjacent to the SCW-PSB location, and SCW-2 through SCW-10 were collected at random locations within a 15 ft radius of SCW-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample SCW-1 was submitted to Geotechnics of Pittsburgh, PA for seive and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample SCW 0.0-2.0 ft
2. Homogenized soil from 0.0-2.0 ft deep (sampling location SCW-1) consists of **USCS Lean Clay with Sand / USDA Clay Loam** based on laboratory analysis

SURVEY BENCHMARK & DATUM: Google Earth

Ohio Environmental Protection Agency	Three Creeks Metro Park	DERR-SIFU Soil Boring Log
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	3860 Bixby Road Groveport, OH 43125 Franklin County, CDO Project No./Type: NA/County Soil Background	**TC-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 39.880092° / Long -82.908467°, 200 ft N of Confluence/ACG Trs inter, 75 ft E of Confluence Tr

GROUND ELEVATION: 723.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 4/17/13	**COMPLETION DATE:** 4/17/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin, Wendy Vorwerk
DIAMETER (in): 2	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): NR

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
04/17/13	00:00		not encountered

NOTES: PSB sampling performed on a cool (55-65 F), cloudy day with light rain. Soil samples were moist to very 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	1		CL	**USCS Lean Clay (USDA Silty Clay Loam)** : very dark grayish brown; low to medium plasticity; trace to few sand
	HA	0.5-1.0 0.5	0.5 - 1.0			2	1'		
1	HA	1.0-1.5 0.5	1.0 - 1.5					CL	**USCS Lean Clay (USDA Silty Clay Loam)** : dark brown; low to medium plasticity; trace to few sand
	HA	1.5-2.0 0.5	1.5 - 2.0						
2	HA	2.0-2.5 0.5	2.0 - 2.5			3	2.5'		
	HA	2.5-3.0 0.5	2.5 - 3.0				3'	CL	**USCS Lean Clay (USDA Silty Clay)** : dark brown; medium plasticity; trace to few sand
3	HA	3.0-3.5 0.5	3.0 - 3.5			4			**USCS Lean Clay (USDA Silty Clay)** : dark yellowish brown; medium to high plasticity; trace to few sand
4	HA	3.5-4.0 0.5	3.5 - 4.0				4'	CL	

Soil analytical and geotechnical testing samples TC-1 through TC-10 were collected on 5-13-13. TC-1 was collected adjacent to the TC-PSB location, and TC-2 through TC-10 were collected at random locations within a 15 ft radius of TC-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample TC-1 was submitted to Geotechnics of Pittsburgh, PA for seive and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample TC-PSB-A 0.0-0.5 ft
2. FP-XRF screening sample TC-PSB-B 0.5-2.0 ft
3. Homogenized soil from 0.0-2.0 ft deep (sampling location TC-1) consists of **USCS Fat Clay / USDA Silty Clay Loam** based on laboratory analysis
4. FP-XRF screening sample TC-PSB-C 3.0-3.5 ft

SURVEY BENCHMARK & DATUM: Google Earth

Ohio Environmental Protection Agency	Wexford Green Park	DERR-SIFU
4675 Homer-Ohio Lane Groveport, OH 43215 Telephone: (614) 836-8820, Fax: (614) 836-8795	6052 Wexford Park Drive Columbus, OH 43119 Franklin County, CDO Project No./Type: NA/County Soil Background	Soil Boring Log **WEX-PSB** Page 1 of 1

LAT/LONG and/or **LOCATION DESCRIPTION:** Lat 39.976767° / Long -83.162892°, in woods approx 135 ft NE of entrance to park playground

GROUND ELEVATION: 935.0 ft	**TOC ELEVATION:** NA	**DRILLING SERVICES:** Ohio EPA SIFU
START DATE: 6/5/13	**COMPLETION DATE:** 6/5/13	**DRILLER:** Jeff Martin
DRILLING & SAMPLING METHODS: Hand Auger		**LOGGED BY:** Jeff Martin
DIAMETER (in): 1.5	**TOTAL DEPTH** (ft): 4	**REFUSAL** (ft): 2.2

GROUND WATER LEVELS

Date	Time	Depth (ft)	Notes
06/05/13	00:00		not encountered

NOTES: PSB sampling performed on a clear day, T approx 80 F, slight SW wind. Soil samples were 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	**USCS Lean Clay (USDA Silty Clay Loam)** : black; low plasticity; trace to few sand
	HA	0.5-1.0 0.5	0.5 - 1.0				1'	CL	**USCS Lean Clay (USDA Silty Clay Loam to Silty Clay)** : very dark grayish brown; medium plasticity; trace to few sand
1	HA	1.0-1.5 0.5	1.0 - 1.5			1	1.5'	CL	**USCS Lean Clay (USDA Silty Clay)** : very dark grayish brown with dark yellowish brown mottling; medium to high plasticity; trace to few sand
	HA	1.5-2.0 0.5	1.5 - 2.0				1.8'	CL	mottled very pale brown, yellowish brown and dark yellowish brown; carbonate mineralization along fracture planes
2	HA	2.0-2.2 0.2	2.0 - 2.2			2	2'	CL	pale brown
							2.2'	CL	**USCS Lean Clay (USDA Silty Clay Loam to Clay Loam)** : dark yellowish brown with dark brown mottling; medium plasticity; few to little sand; massive structure, fractures with carbonate mineralization; dense, oxidized till refusal on dense till or cobble at 2.2 ft
3									
4									

Soil analytical and geotechnical testing samples WEX-1 through WEX-10 were collected on 6-27-13. WEX-1 was collected adjacent to the WEX-PSB location, and WEX-2 through WEX-10 were collected at random locations within a 15 ft radius of WEX-PSB. Each sample was collected from ground surface to a depth of 2 ft using a 1.5 to 2-inch inside diameter hand auger. Each sample was homogenized in the field and submitted to Microbac Laboratories of Marietta, OH for RCRA metals analysis (As, Ba, Cd, Cr, Pb, Hg, Se) with Ni substituted for Ag and Tl added. In addition, sample WEX-1 was submitted to Geotechnics of Pittsburgh, PA for selve and hydrometer analyses, Atterberg limits, and USDA and USCS laboratory soil classfication.

REMARKS:

1. FP-XRF screening sample WEX 0.0-2.0 ft
2. Homogenized soil from 0.0-2.0 ft deep (sampling location WEX-1) consists of **USCS Fat Clay / USDA Silty Clay Loam** based on laboratory analysis

SURVEY BENCHMARK & DATUM: Google Earth

APPENDIX B

FP-XRF SOIL ANALYTICAL SCREENING RESULTS

FP-XRF Screening Results for Metals, Evaluation of Background Metal Soil Concentrations in Franklin County

Innov-X Tube-Based Alpha Series™ Handheld XRF Analyzer: analytical results in parts-per-million (ppm), LOD = Level of Detection (ppm)

Sample Location	Sample Identification	Sample Depth (ft)	Sampling Date	Screening (Analysis) Date	Reading Number	Titanium (LOD 10-100)	Chromium (LOD 10-100)	Manganese (LOD 10-100)	Iron (LOD 10-100)	Cobalt (LOD 10-100)	Nickel (LOD 10-100)	Copper (LOD 10-100)
QA/QC	Pass Internal Standardization	N/A	N/A	04/26/13	1	Pass	Pass	Pass	Pass	Pass	Pass	Pass
QA/QC	Pass Internal Standardization	N/A	N/A	06/19/13	1	Pass	Pass	Pass	Pass	Pass	Pass	Pass
QA/QC	SiO_2 Blank	N/A	N/A	04/26/13	1	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
QA/QC	SiO_2 Blank	N/A	N/A	06/19/13	1	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Big Darby Creek Metro Park	BDC-PSB-A	0.0-0.5	4/17/13	04/26/13	1	4,133.23	<LOD	662.43	36,403.66	218.57	<LOD	80.23
					2	3,656.72	<LOD	596.77	35,796.18	<LOD	55.87	94.85
	BDC-PSB-B	0.5-2.0	4/17/13	04/26/13	1	3,181.61	<LOD	421.94	30,056.40	<LOD	<LOD	34.28
					2	3,480.99	<LOD	446.48	31,556.87	<LOD	<LOD	28.29
	BDC-PSB-C	3.0-3.5	4/17/13	04/26/13	1	4,170.54	<LOD	587.41	31,706.54	<LOD	<LOD	51.57
					2	3,812.43	<LOD	600.45	30,846.94	<LOD	51.01	<LOD
Blendon Woods Metro Park	BW-PSB-A	0.0-0.5	4/17/13	04/26/13	1	4,857.53	<LOD	350.59	19,186.87	181.53	<LOD	<LOD
					2	5,199.12	<LOD	387.37	18,116.18	160.95	<LOD	<LOD
					3	4,851.97	<LOD	353.67	18,372.97	139.41	<LOD	<LOD
	BW-PSB-B	0.5-2.0	4/17/13	04/26/13	1	4,451.43	<LOD	203.43	27,764.25	190.11	<LOD	38.42
					2	5,052.18	<LOD	205.60	27,588.35	<LOD	<LOD	<LOD
	BW-PSB-C	3.0-3.5	4/17/13	04/26/13	1	4,453.22	<LOD	494.56	35,401.01	<LOD	57.50	30.48
					2	4,389.26	<LOD	482.17	35,824.16	200.51	64.11	29.80
					3	4,343.27	<LOD	466.91	35,584.29	207.58	<LOD	36.27
Goodale Park	GDL 0.0-2.0	0.0-2.0	6/4/13	06/19/13	1	4,342.80	<LOD	841.97	33,896.43	276.82	<LOD	32.15
					2	4,121.91	<LOD	826.49	32,723.29	<LOD	<LOD	44.15
Griggs Reservoir Park	GRG 0.0-1.5	0.0-1.5	6/5/13	06/19/13	1	4,110.50	<LOD	715.31	31,898.38	<LOD	<LOD	33.00
					2	3,969.54	<LOD	896.05	31,991.00	<LOD	<LOD	<LOD

FP-XRF Screening Results for Metals, Evaluation of Background Metal Soil Concentrations in Franklin County

Innov-X Tube-Based Alpha Series™ Handheld XRF Analyzer: analytical results in parts-per-million (ppm), LOD = Level of Detection (ppm)

Sample Location	Sample Identification	Sample Depth (ft)	Sampling Date	Screening (Analysis) Date	Reading Number	Titanium (LOD 10-100)	Chromium (LOD 10-100)	Manganese (LOD 10-100)	Iron (LOD 10-100)	Cobalt (LOD 10-100)	Nickel (LOD 10-100)	Copper (LOD 10-100)
Highbanks Metro Park	HB 0.0-0.5	0.0-0.5	6/6/13	06/19/13	1	3,903.31	<LOD	841.38	18,958.24	168.01	<LOD	<LOD
					2	4,845.03	<LOD	1,068.13	21,542.50	<LOD	<LOD	<LOD
	HB 0.5-1.0	0.5-1.0	6/6/13	06/19/13	1	4,815.71	233.17	888.13	25,716.78	217.38	<LOD	<LOD
					2	4,672.41	<LOD	764.33	24,056.08	171.60	<LOD	<LOD
	HB 1.0-1.5	1.0-1.5	6/6/13	06/19/13	1	2,995.67	<LOD	358.19	41,296.15	<LOD	<LOD	<LOD
					2	5,459.80	<LOD	248.77	43,008.44	220.24	<LOD	40.01
	HB 1.5-2.0	1.5-2.0	6/6/13	06/19/13	1	4,027.93	<LOD	248.92	48,358.59	<LOD	71.66	34.83
					2	4,593.08	<LOD	275.67	48,768.39	<LOD	<LOD	37.87
	HB 2.0-2.5	2.0-2.5	6/6/13	06/19/13	1	4,665.30	217.16	468.36	50,715.18	263.06	<LOD	36.26
					2	5,482.14	<LOD	445.49	51,282.75	343.43	<LOD	43.85
	HB 2.5-3.0	2.5-3.0	6/6/13	06/19/13	1	4,276.76	<LOD	313.95	61,760.64	<LOD	<LOD	35.89
					2	4,792.52	<LOD	289.14	59,116.36	<LOD	<LOD	39.36
	HB 3.0-3.5	3.0-3.5	6/6/13	06/19/13	1	4,176.11	<LOD	689.53	51,366.74	<LOD	<LOD	30.94
					2	4,247.27	<LOD	579.24	51,690.59	<LOD	<LOD	<LOD
	HB 3.5-4.0	3.5-4.0	6/6/13	06/19/13	1	3,411.91	<LOD	479.98	54,251.53	<LOD	<LOD	54.97
					2	3,629.55	<LOD	515.30	55,017.18	<LOD	<LOD	44.47
Maybury Park	MAY 0.0-2.0	0.0-2.0	6/4/13	06/19/13	1	3,982.30	<LOD	910.46	21,480.50	180.94	<LOD	<LOD
					2	4,134.58	<LOD	866.72	21,698.35	<LOD	56.28	<LOD
Schiller Park	SCH 0.0-0.5	0.0-0.5	6/4/13	06/19/13	1	3,705.45	<LOD	764.01	24,450.21	<LOD	<LOD	43.39
					2	4,091.91	169.16	799.90	25,024.04	<LOD	<LOD	35.94
	SCH 0.5-1.0	0.5-1.0	6/4/13	06/19/13	1	4,315.08	<LOD	797.19	21,885.80	<LOD	<LOD	49.60
					2	4,099.12	<LOD	856.00	21,962.92	<LOD	<LOD	38.57
	SCH 1.0-1.5	1.0-1.5	6/4/13	06/19/13	1	4,217.21	<LOD	635.03	18,544.15	<LOD	<LOD	<LOD
					2	4,393.22	<LOD	572.57	18,488.86	162.30	<LOD	30.17
	SCH 1.5-2.0	1.5-2.0	6/4/13	06/19/13	1	4,258.94	<LOD	518.68	22,932.15	<LOD	<LOD	<LOD
					2	3,544.84	<LOD	512.16	22,733.42	165.11	<LOD	<LOD
	SCH 2.0-2.5	2.0-2.5	6/4/13	06/19/13	1	3,870.16	<LOD	449.22	29,194.19	<LOD	<LOD	35.83
					2	3,645.34	<LOD	486.43	29,069.91	196.36	<LOD	<LOD
	SCH 2.5-3.0	2.5-3.0	6/4/13	06/19/13	1	3,027.00	<LOD	500.36	37,347.04	<LOD	<LOD	29.74
					2	3,857.60	<LOD	575.31	36,945.58	<LOD	56.69	<LOD
	SCH 3.0-3.5	3.0-3.5	6/4/13	06/19/13	1	4,246.73	<LOD	612.50	63,301.61	<LOD	<LOD	37.28
					2	4,780.31	<LOD	550.79	64,566.97	<LOD	<LOD	33.05
	SCH 3.5-4.0	3.5-4.0	6/4/13	06/19/13	1	4,541.97	223.28	597.80	54,287.12	<LOD	<LOD	31.90
					2	4,711.99	<LOD	489.45	54,559.14	264.70	<LOD	61.92

FP-XRF Screening Results for Metals, Evaluation of Background Metal Soil Concentrations in Franklin County

Innov-X Tube-Based Alpha Series™ Handheld XRF Analyzer: analytical results in parts-per-million (ppm), LOD = Level of Detection (ppm)

Sample Location	Sample Identification	Sample Depth (ft)	Sampling Date	Screening (Analysis) Date	Reading Number	Titanium (LOD 10-100)	Chromium (LOD 10-100)	Manganese (LOD 10-100)	Iron (LOD 10-100)	Cobalt (LOD 10-100)	Nickel (LOD 10-100)	Copper (LOD 10-100)
Scioto South Metro Park	SS-PSB-A	0.0-0.5	4/17/13	04/26/13	1	3,595.12	<LOD	559.52	30,406.32	<LOD	<LOD	40.06
					2	3,060.46	<LOD	455.60	28,860.42	198.82	<LOD	51.15
	SS 0.5-1.0	0.5-1.0	4/17/13	06/19/13	1	3,577.99	<LOD	484.35	28,618.82	180.43	<LOD	39.53
					2	3,506.64	<LOD	521.62	28,865.84	<LOD	<LOD	39.78
	SS-PSB-B	0.5-2.0	4/17/13	04/26/13	1	4,295.98	<LOD	511.77	30,652.32	<LOD	<LOD	44.97
					2	3,202.98	<LOD	546.77	31,247.09	<LOD	<LOD	35.96
	SS 1.0-1.5	1.0-1.5	4/17/13	06/19/13	1	4,557.34	<LOD	587.60	31,094.75	<LOD	<LOD	27.80
					2	4,391.10	<LOD	556.90	30,312.12	<LOD	<LOD	33.38
	SS 1.5-2.0	1.5-2.0	4/17/13	06/19/13	1	3,138.65	<LOD	666.25	33,939.77	202.55	<LOD	31.95
					2	3,422.99	<LOD	666.36	34,040.11	<LOD	<LOD	34.04
	SS 2.0-2.5	2.0-2.5	4/17/13	06/19/13	1	3,947.12	<LOD	575.25	30,438.90	<LOD	<LOD	36.36
					2	4,325.34	<LOD	616.26	30,864.89	<LOD	<LOD	<LOD
	SS 2.5-3.0	2.5-3.0	4/17/13	06/19/13	1	4,026.50	<LOD	491.19	29,416.99	<LOD	<LOD	<LOD
					2	2,934.92	<LOD	539.99	28,785.28	<LOD	<LOD	<LOD
	SS-PSB-C	3.0-3.5	4/17/13	04/26/13	1	2,638.96	<LOD	347.71	24,454.68	203.08	<LOD	49.74
					2	3,175.59	<LOD	292.19	25,688.24	<LOD	<LOD	41.80
	SS 3.5-4.0	3.5-4.0	4/17/13	06/19/13	1	4,165.98	<LOD	682.02	35,344.75	305.37	<LOD	32.55
					2	4,110.01	<LOD	533.06	31,662.85	<LOD	<LOD	42.95
Scioto Woods Park	SCW 0.0-2.0	0.0-2.0		06/19/13	1	3,233.14	<LOD	356.79	26,900.72	<LOD	<LOD	<LOD
					2	3,148.36	<LOD	382.67	27,722.82	<LOD	<LOD	40.63
Three Creeks Metro Park	TC-PSB-A	0.0-0.5	4/17/13	04/26/13	1	4,039.98	<LOD	457.71	33,236.07	208.85	<LOD	39.65
					2	4,117.46	<LOD	436.61	33,129.35	<LOD	<LOD	41.99
	TC-PSB-B	0.5-2.0	4/17/13	04/26/13	1	3,966.89	<LOD	476.81	34,994.47	<LOD	72.28	28.00
					2	4,142.35	<LOD	536.05	34,749.63	<LOD	<LOD	<LOD
	TC-PSB-C	3.0-3.5	4/17/13	04/26/13	1	4,433.67	<LOD	444.78	45,928.88	<LOD	<LOD	32.51
					2	4,201.76	<LOD	311.06	46,165.36	<LOD	<LOD	51.75
Wexford Green Park	WEX 0.0-2.0	0.0-2.0		06/19/13	1	3,264.90	<LOD	404.08	24,753.64	<LOD	<LOD	<LOD
					2	3,639.76	<LOD	333.04	26,029.57	<LOD	<LOD	<LOD
QA/QC	SiO_2 Blank	N/A	N/A	04/26/13	2	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
QA/QC	SiO2 Blank	N/A	N/A	06/16/13	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	Pass Internal Standardization	N/A	N/A	06/19/13	2	Pass	Pass	Pass	Pass	Pass	Pass	Pass

FP-XRF Screening Results for Metals, Evaluation of Background Metal Soil Concentrations in Franklin County

Innov-X Tube-Based Alpha Series™ Handheld XRF Analyzer: analytical results in parts-per-million (ppm), LOD = Level of Detection (ppm)

Sample Location	Sample Identification	Sample Depth (ft)	Sampling Date	Screening (Analysis) Date	Reading Number	Zinc (LOD 10-100)	Arsenic (LOD 10-100)	Selenium (LOD 10-100)	Rubidium (LOD 10-100)	Strontium (LOD 10-100)	Zirconium (LOD 10-100)	Molybdenum (LOD 10-100)
QA/QC	Pass Internal Standardization	N/A	N/A	04/26/13	1	Pass	Pass	Pass	Pass	Pass	Pass	Pass
QA/QC	Pass Internal Standardization	N/A	N/A	06/19/13	1	Pass	Pass	Pass	Pass	Pass	Pass	Pass
QA/QC	SiO_2 Blank	N/A	N/A	04/26/13	1	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
QA/QC	SiO_2 Blank	N/A	N/A	06/19/13	1	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Big Darby Creek Metro Park	BDC-PSB-A	0.0-0.5	4/17/13	04/26/13	1	113.09	19.62	<LOD	104.08	120.53	237.24	15.78
					2	115.48	19.46	<LOD	103.16	120.93	215.58	13.89
	BDC-PSB-B	0.5-2.0	4/17/13	04/26/13	1	86.48	15.77	<LOD	91.82	108.39	142.50	<LOD
					2	92.61	18.89	<LOD	105.81	108.01	164.71	<LOD
	BDC-PSB-C	3.0-3.5	4/17/13	04/26/13	1	110.80	11.50	<LOD	95.72	163.80	244.63	<LOD
					2	108.19	10.67	<LOD	95.84	162.78	247.94	<LOD
Blendon Woods Metro Park	BW-PSB-A	0.0-0.5	4/17/13	04/26/13	1	83.59	15.92	<LOD	74.49	85.22	313.52	15.73
					2	86.25	13.47	<LOD	76.38	88.92	293.82	11.84
					3	88.61	13.54	<LOD	76.26	84.71	298.75	11.33
	BW-PSB-B	0.5-2.0	4/17/13	04/26/13	1	101.72	19.33	<LOD	94.52	86.96	266.34	19.22
					2	95.50	18.68	<LOD	97.28	86.92	269.00	16.43
	BW-PSB-C	3.0-3.5	4/17/13	04/26/13	1	131.51	24.59	<LOD	109.98	108.71	240.29	13.97
					2	126.36	21.30	<LOD	110.24	112.82	237.85	14.29
					3	121.77	22.04	<LOD	107.45	109.81	253.11	14.40
Goodale Park	GDL 0.0-2.0	0.0-2.0	6/4/13	06/19/13	1	104.03	31.44	<LOD	87.15	104.43	269.39	12.86
					2	98.90	20.43	<LOD	86.89	103.01	273.64	<LOD
Griggs Reservoir Park	GRG 0.0-1.5	0.0-1.5	6/5/13	06/19/13	1	85.62	19.19	<LOD	75.44	72.66	242.84	<LOD
					2	92.20	19.97	<LOD	74.53	79.50	253.74	<LOD

FP-XRF Screening Results for Metals, Evaluation of Background Metal Soil Concentrations in Franklin County

Innov-X Tube-Based Alpha Series™ Handheld XRF Analyzer: analytical results in parts-per-million (ppm), LOD = Level of Detection (ppm)

Sample Location	Sample Identification	Sample Depth (ft)	Sampling Date	Screening (Analysis) Date	Reading Number	Zinc (LOD 10-100)	Arsenic (LOD 10-100)	Selenium (LOD 10-100)	Rubidium (LOD 10-100)	Strontium (LOD 10-100)	Zirconium (LOD 10-100)	Molybdenum (LOD 10-100)
Highbanks Metro Park	HB 0.0-0.5	0.0-0.5	6/6/13	06/19/13	1	77.34	14.29	<LOD	92.89	101.06	303.28	9.82
					2	61.27	19.81	<LOD	88.48	96.84	286.08	<LOD
	HB 0.5-1.0	0.5-1.0	6/6/13	06/19/13	1	71.55	12.34	<LOD	97.87	106.04	314.85	<LOD
					2	64.47	14.30	<LOD	93.25	108.67	273.35	<LOD
	HB 1.0-1.5	1.0-1.5	6/6/13	06/19/13	1	75.57	20.38	<LOD	101.00	101.90	255.72	<LOD
					2	85.97	19.11	<LOD	103.95	108.16	243.72	15.96
	HB 1.5-2.0	1.5-2.0	6/6/13	06/19/13	1	79.11	22.21	<LOD	103.25	109.45	276.76	21.42
					2	82.64	25.65	<LOD	108.19	109.70	249.57	20.33
	HB 2.0-2.5	2.0-2.5	6/6/13	06/19/13	1	97.50	28.36	<LOD	101.88	111.05	234.58	20.69
					2	98.48	25.57	<LOD	102.84	116.27	250.73	22.45
	HB 2.5-3.0	2.5-3.0	6/6/13	06/19/13	1	130.99	33.49	<LOD	104.78	112.80	228.07	21.93
					2	129.15	23.67	<LOD	107.34	117.27	209.98	31.38
	HB 3.0-3.5	3.0-3.5	6/6/13	06/19/13	1	162.15	26.10	<LOD	106.94	115.16	183.57	28.37
					2	180.20	26.91	<LOD	106.37	108.93	219.54	25.17
	HB 3.5-4.0	3.5-4.0	6/6/13	06/19/13	1	221.49	31.25	<LOD	108.52	116.41	185.67	28.87
					2	234.96	31.62	<LOD	107.70	110.94	211.28	28.92
Maybury Park	MAY 0.0-2.0	0.0-2.0	6/4/13	06/19/13	1	88.55	16.94	<LOD	78.83	86.08	281.74	9.83
					2	80.29	15.22	<LOD	86.55	86.17	282.23	15.72
Schiller Park	SCH 0.0-0.5	0.0-0.5	6/4/13	06/19/13	1	137.21	19.08	4.89	75.04	111.88	281.65	<LOD
					2	159.47	11.79	<LOD	74.31	113.35	283.11	<LOD
	SCH 0.5-1.0	0.5-1.0	6/4/13	06/19/13	1	115.18	16.03	<LOD	76.33	115.70	309.11	<LOD
					2	121.22	15.40	<LOD	73.64	113.91	304.27	<LOD
	SCH 1.0-1.5	1.0-1.5	6/4/13	06/19/13	1	76.02	10.11	<LOD	71.79	108.68	332.25	<LOD
					2	72.84	9.02	<LOD	73.33	116.41	328.99	9.41
	SCH 1.5-2.0	1.5-2.0	6/4/13	06/19/13	1	69.95	10.77	<LOD	73.74	110.01	319.77	<LOD
					2	64.86	14.95	<LOD	81.28	109.36	327.92	<LOD
	SCH 2.0-2.5	2.0-2.5	6/4/13	06/19/13	1	80.93	13.41	<LOD	79.06	104.02	349.73	<LOD
					2	71.60	14.73	<LOD	82.28	101.06	341.13	13.15
	SCH 2.5-3.0	2.5-3.0	6/4/13	06/19/13	1	93.87	21.82	<LOD	81.53	92.09	282.53	12.08
					2	91.18	15.47	<LOD	84.66	99.81	309.92	10.97
	SCH 3.0-3.5	3.0-3.5	6/4/13	06/19/13	1	172.08	36.19	<LOD	110.61	95.52	245.33	24.25
					2	186.93	29.10	<LOD	102.53	89.46	215.13	15.09
	SCH 3.5-4.0	3.5-4.0	6/4/13	06/19/13	1	159.30	24.51	<LOD	106.02	84.50	234.88	23.65
					2	155.35	29.45	<LOD	104.45	86.08	199.04	20.43

FP-XRF Screening Results for Metals, Evaluation of Background Metal Soil Concentrations in Franklin County

Innov-X Tube-Based Alpha Series™ Handheld XRF Analyzer: analytical results in parts-per-million (ppm), LOD = Level of Detection (ppm)

Sample Location	Sample Identification	Sample Depth (ft)	Sampling Date	Screening (Analysis) Date	Reading Number	Zinc (LOD 10-100)	Arsenic (LOD 10-100)	Selenium (LOD 10-100)	Rubidium (LOD 10-100)	Strontium (LOD 10-100)	Zirconium (LOD 10-100)	Molybdenum (LOD 10-100)
Scioto South Metro Park	SS-PSB-A	0.0-0.5	4/17/13	04/26/13	1	188.92	19.52	<LOD	97.59	214.49	248.34	10.94
					2	168.60	14.57	<LOD	82.82	219.91	208.45	12.81
	SS 0.5-1.0	0.5-1.0	4/17/13	06/19/13	1	164.82	19.19	<LOD	89.62	222.82	223.66	<LOD
					2	170.60	17.47	<LOD	89.23	226.99	215.31	<LOD
	SS-PSB-B	0.5-2.0	4/17/13	04/26/13	1	133.68	13.43	<LOD	90.21	192.25	225.31	<LOD
					2	146.99	16.60	<LOD	93.90	194.81	233.04	<LOD
	SS 1.0-1.5	1.0-1.5	4/17/13	06/19/13	1	135.62	17.44	<LOD	93.15	180.32	244.11	<LOD
					2	126.81	11.75	<LOD	92.71	182.47	259.65	<LOD
	SS 1.5-2.0	1.5-2.0	4/17/13	06/19/13	1	103.03	14.89	<LOD	99.21	180.74	229.90	<LOD
					2	111.13	16.70	<LOD	90.07	174.09	251.05	<LOD
	SS 2.0-2.5	2.0-2.5	4/17/13	06/19/13	1	115.10	14.04	<LOD	96.06	167.08	236.82	<LOD
					2	107.86	11.54	<LOD	91.36	169.74	252.71	<LOD
	SS 2.5-3.0	2.5-3.0	4/17/13	06/19/13	1	103.33	14.07	<LOD	90.18	163.94	248.04	9.64
					2	97.16	16.72	<LOD	88.07	157.30	250.60	9.06
	SS-PSB-C	3.0-3.5	4/17/13	04/26/13	1	81.54	15.25	<LOD	77.47	128.11	134.06	<LOD
					2	74.87	15.78	<LOD	80.20	123.04	123.61	<LOD
	SS 3.5-4.0	3.5-4.0	4/17/13	06/19/13	1	107.71	21.29	<LOD	108.29	163.51	223.27	<LOD
					2	94.26	14.76	<LOD	94.25	169.87	201.26	<LOD
Scioto Woods Park	SCW 0.0-2.0	0.0-2.0		06/19/13	1	73.32	17.45	<LOD	76.51	121.46	202.85	<LOD
					2	93.94	16.56	<LOD	72.13	118.10	240.66	<LOD
Three Creeks Metro Park	TC-PSB-A	0.0-0.5	4/17/13	04/26/13	1	155.35	22.38	<LOD	109.48	103.67	230.25	10.87
					2	141.36	18.33	<LOD	107.86	99.52	235.67	<LOD
	TC-PSB-B	0.5-2.0	4/17/13	04/26/13	1	122.68	21.67	<LOD	117.92	97.93	213.88	12.74
					2	119.17	22.24	<LOD	119.81	99.32	226.96	17.56
	TC-PSB-C	3.0-3.5	4/17/13	04/26/13	1	169.88	23.90	<LOD	130.28	79.88	172.04	24.79
					2	169.03	26.59	<LOD	130.54	86.77	184.41	28.92
Wexford Green Park	WEX 0.0-2.0	0.0-2.0		06/19/13	1	86.31	14.93	<LOD	80.97	136.62	242.83	<LOD
					2	88.53	10.58	<LOD	88.88	139.35	230.16	<LOD
QA/QC	SiO_2 Blank	N/A	N/A	04/26/13	2	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
QA/QC	SiO2 Blank	N/A	N/A	06/16/13	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	Pass Internal Standardization	N/A	N/A	06/19/13	2	Pass	Pass	Pass	Pass	Pass	Pass	Pass

FP-XRF Screening Results for Metals, Evaluation of Background Metal Soil Concentrations in Franklin County

Innov-X Tube-Based Alpha Series™ Handheld XRF Analyzer: analytical results in parts-per-million (ppm), LOD = Level of Detection (ppm)

Sample Location	Sample Identification	Sample Depth (ft)	Sampling Date	Screening (Analysis) Date	Reading Number	Silver (LOD 50-150)	Cadmium (LOD 50-150)	Tin (LOD 50-150)	Antimony (LOD 50-150)	Mercury (LOD 10-100)	Lead (LOD 10-100)
QA/QC	Pass Internal Standardization	N/A	N/A	04/26/13	1	Pass	Pass	Pass	Pass	Pass	Pass
QA/QC	Pass Internal Standardization	N/A	N/A	06/19/13	1	Pass	Pass	Pass	Pass	Pass	Pass
QA/QC	SiO_2 Blank	N/A	N/A	04/26/13	1	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
QA/QC	SiO_2 Blank	N/A	N/A	06/19/13	1	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Big Darby Creek Metro Park	BDC-PSB-A	0.0-0.5	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	29.67
					2	<LOD	<LOD	<LOD	<LOD	<LOD	29.08
	BDC-PSB-B	0.5-2.0	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	14.78	16.68
					2	<LOD	<LOD	<LOD	<LOD	<LOD	16.38
	BDC-PSB-C	3.0-3.5	4/17/13	04/26/13	1	51.13	<LOD	<LOD	<LOD	<LOD	23.29
					2	<LOD	<LOD	<LOD	<LOD	<LOD	25.69
Blendon Woods Metro Park	BW-PSB-A	0.0-0.5	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	20.36
					2	<LOD	<LOD	<LOD	<LOD	<LOD	26.48
					3	<LOD	<LOD	<LOD	<LOD	<LOD	20.68
	BW-PSB-B	0.5-2.0	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	22.07
					2	<LOD	<LOD	<LOD	<LOD	<LOD	19.72
	BW-PSB-C	3.0-3.5	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	20.97
					2	<LOD	<LOD	<LOD	<LOD	<LOD	18.38
					3	<LOD	<LOD	<LOD	<LOD	<LOD	23.31
Goodale Park	GDL 0.0-2.0	0.0-2.0	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	30.25
					2	<LOD	<LOD	<LOD	<LOD	<LOD	43.74
Griggs Reservoir Park	GRG 0.0-1.5	0.0-1.5	6/5/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	24.94
					2	<LOD	<LOD	<LOD	<LOD	<LOD	35.21

FP-XRF Screening Results for Metals, Evaluation of Background Metal Soil Concentrations in Franklin County

Innov-X Tube-Based Alpha Series™ Handheld XRF Analyzer: analytical results in parts-per-million (ppm), LOD = Level of Detection (ppm)

Sample Location	Sample Identification	Sample Depth (ft)	Sampling Date	Screening (Analysis) Date	Reading Number	Silver (LOD 50-150)	Cadmium (LOD 50-150)	Tin (LOD 50-150)	Antimony (LOD 50-150)	Mercury (LOD 10-100)	Lead (LOD 10-100)
Highbanks Metro Park	HB 0.0-0.5	0.0-0.5	6/6/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	24.57
					2	<LOD	<LOD	<LOD	<LOD	<LOD	33.02
	HB 0.5-1.0	0.5-1.0	6/6/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	23.54
					2	<LOD	<LOD	<LOD	<LOD	<LOD	19.55
	HB 1.0-1.5	1.0-1.5	6/6/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	18.90
					2	<LOD	<LOD	<LOD	<LOD	<LOD	13.64
	HB 1.5-2.0	1.5-2.0	6/6/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	24.19
					2	<LOD	<LOD	<LOD	<LOD	<LOD	19.81
	HB 2.0-2.5	2.0-2.5	6/6/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	22.06
					2	<LOD	<LOD	<LOD	<LOD	<LOD	21.90
	HB 2.5-3.0	2.5-3.0	6/6/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	21.60
					2	<LOD	<LOD	<LOD	<LOD	<LOD	24.65
	HB 3.0-3.5	3.0-3.5	6/6/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	27.74
					2	<LOD	<LOD	<LOD	<LOD	<LOD	26.63
	HB 3.5-4.0	3.5-4.0	6/6/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	24.45
					2	<LOD	<LOD	<LOD	<LOD	<LOD	23.77
Maybury Park	MAY 0.0-2.0	0.0-2.0	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	25.57
					2	<LOD	<LOD	<LOD	<LOD	<LOD	19.85
Schiller Park	SCH 0.0-0.5	0.0-0.5	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	77.25
					2	<LOD	<LOD	<LOD	<LOD	<LOD	94.74
	SCH 0.5-1.0	0.5-1.0	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	62.20
					2	<LOD	<LOD	<LOD	<LOD	<LOD	66.44
	SCH 1.0-1.5	1.0-1.5	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	33.73
					2	<LOD	<LOD	<LOD	<LOD	<LOD	30.19
	SCH 1.5-2.0	1.5-2.0	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	24.45
					2	<LOD	<LOD	<LOD	<LOD	<LOD	22.14
	SCH 2.0-2.5	2.0-2.5	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	23.41
					2	<LOD	<LOD	<LOD	<LOD	<LOD	24.97
	SCH 2.5-3.0	2.5-3.0	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	16.60
					2	<LOD	<LOD	<LOD	<LOD	<LOD	26.76
	SCH 3.0-3.5	3.0-3.5	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	29.25
					2	<LOD	<LOD	<LOD	<LOD	<LOD	32.40
	SCH 3.5-4.0	3.5-4.0	6/4/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	33.82
					2	<LOD	<LOD	<LOD	<LOD	<LOD	23.33

FP-XRF Screening Results for Metals, Evaluation of Background Metal Soil Concentrations in Franklin County

Innov-X Tube-Based Alpha Series™ Handheld XRF Analyzer: analytical results in parts-per-million (ppm), LOD = Level of Detection (ppm)

Sample Location	Sample Identification	Sample Depth (ft)	Sampling Date	Screening (Analysis) Date	Reading Number	Silver (LOD 50-150)	Cadmium (LOD 50-150)	Tin (LOD 50-150)	Antimony (LOD 50-150)	Mercury (LOD 10-100)	Lead (LOD 10-100)
Scioto South Metro Park	SS-PSB-A	0.0-0.5	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	59.58
					2	<LOD	<LOD	<LOD	<LOD	<LOD	55.67
	SS 0.5-1.0	0.5-1.0	4/17/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	54.90
					2	<LOD	<LOD	<LOD	<LOD	<LOD	57.49
	SS-PSB-B	0.5-2.0	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	47.07
					2	<LOD	<LOD	<LOD	<LOD	<LOD	40.93
	SS 1.0-1.5	1.0-1.5	4/17/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	15.17	38.64
					2	<LOD	<LOD	<LOD	<LOD	<LOD	41.78
	SS 1.5-2.0	1.5-2.0	4/17/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	29.93
					2	<LOD	<LOD	<LOD	<LOD	<LOD	25.31
	SS 2.0-2.5	2.0-2.5	4/17/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	18.21
					2	<LOD	<LOD	<LOD	<LOD	<LOD	25.93
	SS 2.5-3.0	2.5-3.0	4/17/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	22.85
					2	<LOD	<LOD	<LOD	<LOD	<LOD	24.40
	SS-PSB-C	3.0-3.5	4/17/13	04/26/13	1	47.53	<LOD	<LOD	<LOD	<LOD	16.38
					2	<LOD	<LOD	<LOD	<LOD	<LOD	15.35
	SS 3.5-4.0	3.5-4.0	4/17/13	06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	15.70
					2	<LOD	<LOD	<LOD	<LOD	<LOD	19.30
Scioto Woods Park	SCW 0.0-2.0	0.0-2.0		06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	19.06
					2	54.24	<LOD	<LOD	<LOD	<LOD	18.77
Three Creeks Metro Park	TC-PSB-A	0.0-0.5	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	32.02
					2	<LOD	<LOD	<LOD	<LOD	<LOD	34.42
	TC-PSB-B	0.5-2.0	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	16.57
					2	<LOD	<LOD	<LOD	<LOD	<LOD	22.60
	TC-PSB-C	3.0-3.5	4/17/13	04/26/13	1	<LOD	<LOD	<LOD	<LOD	14.48	27.05
					2	50.88	<LOD	<LOD	<LOD	<LOD	31.55
Wexford Green Park	WEX 0.0-2.0	0.0-2.0		06/19/13	1	<LOD	<LOD	<LOD	<LOD	<LOD	28.32
					2	<LOD	<LOD	<LOD	<LOD	<LOD	24.11
QA/QC	SiO_2 Blank	N/A	N/A	04/26/13	2	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
QA/QC	SiO2 Blank	N/A	N/A	06/16/13	2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
QA/QC	Pass Internal Standardization	N/A	N/A	06/19/13	2	Pass	Pass	Pass	Pass	Pass	Pass

APPENDIX C

USCS AND USDA SOIL CLASSIFICATION
AND TEXTURAL COMPOSITION ANALYSES

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

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INTEGRITY IN TESTING

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BDC-1
Lab ID:	2013-268-001-001	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*	7.31
#4 To #200	*Sand*	21.24
Finer Than #200	*Silt & Clay*	71.45

USCS Symbol ***CL, TESTED***

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

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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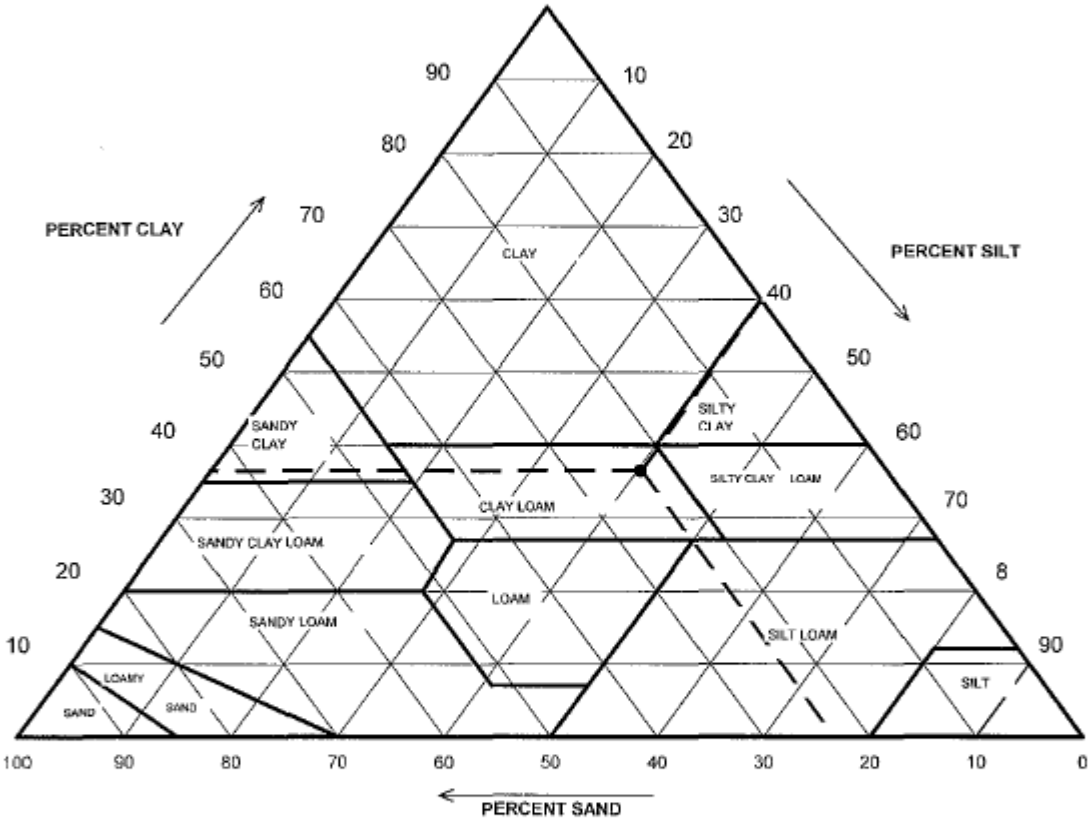
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BDC-1
Lab ID:	2013-268-001-001	Soil Color:	BROWN



Particle Size	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
(mm)	(%)		(%)	(%)
		Gravel	11.07	**0.00**
2	88.93	*Sand*	20.63	**23.20**
0.05	68.29	*Silt*	35.80	**40.26**
0.002	32.49	*Clay*	32.49	**36.54**

USDA Classification: ***CLAY LOAM***

DCN: CT-53A DATE: 3/18/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BDC-1
Lab ID:	2013-268-001-001	Soil Color:	BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	15	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	757.13	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	659.73	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	203.94	Weight of Tare (g)	NA
Weight of Water (g)	97.40	Weight of Water (g)	NA
Weight of Dry Specimen (g)	455.79	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**21.4**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	455.79
Dry Weight of -3/4" Sample (g)	130.11	Weight of - #200 material (g)	325.68
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	130.11
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	19.41	4.26	4.26		95.74	**95.74**
3/8"	9.50	4.56	1.00	5.26		94.74	**94.74**
#4	4.75	9.34	2.05	7.31		92.69	**92.69**
#10	2.00	17.16	3.76	11.07		88.93	**88.93**
#20	0.85	15.66	3.44	14.51		85.49	**85.49**
#40	0.425	12.77	2.80	17.31		82.69	**82.69**
#60	0.250	13.88	3.05	20.36		79.64	**79.64**
#140	0.106	27.27	5.98	26.34		73.66	**73.66**
#200	0.075	10.06	2.21	28.55		71.45	**71.45**
Pan	-	325.68	71.45	100.00		-	-

Tested By	BK	Date	6/4/13	Checked By	KC	Date	6/7/13

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BDC-1
Lab ID:	2013-268-001-001	Soil Color:	BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		54.5	22.7	4.61	49.9	88.0	0.01302	0.0250	**62.9**
5		52.0	22.7	4.61	47.4	83.6	0.01302	0.0162	**59.7**
15		46.0	22.7	4.61	41.4	73.0	0.01302	0.0099	**52.2**
30		43.0	22.7	4.61	38.4	67.7	0.01302	0.0072	**48.4**
61		39.0	22.6	4.64	34.4	60.6	0.01303	0.0053	**43.3**
250		32.5	22.9	4.55	27.9	49.3	0.01299	0.0027	**35.2**
1440		26.5	23.2	4.46	22.0	38.9	0.01294	0.0012	**27.8**

Soil Specimen Data		Other Corrections		
Tare No.	2337			
Weight of Tare & Dry Material (g)	157.42	a - Factor	0.99	
Weight of Tare (g)	96.3			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	71.45	
Weight of Dry Material (g)	56.12			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 6/5/13 Checked By KC Date 6/7/13

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BDC-1
Lab ID:	2013-268-001-001	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)

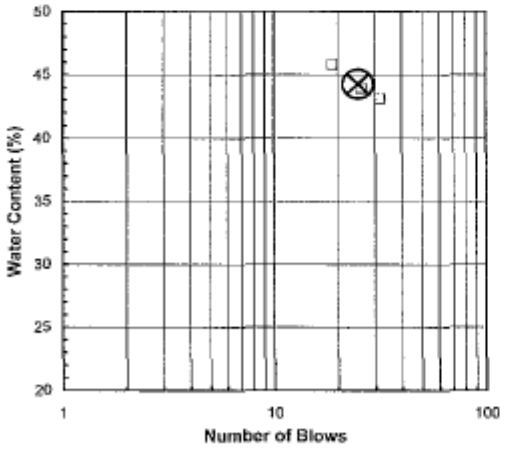
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	430	437	461	**U**
Wt. of Tare & Wet Sample (g)	31.88	38.23	39.36	**L**
Wt. of Tare & Dry Sample (g)	25.75	30.85	31.73	**T**
Wt. of Tare (g)	11.52	14.03	15.06	**I**
Wt. of Water (g)	6.1	7.4	7.6	**P**
Wt. of Dry Sample (g)	14.2	16.8	16.7	**O**
				I
Moisture Content (%)	**43.1**	**43.9**	**45.8**	**N**
Number of Blows	**32**	**26**	**19**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	360	366	
Wt. of Tare & Wet Sample (g)	22.71	23.38	
Wt. of Tare & Dry Sample (g)	21.60	22.26	
Wt. of Tare (g)	16.61	17.09	
Wt. of Water (g)	1.1	1.1	
Wt. of Dry Sample (g)	5.0	5.2	
Moisture Content (%)	**22.2**	**21.7**	**0.6**

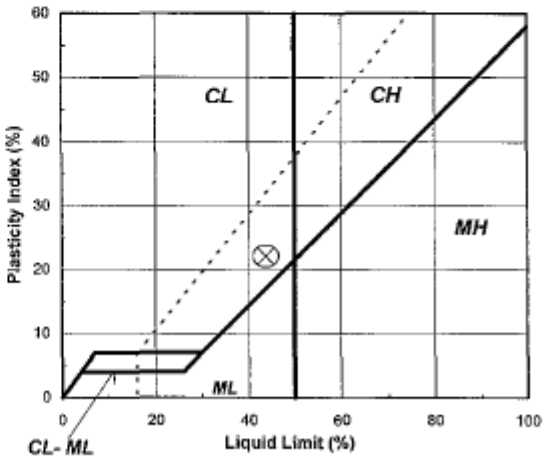
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**44**
Plastic Limit (%)	**22**
Plasticity Index (%)	**22**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By	*JP*	*Date*	*6/6/13*	*Checked By*	*KC*	*Date*	*6/7/13*

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

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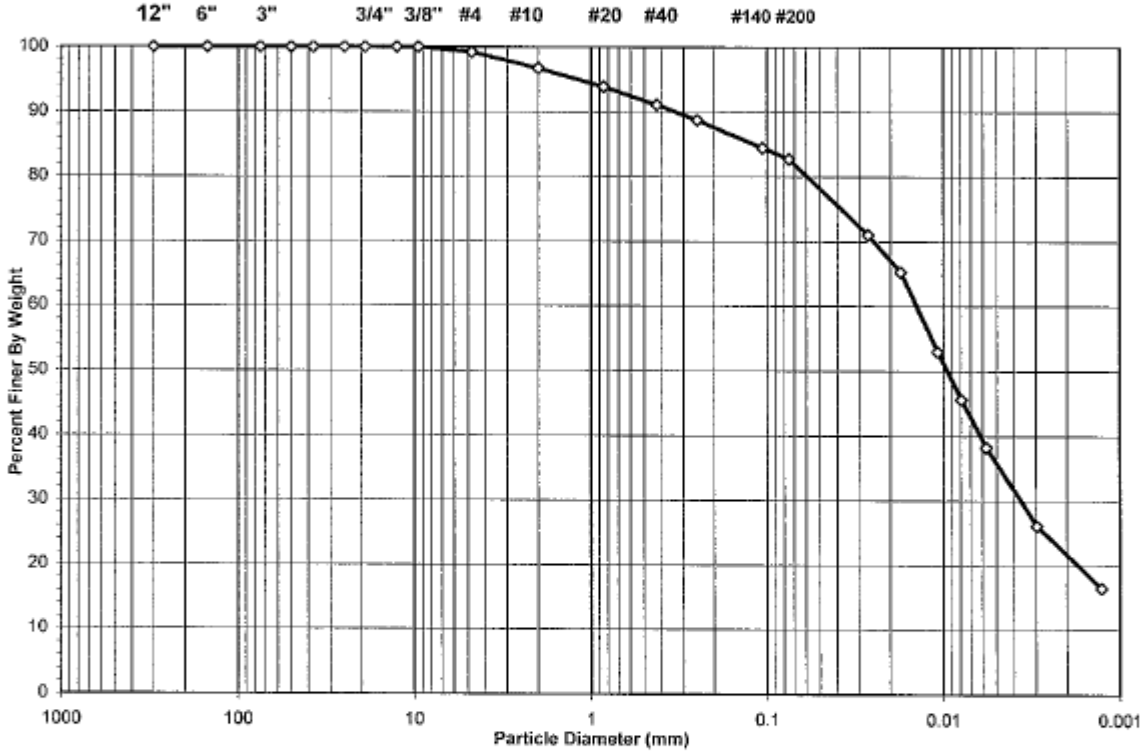
INTEGRITY IN TESTING

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BW-1
Lab ID:	2013-268-001-002	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*	0.80
#4 To #200	*Sand*	16.41
Finer Than #200	*Silt & Clay*	82.80

USCS Symbol *CL, TESTED*

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

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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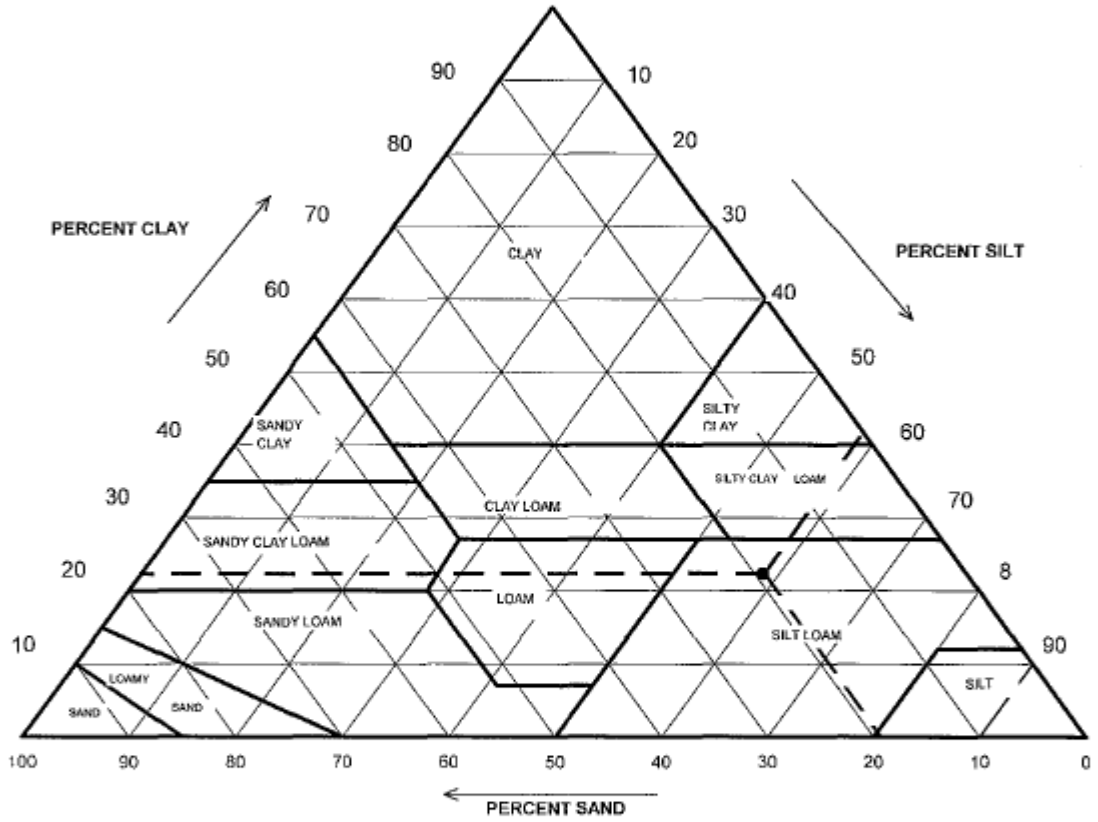
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BW-1
Lab ID:	2013-268-001-002	Soil Color:	BROWN



Particle Size (mm)	Percent Finer (%)	USDA SUMMARY	Actual Percentage (%)	Corrected % of Minus 2.0 mm material for USDA Classificat. (%)
		Gravel	3.27	**0.00**
2	96.73	*Sand*	18.55	**19.18**
0.05	78.18	*Silt*	56.54	**58.45**
0.002	21.64	*Clay*	21.64	**22.37**

USDA Classification: ***SILT LOAM***

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BW-1
Lab ID:	2013-268-001-002	Soil Color:	BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	63	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	636.05	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	561.22	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	202.70	Weight of Tare (g)	NA
Weight of Water (g)	74.83	Weight of Water (g)	NA
Weight of Dry Specimen (g)	358.52	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**20.9**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	358.52
Dry Weight of -3/4" Sample (g)	61.68	Weight of - #200 material (g)	296.84
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	61.68
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	2.86	0.80	0.80		99.20	**99.20**
#10	2.00	8.86	2.47	3.27		96.73	**96.73**
#20	0.85	10.20	2.85	6.11		93.89	**93.89**
#40	0.425	9.98	2.78	8.90		91.10	**91.10**
#60	0.250	8.48	2.37	11.26		88.74	**88.74**
#140	0.106	15.25	4.25	15.52		84.48	**84.48**
#200	0.075	6.05	1.69	17.20		82.80	**82.80**
Pan	-	296.84	82.80	100.00		-	-

Tested By	BK	Date	6/4/13	Checked By	KC	Date	6/7/13

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BW-1
Lab ID:	2013-268-001-002	Soil Color:	BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		48.0	22.7	4.61	43.4	85.8	0.01302	0.0267	**71.1**
5		44.5	22.7	4.61	39.9	78.9	0.01302	0.0175	**65.3**
15		37.0	22.7	4.61	32.4	64.1	0.01302	0.0108	**53.0**
30		32.5	22.7	4.61	27.9	55.2	0.01302	0.0079	**45.7**
61		28.0	22.6	4.64	23.4	46.2	0.01303	0.0057	**38.2**
250		20.5	22.9	4.55	15.9	31.5	0.01299	0.0030	**26.1**
1440		14.5	23.2	4.46	10.0	19.9	0.01294	0.0013	**16.4**

Soil Specimen Data		Other Corrections		
Tare No.	1092			
Weight of Tare & Dry Material (g)	155.55	a - Factor	0.99	
Weight of Tare (g)	100.5			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	82.80	
Weight of Dry Material (g)	50.05			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 6/5/13 Checked By KC Date 6/7/13

DCN: CT-83A DATE: 3/18/13 REVISION: 11

Sievehyd.xls

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	BW-1
Lab ID:	2013-268-001-002	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)

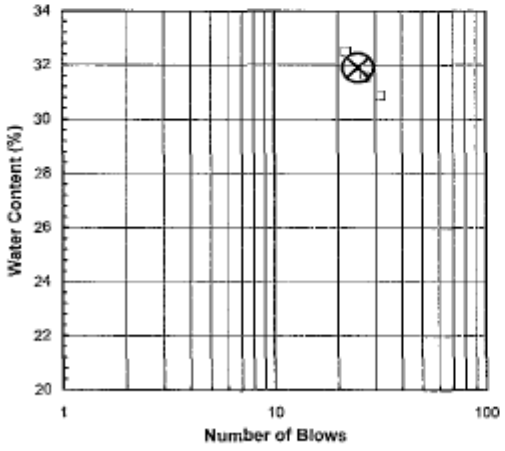
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	147	316	395	**U**
Wt. of Tare & Wet Sample (g)	43.66	39.19	40.66	**L**
Wt. of Tare & Dry Sample (g)	38.18	34.19	34.99	**T**
Wt. of Tare (g)	20.42	18.34	17.53	**I**
Wt. of Water (g)	5.5	5.0	5.7	**P**
Wt. of Dry Sample (g)	17.8	15.9	17.5	**O**
				I
Moisture Content (%)	**30.9**	**31.5**	**32.5**	**N**
Number of Blows	**32**	**27**	**22**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	411	415	
Wt. of Tare & Wet Sample (g)	20.03	19.39	
Wt. of Tare & Dry Sample (g)	19.07	18.33	
Wt. of Tare (g)	13.79	12.81	
Wt. of Water (g)	1.0	1.1	
Wt. of Dry Sample (g)	5.3	5.5	
Moisture Content (%)	**18.2**	**19.2**	**-1.0**

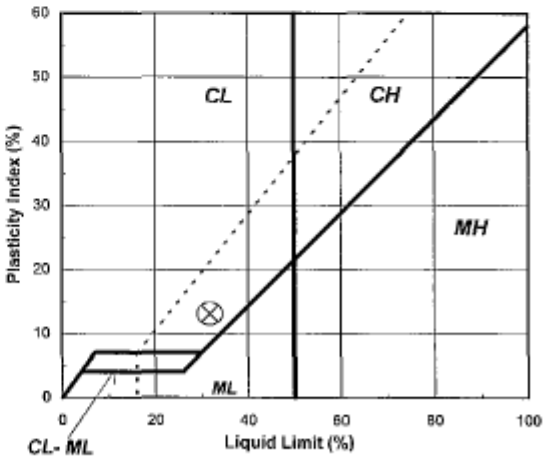
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**32**
Plastic Limit (%)	**19**
Plasticity Index (%)	**13**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By *JP* *Date* *6/6/13* *Checked By* *KC* *Date* 6/10/13

page 1 of 1 **DCN:** CT-S4B **DATE:** 3/18/13 **REVISION:** 4 *3pllimit.xls*

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

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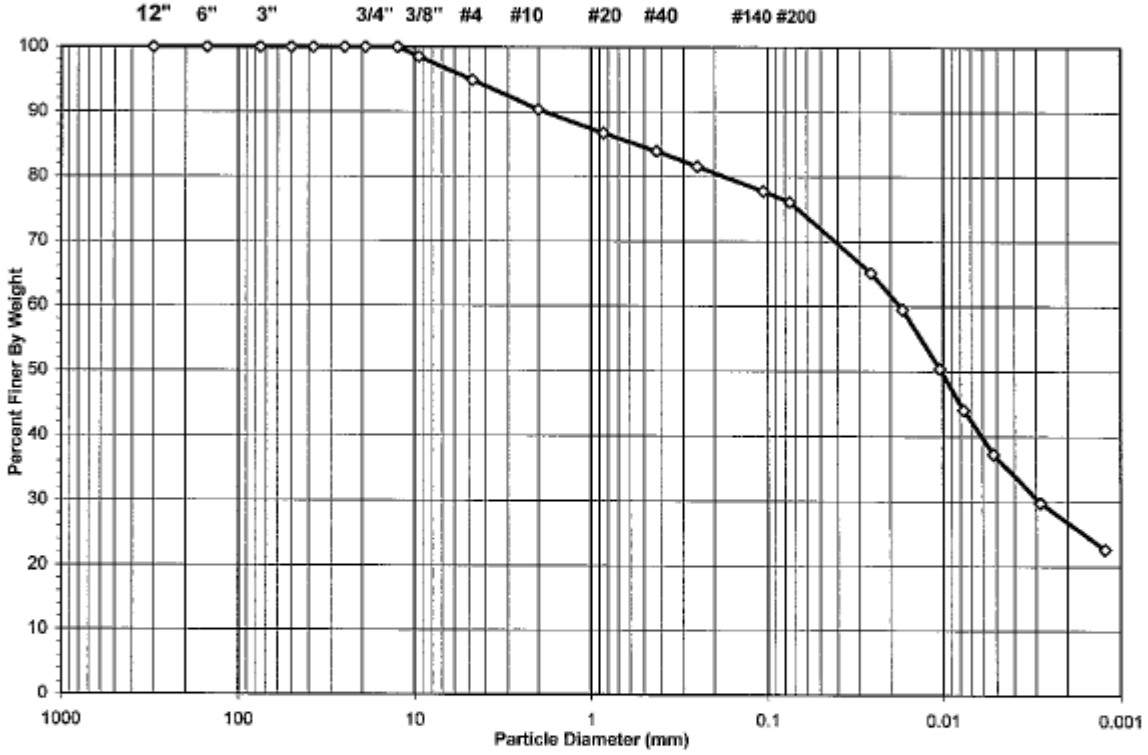
Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GDL-1
Lab ID:	2013-268-002-002	Soil Color:	DARK BROWN

	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*	5.10
#4 To #200	*Sand*	18.80
Finer Than #200	*Silt & Clay*	76.10

USCS Symbol *CL, TESTED*

USCS Classification *LEAN CLAY WITH SAND*

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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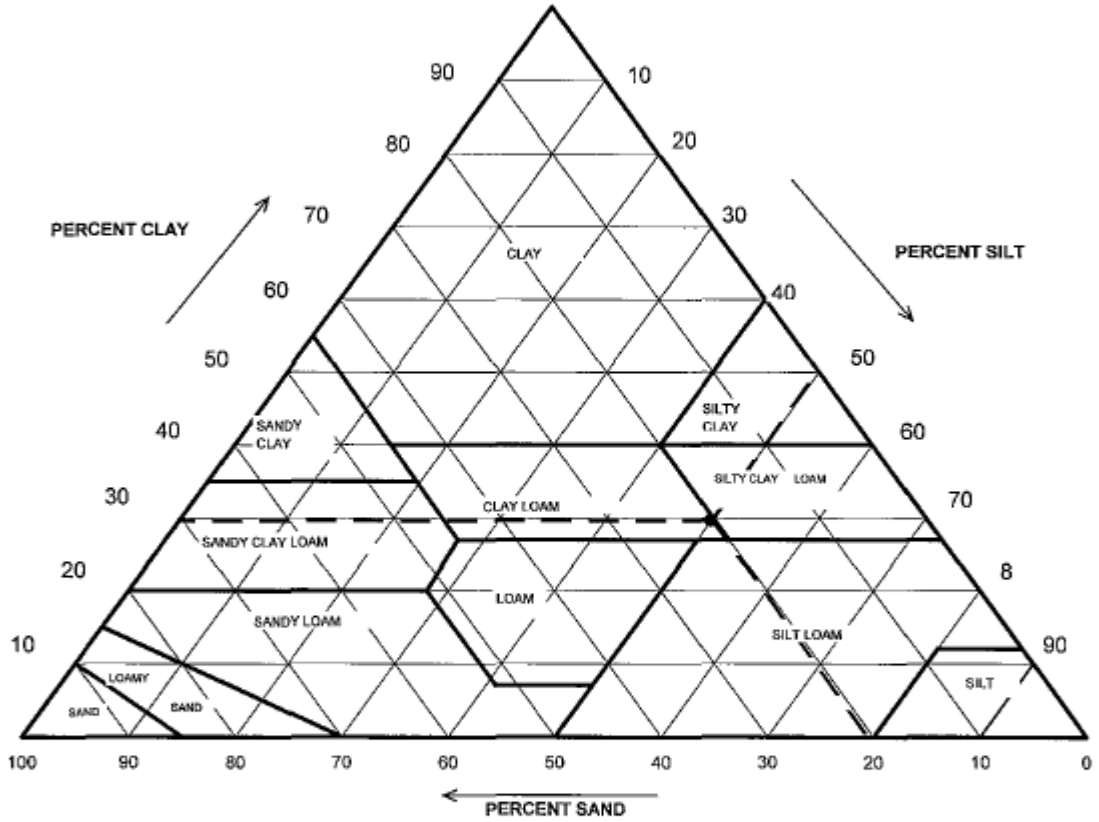
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GDL-1
Lab ID:	2013-268-002-002	Soil Color:	DARK BROWN



Particle Size (mm)	Percent Finer (%)	USDA SUMMARY	Actual Percentage (%)	Corrected % of Minus 2.0 mm material for USDA Classificat. (%)
		Gravel	9.63	**0.00**
2	90.37	*Sand*	18.44	**20.41**
0.05	71.93	*Silt*	45.11	**49.92**
0.002	26.82	*Clay*	26.82	**29.67**

USDA Classification: ***CLAY LOAM***

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GDL-1
Lab ID:	2013-268-002-002	Soil Color:	DARK BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1422	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	621.44	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	540.44	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	144.91	Weight of Tare (g)	NA
Weight of Water (g)	81.00	Weight of Water (g)	NA
Weight of Dry Specimen (g)	395.53	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**20.5**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	395.53
Dry Weight of -3/4" Sample (g)	94.53	Weight of - #200 material (g)	301.00
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	94.53
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	5.93	1.50	1.50		98.50	**98.50**
#4	4.75	14.25	3.60	5.10		94.90	**94.90**
#10	2.00	17.91	4.53	9.63		90.37	**90.37**
#20	0.85	14.52	3.67	13.30		86.70	**86.70**
#40	0.425	10.99	2.78	16.08		83.92	**83.92**
#60	0.250	9.32	2.36	18.44		81.56	**81.56**
#140	0.106	14.94	3.78	22.21		77.79	**77.79**
#200	0.075	6.67	1.69	23.90		76.10	**76.10**
Pan	-	301.00	76.10	100.00		-	-

Tested By	BK	Date	7/5/13	Checked By	KC	Date	7/10/13

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GDL-1
Lab ID:	2013-268-002-002	Soil Color:	DARK BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		51.0	22.7	4.61	46.4	85.6	0.01302	0.0259	**65.2**
5		47.0	22.7	4.61	42.4	78.2	0.01302	0.0171	**59.5**
15		40.5	22.7	4.61	35.9	66.2	0.01302	0.0104	**50.4**
30		36.0	22.7	4.61	31.4	57.9	0.01302	0.0077	**44.1**
69		31.0	23.1	4.49	26.5	48.9	0.01296	0.0052	**37.2**
250		25.5	23.7	4.30	21.2	39.1	0.01287	0.0028	**29.8**
1440		20.5	23.4	4.39	16.1	29.7	0.01291	0.0012	**22.6**

Soil Specimen Data		Other Corrections		
Tare No.	929			
Weight of Tare & Dry Material (g)	160.46	a - Factor	0.99	
Weight of Tare (g)	101.83			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	76.10	
Weight of Dry Material (g)	53.63			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 7/8/13 Checked By KC Date 7/10/13

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GDL-1
Lab ID:	2013-268-002-002	Soil Description:	**DARK 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)

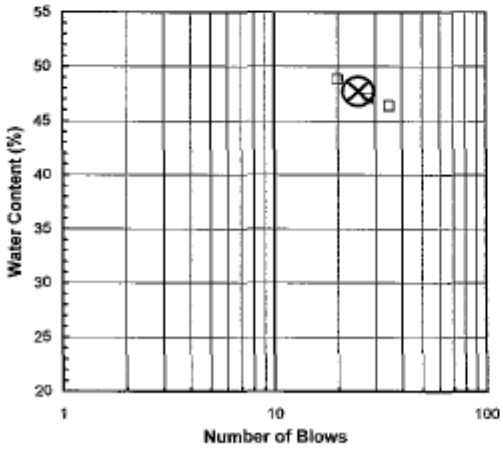
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	396	279	418	**U**
Wt. of Tare & Wet Sample (g)	43.45	43.94	47.01	**L**
Wt. of Tare & Dry Sample (g)	35.30	35.47	38.63	**T**
Wt. of Tare (g)	17.72	17.46	21.45	**I**
Wt. of Water (g)	8.2	8.5	8.4	**P**
Wt. of Dry Sample (g)	17.6	18.0	17.2	**O**
				I
Moisture Content (%)	**46.4**	**47.0**	**48.8**	**N**
Number of Blows	**35**	**28**	**20**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	2045	317	
Wt. of Tare & Wet Sample (g)	25.11	25.15	
Wt. of Tare & Dry Sample (g)	23.95	23.90	
Wt. of Tare (g)	19.01	18.75	
Wt. of Water (g)	1.2	1.3	
Wt. of Dry Sample (g)	4.9	5.2	
Moisture Content (%)	**23.5**	**24.3**	**-0.8**

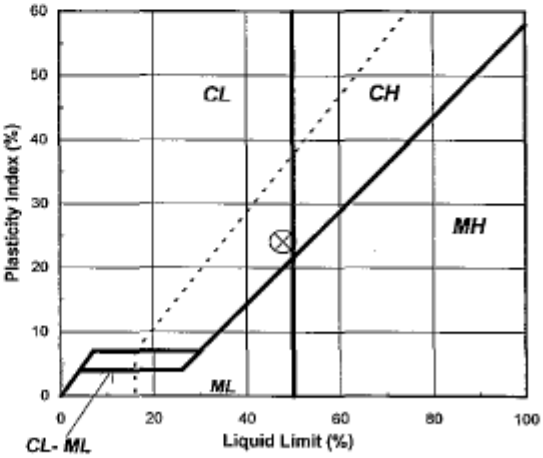
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**48**
Plastic Limit (%)	**24**
Plasticity Index (%)	**24**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By	*TO*	*Date*	*7/8/13*	*Checked By*	*KC*	*Date*	*7/9/13*

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

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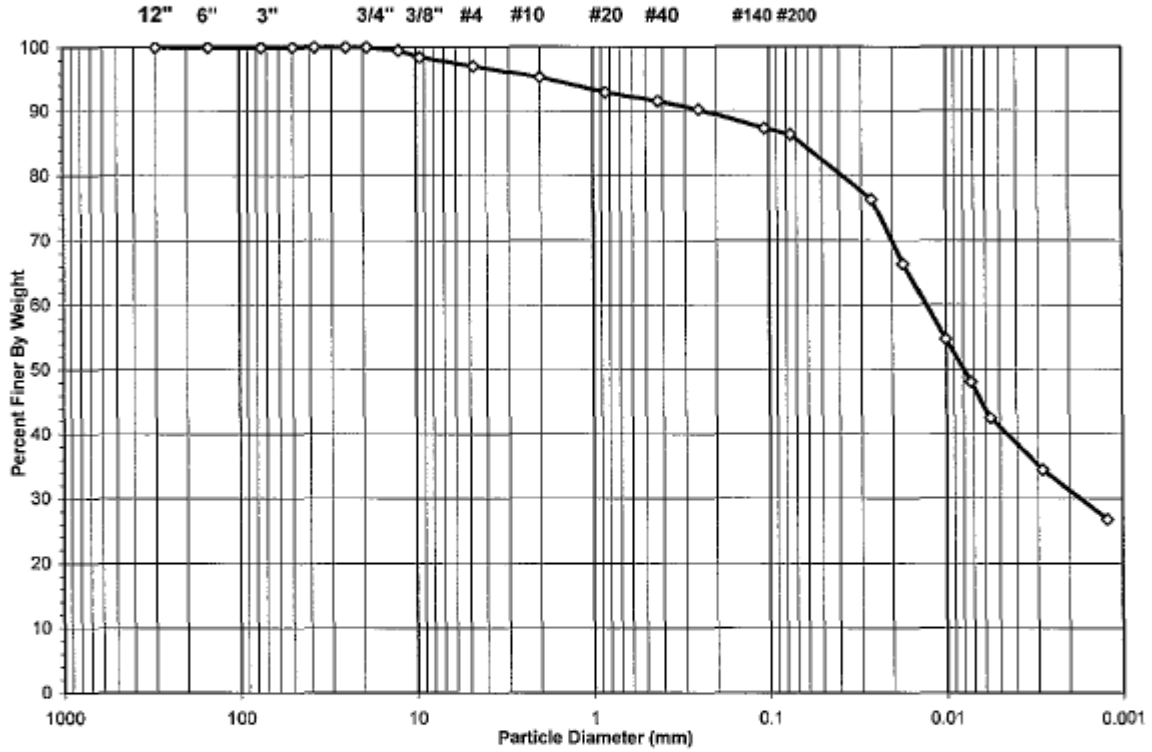
Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GRG-1
Lab ID:	2013-268-002-006	Soil Color:	BROWN

	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*	2.91
#4 To #200	*Sand*	10.79
Finer Than #200	*Silt & Clay*	86.30

USCS Symbol *CL, TESTED*

USCS Classification *LEAN CLAY*

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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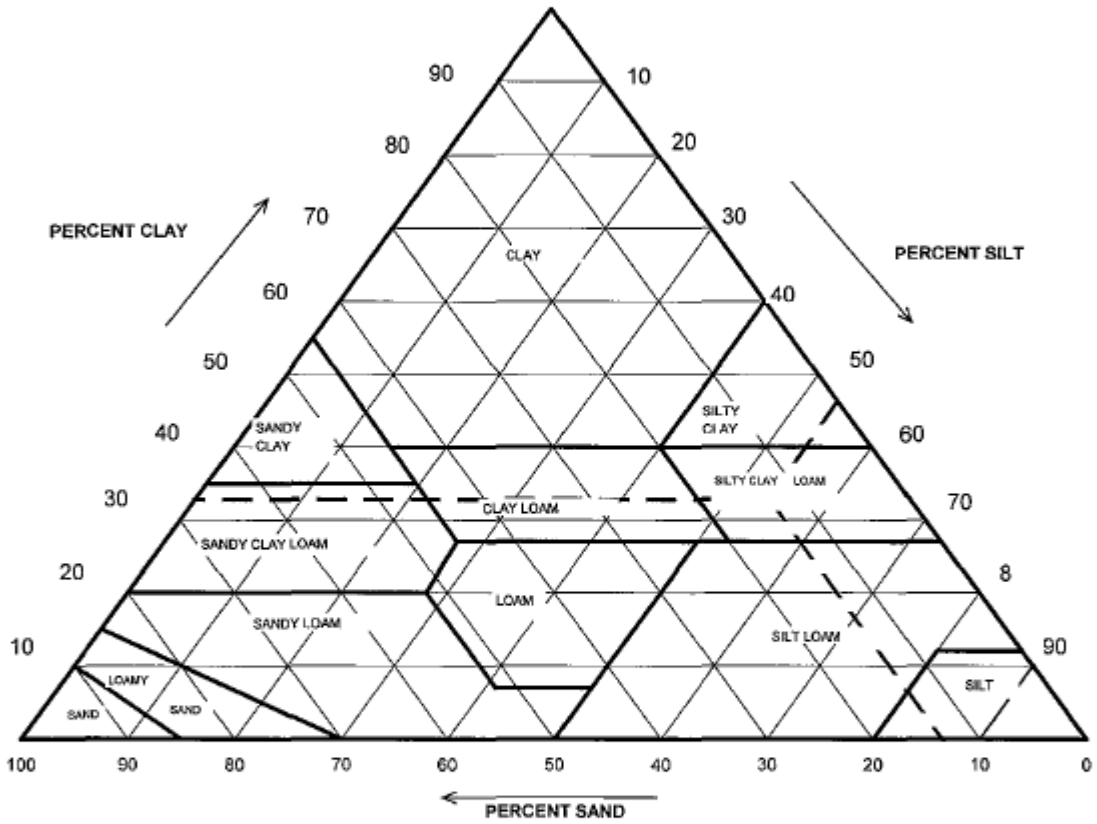
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GRG-1
Lab ID:	2013-268-002-006	Soil Color:	BROWN



Particle Size	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
(mm)	(%)		(%)	(%)
		Gravel	4.73	**0.00**
2	95.27	*Sand*	12.79	**13.43**
0.05	82.48	*Silt*	51.23	**53.77**
0.002	31.26	*Clay*	31.26	**32.81**

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

DCN: CT-53A DATE: 3/16/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GRG-1
Lab ID:	2013-268-002-006	Soil Color:	BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1439	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	779.05	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	657.84	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	145.60	Weight of Tare (g)	NA
Weight of Water (g)	121.21	Weight of Water (g)	NA
Weight of Dry Specimen (g)	512.24	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**23.7**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	512.24
Dry Weight of -3/4" Sample (g)	70.18	Weight of - #200 material (g)	442.06
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	70.18
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	2.65	0.52	0.52		99.48	**99.48**
3/8"	9.50	5.09	0.99	1.51		98.49	**98.49**
#4	4.75	7.15	1.40	2.91		97.09	**97.09**
#10	2.00	9.33	1.82	4.73		95.27	**95.27**
#20	0.85	12.52	2.44	7.17		92.83	**92.83**
#40	0.425	6.66	1.30	8.47		91.53	**91.53**
#60	0.250	6.90	1.35	9.82		90.18	**90.18**
#140	0.106	14.96	2.92	12.74		87.26	**87.26**
#200	0.075	4.92	0.96	13.70		86.30	**86.30**
Pan	-	442.06	86.30	100.00		-	-

Tested By	BK	Date	7/5/13	Checked By	KC	Date	7/10/13

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GRG-1
Lab ID:	2013-268-002-006	Soil Color:	BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		50.5	22.7	4.61	45.9	88.5	0.01302	0.0261	**76.3**
5		44.5	22.7	4.61	39.9	76.9	0.01302	0.0175	**66.4**
17		37.5	22.7	4.61	32.9	63.4	0.01302	0.0101	**54.7**
35		33.5	22.7	4.61	28.9	55.7	0.01302	0.0072	**48.1**
60		30.0	23.1	4.49	25.5	49.2	0.01296	0.0056	**42.4**
250		25.0	23.7	4.30	20.7	39.9	0.01287	0.0028	**34.4**
1440		20.5	23.4	4.39	16.1	31.1	0.01291	0.0012	**26.8**

Soil Specimen Data		Other Corrections		
Tare No.	969			
Weight of Tare & Dry Material (g)	157.7	a - Factor	0.99	
Weight of Tare (g)	101.35			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	86.30	
Weight of Dry Material (g)	51.35			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 7/8/13 Checked By KC Date 7/10/13

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	GRG-1
Lab ID:	2013-268-002-006	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)

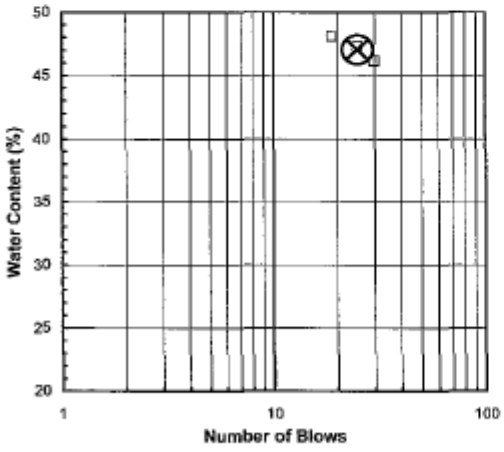
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	414	442	443	**U**
Wt. of Tare & Wet Sample (g)	35.49	40.31	37.08	**L**
Wt. of Tare & Dry Sample (g)	28.61	32.52	30.07	**T**
Wt. of Tare (g)	13.70	16.05	15.49	**I**
Wt. of Water (g)	6.9	7.8	7.0	**P**
Wt. of Dry Sample (g)	14.9	16.5	14.6	**O**
				I
Moisture Content (%)	**46.1**	**47.3**	**48.1**	**N**
Number of Blows	**30**	**25**	**19**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	451	471	
Wt. of Tare & Wet Sample (g)	16.44	21.56	
Wt. of Tare & Dry Sample (g)	15.21	20.32	
Wt. of Tare (g)	10.27	15.30	
Wt. of Water (g)	1.2	1.2	
Wt. of Dry Sample (g)	4.9	5.0	
Moisture Content (%)	**24.9**	**24.7**	**0.2**

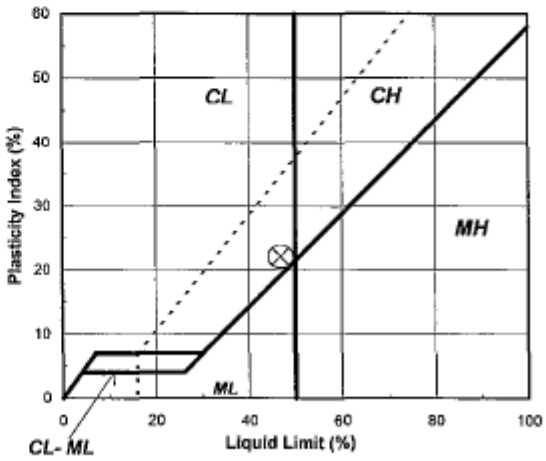
Note: The acceptable range of the two Moisture contents is ± 2.6

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

Flow Curve



Plasticity Chart



Tested By	*JP*	*Date*	*7/9/13*	*Checked By*	*KC*	*Date*	*7/10/13*

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

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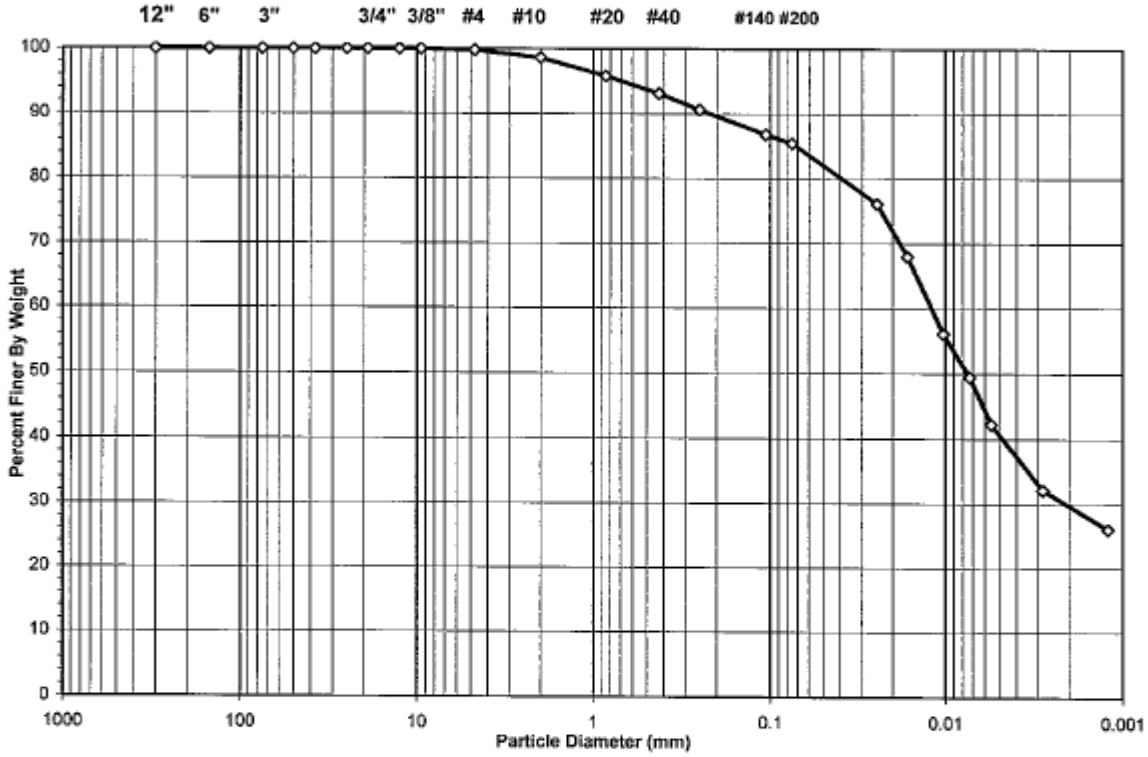
Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	HB-1
Lab ID:	2013-268-002-001	Soil Color:	BROWN

	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*	0.20
#4 To #200	*Sand*	14.39
Finer Than #200	*Silt & Clay*	85.41

USCS Symbol *CL, TESTED*

USCS Classification *LEAN CLAY*

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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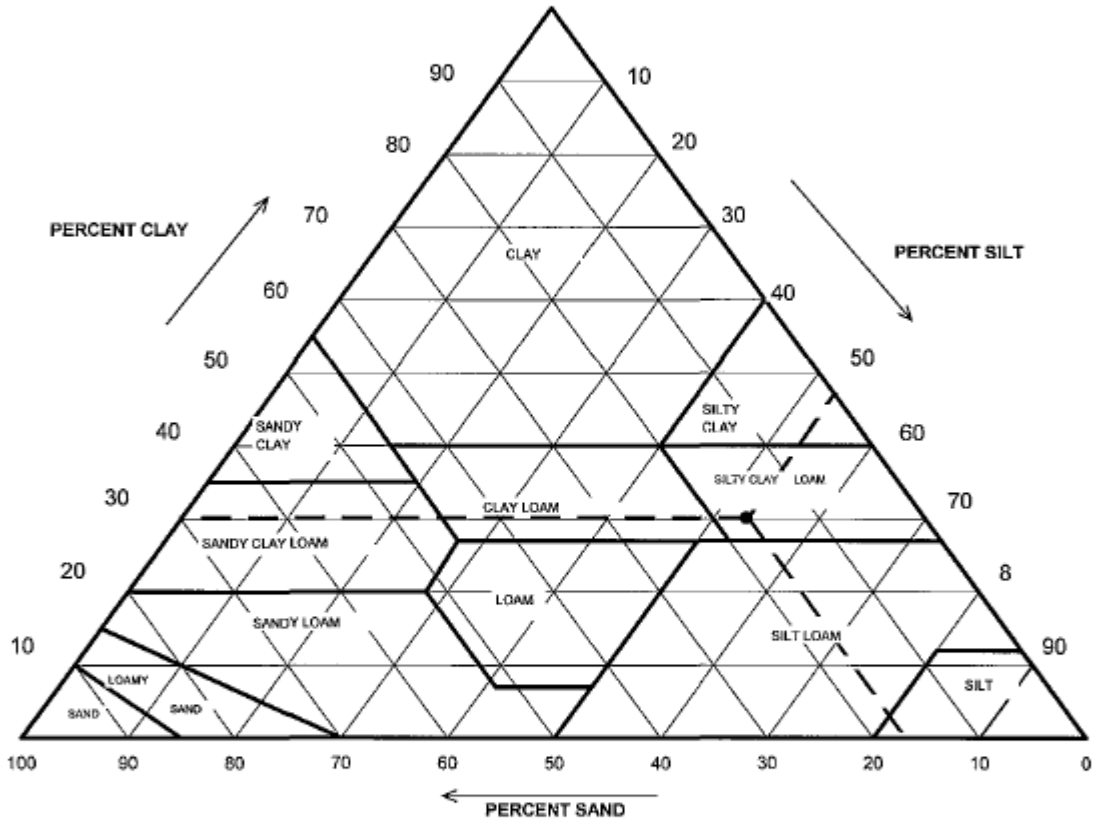
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	HB-1
Lab ID:	2013-268-002-001	Soil Color:	BROWN



Particle Size (mm)	Percent Finer (%)	USDA SUMMARY	Actual Percentage (%)	Corrected % of Minus 2.0 mm material for USDA Classificat. (%)
		Gravel	1.38	**0.00**
2	98.62	*Sand*	16.57	**16.81**
0.05	82.04	*Silt*	52.36	**53.10**
0.002	29.68	*Clay*	29.68	**30.09**

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

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	HB-1
Lab ID:	2013-268-002-001	Soil Color:	BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1423	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	736.69	Wt. of Tare & Wet.Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	620.05	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	143.96	Weight of Tare (g)	NA
Weight of Water (g)	116.64	Weight of Water (g)	NA
Weight of Dry Specimen (g)	476.09	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**24.5**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	476.09
Dry Weight of -3/4" Sample (g)	69.44	Weight of - #200 material (g)	406.65
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	69.44
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	0.94	0.20	0.20		99.80	**99.80**
#10	2.00	5.65	1.19	1.38		98.62	**98.62**
#20	0.85	13.23	2.78	4.16		95.84	**95.84**
#40	0.425	13.16	2.76	6.93		93.07	**93.07**
#60	0.250	11.69	2.46	9.38		90.62	**90.62**
#140	0.106	18.13	3.81	13.19		86.81	**86.81**
#200	0.075	6.64	1.39	14.59		85.41	**85.41**
Pan	-	406.65	85.41	100.00		-	-

Tested By BK Date 7/5/13 Checked By KC Date 7/10/13

DCN: CT-SSA DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	HB-1
Lab ID:	2013-268-002-001	Soil Color:	BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		56.0	22.7	4.61	51.4	89.1	0.01302	0.0246	**76.1**
5		50.5	22.7	4.61	45.9	79.6	0.01302	0.0165	**68.0**
15		42.5	22.7	4.61	37.9	65.7	0.01302	0.0103	**56.1**
32		38.0	22.7	4.61	33.4	57.9	0.01302	0.0073	**49.5**
60		33.0	23.1	4.49	28.5	49.5	0.01296	0.0055	**42.2**
250		26.0	23.7	4.30	21.7	37.6	0.01287	0.0028	**32.1**
1440		22.0	23.4	4.39	17.6	30.5	0.01291	0.0012	**26.1**

Soil Specimen Data		Other Corrections		
Tare No.	1913			
Weight of Tare & Dry Material (g)	161.02	a - Factor	0.99	
Weight of Tare (g)	98.94			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	85.41	
Weight of Dry Material (g)	57.08			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 7/8/13 Checked By KC Date 7/10/13

DCN: CT-53A DATE: 3/18/13 REVISION: 11

Sievehyd.xls

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	HB-1
Lab ID:	2013-268-002-001	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)

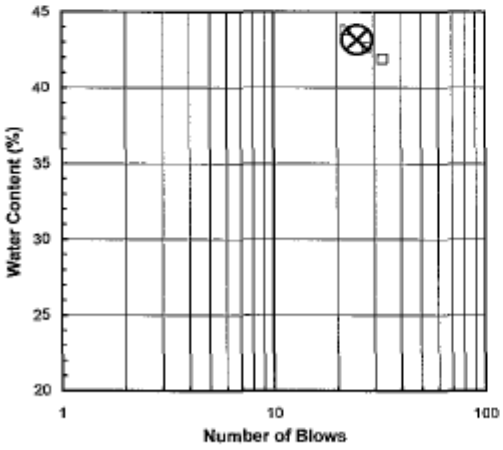
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	400	453	457	U
Wt. of Tare & Wet Sample (g)	43.27	36.19	36.19	L
Wt. of Tare & Dry Sample (g)	35.13	29.29	29.01	T
Wt. of Tare (g)	15.69	13.11	12.60	I
Wt. of Water (g)	8.1	6.9	7.2	P
Wt. of Dry Sample (g)	19.4	16.2	16.4	O
				I
Moisture Content (%)	**41.9**	**42.6**	**43.8**	N
Number of Blows	**33**	**28**	**22**	T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	416	446	
Wt. of Tare & Wet Sample (g)	19.88	26.70	
Wt. of Tare & Dry Sample (g)	18.77	25.58	
Wt. of Tare (g)	13.84	20.31	
Wt. of Water (g)	1.1	1.1	
Wt. of Dry Sample (g)	4.9	5.3	
Moisture Content (%)	**22.5**	**21.3**	**1.3**

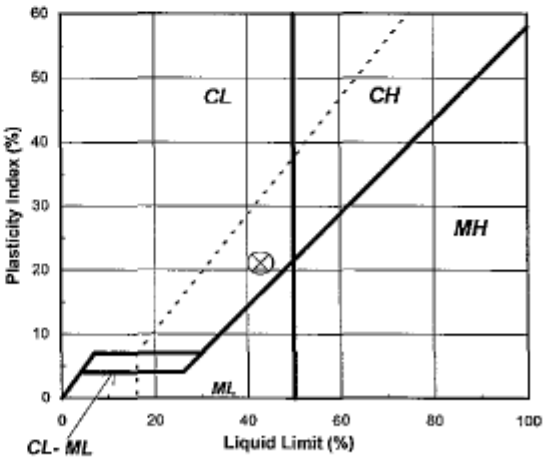
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**43**
Plastic Limit (%)	**22**
Plasticity Index (%)	**21**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By	*JP*	*Date*	*7/8/13*	*Checked By*	*KC*	*Date*	*7/9/13*

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

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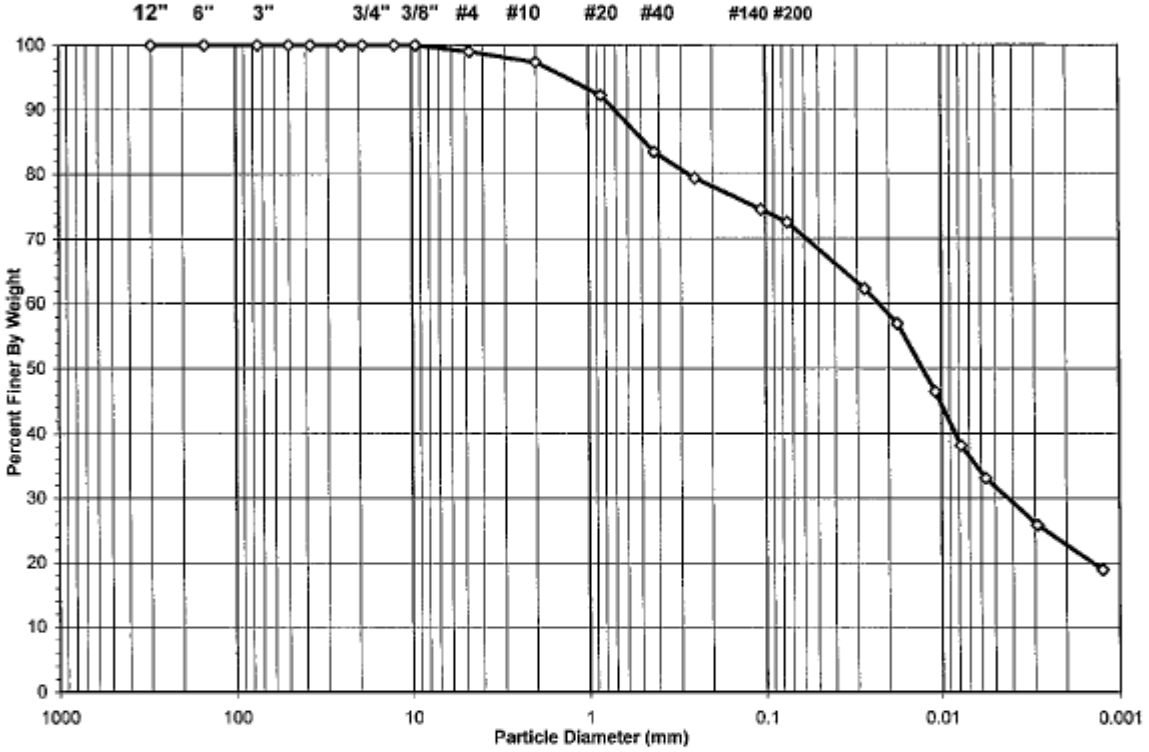
Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	MAY-1
Lab ID:	2013-268-002-007	Soil Color:	BROWN

	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*	0.98
#4 To #200	*Sand*	26.41
Finer Than #200	*Silt & Clay*	72.62

USCS Symbol ***CL, TESTED***

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

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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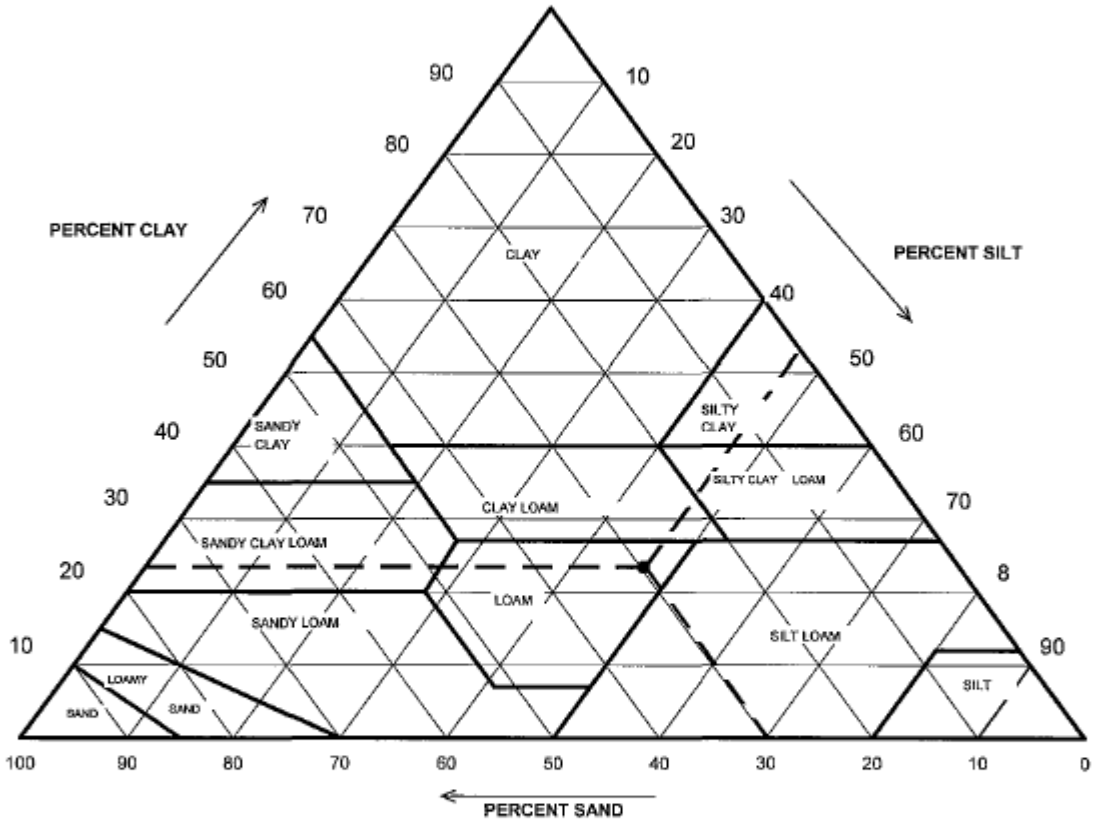
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	MAY-1
Lab ID:	2013-268-002-007	Soil Color:	BROWN



Particle Size	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
(mm)	(%)		(%)	(%)
		Gravel	2.65	**0.00**
2	97.35	*Sand*	28.89	**29.68**
0.05	68.46	*Silt*	45.66	**46.90**
0.002	22.80	*Clay*	22.80	**23.42**

USDA Classification: ***LOAM***

DGN: CT-S3A DATE: 3/18/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	MAY-1
Lab ID:	2013-268-002-007	Soil Color:	BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1433	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	659.58	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	584.38	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	144.66	Weight of Tare (g)	NA
Weight of Water (g)	75.20	Weight of Water (g)	NA
Weight of Dry Specimen (g)	439.72	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**17.1**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	439.72
Dry Weight of -3/4" Sample (g)	120.41	Weight of - #200 material (g)	319.31
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	120.41
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	4.29	0.98	0.98		99.02	**99.02**
#10	2.00	7.36	1.67	2.65		97.35	**97.35**
#20	0.85	22.47	5.11	7.76		92.24	**92.24**
#40	0.425	38.81	8.83	16.59		83.41	**83.41**
#60	0.250	17.62	4.01	20.59		79.41	**79.41**
#140	0.106	21.43	4.87	25.47		74.53	**74.53**
#200	0.075	8.43	1.92	27.38		72.62	**72.62**
Pan	-	319.31	72.62	100.00		-	-

Tested By	BK	Date	7/5/13	Checked By	KC	Date	7/10/13

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	MAY-1
Lab ID:	2013-268-002-007	Soil Color:	BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		46.0	22.7	4.61	41.4	85.7	0.01302	0.0272	**62.2**
5		42.5	22.7	4.61	37.9	78.5	0.01302	0.0178	**57.0**
15		35.5	22.7	4.61	30.9	64.0	0.01302	0.0109	**46.4**
32		30.0	22.7	4.61	25.4	52.6	0.01302	0.0078	**38.2**
63		26.5	23.1	4.49	22.0	45.6	0.01296	0.0056	**33.1**
250		21.5	23.7	4.30	17.2	35.6	0.01287	0.0029	**25.9**
1440		17.0	23.4	4.39	12.6	26.1	0.01291	0.0013	**19.0**

Soil Specimen Data		Other Corrections		
Tare No.	2343			
Weight of Tare & Dry Material (g)	147.54	a - Factor	0.99	
Weight of Tare (g)	94.73			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	72.62	
Weight of Dry Material (g)	47.81			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 7/8/13 Checked By KC Date 7/10/13

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

Sievehyd.xls

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	MAY-1
Lab ID:	2013-268-002-007	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)

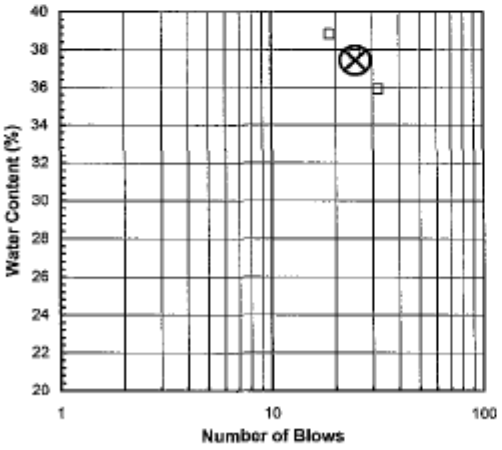
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	412	415	416	U
Wt. of Tare & Wet Sample (g)	43.16	36.02	38.66	L
Wt. of Tare & Dry Sample (g)	36.89	29.67	31.73	T
Wt. of Tare (g)	19.42	12.85	13.87	I
Wt. of Water (g)	6.3	6.4	6.9	P
Wt. of Dry Sample (g)	17.5	16.8	17.9	O
				I
Moisture Content (%)	**35.9**	**37.8**	**38.8**	N
Number of Blows	**32**	**25**	**19**	T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	473	475	
Wt. of Tare & Wet Sample (g)	27.53	18.26	
Wt. of Tare & Dry Sample (g)	26.50	17.20	
Wt. of Tare (g)	21.53	12.06	
Wt. of Water (g)	1.0	1.1	
Wt. of Dry Sample (g)	5.0	5.1	
Moisture Content (%)	**20.7**	**20.6**	**0.1**

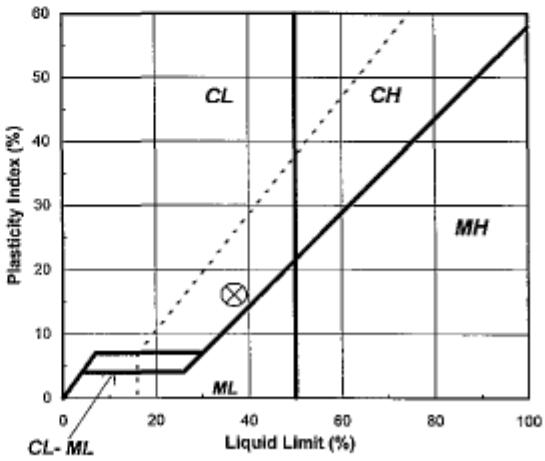
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**37**
Plastic Limit (%)	**21**
Plasticity Index (%)	**16**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By	*JP*	*Date*	*7/9/13*	*Checked By*	*KC*	*Date*	*7/10/13*

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

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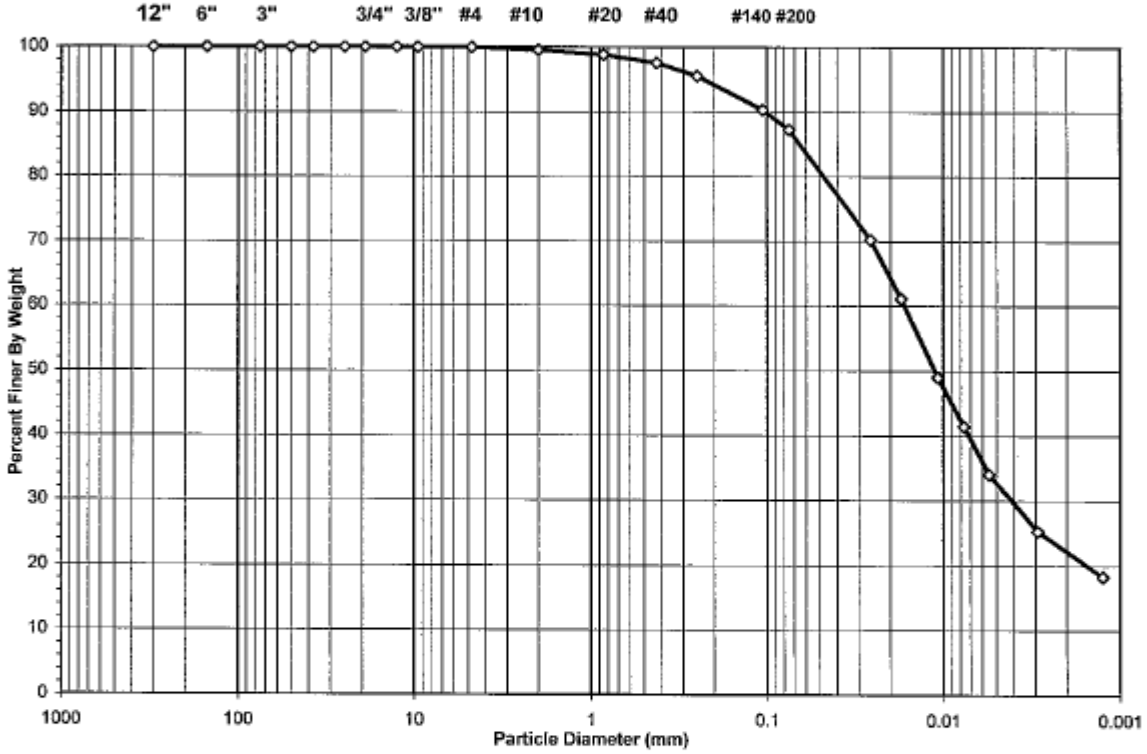
Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCH-1
Lab ID:	2013-268-002-003	Soil Color:	BROWN

	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*	0.03
#4 To #200	*Sand*	12.68
Finer Than #200	*Silt & Clay*	87.29

USCS Symbol *CL, TESTED*

USCS Classification *LEAN CLAY*

 DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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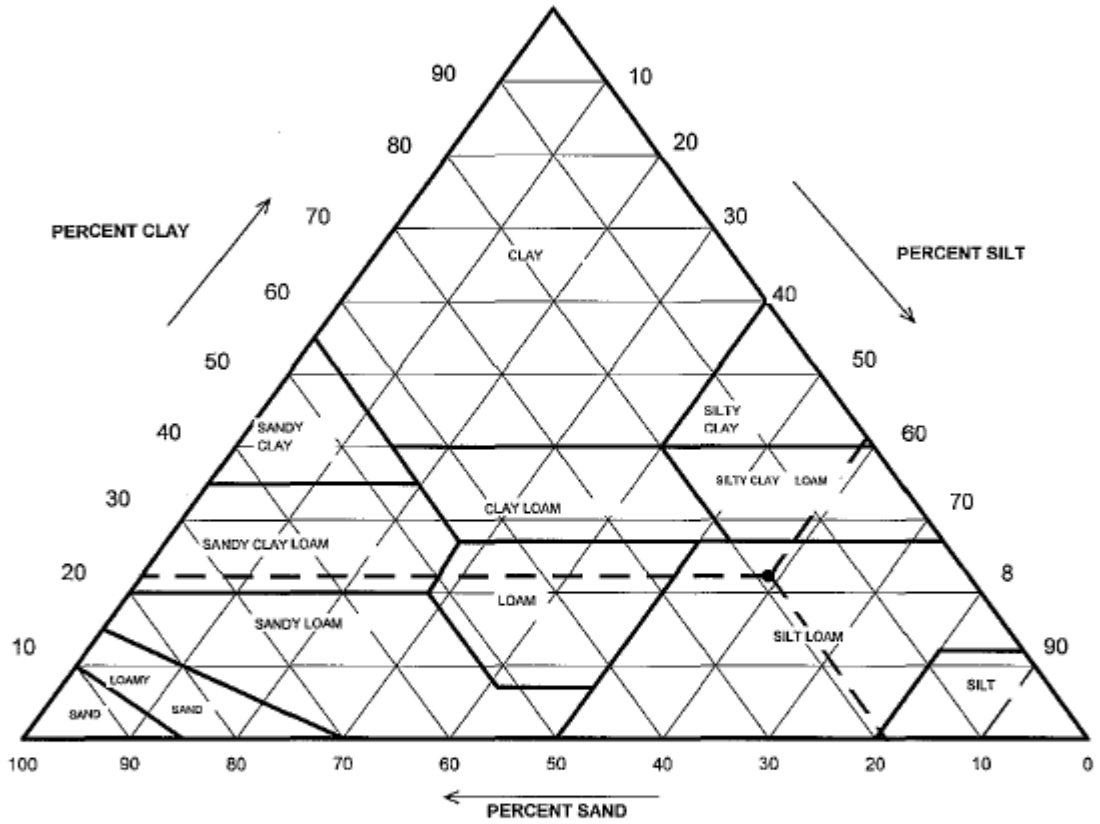
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCH-1
Lab ID:	2013-268-002-003	Soil Color:	BROWN



Particle Size	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
(mm)	(%)		(%)	(%)
		Gravel	0.46	**0.00**
2	99.54	*Sand*	18.77	**18.85**
0.05	80.77	*Silt*	58.60	**58.87**
0.002	22.17	*Clay*	22.17	**22.28**

USDA Classification: ***SILT LOAM***

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCH-1
Lab ID:	2013-268-002-003	Soil Color:	BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1421	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	673.14	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	600.99	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	144.87	Weight of Tare (g)	NA
Weight of Water (g)	72.15	Weight of Water (g)	NA
Weight of Dry Specimen (g)	456.12	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**15.8**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	456.12
Dry Weight of -3/4" Sample (g)	57.98	Weight of - #200 material (g)	398.14
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	57.98
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	0.14	0.03	0.03		99.97	**99.97**
#10	2.00	1.96	0.43	0.46		99.54	**99.54**
#20	0.85	3.46	0.76	1.22		98.78	**98.78**
#40	0.425	5.59	1.23	2.44		97.56	**97.56**
#60	0.250	8.97	1.97	4.41		95.59	**95.59**
#140	0.106	23.81	5.22	9.63		90.37	**90.37**
#200	0.075	14.05	3.08	12.71		87.29	**87.29**
Pan	-	398.14	87.29	100.00		-	-

Tested By	BK	Date	7/5/13	Checked By	KC	Date	7/10/13

DCN: CT-63A DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCH-1
Lab ID:	2013-268-002-003	Soil Color:	BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		51.0	22.7	4.61	46.4	80.5	0.01302	0.0259	**70.2**
5		45.0	22.7	4.61	40.4	70.0	0.01302	0.0174	**61.1**
15		37.0	22.7	4.61	32.4	56.2	0.01302	0.0108	**49.0**
32		32.0	22.7	4.61	27.4	47.5	0.01302	0.0077	**41.5**
66		27.0	23.1	4.49	22.5	39.0	0.01296	0.0055	**34.1**
250		21.0	23.7	4.30	16.7	29.0	0.01287	0.0029	**25.3**
1440		16.5	23.4	4.39	12.1	21.0	0.01291	0.0013	**18.3**

Soil Specimen Data		Other Corrections		
Tare No.	924			
Weight of Tare & Dry Material (g)	162.91	a - Factor	0.99	
Weight of Tare (g)	100.83			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	87.29	
Weight of Dry Material (g)	57.08			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 7/8/13 Checked By KC Date 7/10/13

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCH-1
Lab ID:	2013-268-002-003	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)

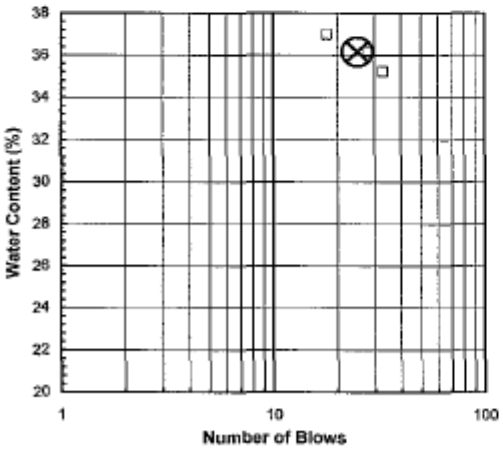
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	133	438	431	**U**
Wt. of Tare & Wet Sample (g)	39.16	39.65	37.62	**L**
Wt. of Tare & Dry Sample (g)	33.70	33.68	31.69	**T**
Wt. of Tare (g)	18.93	17.17	14.85	**I**
Wt. of Water (g)	5.5	6.0	5.9	**P**
Wt. of Dry Sample (g)	14.8	16.5	16.8	**O**
				I
Moisture Content (%)	**37.0**	**36.2**	**35.2**	**N**
Number of Blows	**18**	**28**	**33**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	245	367	
Wt. of Tare & Wet Sample (g)	26.40	26.86	
Wt. of Tare & Dry Sample (g)	25.29	25.75	
Wt. of Tare (g)	20.03	20.38	
Wt. of Water (g)	1.1	1.1	
Wt. of Dry Sample (g)	5.3	5.4	
Moisture Content (%)	**21.1**	**20.7**	**0.4**

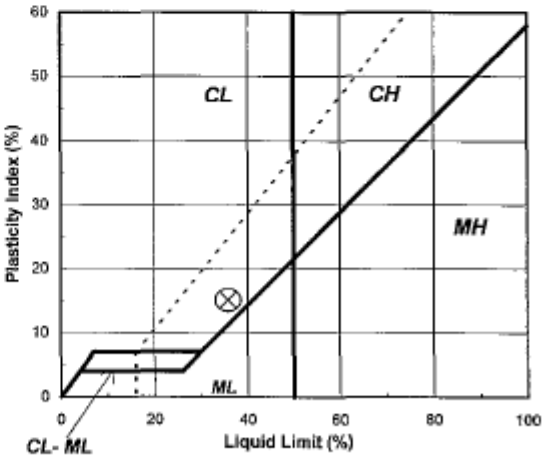
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**36**
Plastic Limit (%)	**21**
Plasticity Index (%)	**15**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By	*BK*	*Date*	*7/8/13*	*Checked By*	*KC*	*Date*	*7/9/13*		
page 1 of 1		**DCN:**	CT-S4B	**DATE:**	3/18/13	**REVISION:**	4		*3ptlimit.xls*

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

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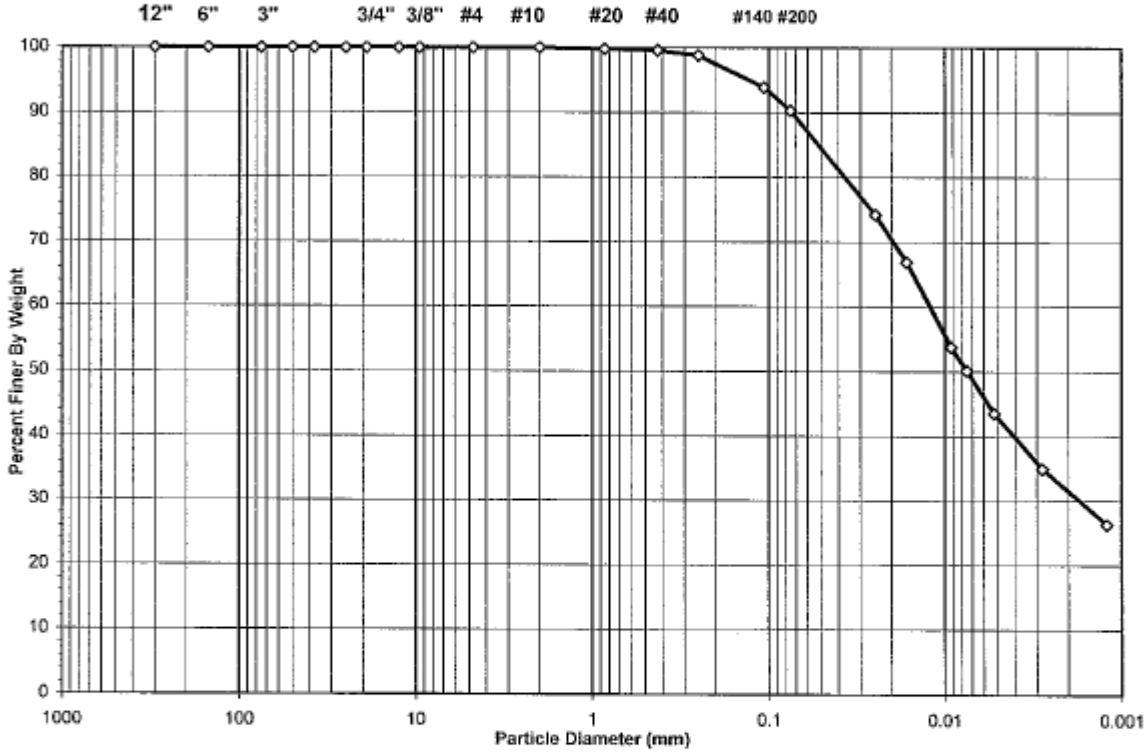
Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	SS-1
Lab ID:	2013-268-001-003	Soil Color:	BROWN

	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*	0.02
#4 To #200	*Sand*	9.65
Finer Than #200	*Silt & Clay*	90.33

USCS Symbol *CL, TESTED*

USCS Classification *LEAN CLAY*

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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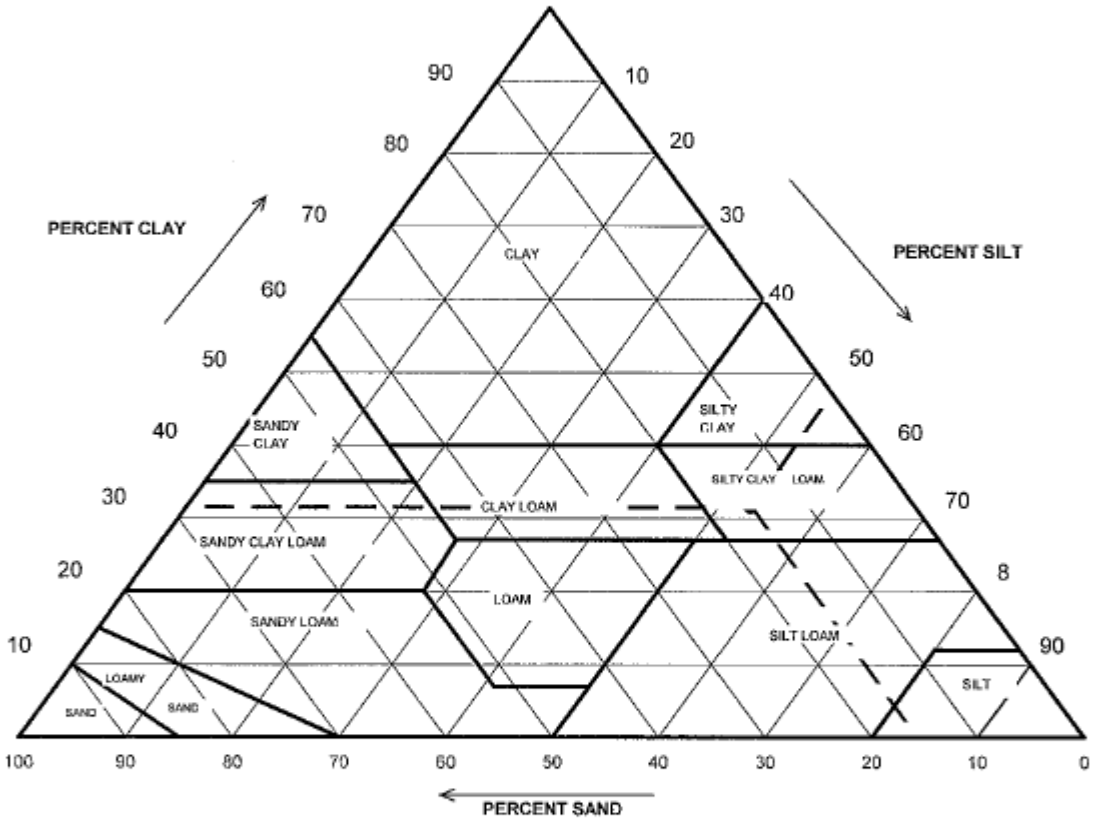
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	SS-1
Lab ID:	2013-268-001-003	Soil Color:	BROWN



Particle Size (mm)	Percent Finer (%)	USDA SUMMARY	Actual Percentage (%)	Corrected % of Minus 2.0 mm material for USDA Classificat. (%)
		Gravel	0.02	**0.00**
2	99.98	*Sand*	15.54	**15.55**
0.05	84.44	*Silt*	52.98	**52.99**
0.002	31.46	*Clay*	31.46	**31.47**

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

DCN: CT-53A DATE: 3/18/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	SS-1
Lab ID:	2013-268-001-003	Soil Color:	BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	29	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	783.41	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	669.90	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	204.61	Weight of Tare (g)	NA
Weight of Water (g)	113.51	Weight of Water (g)	NA
Weight of Dry Specimen (g)	465.29	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**24.4**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	465.29
Dry Weight of -3/4" Sample (g)	45.01	Weight of - #200 material (g)	420.28
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	45.01
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	0.09	0.02	0.02		99.98	**99.98**
#10	2.00	0.00	0.00	0.02		99.98	**99.98**
#20	0.85	0.65	0.14	0.16		99.84	**99.84**
#40	0.425	1.23	0.26	0.42		99.58	**99.58**
#60	0.250	3.64	0.78	1.21		98.79	**98.79**
#140	0.106	22.84	4.91	6.11		93.89	**93.89**
#200	0.075	16.56	3.56	9.67		90.33	**90.33**
Pan	-	420.28	90.33	100.00		-	-

Tested By	BK	Date	6/4/13	Checked By	KC	Date	6/7/13

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	SS-1
Lab ID:	2013-268-001-003	Soil Color:	BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		55.5	22.7	4.61	50.9	82.1	0.01302	0.0247	**74.2**
5		50.5	22.7	4.61	45.9	74.1	0.01302	0.0165	**66.9**
19		41.5	22.7	4.61	36.9	59.5	0.01302	0.0092	**53.8**
30		39.0	22.7	4.61	34.4	55.5	0.01302	0.0075	**50.1**
66		34.5	22.6	4.64	29.9	48.2	0.01303	0.0052	**43.5**
250		28.5	22.9	4.55	23.9	38.7	0.01299	0.0028	**34.9**
1440		22.5	23.2	4.46	18.0	29.1	0.01294	0.0012	**26.3**

Soil Specimen Data		Other Corrections		
Tare No.	2353			
Weight of Tare & Dry Material (g)	160.84	a - Factor	0.99	
Weight of Tare (g)	94.51			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	90.33	
Weight of Dry Material (g)	61.33			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 6/5/13 Checked By KC Date 6/7/13

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	SS-1
Lab ID:	2013-268-001-003	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)

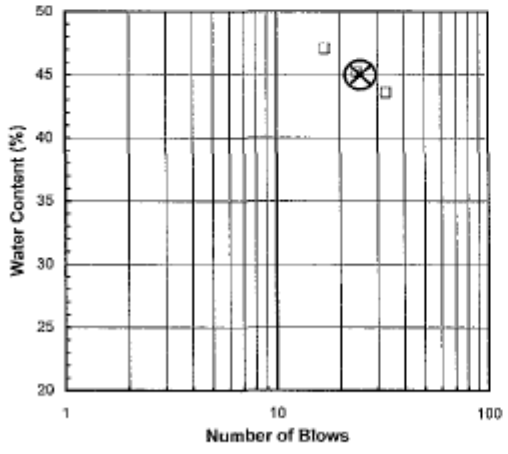
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	301	310	2301	**U**
Wt. of Tare & Wet Sample (g)	39.38	40.52	41.15	**L**
Wt. of Tare & Dry Sample (g)	32.77	33.74	34.66	**T**
Wt. of Tare (g)	18.71	18.74	19.75	**I**
Wt. of Water (g)	6.6	6.8	6.5	**P**
Wt. of Dry Sample (g)	14.1	15.0	14.9	**O**
				I
Moisture Content (%)	**47.0**	**45.2**	**43.5**	**N**
Number of Blows	**17**	**24**	**33**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	409	416	
Wt. of Tare & Wet Sample (g)	21.05	19.02	
Wt. of Tare & Dry Sample (g)	19.96	18.10	
Wt. of Tare (g)	14.90	13.85	
Wt. of Water (g)	1.1	0.9	
Wt. of Dry Sample (g)	5.1	4.3	
Moisture Content (%)	**21.5**	**21.6**	**-0.1**

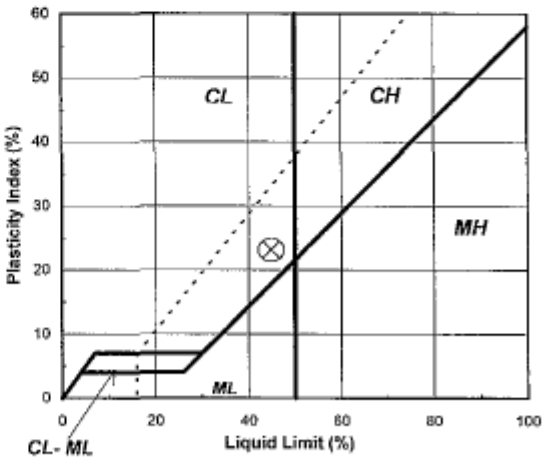
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**45**
Plastic Limit (%)	**22**
Plasticity Index (%)	**23**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By	*JP*	*Date*	*6/6/13*	*Checked By*	*KC*	*Date*	*6/7/13*

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

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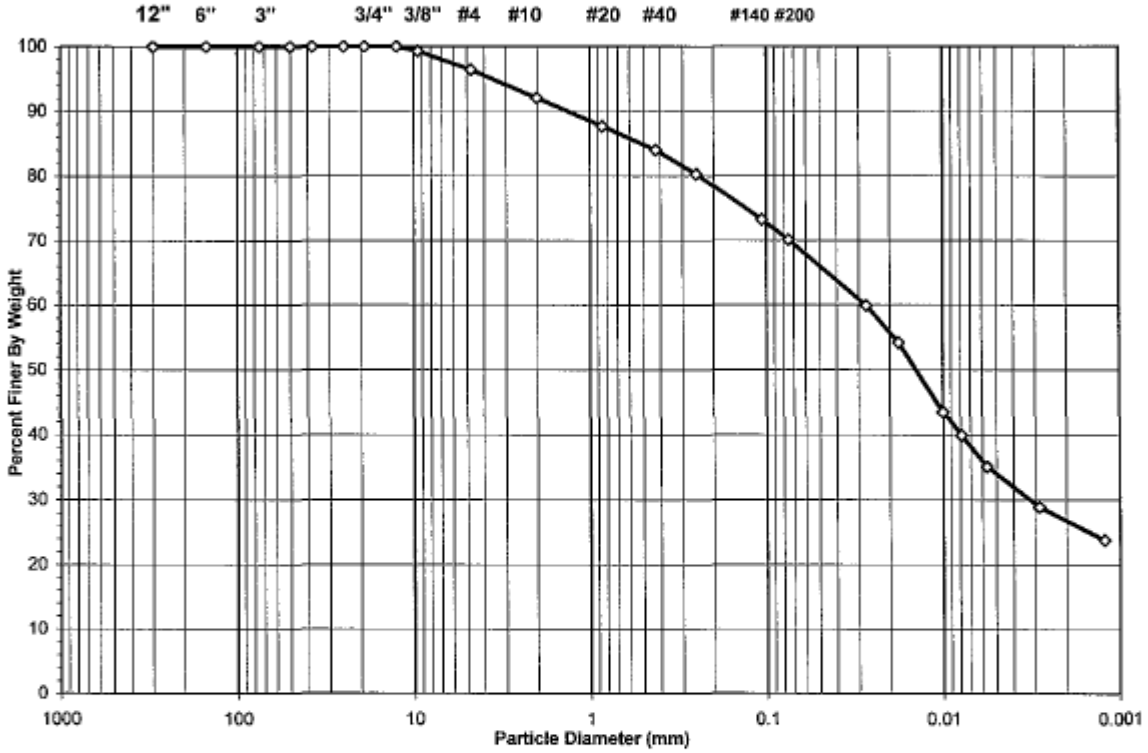
Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCW-1
Lab ID:	2013-268-002-005	Soil Color:	BROWN

	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*	3.60
#4 To #200	*Sand*	26.28
Finer Than #200	*Silt & Clay*	70.12

USCS Symbol *CL, TESTED*

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

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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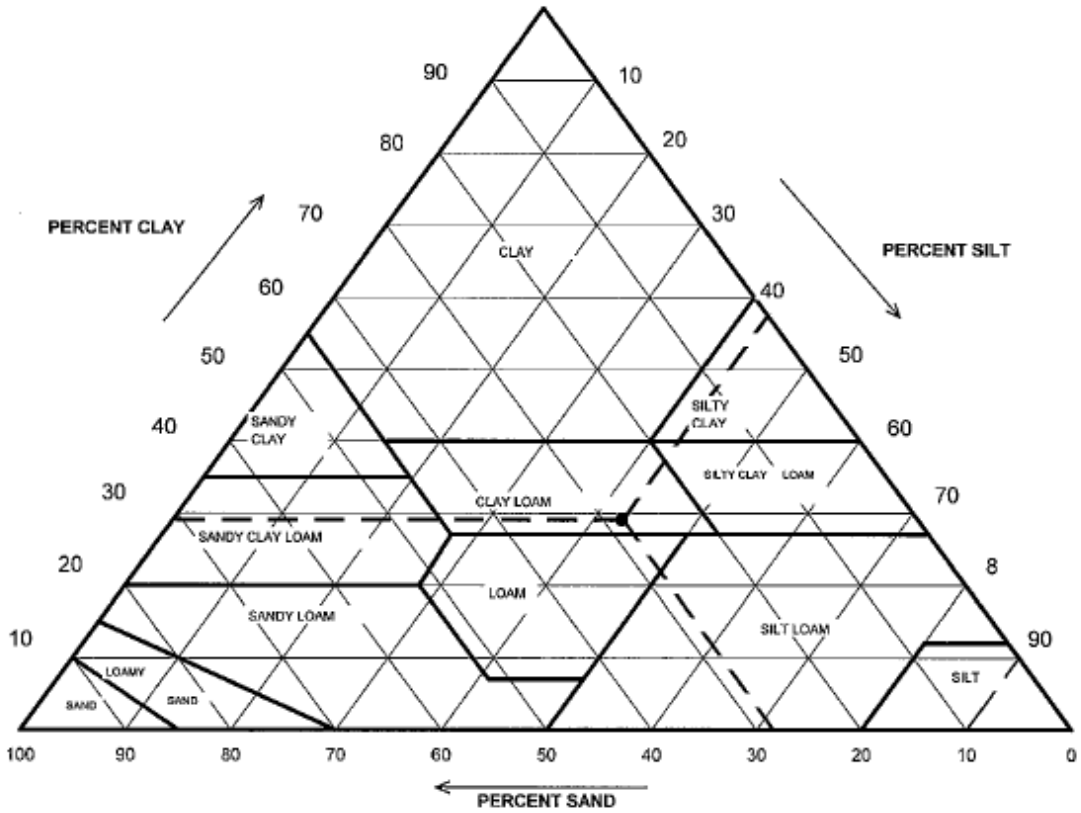
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCW-1
Lab ID:	2013-268-002-005	Soil Color:	BROWN



Particle Size (mm)	Percent Finer (%)	USDA SUMMARY	Actual Percentage (%)	Corrected % of Minus 2.0 mm material for USDA Classificat. (%)
		Gravel	7.95	**0.00**
2	92.05	*Sand*	26.00	**28.24**
0.05	66.05	*Silt*	39.31	**42.70**
0.002	26.74	*Clay*	26.74	**29.06**

USDA Classification: ***CLAY LOAM***

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCW-1
Lab ID:	2013-268-002-005	Soil Color:	BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1416	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	696.66	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	608.47	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	145.79	Weight of Tare (g)	NA
Weight of Water (g)	88.19	Weight of Water (g)	NA
Weight of Dry Specimen (g)	462.68	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**19.1**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	462.68
Dry Weight of -3/4" Sample (g)	138.23	Weight of - #200 material (g)	324.45
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	138.23
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	3.48	0.75	0.75		99.25	**99.25**
#4	4.75	13.16	2.84	3.60		96.40	**96.40**
#10	2.00	20.15	4.36	7.95		92.05	**92.05**
#20	0.85	20.36	4.40	12.35		87.65	**87.65**
#40	0.425	16.98	3.67	16.02		83.98	**83.98**
#60	0.250	17.11	3.70	19.72		80.28	**80.28**
#140	0.106	32.56	7.04	26.76		73.24	**73.24**
#200	0.075	14.43	3.12	29.88		70.12	**70.12**
Pan	-	324.45	70.12	100.00		-	-

Tested By	BK	Date	7/5/13	Checked By	KC	Date	7/10/13

DCN: CT-SSA DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCW-1
Lab ID:	2013-268-002-005	Soil Color:	BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		46.5	22.7	4.61	41.9	85.4	0.01302	0.0271	**59.9**
5		42.5	22.7	4.61	37.9	77.3	0.01302	0.0178	**54.2**
18		35.0	22.7	4.61	30.4	62.0	0.01302	0.0100	**43.5**
30		32.5	22.7	4.61	27.9	56.9	0.01302	0.0079	**39.9**
61		29.0	23.1	4.49	24.5	50.0	0.01296	0.0056	**35.1**
250		24.5	23.7	4.30	20.2	41.2	0.01287	0.0029	**28.9**
1440		21.0	23.4	4.39	16.6	33.9	0.01291	0.0012	**23.8**

Soil Specimen Data		Other Corrections		
Tare No.	695			
Weight of Tare & Dry Material (g)	147.33	a - Factor	0.99	
Weight of Tare (g)	93.79			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	70.12	
Weight of Dry Material (g)	48.54			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 7/8/13 Checked By KC Date 7/10/13

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

Sievehyd.xls

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	SCW-1
Lab ID:	2013-268-002-005	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)

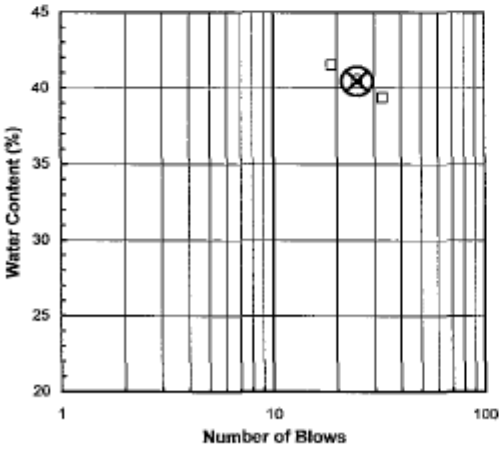
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	366	367	386	**U**
Wt. of Tare & Wet Sample (g)	39.33	44.16	43.87	**L**
Wt. of Tare & Dry Sample (g)	33.05	37.30	37.05	**T**
Wt. of Tare (g)	17.09	20.38	20.62	**I**
Wt. of Water (g)	6.3	6.9	6.8	**P**
Wt. of Dry Sample (g)	16.0	16.9	16.4	**O**
				I
Moisture Content (%)	**39.3**	**40.5**	**41.5**	**N**
Number of Blows	**33**	**25**	**19**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	408	409	
Wt. of Tare & Wet Sample (g)	27.20	21.05	
Wt. of Tare & Dry Sample (g)	26.24	20.09	
Wt. of Tare (g)	21.20	14.88	
Wt. of Water (g)	1.0	1.0	
Wt. of Dry Sample (g)	5.0	5.2	
Moisture Content (%)	**19.0**	**18.4**	**0.6**

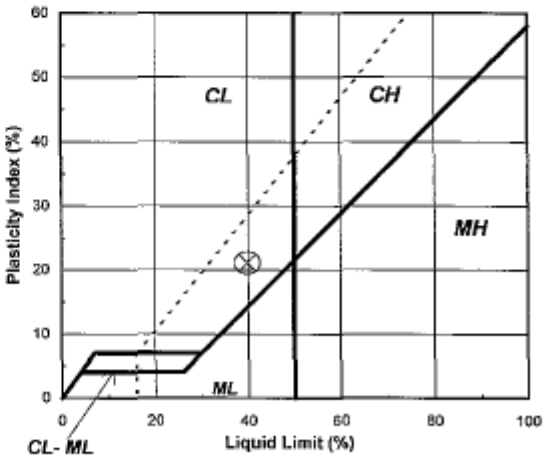
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**40**
Plastic Limit (%)	**19**
Plasticity Index (%)	**21**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By	*JP*	*Date*	*7/9/13*	*Checked By*	*KC*	*Date*	7/10/13		

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

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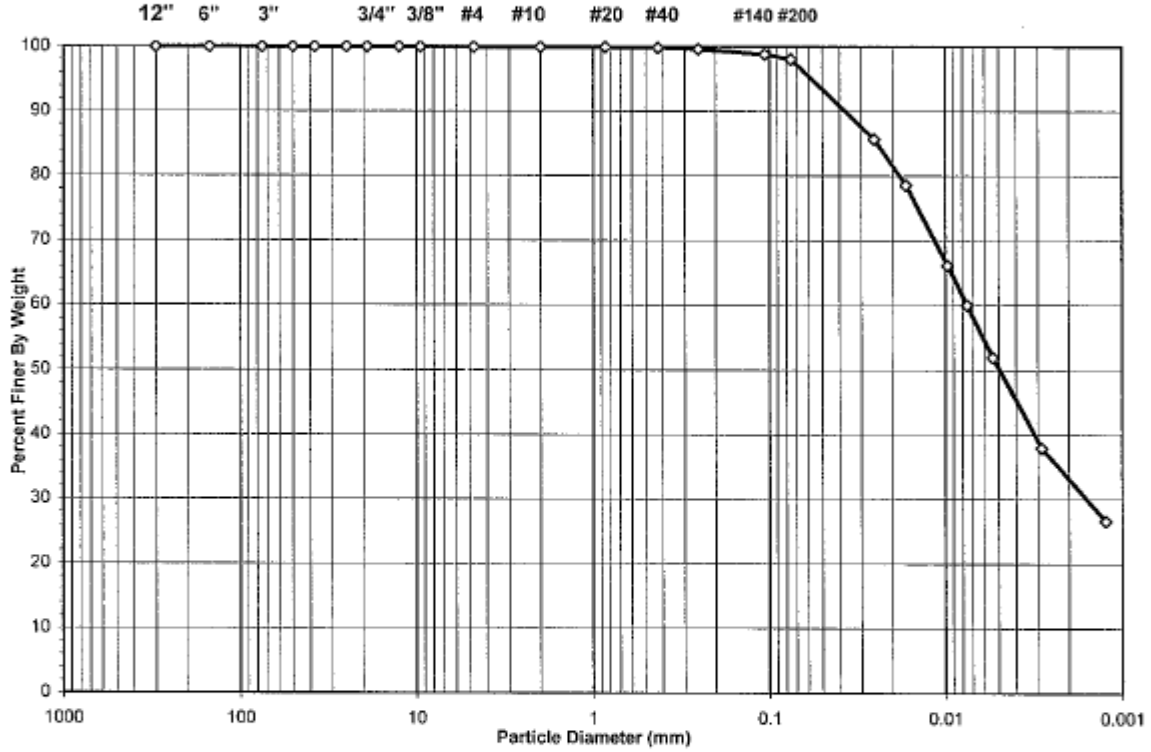
Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	TC-1
Lab ID:	2013-268-001-004	Soil Color:	BROWN

	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*	0.03
#4 To #200	*Sand*	1.91
Finer Than #200	*Silt & Clay*	98.05

USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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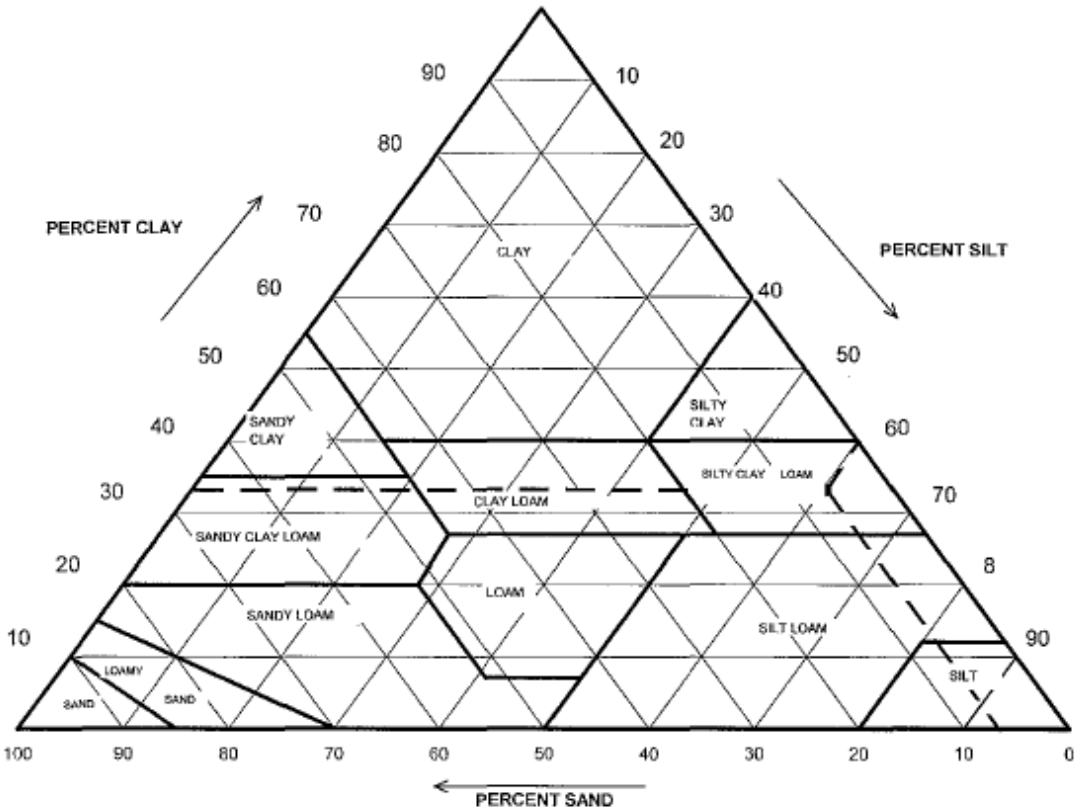
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	TC-1
Lab ID:	2013-268-001-004	Soil Color:	BROWN



Particle Size (mm)	Percent Finer (%)	USDA SUMMARY	Actual Percentage (%)	Corrected % of Minus 2.0 mm material for USDA Classificat. (%)
		Gravel	0.08	**0.00**
2	99.92	*Sand*	6.52	**6.53**
0.05	93.40	*Silt*	60.24	**60.29**
0.002	33.16	*Clay*	33.16	**33.18**

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

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	TC-1
Lab ID:	2013-268-001-004	Soil Color:	BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	47	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	850.89	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	698.60	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	203.99	Weight of Tare (g)	NA
Weight of Water (g)	152.29	Weight of Water (g)	NA
Weight of Dry Specimen (g)	494.61	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**30.8**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	494.61
Dry Weight of -3/4" Sample (g)	9.63	Weight of - #200 material (g)	484.99
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	9.63
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	0.17	0.03	0.03		99.97	**99.97**
#10	2.00	0.22	0.04	0.08		99.92	**99.92**
#20	0.85	0.03	0.01	0.08		99.92	**99.92**
#40	0.425	0.46	0.09	0.18		99.82	**99.82**
#60	0.250	0.94	0.19	0.37		99.63	**99.63**
#140	0.106	4.02	0.81	1.18		98.82	**98.82**
#200	0.075	3.79	0.77	1.95		98.05	**98.05**
Pan	-	484.99	98.05	100.00		-	-

Tested By	BK	Date	6/4/13	Checked By	KC	Date	6/7/13

DCN: CT-83A DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	TC-1
Lab ID:	2013-268-001-004	Soil Color:	BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		53.0	22.7	4.61	48.4	87.3	0.01302	0.0254	**85.6**
5		49.0	22.7	4.61	44.4	80.1	0.01302	0.0167	**78.5**
17		42.0	22.7	4.61	37.4	67.5	0.01302	0.0097	**66.2**
30		38.5	22.7	4.61	33.9	61.2	0.01302	0.0075	**60.0**
63		34.0	22.6	4.64	29.4	53.0	0.01303	0.0054	**51.9**
250		26.0	22.9	4.55	21.4	38.7	0.01299	0.0028	**38.0**
1440		19.5	23.2	4.46	15.0	27.1	0.01294	0.0012	**26.6**

Soil Specimen Data		Other Corrections		
Tare No.	889			
Weight of Tare & Dry Material (g)	162.56	a - Factor	0.99	
Weight of Tare (g)	102.7			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	98.05	
Weight of Dry Material (g)	54.86			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 6/5/13 Checked By KC Date 6/7/13

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-001	Sample No.:	TC-1
Lab ID:	2013-268-001-004	Soil Description:	**BROWN FAT 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)

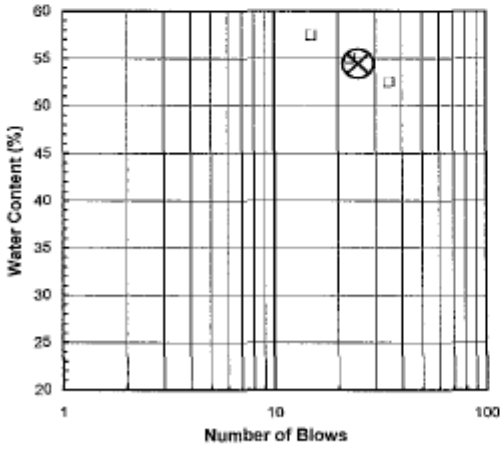
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	2289	292	418	**U**
Wt. of Tare & Wet Sample (g)	43.75	43.00	44.52	**L**
Wt. of Tare & Dry Sample (g)	35.25	34.88	36.58	**T**
Wt. of Tare (g)	20.44	20.12	21.45	**I**
Wt. of Water (g)	8.5	8.1	7.9	**P**
Wt. of Dry Sample (g)	14.8	14.8	15.1	**O**
				I
Moisture Content (%)	**57.4**	**55.0**	**52.5**	**N**
Number of Blows	**15**	**23**	**35**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	368	222	
Wt. of Tare & Wet Sample (g)	24.02	27.25	
Wt. of Tare & Dry Sample (g)	22.76	25.91	
Wt. of Tare (g)	17.97	20.89	
Wt. of Water (g)	1.3	1.3	
Wt. of Dry Sample (g)	4.8	5.0	
Moisture Content (%)	**26.3**	**26.7**	**-0.4**

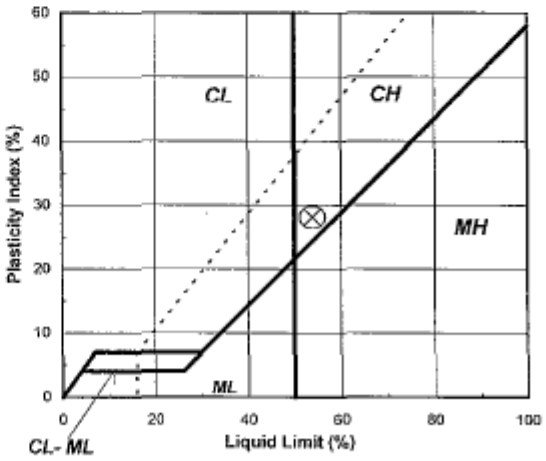
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**54**
Plastic Limit (%)	**26**
Plasticity Index (%)	**28**
USCS Symbol	**CH**

Flow Curve



Plasticity Chart



Tested By	*BK*	*Date*	*6/7/13*	*Checked By*	*KC*	*Date*	*6/10/13*

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

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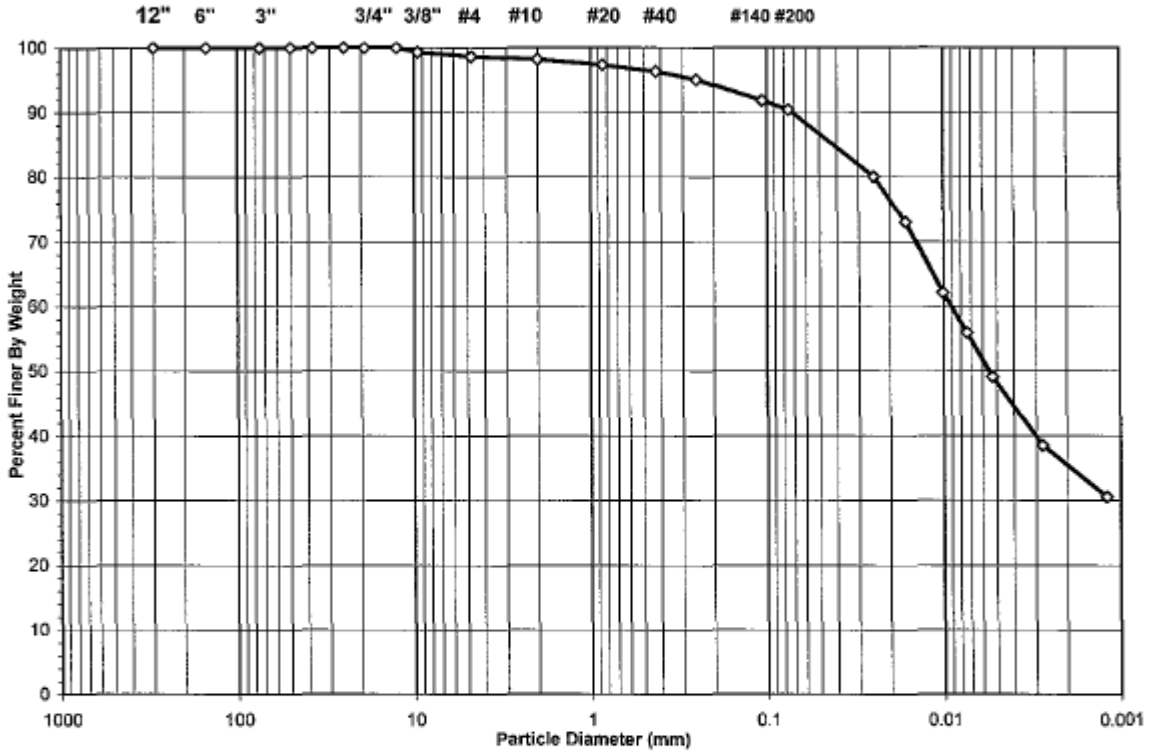
Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	WEX-1
Lab ID:	2013-268-002-004	Soil Color:	DARK BROWN

	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*	1.32
#4 To #200	*Sand*	8.29
Finer Than #200	*Silt & Clay*	90.38

USCS Symbol *CH, TESTED*

USCS Classification *FAT CLAY*

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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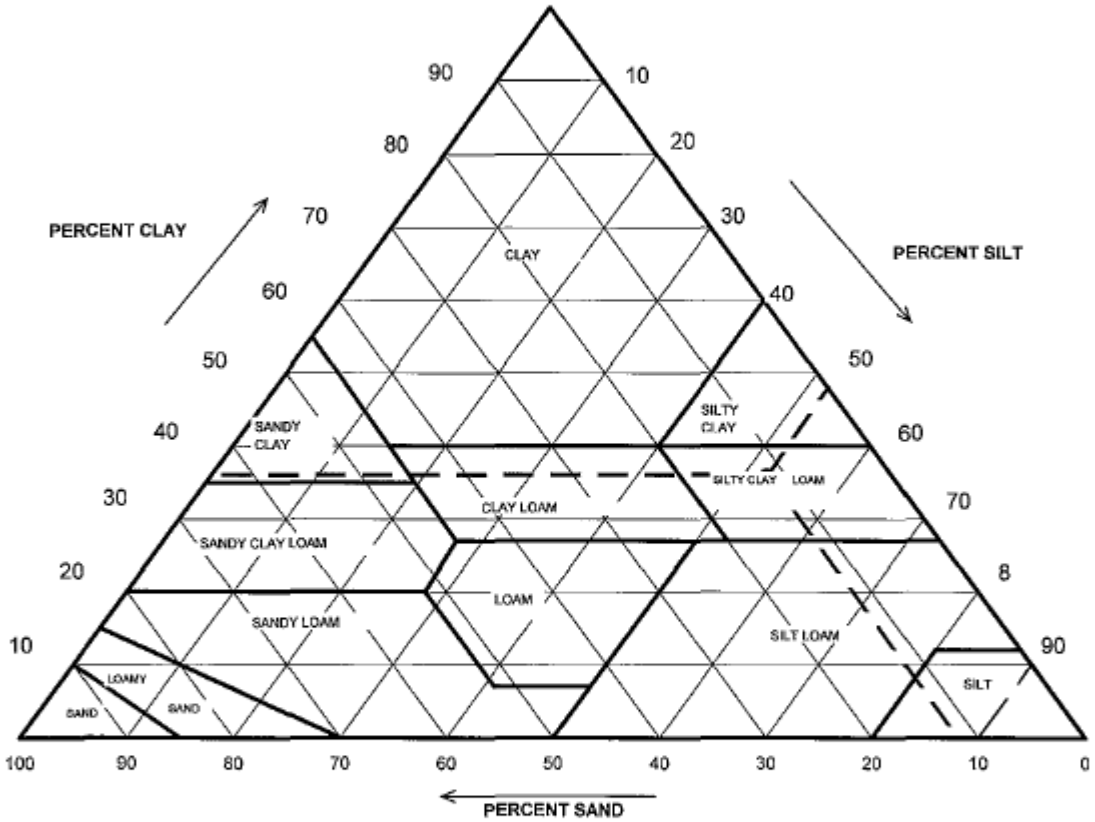
USDA CLASSIFICATION CHART

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	WEX-1
Lab ID:	2013-268-002-004	Soil Color:	DARK BROWN



Particle Size	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
(mm)	(%)		(%)	(%)
		Gravel	1.80	**0.00**
2	98.20	*Sand*	11.57	**11.78**
0.05	86.63	*Silt*	51.22	**52.16**
0.002	35.41	*Clay*	35.41	**36.06**

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

DCN: CT-53A DATE: 2/14/13 REVISION: 11

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WASH SIEVE ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	WEX-1
Lab ID:	2013-268-002-004	Soil Color:	DARK BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1418	Tare No.	NA
Wt. of Tare & Wet Specimen (g)	688.13	Wt. of Tare & Wet Specimen (g)	NA
Wt. of Tare & Dry Specimen (g)	679.27	Wt. of Tare & Dry Specimen (g)	NA
Weight of Tare (g)	145.28	Weight of Tare (g)	NA
Weight of Water (g)	8.86	Weight of Water (g)	NA
Weight of Dry Specimen (g)	533.99	Weight of Dry Specimen (g)	NA
Moisture Content (%)	**1.7**	**Moisture Content (%)**	**NA**

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Specimen (g)	533.99
Dry Weight of -3/4" Sample (g)	51.35	Weight of - #200 material (g)	482.64
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 material (g)	51.35
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
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	3.44	0.64	0.64		99.36	**99.36**
#4	4.75	3.63	0.68	1.32		98.68	**98.68**
#10	2.00	2.54	0.48	1.80		98.20	**98.20**
#20	0.85	4.57	0.86	2.66		97.34	**97.34**
#40	0.425	5.36	1.00	3.66		96.34	**96.34**
#60	0.250	6.84	1.28	4.94		95.06	**95.06**
#140	0.106	17.32	3.24	8.18		91.82	**91.82**
#200	0.075	7.65	1.43	9.62		90.38	**90.38**
Pan	-	482.64	90.38	100.00		-	-

Tested By BK Date 7/5/13 Checked By KC Date 7/10/13

DCN: CT-S3A DATE: 3/18/13 REVISION: 11

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HYDROMETER ANALYSIS

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

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	WEX-1
Lab ID:	2013-268-002-004	Soil Color:	DARK BROWN

Elapsed Time		R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)			(°C)			(%)		(mm)	(%)
0		NA	NA	NA	NA	NA	NA	NA	NA
2		56.0	22.7	4.61	51.4	88.6	0.01302	0.0246	**80.0**
5		51.5	22.7	4.61	46.9	80.8	0.01302	0.0163	**73.0**
15		44.5	22.7	4.61	39.9	68.7	0.01302	0.0101	**62.1**
30		40.5	22.7	4.61	35.9	61.9	0.01302	0.0074	**55.9**
63		36.0	23.1	4.49	31.5	54.3	0.01296	0.0053	**49.1**
250		29.0	23.7	4.30	24.7	42.6	0.01287	0.0028	**38.5**
1440		24.0	23.4	4.39	19.6	33.8	0.01291	0.0012	**30.5**

Soil Specimen Data		Other Corrections		
Tare No.	2354			
Weight of Tare & Dry Material (g)	157.15	a - Factor	0.99	
Weight of Tare (g)	94.71			
Weight of Deflocculant (g)	5.0	Percent Finer than # 200	90.38	
Weight of Dry Material (g)	57.44			
		Specific Gravity	2.7	Assumed

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

Tested By TO Date 7/8/13 Checked By KC Date 7/10/13

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10

Client:	MICROBAC	Boring No.:	NA
Client Reference:	Franklin County Background Soils	Depth (ft):	NA
Project No.:	2013-268-002	Sample No.:	WEX-1
Lab ID:	2013-268-002-004	Soil Description:	**DARK BROWN FAT 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)

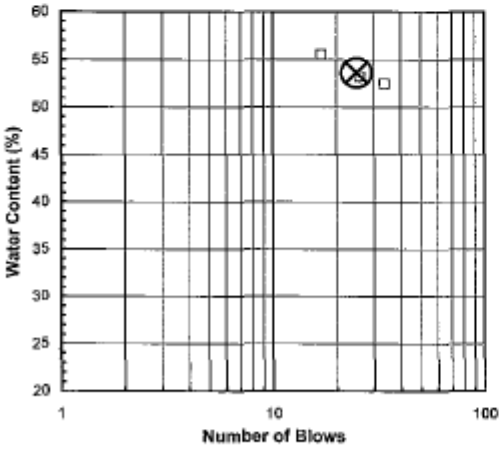
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	115	399	3166	**U**
Wt. of Tare & Wet Sample (g)	47.42	38.18	44.07	**L**
Wt. of Tare & Dry Sample (g)	37.71	29.66	34.81	**T**
Wt. of Tare (g)	19.18	13.63	18.11	**I**
Wt. of Water (g)	9.7	8.5	9.3	**P**
Wt. of Dry Sample (g)	18.5	16.0	16.7	**O**
				I
Moisture Content (%)	**52.4**	**53.2**	**55.4**	**N**
Number of Blows	**34**	**26**	**17**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	458	312	
Wt. of Tare & Wet Sample (g)	24.14	25.36	
Wt. of Tare & Dry Sample (g)	22.99	24.27	
Wt. of Tare (g)	17.92	19.30	
Wt. of Water (g)	1.2	1.1	
Wt. of Dry Sample (g)	5.1	5.0	
Moisture Content (%)	**22.7**	**21.9**	**0.8**

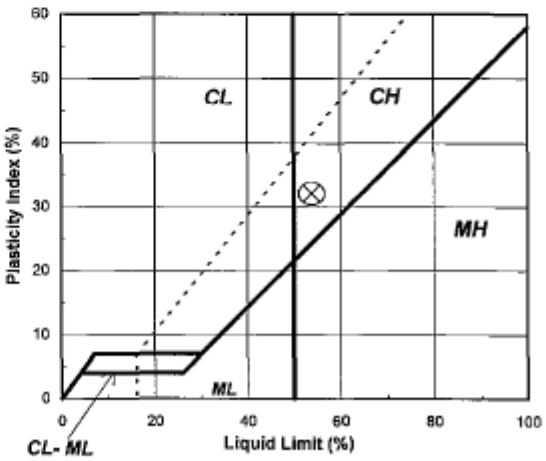
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**54**
Plastic Limit (%)	**22**
Plasticity Index (%)	**32**
USCS Symbol	**CH**

Flow Curve



Plasticity Chart



Tested By	*BK*	*Date*	*7/9/13*	*Checked By*	*KC*	*Date*	*7/9/13*

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APPENDIX D

PROUCL DATASET RUNS

General Background Statistics for Full Data Sets

User Selected Options

From File	Franklin.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	109	Number of Distinct Observations	77
Number of Missing Values	1		

Raw Statistics

Minimum	2.72
Maximum	25.4
Second Largest	25.2
First Quartile	10.6
Median	12.2
Third Quartile	15.4
Mean	12.73
SD	4.322
Coefficient of Variation	0.34
Skewness	0.303

Log-Transformed Statistics

Minimum	1.001
Maximum	3.235
Second Largest	3.227
First Quartile	2.361
Median	2.501
Third Quartile	2.734
Mean	2.473
SD	0.412

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.0933
Lilliefors Critical Value	0.0849

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.156
Lilliefors Critical Value	0.0849

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	19.26
95% UPL (t)	19.93
90% Percentile (z)	18.27
95% Percentile (z)	19.84
99% Percentile (z)	22.78

Assuming Lognormal Distribution

95% UTL with 90% Coverage	22.1
95% UPL (t)	23.55
90% Percentile (z)	20.1
95% Percentile (z)	23.34
99% Percentile (z)	30.89

Gamma Distribution Test

k star	7.057
Theta Star	1.803
MLE of Mean	12.73
MLE of Standard Deviation	4.791
nu star	1538

A-D Test Statistic	2.804
5% A-D Critical Value	0.753
K-S Test Statistic	0.126
5% K-S Critical Value	0.0872

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile	17.02
95% Percentile	19.8
99% Percentile	25.14

Assuming Gamma Distribution

90% Percentile	19.12
95% Percentile	21.49
99% Percentile	26.42
95% WH Approx. Gamma UPL	21.54
95% HW Approx. Gamma UPL	21.92
95% WH Approx. Gamma UTL with 90% Coverage	20.52
95% HW Approx. Gamma UTL with 90% Coverage	20.83

95% UTL with 90% Coverage	19.8
95% Percentile Bootstrap UTL with 90% Coverage	19.4
95% BCA Bootstrap UTL with 90% Coverage	19.3
95% UPL	20.65
95% Chebyshev UPL	31.65
Upper Threshold Limit Based upon IQR	22.6

General Background Statistics for Full Data Sets

Barium

General Statistics

Total Number of Observations	110	Number of Distinct Observations	84

Raw Statistics		Log-Transformed Statistics	
Minimum	48.9	Minimum	3.89
Maximum	163	Maximum	5.094
Second Largest	158	Second Largest	5.063
First Quartile	77.48	First Quartile	4.35
Median	102	Median	4.625
Third Quartile	128.8	Third Quartile	4.858
Mean	103.7	Mean	4.593
SD	31.43	SD	0.319
Coefficient of Variation	0.303		
Skewness	0.122		

Background Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.0897	Lilliefors Test Statistic	0.0929
Lilliefors Critical Value	0.0845	Lilliefors Critical Value	0.0845
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	151.2	95% UTL with 90% Coverage	160.1
95% UPL (t)	156.1	95% UPL (t)	168.2
90% Percentile (z)	144	90% Percentile (z)	148.7
95% Percentile (z)	155.4	95% Percentile (z)	167.1
99% Percentile (z)	176.8	99% Percentile (z)	207.7

Gamma Distribution Test		Data Distribution Test
k star	10.17	Data Follow Appr. Gamma Distribution at 5% Significance Level
Theta Star	10.19	
MLE of Mean	103.7	
MLE of Standard Deviation	32.51	
nu star	2238	

		Nonparametric Statistics	
A-D Test Statistic	1.107	90% Percentile	148
5% A-D Critical Value	0.752	95% Percentile	154
K-S Test Statistic	0.0826	99% Percentile	157.8
5% K-S Critical Value	0.0868		
Data follow Appx. Gamma Distribution at 5% Significance Level			

Assuming Gamma Distribution			
90% Percentile	146.9	95% UTL with 90% Coverage	154
95% Percentile	162.3	95% Percentile Bootstrap UTL with 90% Coverage	154
99% Percentile	193.9	95% BCA Bootstrap UTL with 90% Coverage	154
		95% UPL	154.9
95% WH Approx. Gamma UPL	162.7	95% Chebyshev UPL	241.3
95% HW Approx. Gamma UPL	163.9	Upper Threshold Limit Based upon IQR	205.7
95% WH Approx. Gamma UTL with 90% Coverage	156.1		
95% HW Approx. Gamma UTL with 90% Coverage	157		

General Background Statistics for Full Data Sets

Cadmium

General Statistics

Number of Valid Data	110
Number of Distinct Detected Data	73
Number of Detected Data	79
Number of Non-Detect Data	31
Percent Non-Detects	28.18%

Raw Statistics

Minimum Detected	0.232
Maximum Detected	1
Mean of Detected	0.478
SD of Detected	0.236
Minimum Non-Detect	0.414
Maximum Non-Detect	0.487

Log-transformed Statistics

Minimum Detected	-1.461
Maximum Detected	0
Mean of Detected	-0.841
SD of Detected	0.434
Minimum Non-Detect	-0.882
Maximum Non-Detect	-0.719

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	89
Number treated as Detected with Single DL	21
Single DL Non-Detect Percentage	80.91%

Background Statistics

Normal Distribution Test with Detected Values Only

Lilliefors Test Statistic	0.248
5% Lilliefors Critical Value	0.0997

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Lilliefors Test Statistic	0.177
5% Lilliefors Critical Value	0.0997

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	0.407
SD	0.23
95% UTL 90% Coverage	0.754
95% UPL (t)	0.789
90% Percentile (z)	0.701
95% Percentile (z)	0.784
99% Percentile (z)	0.941

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean (Log Scale)	-1.023
SD (Log Scale)	0.47
95% UTL 90% Coverage	0.732
95% UPL (t)	0.787
90% Percentile (z)	0.657
95% Percentile (z)	0.779
99% Percentile (z)	1.073

Maximum Likelihood Estimate(MLE) Method

Mean	0.0204
SD	0.554
95% UTL with 90% Coverage	0.857
95% UPL (t)	0.943
90% Percentile (z)	0.73
95% Percentile (z)	0.931
99% Percentile (z)	1.308

Log ROS Method

Mean in Original Scale	0.444
SD in Original Scale	0.207
95% UTL with 90% Coverage	0.727
95% BCA UTL with 90% Coverage	0.915
95% Bootstrap (%) UTL with 90% Coverage	0.927
95% UPL (t)	0.771
90% Percentile (z)	0.666
95% Percentile (z)	0.765
99% Percentile (z)	0.991

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	4.902
Theta Star	0.0974
nu star	774.5
A-D Test Statistic	5.113
5% A-D Critical Value	0.754
K-S Test Statistic	0.204
5% K-S Critical Value	0.101

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.481
Median	0.438
SD	0.2
k star	6.773
Theta star	0.071
Nu star	1490
95% Percentile of Chisquare (2k)	23.08
90% Percentile	0.728
95% Percentile	0.82
99% Percentile	1.011

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.438
SD	0.211
SE of Mean	0.0205
95% KM UTL with 90% Coverage	0.756
95% KM Chebyshev UPL	1.36
95% KM UPL (t)	0.789
90% Percentile (z)	0.708
95% Percentile (z)	0.784
99% Percentile (z)	0.928

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.821
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.823
95% WH Approx. Gamma UTL with 90% Coverage	0.781
95% HW Approx. Gamma UTL with 90% Coverage	0.782

	A	B	C	D	E	F	G	H	I	J	K	L
1				General Background Statistics for Data Sets with Non-Detects								
2			User Selected Options									
3			From File	Sheet1.wst								
4			Full Precision	ON								
5			Confidence Coefficient	95%								
6			Coverage	90%								
7			Different or Future K Values	1								
8			Number of Bootstrap Operations	2000								
9												
10												
11	Chromium											
12												
13						General Statistics						
14						Number of Valid Data	110				Number of Detected Data	108
15						Number of Distinct Detected Data	96				Number of Non-Detect Data	2
16						Tolerance Factor	1.5116741				Percent Non-Detects	1.82%
17												
18						Raw Statistics					Log-transformed Statistics	
19						Minimum Detected	0.764				Minimum Detected	-0.269187
20						Maximum Detected	19.8				Maximum Detected	2.9856819
21						Mean of Detected	9.0690185				Mean of Detected	2.1070083
22						SD of Detected	3.6674103				SD of Detected	0.4897115
23						Minimum Non-Detect	0.825				Minimum Non-Detect	-0.192372
24						Maximum Non-Detect	9.1				Maximum Non-Detect	2.2082744
25												
26						Data with Multiple Detection Limits					Single Detection Limit Scenario	
27						Note: Data have multiple DLs - Use of KM Method is recommended					Number treated as Non-Detect with Single DL	61
28						For all methods (except KM, DL/2, and ROS Methods),					Number treated as Detected with Single DL	49
29						Observations < Largest ND are treated as NDs					Single DL Non-Detect Percentage	55.45%
30												
31						Background Statistics						
32						Normal Distribution Test with Detected Values Only					Lognormal Distribution Test with Detected Values Only	
33						Lilliefors Test Statistic	0.0733384				Lilliefors Test Statistic	0.0888504
34						5% Lilliefors Critical Value	0.0852554				5% Lilliefors Critical Value	0.0852554
35						Data appear Normal at 5% Significance Level					Data not Lognormal at 5% Significance Level	
36												
37						Assuming Normal Distribution					Assuming Lognormal Distribution	
38						DL/2 Substitution Method					DL/2 Substitution Method	
39						Mean	8.9492409				Mean (Log Scale)	2.0744228
40						SD	3.7501289				SD (Log Scale)	0.5654357
41						95% UTL 90% Coverage	14.618214				95% UTL 90% Coverage	18.712228
42						95% UPL (t)	15.198745				95% UPL (t)	20.423954
43						90% Percentile (z)	13.755224				90% Percentile (z)	16.429159
44						95% Percentile (z)	15.117654				95% Percentile (z)	20.175755
45						99% Percentile (z)	17.673345				99% Percentile (z)	29.660696
46												
47						Maximum Likelihood Estimate(MLE) Method					Log ROS Method	
48						Mean	8.4398727				Mean in Original Scale	8.9832435
49						SD	4.3106051				SD in Original Scale	3.6959796
50						95% UTL with 90% Coverage	14.956103				95% UTL with 90% Coverage	17.23538

	A	B	C	D	E	F	G	H	I	J	K	L
1				General Background Statistics for Full Data Sets								
2			User Selected Options									
3			From File	Sheet1_b.wst								
4			Full Precision	ON								
5			Confidence Coefficient	95%								
6			Coverage	90%								
7			Different or Future K Values	1								
8			Number of Bootstrap Operations	2000								
9												
10												
11	Lead											
12												
13						General Statistics						
14						Total Number of Observations	110				Number of Distinct Observations	78
15						Tolerance Factor	1.5116741					
16												
17						Raw Statistics					Log-Transformed Statistics	
18						Minimum	12.7				Minimum	2.541602
19						Maximum	51.1				Maximum	3.9337845
20						Second Largest	45.3				Second Largest	3.813307
21						First Quartile	16.975				First Quartile	2.8317126
22						Median	19.05				Median	2.9470637
23						Third Quartile	24.325				Third Quartile	3.1914903
24						Mean	22.42				Mean	3.0519496
25						Geometric Mean	21.156551				SD	0.3265079
26						SD	8.4780321					
27						Coefficient of Variation	0.3781459					
28						Skewness	1.4377207					
29												
30						Background Statistics						
31						Normal Distribution Test					Lognormal Distribution Test	
32						Lilliefors Test Statistic	0.2487068				Lilliefors Test Statistic	0.1989465
33						Lilliefors Critical Value	0.0844768				Lilliefors Critical Value	0.0844768
34						Data not Normal at 5% Significance Level					Data not Lognormal at 5% Significance Level	
35												
36						Assuming Normal Distribution					Assuming Lognormal Distribution	
37						95% UTL with 90% Coverage	35.236021				95% UTL with 90% Coverage	34.65781
38						95% UPL (t)	36.548448				95% UPL (t)	36.454596
39						90% Percentile (z)	33.285035				90% Percentile (z)	32.149158
40						95% Percentile (z)	36.365122				95% Percentile (z)	36.198123
41						99% Percentile (z)	42.142852				99% Percentile (z)	45.219143
42												
43						Gamma Distribution Test					Data Distribution Test	
44						k star	8.5499876				Data do not follow a Discernable Distribution (0.05)	
45						Theta Star	2.622226					
46						MLE of Mean	22.42					
47						MLE of Standard Deviation	7.6674838					
48						nu star	1880.9973					
49												
50						A-D Test Statistic	5.9967104				Nonparametric Statistics	

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

Mercury

General Statistics

Total Number of Observations	97	Number of Distinct Observations	90
Tolerance Factor	1.528	Number of Missing Values	14

Raw Statistics		Log-Transformed Statistics	
Minimum	0.0185	Minimum	-3.99
Maximum	0.092	Maximum	-2.386
Second Largest	0.0857	Second Largest	-2.457
First Quartile	0.0283	First Quartile	-3.565
Median	0.0388	Median	-3.249
Third Quartile	0.0486	Third Quartile	-3.024
Mean	0.041	Mean	-3.267
SD	0.0166	SD	0.379
Coefficient of Variation	0.405	Back-transformed MAL (mean + 2 SD)	0.0813
Skewness	1.083		

Background Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.11	Lilliefors Test Statistic	0.0841
Lilliefors Critical Value	0.09	Lilliefors Critical Value	0.09
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	0.0664	95% UTL with 90% Coverage	0.068
95% UPL (t)	0.0687	95% UPL (t)	0.0717
90% Percentile (z)	0.0623	90% Percentile (z)	0.0619
95% Percentile (z)	0.0683	95% Percentile (z)	0.0711
99% Percentile (z)	0.0796	99% Percentile (z)	0.092

Gamma Distribution Test		Data Distribution Test
k star	6.767	Data appear Lognormal at 5% Significance Level
Theta Star	0.00606	
MLE of Mean	0.041	
MLE of Standard Deviation	0.0158	
nu star	1313	
A-D Test Statistic	1.185	**Nonparametric Statistics**
5% A-D Critical Value	0.754	90% Percentile 0.0676
K-S Test Statistic	0.0966	95% Percentile 0.0742
5% K-S Critical Value	0.091	99% Percentile 0.086
Data not Gamma Distributed at 5% Significance Level		

Assuming Gamma Distribution			
90% Percentile	0.0621	95% UTL with 90% Coverage	0.0719
95% Percentile	0.0699	95% Percentile Bootstrap UTL with 90% Coverage	0.0726
99% Percentile	0.0863	95% BCA Bootstrap UTL with 90% Coverage	0.0726
		95% UPL	0.0765
		95% Chebyshev UPL	0.114
95% WH Approx. Gamma UPL	0.0701	Upper Threshold Limit Based upon IQR	0.0791
95% HW Approx. Gamma UPL	0.0704		
95% WH Approx. Gamma UTL with 90% Coverage	0.067		
95% HW Approx. Gamma UTL with 90% Coverage	0.0672		

	A	B	C	D	E	F	G	H	I	J	K	L
1				General Background Statistics for Full Data Sets								
2			User Selected Options									
3			From File	Sheet1_a.wst								
4			Full Precision	ON								
5			Confidence Coefficient	95%								
6			Coverage	90%								
7			Different or Future K Values	1								
8			Number of Bootstrap Operations	2000								
9												
10												
11	Nickel											
12												
13						General Statistics						
14						Total Number of Observations	110				Number of Distinct Observations	89
15						Tolerance Factor	1.5116741					
16												
17						Raw Statistics					Log-Transformed Statistics	
18						Minimum	10.9				Minimum	2.3887628
19						Maximum	39				Maximum	3.6635616
20						Second Largest	38				Second Largest	3.6375862
21						First Quartile	14.95				First Quartile	2.7046946
22						Median	17.85				Median	2.8819054
23						Third Quartile	25.95				Third Quartile	3.256166
24						Mean	20.738182				Mean	2.9746341
25						Geometric Mean	19.582457				SD	0.3356192
26						SD	7.3043154					
27						Coefficient of Variation	0.3522158					
28						Skewness	0.8268625					
29												
30						Background Statistics						
31						Normal Distribution Test					Lognormal Distribution Test	
32						Lilliefors Test Statistic	0.166269				Lilliefors Test Statistic	0.1247669
33						Lilliefors Critical Value	0.0844768				Lilliefors Critical Value	0.0844768
34						Data not Normal at 5% Significance Level					Data not Lognormal at 5% Significance Level	
35												
36						Assuming Normal Distribution					Assuming Lognormal Distribution	
37						95% UTL with 90% Coverage	31.779926				95% UTL with 90% Coverage	32.524087
38						95% UPL (t)	32.910657				95% UPL (t)	34.25854
39						90% Percentile (z)	30.099039				90% Percentile (z)	30.10669
40						95% Percentile (z)	32.752712				95% Percentile (z)	34.010815
41						99% Percentile (z)	37.730561				99% Percentile (z)	42.751365
42												
43						Gamma Distribution Test					Data Distribution Test	
44						k star	8.646743				Data do not follow a Discernable Distribution (0.05)	
45						Theta Star	2.3983807					
46						MLE of Mean	20.738182					
47						MLE of Standard Deviation	7.0525212					
48						nu star	1902.2835					
49												
50						A-D Test Statistic	2.331018				Nonparametric Statistics	

	A	B	C	D	E	F	G	H	I	J	K	L
1					Outlier Tests for Selected Variables							
2				User Selected Options								
3				From File	K:\CCA\EPA\VAP\Background\Franklin County\Chromium.xls.wst							
4				Full Precision	OFF							
5				Test for Suspected Outliers with Dixon test	1							
6				Test for Suspected Outliers for Rosner test	1							
7												
8												
9				Rosner's Outlier Test for Chromium								
10												
11												
12				Mean	4.542							
13				Standard Deviation	1.902							
14				Number of data	110							
15				Number of suspected outliers	1							
16												
17				Potential	Obs.	Test	Critical	Critical				
18	#	Mean	sd	outlier	Number	value	value (5%)	value (1%)				
19	1	4.542	1.893	9.9	1	2.83	3.408	3.778				
20												
21	For 5% Significance Level, there is no Potential Outlier											
22												
23	For 1% Significance Level, there is no Potential Outlier											
24												

	A	B	C	D	E	F	G	H	I	J	K	L
1					Outlier Tests for Selected Variables							
2			User Selected Options									
3			From File		Sheet1_b.wst							
4			Full Precision		ON							
5		Test for Suspected Outliers with Dixon test			1							
6		Test for Suspected Outliers with Rosner test			1							
7												
8												
9			Rosner's Outlier Test for Lead									
10												
11												
12			Mean	22.42								
13			Standard Deviation	8.478								
14			Number of data	110								
15		Number of suspected outliers		1								
16												
17				Potential	Obs.	Test	Critical	Critical				
18	#	Mean	sd	outlier	Number	value	value (5%)	value (1%)				
19	1	22.42	8.439	51.1	1	3.398	3.408	3.778				
20												
21	For 5% Significance Level, there is no Potential Outlier											
22												
23	For 1% Significance Level, there is no Potential Outlier											
24												

	A	B	C	D	E	F	G	H	I	J	K	L
1					Outlier Tests for Selected Variables							
2			User Selected Options									
3			From File		Sheet1_a.wst							
4			Full Precision		ON							
5			Test for Suspected Outliers with Dixon test		1							
6			Test for Suspected Outliers for Rosner test		1							
7												
8												
9			Rosner's Outlier Test for Nickel									
10												
11												
12			Mean	10.37								
13			Standard Deviation	3.652								
14			Number of data	110								
15			Number of suspected outliers	1								
16												
17				Potential	Obs.	Test	Critical	Critical				
18	#	Mean	sd	outlier	Number	value	value (5%)	value (1%)				
19	1	10.37	3.636	19.5	1	2.512	3.408	3.778				
20												
21	For 5% Significance Level, there is no Potential Outlier											
22												
23	For 1% Significance Level, there is no Potential Outlier											
24												

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

Selenium

General Statistics

Total Number of Observations	110	Number of Distinct Observations	105
Tolerance Factor	1.512	Number of Missing Values	1

Raw Statistics		Log-Transformed Statistics	
Minimum	0.164	Minimum	-1.808
Maximum	1.11	Maximum	0.104
Second Largest	1.07	Second Largest	0.0677
First Quartile	0.516	First Quartile	-0.662
Median	0.689	Median	-0.373
Third Quartile	0.808	Third Quartile	-0.214
Mean	0.651	Mean	-0.496
SD	0.211	SD	0.398
Coefficient of Variation	0.325		
Skewness	-0.29		

Background Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.0801	Lilliefors Test Statistic	0.134
Lilliefors Critical Value	0.0845	Lilliefors Critical Value	0.0845
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% UTL with 90% Coverage	0.971	95% UTL with 90% Coverage	1.111
95% UPL (t)	1.004	95% UPL (t)	1.182
90% Percentile (z)	0.922	90% Percentile (z)	1.014
95% Percentile (z)	0.999	95% Percentile (z)	1.171
99% Percentile (z)	1.143	99% Percentile (z)	1.536

Gamma Distribution Test		Data Distribution Test
k star	7.423	Data appear Normal at 5% Significance Level
Theta Star	0.0877	
MLE of Mean	0.651	
MLE of Standard Deviation	0.239	
nu star	1633	
A-D Test Statistic	1.956	
5% A-D Critical Value	0.753	
K-S Test Statistic	0.119	
5% K-S Critical Value	0.0869	
Data not Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
90% Percentile	0.901
95% Percentile	0.949
99% Percentile	1.069

Assuming Gamma Distribution			
90% Percentile	0.97	95% UTL with 90% Coverage	0.927
95% Percentile	1.087	95% Percentile Bootstrap UTL with 90% Coverage	0.937
99% Percentile	1.331	95% BCA Bootstrap UTL with 90% Coverage	0.937
		95% UPL	0.982
		95% Chebyshev UPL	1.577
95% WH Approx. Gamma UPL	1.091	Upper Threshold Limit Based upon IQR	1.245
95% HW Approx. Gamma UPL	1.109		
95% WH Approx. Gamma UTL with 90% Coverage	1.04		
95% HW Approx. Gamma UTL with 90% Coverage	1.054		

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

Thallium

General Statistics

Total Number of Observations	110	Number of Distinct Observations	99
Tolerance Factor	1.512	Number of Missing Values	1

Raw Statistics		Log-Transformed Statistics	
Minimum	0.131	Minimum	-2.033
Maximum	0.956	Maximum	-0.045
Second Largest	0.836	Second Largest	-0.179
First Quartile	0.305	First Quartile	-1.187
Median	0.378	Median	-0.974
Third Quartile	0.526	Third Quartile	-0.643
Mean	0.429	Mean	-0.916
SD	0.164	SD	0.372
Coefficient of Variation	0.382		
Skewness	0.873		

Background Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.152	Lilliefors Test Statistic	0.0873
Lilliefors Critical Value	0.0845	Lilliefors Critical Value	0.0845
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	0.676	95% UTL with 90% Coverage	0.702
95% UPL (t)	0.701	95% UPL (t)	0.744
90% Percentile (z)	0.638	90% Percentile (z)	0.645
95% Percentile (z)	0.698	95% Percentile (z)	0.738
99% Percentile (z)	0.809	99% Percentile (z)	0.951

Gamma Distribution Test		Data Distribution Test
k star	7.232	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.0593	
MLE of Mean	0.429	
MLE of Standard Deviation	0.159	
nu star	1591	
A-D Test Statistic	1.39	**Nonparametric Statistics**
5% A-D Critical Value	0.753	90% Percentile 0.675
K-S Test Statistic	0.111	95% Percentile 0.728
5% K-S Critical Value	0.0869	99% Percentile 0.833
Data not Gamma Distributed at 5% Significance Level		

Assuming Gamma Distribution			
90% Percentile	0.641	95% UTL with 90% Coverage	0.71
95% Percentile	0.72	95% Percentile Bootstrap UTL with 90% Coverage	0.71
99% Percentile	0.883	95% BCA Bootstrap UTL with 90% Coverage	0.71
		95% UPL	0.743
		95% Chebyshev UPL	1.145
95% WH Approx. Gamma UPL	0.721	Upper Threshold Limit Based upon IQR	0.857
95% HW Approx. Gamma UPL	0.726		
95% WH Approx. Gamma UTL with 90% Coverage	0.687		
95% HW Approx. Gamma UTL with 90% Coverage	0.69		

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 Mercury (first 10)

Mean	0.0572
Standard Deviation	0.0496
Number of data	110
Number of suspected outliers	10

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.0572	0.0494	0.27	1	4.311	3.408	3.778
2	0.0552	0.0454	0.244	2	4.16	3.406	3.778
3	0.0535	0.0417	0.214	3	3.846	3.406	3.778
4	0.052	0.0389	0.195	4	3.677	3.398	3.768
5	0.0506	0.0365	0.189	5	3.793	3.398	3.768
6	0.0493	0.034	0.184	6	3.958	3.394	3.764
7	0.048	0.0315	0.184	7	4.319	3.391	3.761
8	0.0467	0.0286	0.173	8	4.417	3.387	3.757
9	0.0454	0.0258	0.159	9	4.399	3.384	3.754
10	0.0443	0.0233	0.147	10	4.407	3.38	3.75

For 5% significance level, there are 10 Potential Outliers

Therefore, Potential Statistical Outliers are

0.27, 0.244, 0.214, 0.195, 0.189, 0.184, 0.184, 0.173, 0.159, 0.147

For 1% Significance Level, there are 10 Potential Outliers

Therefore, Potential Statistical Outliers are

0.27, 0.244, 0.214, 0.195, 0.189, 0.184, 0.184, 0.173, 0.159, 0.147

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 Mercury (second 10)

Mean	**0.0433**
Standard Deviation	**0.021**
Number of data	**100**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.0433	0.0209	0.134	1	4.342	3.38	3.75
2	0.0424	0.019	0.114	2	3.772	3.38	3.75
3	0.0416	0.0176	0.102	3	3.424	3.38	3.75
4	0.041	0.0166	0.092	4	3.07	3.37	3.74
5	0.0405	0.0158	0.0857	5	2.854	3.37	3.74
6	0.04	0.0152	0.0832	6	2.838	3.366	3.736
7	0.0395	0.0146	0.0778	7	2.615	3.362	3.732
8	0.0391	0.0141	0.0763	8	2.627	3.358	3.728
9	0.0387	0.0137	0.0737	9	2.557	3.354	3.724
10	0.0383	0.0132	0.0719	10	2.534	3.35	3.72

For 5% significance level, there are 3 Potential Outliers

Therefore, Potential Statistical Outliers are

0.134, 0.114, 0.102

For 1% Significance Level, there are 2 Potential Outliers

Therefore, Potential Statistical Outliers are

0.134, 0.114

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 Selenium

Mean	**0.651**
Standard Deviation	**0.211**
Number of data	**110**
Number of suspected outliers	**10**

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.651	0.211	0.164	110	2.314	3.408	3.778
2	0.656	0.207	0.198	109	2.209	3.406	3.778
3	0.66	0.203	0.199	108	2.266	3.406	3.778
4	0.664	0.199	0.2	107	2.329	3.398	3.768
5	0.669	0.195	0.213	106	2.336	3.398	3.768
6	0.673	0.191	1.11	1	2.292	3.394	3.764
7	0.669	0.187	0.251	105	2.237	3.391	3.761
8	0.673	0.183	0.253	104	2.294	3.387	3.757
9	0.677	0.179	1.07	2	2.196	3.384	3.754
10	0.673	0.176	1.06	3	2.205	3.38	3.75

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 Thallium

Mean	0.429
Standard Deviation	0.164
Number of data	110
Number of suspected outliers	10

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.429	0.163	0.956	39	3.236	3.408	3.778
2	0.424	0.156	0.836	34	2.637	3.406	3.778
3	0.42	0.152	0.806	40	2.542	3.406	3.778
4	0.416	0.148	0.752	104	2.27	3.398	3.768
5	0.413	0.145	0.743	32	2.276	3.398	3.768
6	0.41	0.142	0.743	33	2.346	3.394	3.764
7	0.407	0.139	0.71	31	2.185	3.391	3.761
8	0.404	0.136	0.71	35	2.249	3.387	3.757
9	0.401	0.133	0.701	36	2.251	3.384	3.754
10	0.398	0.131	0.699	51	2.306	3.38	3.75

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier