GEOTECHNICAL ENGINEERING REPORT

SUBGRADE EXPLORATION

PID, No. 90465

11TH STREET IMPROVEMENTS

Prepared for

City of Canton
2436 30th Street NE
Canton, Ohio 44705

August 1, 2013

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This project for the City of Canton, 11th Street Improvements (PID 90465), extends from Market Avenue South (Market Ave) to Cherry Avenue Southeast (Cherry Ave) along 11th Street Southeast (11th Street) and includes improvements to Market Ave and Cherry Ave north of 11th Street in the City of Canton, Ohio. The project consists of the following:

- Realignment of 11th Street through a vacant industrial parcel and resurfacing the existing portions of 11th Street that are not affected by the realignment.
- Widening of 11th Street to include an area for a center turn lane and two bike lanes.
- Reconfiguring the intersection of 11th Street and Cherry Ave to include a traffic circle roundabout.
- Resurfacing the roadway and reconstruction of roadway curbs for Market Ave from 11th Street to Halliwell Place Southwest,
- Resurfacing Cherry Avenue SE just north of the proposed roundabout to the Cherry Ave bridge overpass.

A subsurface exploration of the project area was performed, in general accordance with the Ohio Department of Transportation's (ODOT's) *Specifications for Geotechnical Explorations* (SGE). The exploration focused on establishing the geotechnical characteristics of the subgrade soils that will support new pavement for the proposed realignment and widening of 11th Street and new roadway resurfacing on Cherry and Market Ave.

A total of five (5) borings were drilled within the project limits. Three (3) borings designated for the proposed roadway widening and bike path were extended to a depth of 6 to 8 feet below the ground surface (bgs), and two (2) borings were advanced 10 ft bgs to establish the existing conditions within the new 11th Street alignment. In addition, three (3) pavement cores were advanced through existing pavements to establish the existing pavement cross-sections. Two pavement cores were advanced within the Market Ave roadway and one core was advanced within the Cherry Ave roadway.

The subsurface profile consisted of surficial materials consisting of topsoil or roadway pavement materials and base, overlying fill materials, and natural deposits. The majority of fill soils encountered were coarse-grained materials, with classifications of coarse and fine sand (A-3a), gravel and/or stone fragments with sand (A-1-b) most often encountered. Isolated layers of fine-grained fill soils (with A-4a and A-6a classifications) were occasionally encountered interbedded with the coarse-grained fill soils. The granular fill had a relative density range of loose to medium dense and the fine-grained fill had a medium stiff to stiff consistency. The majority of natural soils encountered on the project were granular with similar classifications to the

overlying granular fills soils (A-3a and A-1-b) and with a loose to dense relative density. All borings advanced to date were terminated within either the fill or native soils and were not extend to depths deep enough to encounter the underlying bedrock.

Subgrade evaluation per the recommendations given in ODOT's *Geotechnical Bulletin No. 1 Plan Subgrades* (GB-1) was performed. The analysis indicates that some areas within the project will require improvement to the subgrade. Proofrolling (in accordance with ODOT item 204) will identify the isolated regions of unsuitable subgrade which at this time is anticipated to be on the order of 20% of the roadway improvements surface limits. Given the length of the project (less than a ½ mile) and the results of the GB-1 evaluation, global stabilization of the subgrade soils is not anticipated. In lieu of global stabilization, the regions of the new roadway that do require subsurface stabilization are recommended to utilize full depth replacement of pavement materials and undercut and replacement of unsuitable soils. The undercut depth should extend to a minimum depth of 18-inches and should be replaced with Granular Material Type B, in accordance with ODOT GB-1.

1.1 EXISTING SITE CONDITIONS

The proposed 11th Street Improvements project (PID No. 90465) extends along 11th Street SE (11th Street) from the intersection of Market Avenue S (Market Ave) at (11th Street Sta. 3+16.) to the intersection of Cherry Avenue SE (Cherry Ave) at (11th Street Sta. 19+65). The project also includes improvements to Market Ave and Cherry Ave (State Route 43) to the north of 11th Street. The project location is northeast of the Interstate 77 and State Route 30 interchange and north of State Route 30 in the industrial portions of the City of Canton in Stark County, Ohio. The site location and extent are shown on the Site Location Map and Boring Location Map included as **Appendix A and B** respectively**.**

The segment of 11th Street roadway between Market and Cherry Ave targeted for improvement is an asphalt pavement roadway generally comprised mostly of two lane traffic, where the roadway is a single east and west bound traffic lane. At the intersection with Market Ave, the westbound 11th Street traffic is segregated by a triangular concrete divider to separate the westbound traffic from the right turning lane onto Market Ave northbound. Market Ave north of 11th Street is a four lane roadway that transitions into a five lane roadway where the 11th Street westbound traffic turning lane merges onto Market Ave northbound traffic. On the eastern end of 11th street near the Rex Avenue SE intersection, the roadway widens into a five lane roadway with two east and westbound lanes including a center turning lane. This section of the widened roadway begins approximately 200 ft west of the Rex Avenue SE intersection near roadway Sta. 14+00 and continues through to the Cherry Ave intersection. Cherry Ave which is located on the eastern end of the 11th Street improvements is currently a six lane roadway with two north and south bound lanes and two turning lanes on each side of 11th Street. The condition of the pavement along 11th Street varies over the limits for improvement. The frequency of visibly cracked and/or fractured pavement is greater within the western roadway limits near Market Ave than along the eastern limits where very little to no visible defects in the roadway pavement were observed at the intersection of 11th Street and Cherry Ave. Sidewalks are attached to the roadway curb on both sides of 11th Street and Market Ave. Sidewalk exists only on the western side of Cherry Ave.

The vertical alignment of the existing 11th Street roadway is generally flat with a roadway centerline elevation (El.) near 1034 feet (ft) at Sta. 3+16 near the Market Ave intersection and El. 1031 ft near the Cherry Ave intersection. Market Ave is also generally flat with the roadway elevation varying from El. 1034 ft at the 11th Street intersection to El. 1034.6 near Market Ave at Sta. 24+00 (the proposed limit of Market Ave improvements). Cherry Ave has a gradual 2%

grade up slope from 11th Street to the Cherry Ave bridge approximately 500 ft north of the intersection with 11th Street. The topography adjacent to the roads is generally consistent with the existing roadway grade with the exception of the area along the proposed realignment of 11th Street (Sta. 6+50 to 14+00), where the existing elevation is approximately 1 to 3 ft above the existing roadway elevation.

The properties surrounding this segment of 11th Street are predominately industrial or formerly industrial with the exception of the residential and commercial parcels in the south western area surrounding the intersection of Market Ave and 11th Street. A vacant lot occupies the parcel east of Housel Ave SE and south of the City Scale parcel which is directly south of 11th street. At the time of this report, this property is under environmental study to screen for the presence of subsurface impacted soils. The western side of Cherry Ave, north of 11th Street is bounded by a parking lot serving the Timken Steel Company plant located on the eastern side of Cherry Ave, north of 11th Street.

Existing utilities noted onsite include overhead electrical power lines and telephone or cable lines supported by timber utility poles located primarily on the northern side of 11th Street. Underground utilities consisting of sanitary and storm sewers, waterlines, and gas lines are all present within the project improvement areas. The eastern limits of 11th Street near roadway Sta. 15+00 have numerous utilities within the roadway and adjacent to the roadway limits. This area includes the following: 6-inch and 12-inch water lines with offsetting hydrants, three storm sewers (18, 48, and 54-inch lines), and sanitary sewers consisting of a 6-inch and 21-inch lines that ties into a manhole near Sta. 14+80 south of 11th Street.

1.2 PROJECT UNDERSTANDING

The subsequent sections below outline URS's understanding of the proposed roadway improvements that encompass the 11th Street Improvements project at the time of this report.

1.2.1 11th Street Improvements

The proposed improvements to 11th Street consist of realignment of a major portion of the existing roadway, roadway widening, sidewalk reconfiguration, full depth replacement, and construction of a traffic circle roundabout at the intersection with Cherry Ave. From Sta. 3+16 to Sta. 5+50, the existing 11th Street roadway will be widened from 32 ft to 43 ft. Pavement materials of the proposed roadway alignment within the existing roadway will be subject to full depth replacement to build the new roadway alignment and roadway drainage system. Full depth

replacement of pavement materials will extend east and west of the proposed 11th Street realignment to the project limits. Between Sta. 5+50 and 14+00, 11th Street will be realigned to extend through the existing vacant industrial lot (south of the existing 11th Street roadway), requiring construction of a new roadway on virgin subgrades, where the proposed roadway grade will be below the surrounding site topography with depth of excavation varying from 1 to 3 ft below the existing elevation. The new roadway will require the construction of a roadway drainage system, placement of roadway base materials, and placement of full depth pavement build-up. East of the realignment, between Sta. 14+00 and the proposed roundabout, the existing 11th Street roadway will be widened as described previously. The proposed roundabout will have a dual lane and will be centered near 11th Street Sta.19+65 and Cherry Ave Sta. 10+00.

As part of the overall roadway footprint widening, 8 ft wide concrete sidewalks will be placed directly behind the roadway curbs, over a majority of the length of the proposed roadway improvements.

1.2.2 Market Avenue Improvements

Market Ave will receive full depth replacement of the roadway pavement from roadway Sta. 14+25 to Sta. 24+00. The final pavement elevation of Market Ave will be near the current roadway grade and will merge to match the existing roadway grade at the extent of the full depth replacement. Roadway drainage curbs and pedestrian sidewalks will be rebuilt for the entire length of the full depth replacement. Proposed sidewalks will merge to the sidewalks on 11th Street and will also be 8 ft wide.

1.2.3 Cherry Avenue Improvements

The improvements to Cherry Ave consist of the reconfiguration of the 11th Street intersection by construction of a roundabout intersection and roadway resurfacing from south of the roundabout near Sta. 10+00 through the intersection to the Cherry Ave overpass bridge abutment near Sta. 15+00.

2.1 GENERAL GEOLOGIC SETTING

The project site is located in the glaciated region of Ohio. According to the Ohio Department of Natural Resources (ODNR) Map entitled *Physiographic Regions of Ohio, 1998* the site is located south of the Allegheny Escarpment and within the Akron-Canton Interlobate Plateau of the glaciated Allegheny Plateaus section of the Appalachian Plateaus Providence. The ODNR *Surficial Geology of the Canton 30 x 60 Quadrangle, 2002* indicates the regional soil in the upper 40 ft to consist of Wisconsin age (14,000 to 25,000 years ago) sand and gravel generally described as well to moderately sorted and moderately to well-rounded with interbedded thin layers of silt and clay. The soils beneath the Wisconsin age soils are generally described as Illinoian-age sand and gravel with varying thickness overlying the bedrock. The ODNR *Reconnaissance Bedrock Topography of the East and West Canton, Ohio, Quadrangles* indicates the depth of bedrock to vary in range of approximately two hundred (200) feet to two hundred forty (240) feet below ground surface (bgs). According to the ODNR Surficial Geology map noted above, the uppermost bedrock within the site vicinity is generally comprised of sandstone, shale, siltstone, and limestone from the Pennsylvanian-age Pottsville, Allegheny, and Conemaugh Groups.

3.1 SUBSURFACE EXPLORATION

Borings were located in the field by URS personnel during initial site reconnaissance based on existing site features as depicted on **Appendix B**. The Ohio Utilities Protection Service was notified, and boring locations were verified as clear of utility conflicts prior to the start of drilling activities. Borings were located in deference to traffic safety but were otherwise located as close as possible to the edge of existing pavement and along the centerline of the anticipated location of the proposed new pavement as applicable.

URS's subsurface exploration at the project site included five (5) soil borings, RB-1, RB-2, and RB-4 through RB-6 and three (3) pavement cores PC-1 through PC-3. Specifically, borings RB-1 and RB-5 were located within the areas of the proposed widening of 11th Street, borings RB-2 and RB-4 were located within the proposed realignment segment of 11th Street, and boring RB-6 was located within the limits of the intersection of 11th Street and Cherry Ave near the location of the proposed roundabout. Pavement cores PC-1 and PC-2 were located within the roadway limits of Market Ave and PC-3 was advanced through Cherry Ave. These locations are depicted in **Appendix A**. Originally proposed boring RB-3 was not advanced due to the suspicion of environmentally impacted soils on the current vacant parcel and associated safety concerns.

All borings and cores were located within the extents of the proposed project improvements with the intent to identify the subsurface conditions related to subgrade that will support the proposed new pavement and to determine the cross-section of existing pavement. The soil borings were drilled to depths ranging from 6.5 to 10 feet below ground surface (bgs). Three (3) borings, RB-1, RB-5, and RB-6, represent the roadway widening and were drilled to nominal depths of 6.5 to 8 ft bgs. Borings RB-2 and RB-4 where advanced to 10 ft bgs representing the proposed new roadway alignment.

URS subcontracted Ohio TestBor, Inc. of Hinckley, Ohio to provide drilling services. All soil borings were drilled using a Mobile B-57 truck mounted drill rig utilizing 3¼-inch inner diameter hollow stem augers. Drilling activities were conducted on April 4, 2013.

A URS Geotechnical Engineer accompanied and directed the subcontractor during all aspects of the drilling operation and logged the soils encountered in accordance with the ODOT *Specifications for Geotechnical Explorations* (SGE) guidance document. During drilling activities, representative soil samples were collected from the borings for classification and/or testing. The samples were obtained by Standard Penetration Testing (SPT) utilizing a split-spoon, in general accordance with the ODOT SGE and ASTM 1586. Samples were collected

continuously from 0 to 7 ft bgs and every 2.5 ft thereafter. Where applicable, a pocket penetrometer was used to estimate unconfined compression strength of cohesive fine-grained soils. Samples were visually classified in the field with some being placed in sealed glass jars upon recovery for additional analysis. Soil samples were returned to URS's Cleveland, Ohio office, where the visual classification was confirmed and samples were prepared for shipment to the soil laboratory for index property testing. Where groundwater was encountered, the water level in the open borehole was measured prior to backfilling. Complete graphical boring logs are provided in **Appendix B**.

Upon completion, borings were backfilled with soil cuttings mixed with cement to seal the borehole. When advanced through the existing roadways, borings were patched with an asphalt cold patch, in general accordance with SGE requirements.

3.2 LABORATORY TESTING

Sealed soil samples were transported to the URS Cleveland office, where a geotechnical engineer selected samples for laboratory testing. The selected split spoon soil samples were then sent to URS's soil testing lab subcontractor CTL Engineering in Brunswick, Ohio for testing. Laboratory testing was performed to confirm soil classifications and to establish the index and engineering properties of the soils. The laboratory-testing program included the following type and number of tests, which were assigned in general accordance with guidance given in ODOT's *Geotechnical Bulletin No. 1: Plan Subgrades* (GB-1):

Table 1: Summary of Laboratory Testing

TEST SPECIFICATION	REFERENCE STANDARD	NUMBER OF TESTS
Natural Moisture Content	ASTM D 2216	22
Atterberg Limits (Plasticity Index, Liquid Limit)	ASTM D 4318	12
Particle Size Analysis	ASTM D 422	12

Pertinent test results are summarized in Section 5 of this report. Complete lab result sheets are presented in **Appendix C**.

4.1 SUBSURFACE CONDITIONS

The following sections present the site-specific subsurface conditions in detail. The discussion is based on the results of the soil borings and laboratory testing.

In summary, the subsurface exploration encountered surficial materials such as topsoil or asphalt pavement and granular base, underlain by fill materials, and predominately coarse-grained natural deposits.

During field investigation and activities, all representative fill and native samples were visually inspected for gypsum sulfate crystals ($CaSO_4$ $2H_2O$) within the soil matrix. None of the representative samples had discernible traces of sulfate crystals; therefore, sulfate testing was not necessary.

4.1.1 Surficial Materials

All borings advanced during the exploration, with the exception of Boring RB-4, encountered surficial materials comprised of topsoil or roadway materials. The soil material encountered at the ground surface in Boring RB-4 was granular fill as described below. The thickness of the surficial materials encountered is summarized in **Table 2**.

Table 2: Summary of Surficial Materials

BORING OR CORE ID	TOPSOIL THICKNESS (INCHES)	ASPHALT THICKNESS (INCHES)	CONCRETE THICKNESS (INCHES)	BRICK THICKNESS (INCHES)	BEDDING SAND THICKNESS (INCHES)	GRANULAR BASE THICKNESS (INCHES)
RB-1	4.0	-	-	-		-
RB-2	6.0	-	-	-		-
RB-5	-	2.0	10.0	-		8.0
RB-6	8.0	-	-	-		-
PC-1	-	1.5	-	4.0	1.0	14.5
PC-2	-	2.0	-	4.0	2.0	7.0
PC-3	-	3.0	9.0	-	-	6.0

4.1.2 Fill Materials

Fill material were encountered below the surficial materials in all the borings with the exception of Boring RB-4, where the fill materials began at the ground surface. The fill is likely to be the result of grade changes during the initial roadway construction and for different land purposes and/or utility placement. The majority of fill materials in all the borings were granular in composition with interbedded fine-grained soil layers noted in some of the borings (RB-2, RB-4, and RB-6). RB-1 was the exception where the fill was generally fine-grained in composition. In general, the fill was similar in composition to the underlying natural soils described in the section below, but included man-made materials such as brick fragments and slag in trace amounts. In boring RB-2, the presence of a chemical odor and dark brown and black streaks were noted in the bottom most sample that may indicate the presence of environmentally impacted soils. Following the observations made in Boring RB-2, Boring RB-3 was not drilled. An environmental assessment to determine the type and extent of impacted chemicals within the soils is currently underway and the results of this assessment will be published as part of a separate report.

The fill materials were encountered beginning at depths ranging from the ground surface to 1.67 feet below ground surface (bgs). Thickness of the soil fill typically varied from 1.6 to 7.5 ft. Borings RB-2 and RB-6 were terminated in the fill deposit, so the deposit thickness was not established at these locations. Final depth of boring RB-2 was 10 ft bgs and RB-6 was advanced to 6.5 ft bgs.

Granular fills were generally described as damp to wet, brown coarse and fine sand (A-3a) or gravel and/or stone fragments with sand (A-1-b) and in some cases trace to some amounts of silt and trace clay. Standard Penetration test (SPT) N_{60}-values within the granular fill varied from 5 to 15 blows per foot (bpf), with an average of 11 bpf indicating a loose to medium dense consistency on average. Average laboratory test results in the granular fill materials include moisture contents near 12.8% with non-plastic fines.

Fine-grained fills were generally described as damp to moist, brown sandy silt (A-4a) or silt and clay (A-6a) with gravel noted in trace amounts. SPT N_{60}-values within the fine-grained fill varied from 8 to 33 bpf with an average of 15 bpf. Pocket penetrometer results within the fine-grained fill soils varied from 0.5 to 2.75 tons per square foot (tsf), with an average value of 1.8 tsf indicating a stiff consistency, on average. Average laboratory test results in the fine-grained fill soils include moisture contents near 15%, liquid limits (LL) near 28, plastic limits (PL) near

17, and plasticity indices (PI) near 11. Moisture contents were generally higher than the plastic limit, but lower than the liquid limit.

4.1.3 Native Deposits

Borings that extended deep enough to encounter the native soils (RB-1, RB-4, and RB-5) generally encountered native deposits consisting of granular and fine-grained deposits below the fill materials. The native soils were predominately granular and generally classified as damp to wet, brown coarse and fine sand (A-3a) whereas the fine grained deposits were generally described as damp to moist, brown sandy silt (A-4a). For the borings that extended to the native deposits, the native soils where first encountered from 2 to 7.5 feet bgs. The thickness of the native soils was not determined because all borings that encountered the native soils were terminated within the deposit.

Standard Penetration test (SPT) N_{60}-values within the native deposit varied from 4 to 45 blows per foot (bpf), with an average near 17 bpf. Pocket penetrometer results within the native fine-grained deposit varied from 0.75 to 1.75 tons per square foot (tsf), with an average value near 1 tsf indicating a medium stiff to stiff consistency on average. Laboratory test results in the native deposit include average moisture contents near 13%, non-plastic fines in the granular soils and liquid limit (LL) of 22, plastic limit (PL) of 15, and plasticity index (PI) of 7 for the fine grained soils. Moisture contents within the fine-grained soils were generally near or somewhat lower than the plastic limit.

4.2 GROUND WATER CONDITIONS

Groundwater was noted in the samples during drilling, and water levels in the completed boreholes were noted prior to backfilling. The presence of groundwater was detected only at boring RB-4 where groundwater was first encountered in soil samples at a depth of 9 ft bgs and at completion was measured at 9.25 ft bgs (El. 1018.75 ft). The presence of ground water within this boring is anticipated to be perched water between the granular and fine-grained interface of the native soils. However, the boring was not kept open long enough to determine if the water encountered was perched or part of the actual groundwater table.

Based on the short time the boreholes were left open, groundwater levels during the subsurface exploration most likely did not reach equilibrium. The static groundwater table will most likely follow the natural topography of the site area and will fluctuate with seasonal variations in

climate. Fluctuations in the level of perched water zones above the static water table are anticipated to be more sensitive to weather conditions.

5.1 SUBGRADE ANALYSIS

Subgrade analysis was performed in general accordance with the Ohio Department of Transportation Geotechnical Bulletin No.1 "Plan Subgrades" (GB-1) dated January 3, 2012. Where necessary, methods for improvement of the subgrade were reviewed and compared to prepare a recommendation based on cost, efficiency, and other relevant parameters. These evaluations are further detailed in the following sections. Complete results of the GB-1 spreadsheet analysis are provided in in **Appendix E**.

5.1.1 GB-1 Subgrade Analysis

The subgrade analysis was performed using ODOT's GB-1 analysis spreadsheet, and incorporated data from all of the borings and laboratory testing performed for this project.

Subgrade for the proposed roadway widening and realignment consists predominantly of loose to medium dense granular fill soils. The results of the GB-1 analysis indicate that need for localized subgrade improvement should be anticipated at the site. This is driven primarily by lower SPT-N_{60} values at some of the coarse and fine-grained materials encountered at the site, and due to presence of unsuitable A-4b materials that were occasionally encountered in the borings (such as at boring RB-2). Subgrade soil in these areas is anticipated to provide relatively low to moderate support to new pavements without improvement. Based on the analysis, it may be anticipated that localized areas of unsuitable subgrade may be encountered across the alignment, and that 20 to 30 percent of the proposed pavement footprint may require subgrade improvement. A greater proportion of the total area to be improved may be expected where 11th Street is to be realigned and constructed on virgin subgrade materials.

Based on the results of the analysis, possible subgrade improvements include:

- **Undercutting and replacement of deficient subgrade soils.** Based on the GB-1 analysis, the undercut depth generally ranges from 14 to 36-inches, with an average of approximately 18-inches.

- **Chemical Stabilization.** Due to the high granular composition of the subgrade soils and non-plastic consistency of the soil fine materials, applicable methods exclude lime and lime kiln dust. Therefore, it was concluded that cement stabilization is the only applicable method for the site if chemical stabilization is used. The GB-1 analysis

indicates that an average depth of 14-inches will be required for stabilization and up to 16-inches will be necessary for portions of the roadway near Boring RB-2.

The scope and size of the project is less than one half mile long and approximately 2500 square yards of new roadway area. Given the limited extent of the roadway that will need improvement, chemical stabilization is unlikely to be cost effective, will require specialized equipment and testing that would not otherwise be utilized during construction of this project, will increase the duration of road construction and access restrictions for the public, and is generally not suitable for application on sites where localized and intermittent subgrade improvements are anticipated (i.e., use of chemical stabilization for this project would require the project to use global stabilization). For these reasons, undercut and replacement is recommended as the preferred subgrade improvement technique for this project.

5.2 GEOTECHNICAL RECOMMENDATIONS

5.2.1 Subgrade Preparation

As noted in Section 5.1, undercut and replacement is recommended for the improving the subgrade along some areas of the roadway. Subgrade should be prepared as follows:

- All subgrades on which full depth pavements will be constructed (both in widening areas and in areas of existing pavement) should first be compacted and then should receive a proofroll , performed in accordance with ODOT Construction and Material Specifications (ODOT CMS) Item 204.

- Subgrades that fail a proofroll should be considered unsatisfactory and should be improved. The recommended improvement method (as described previously) is undercut and replacement. The recommended minimum depth of undercut and replacement is 18-inches, across the project. Where deficient soils consist of granular materials (classified as A-1 or A-3 soils), the materials removed from the undercut excavations may be moisture conditioned and then recompacted back in place. Where silty or clayey soils (classified as A-4, A-6, or A-7 materials) are encountered within undercuts, the undercuts should be backfilled with ODOT CMS Item 703.19 Granular Material Type B, and the excavation spoils should be appropriately managed or removed from the site.

- In isolated areas of the site, (near Boring RB-2) the recommended undercut and replacement depth is 36-inches due to the presence of silty soil (A-4b). The extent of the 36-inch over-excavated region should be determined by visual inspection between Sta. 7+00 to 8+50 over the entire roadway footprint.

- All cut and replaced subgrades should be compacted and then proofrolled per ODOT Item 204 requirements following placement of sufficient length of the roadway segments to verify that the stabilization is adequate.

Project schedule and maintenance of traffic schemes will need to accommodate construction of the subgrade improvement. Surface drainage of the site should be properly maintained during construction such that subgrades are kept free of standing water, and scheduling should be such that pavement construction occurs quickly after the subgrade has been prepared. Since construction traffic and wet weather conditions can cause the subgrade soils to soften, areas of roadway along the construction alignment should be segmented as improvements are made to limit exposure to traffic, weathering, or excessive moisture and avoid exposure of large areas.

5.2.2 Pavement Design Recommendations

As mentioned previously, subgrade for flexible pavements throughout the project will consist mainly of loose to medium dense granular fill soils. The results of the GB-1 analysis indicate an average California Bearing Ratio (CBR) of 10 was calculated for the project. However, a design value of CBR of 8 may be assumed to account for variability in the subgrade assuming that the recommended stabilization is implemented.

Adequate drainage is one of the most critical variables in both the life and performance of flexible pavement. The necessity of maintaining adequate drainage is heightened considering that isolated regions of the subgrade soil that will support new pavement on this project are fine-grained, low permeability materials that are prone to soften upon water infiltration. In order to maintain a uniform subgrade condition across the site, the roadway geometry should be pitched or crowned such that positive surface drainage is maintained away from the pavement. Furthermore, an underdrain system should be constructed for the new roadway alignment and extended into the new widening areas such that all newly constructed pavement includes adequate subsurface drainage.

5.2.3 Excavation

Site excavation is anticipated to be minor (less than 5 ft thick) to cut the existing down to the top of subgrade for the proposed improvements to 11th Street and Cherry Ave. Excavations implemented by open cut methods should be in accordance with OSHA 29 CFR, Part 1926, Subpart P. The insitu soil (fill and native soil) should be considered as OSHA Type C materials, and the portion of excavations extending through these materials should be sloped back at no steeper than 1.5H:1V.

In areas designated for 11th Street realignment through the existing industrial vacant lot (roadway Sta. 7+50 to 14+00) special consideration for handling these excavated soils should be utilized. At the time of this report, an environmental site assessment is being performed to determine the presence of impacted soils within this region of the site. The contractor should base removal and disposal methods for the excavated soils on the results and recommendations of this assessment.

5.2.4 Engineered Fill

Engineered fill is anticipated to be minor (less than 2 ft thick) to bring the existing site up to the assumed top of subgrade for the proposed improvements to 11th Street and Cherry Ave. All new fill should be selected, placed, and compacted per ODOT Item 203. In general, soils harvested from the site in excavation areas should be suitable for reuse as fill as long as they are not environmentally impacted soils as indicated in the forthcoming environmental report. Some moisture conditioning of on-site soils may be required and should be anticipated. It is further noted that Silt materials (A-4b) were encountered in some soil borings. These materials should not be placed within three feet (vertically) of any pavements. These materials will need to be identified and segregated or will need to be mixed with other suitable soil to meet acceptable classifications prior to use. In addition, prior to placement of fill, all topsoil and vegetative cover shall be stripped to expose subgrade material that does not contain organic components. Organic materials such as topsoil may be temporarily stored onsite and later reused if directed by the Engineer.

The conclusions and recommendations presented in this report are based on the assumptions that our understanding of the existing site conditions and the scope of the project do not change substantially from what has been described herein, and that soil conditions do not deviate substantially from those represented by the borings performed during the subsurface exploration. It is recommended that communication be maintained with URS in order to ensure that the recommendations made herein are properly interpreted and incorporated into the design and construction.

Borings were performed in the number and at the approximate locations selected by URS. Variations in subsurface conditions between borings that may become evident during construction are possible. URS should be made aware of any variations and, if necessary, issue changes to the conclusions and recommendations made, where applicable.

In the event that changes are made to the nature, design, or location of the proposed improvements, the conclusions and recommendations presented herein should not be considered valid, unless URS has reviewed the changes and addresses their impact to the recommendations provided.

The conclusions and recommendations presented in this report are based on our analysis of the data collected for this project. The recommendations presented in this report should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

APPENDIX A

Site Location Map and Soil Boring Location Plan

PROJECT DESCRIPTION

THIS PROJECT, PID. 90465, IS THE 11TH STREET IMPROVEMENTS IN CANTON, OHIO. IT INCLUDES, REALIGNMENT, WIDENING AND RESURFACING OF 11TH STREET SE AS WELL AS INSTALLATION OF A ROUNDABOUT AT THE INTERSECTION OF 11TH STREET SE AND CHERRY AVENUE S AMONG OTHER IMPROVEMENTS.

GEOLOGY

THE SITE LIES IN THE GLACIATED PORTION OF OHIO, SOUTH OF THE ALLEGHENY ESCARPMENT AND WITHIN THE AKRON–CANTON INTERLOBATE PLATEAU OF THE GLACIATED ALLEGHENY PLATEAUS SECTION OF THE APPALACHIAN PLATEAUS PROVIDENCE. THE SOILS UNDERLYING THE PROJECT AREA ARE COMPOSED PRIMARILY OF GLACIALLY DEPOSITED WISCONSIN AGE SAND AND GRAVEL GENERALLY DESCRIBED AS WELL TO MODERATELY SORTED, AND MODERATELY TO WELL–ROUNDED WITH INTERBEDDED THIN LAYERS OF SILT AND CLAY APPROXIMATELY 40 FT THICK. THE UPPERMOST BEDROCK WITHIN THE SITE VICINITY IS GENERALLY COMPRISED OF SANDSTONE, SHALE, SILTSTONE, AND LIMESTONE FROM THE PENNSYLVANIAN–AGE POTTSVILLE, ALLEGHENY, AND CONEMAUGH GROUPS AT APPROXIMATELY 200 FT TO 240 FT BELOW GROUND SURFACE (BGS).

RECONNAISSANCE

THE SITE WAS VISITED ON MARCH 14, 2013 STAKE BORING LOCATIONS FOR UTILITY CLEARANCE AND ASSESS THE SITE DRILLING LOCATIONS. THE LAND USAGE AROUND THE PROJECT IS GENERALLY COMMERCIAL AND INDUSTRIAL. THE CONDITION OF THE PAVEMENT ALONG 11TH STREET SE VARIES OVER THE LIMITS FOR IMPROVEMENT. THE FREQUENCY OF VISIBLY CRACKED AND/OR FRACTURED PAVEMENT IS GREATER WITHIN THE WESTERN ROADWAY LIMITS NEAR MARKET AVENUE S THAN ALONG THE EASTERN LIMITS WHERE VERY LITTLE TO NO VISIBLE DEFECTS IN THE ROADWAY PAVEMENT WERE OBSERVED AT THE INTERSECTION OF 11TH STREET SE AND CHERRY AVENUE SE. THERE ARE A NUMBER OF UNDERGROUND AND OVERHEAD UTILITIES IN THE AREA, PARTICULARLY ALONG THE EASTERN PORTION OF 11TH STREET SE. BASED ON THE INFORMATION OBTAINED DURING ENVIRONMENTAL SCREENING, THE PROJECT AREA HAS BEEN DEVELOPED AND USED FOR INDUSTRIAL, COMMERCIAL, AND RESIDENTIAL USES SINCE AT LEAST THE LATE 1800S. SEVERAL FACILITIES OF ENVIRONMENTAL CONCERN, INCLUDING LARGE INDUSTRIAL OPERATIONS, DRY CLEANERS, FILLING STATIONS AND AUTO REPAIR OPERATIONS, WERE IDENTIFIED IN THE PROJECT AREA

SUBSURFACE EXPLORATION

FIVE TEST BORINGS WERE COMPLETED AS PART OF THIS SUBSURFACE EXPLORATION, ON APRIL 14, 2013. BORINGS WERE DRILLED WITH A TRUCK MOUNTED ROTARY DRILL RIG USING 3 1/4–INCH ID HOLLOW STEM AUGERS TO ADVANCE THE HOLES THROUGH THE SOIL. THE SAMPLES WERE OBTAINED BY STANDARD PENETRATION TESTING (SPT) UTILIZING A SPLIT–SPOON, IN GENERAL ACCORDANCE WITH THE ODOT SGE AND ASTM 1586. SAMPLES WERE OBTAINED CONTINUOUSLY FROM 0 TO 7 FT BGS AND EVERY 2.5 FT THEREAFTER. NO UNDISTURBED SAMPLES WERE OBTAINED. BEDROCK WAS NOT ENCOUNTERED DURING THE EXPLORATION.

EXPLORATION FINDINGS

SOIL MATERIAL ENCOUNTERED DURING THE SUBSURFACE EXPLORATION WAS PRIMARILY GRANULAR FILL FROM 2 TO 7 FT THICK WITH INTERBEDDED FINE–GRAINED SOIL LAYERS AS NOTED IN THE BORING LOGS. RB–1 WAS THE EXCEPTION WHERE SANDY SILT WAS ENCOUNTERED THROUGHOUT THE PROFILE. GRANULAR FILL WAS CLASSIFIED AS A–3A AND A–1–B WHILE FINE GRAINED FILL WAS CLASSIFIED AS A–4A. NATIVE MATERIALS WERE ENCOUNTERED UNDERLYING THE FILL IN BORINGS RB–1, RB–4, AND RB–5. NATIVE DEPOSITS CONSISTED PRIMARILY OF GRANULAR DEPOSITS WITH INTERBEDDED FILL MATERIALS. GRANULAR DEPOSITS WERE GENERALLY CLASSIFIED AS DAMP TO WET, BROWN COARSE AND FINE SAND (A–3A) WHEREAS THE FINE GRAINED DEPOSITS WERE GENERALLY DESCRIBED AS DAMP TO MOIST, BROWN SANDY SILT (A–4A).

RB–3 LOCATED IN THE VACANT LOT ALONG THE PROPOSED REALIGNMENT OF 11TH STREET SE WAS NOT PERFORMED BECAUSE POTENTIALLY ENVIRONMENTALLY IMPACTED SOIL WAS ENCOUNTERED AS EVIDENCED BY DISCOLORATION AND ODOR AT THAT LOCATION. THERE ARE ALSO A NUMBER OF APPARENT GROUND WATER MONITORING WELLS LOCATED NEAR THIS BORING LOCATION.

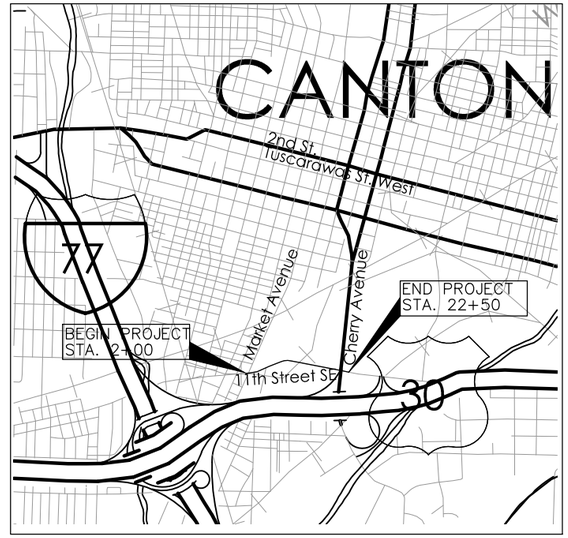
SPECIFICATIONS

THIS GEOTECHNICAL EXPLORATION WAS PERFORMED IN GENERAL ACCORDANCE WITH THE STATE OF OHIO DEPARTMENT OF TRANSPORTATION OFFICE OF GEOTECHNICAL ENGINEERING SPECIFICATIONS FOR GEOTECHNICAL EXPLORATIONS.

LEGEND

DESCRIPTION	ODOT CLASS	CLASSIFIED MECH.	CLASSIFIED VISUAL
GRAVEL AND/OR STONE FRAGMENTS WITH SAND	A–1–b	2	2
GRAVEL AND/OR ST. FRAGS. WITH SAND AND SILT	A–2–4	1	0
COARSE AND FINE SAND	A–3a	5	6
SANDY SILT	A–4a	2	6
SILT	A–4b	1	0
SILT AND CLAY	A–6a	1	1
	TOTAL	12	15

PAVEMENT OR BASE = X = APPROXIMATE THICKNESS	VISUAL
SOD AND TOPSOIL = X = APPROXIMATE THICKNESS	VISUAL
EXPLORATION LOCATION – PLAN VIEW	
DRIVE SAMPLE AND/OR ROCK CORE BORING PLOTTED TO VERTICAL SCALE ONLY. HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY.	
AUGER BORING PLOTTED TO VERTICAL SCALE ONLY. HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY.	
WC	INDICATES WATER CONTENT IN PERCENT.
W—	INDICATES FREE WATER ELEVATION.
N_{60}	INDICATES STANDARD PENETRATION RESISTANCE NORMALIZED TO 60% DRILL ROD ENERGY RATIO.
●	INDICATES A PLASTIC MATERIAL WITH A MOISTURE CONTENT EQUAL TO OR GREATER THAN THE LIQUID LIMIT MINUS 3.
⊖	INDICATES A NON–PLASTIC MATERIAL WITH A MOISTURE CONTENT GREATER THAN 25% OR GREATER THAN 19% WITH A WET APPEARANCE.
*	INDICATES A SAMPLE TAKEN WITHIN 3 FT OF PROPOSED GRADE.
SS	INDICATES A SPLIT–SPOON SAMPLE.
ST	INDICATES A SHELBY TUBE SAMPLE.
HA	INDICATES A HAND AUGER SAMPLE.
NP	INDICATES A NON–PLASTIC SAMPLE.
TR	INDICATES THE TOP OF ROCK.



LOCATION MAP

SCALE IN MILES

0 1/4 1/2 3/4 1

N

PARTICLE SIZE DEFINITIONS

12"	3"	2.0 mm	0.42 mm	0.074 mm	0.005 mm
BOULDERS |	COBBLES |	GRAVEL |	COARSE SAND |	FINE SAND |	SILT | CLAY
		No. 10 SIEVE	No. 40 SIEVE	No. 200 SIEVE	

INDEX OF SHEETS

LOCATION FROM STA.	TO STA.	PLAN VIEW SHEET	PROFILE SHEET	CROSS–SECTION SHEET	CUT MAX.	FILL EMB. MAX.
11TH STREET						
2+00	12+00	2	2	–	3 FT	1 FT
12+00	22+50	3	3	–	1 FT	<1 FT
MARKET AVENUE						
14+00	24+00	4	4	–	<1 FT	<1 FT
CHERRY AVENUE						
14+00	15+00	5	5	–	<1 FT	<1 FT

RECON. – CAD 03/25/13
DRILLING – CAD 04/04/13
DRAWN – CAD 07/26/13
REVIEWED – JLM 07/26/13

DESIGN AGENCY URS COLUMBUS CLEVELAND AKRON

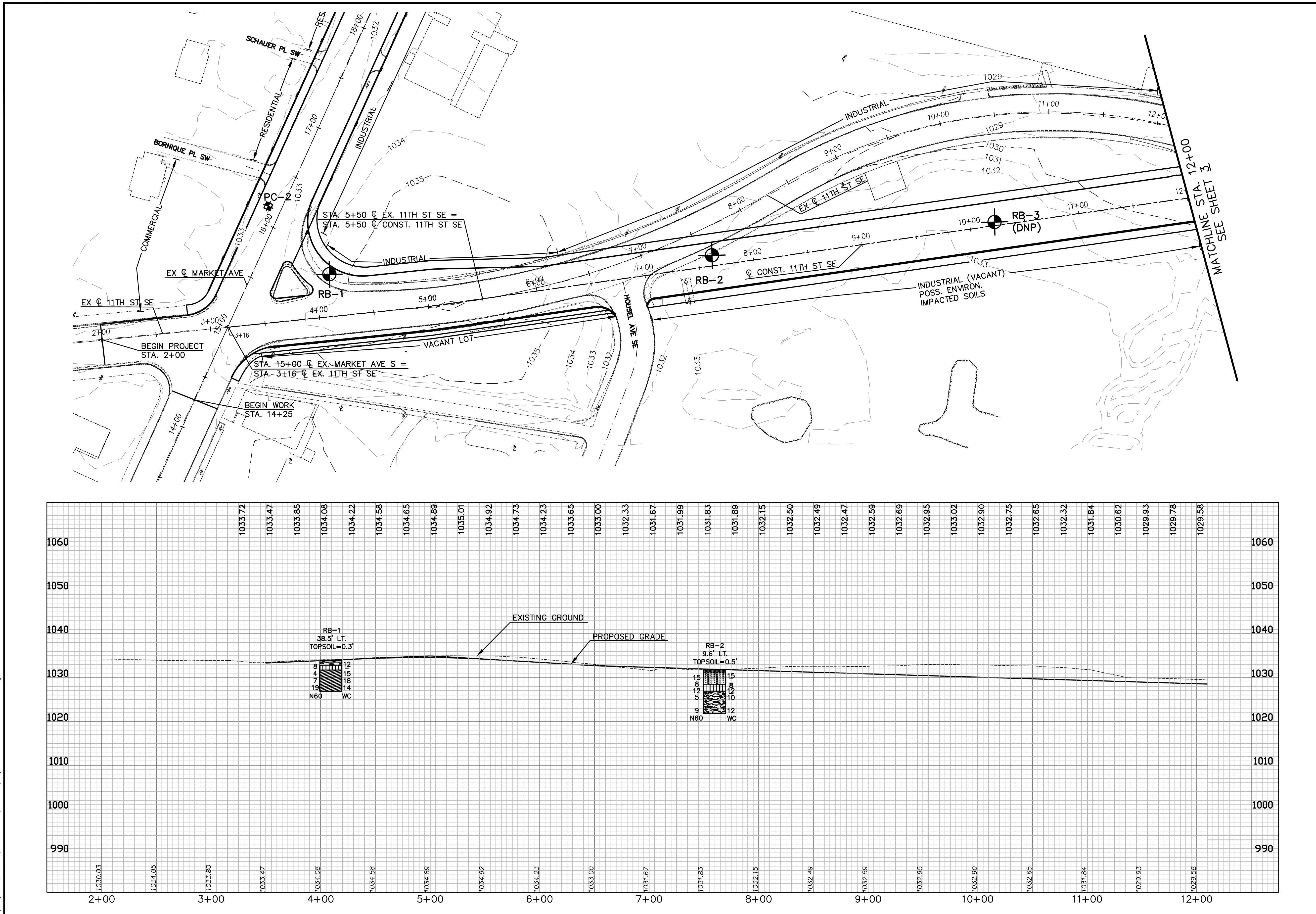
PID NO. 90465

SOIL PROFILE TITLE SHEET

CANTON-11TH STREET IMPROVEMENTS

1 | 1

1 / 5



SOIL PROFILE
STA. 2+00 TO 12+00 11TH STREET

CANTON-11TH STREET IMPROVEMENTS

CALCULATED CAD
CHECKED JLM

1 / 2

2 / 5

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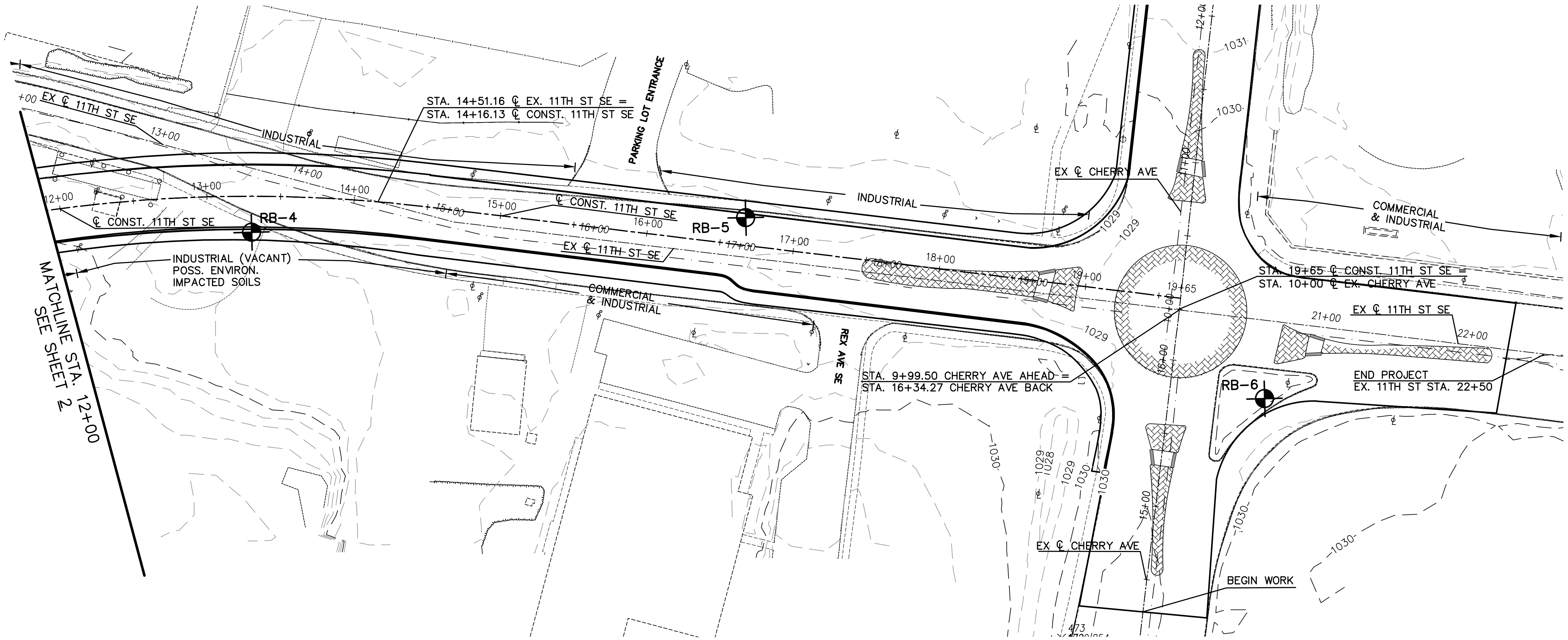

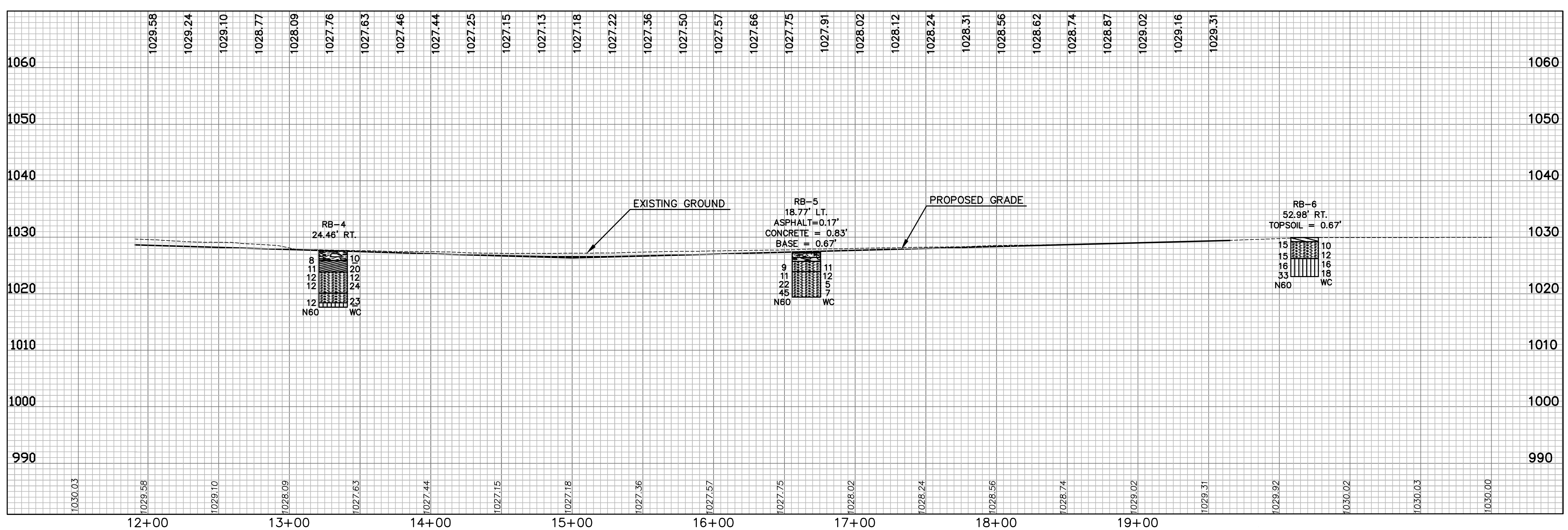

HORIZONTAL SCALE IN FEET

CALCULATED CAD
CHECKED JLM

SOIL PROFILE
STA. 12+00 TO 19+65 11TH STREET

CANTON-11TH STREET IMPROVEMENTS

2 / 2

3 / 5

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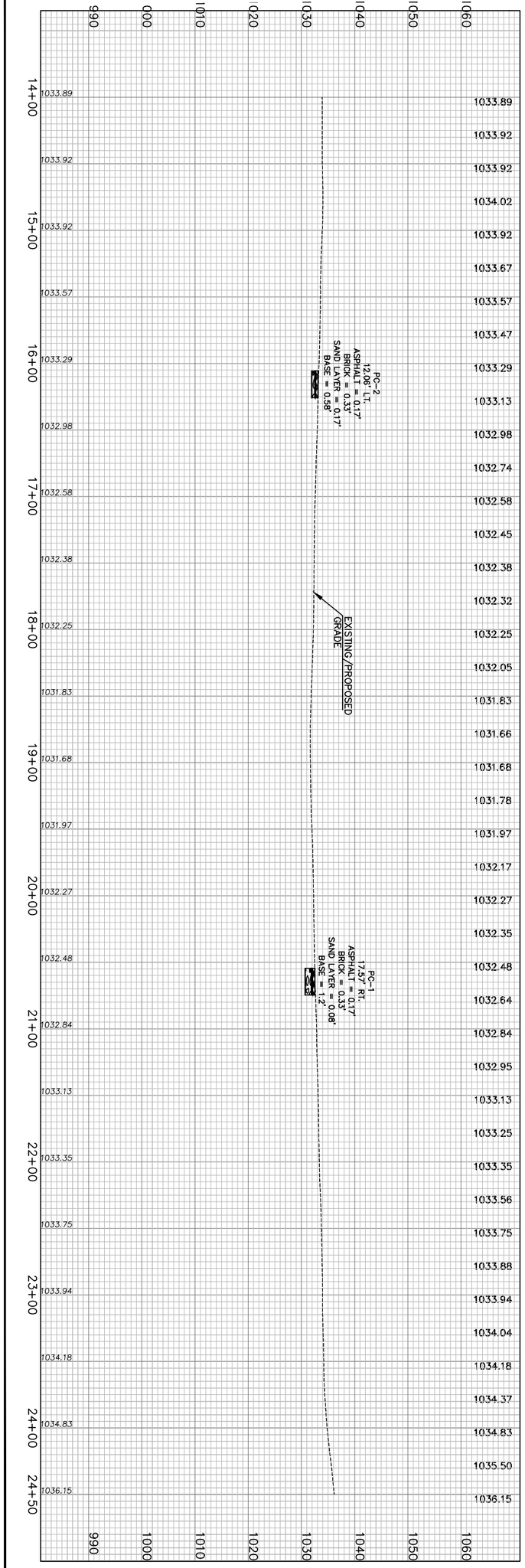
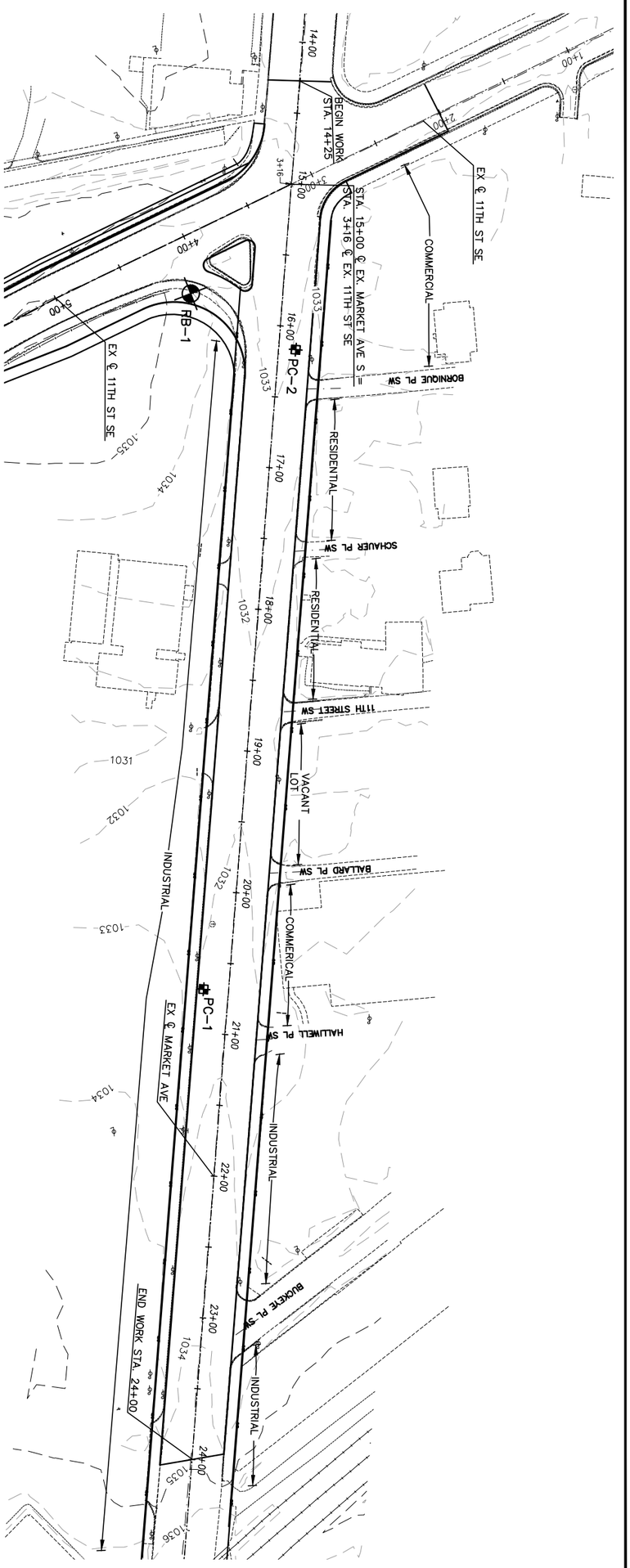
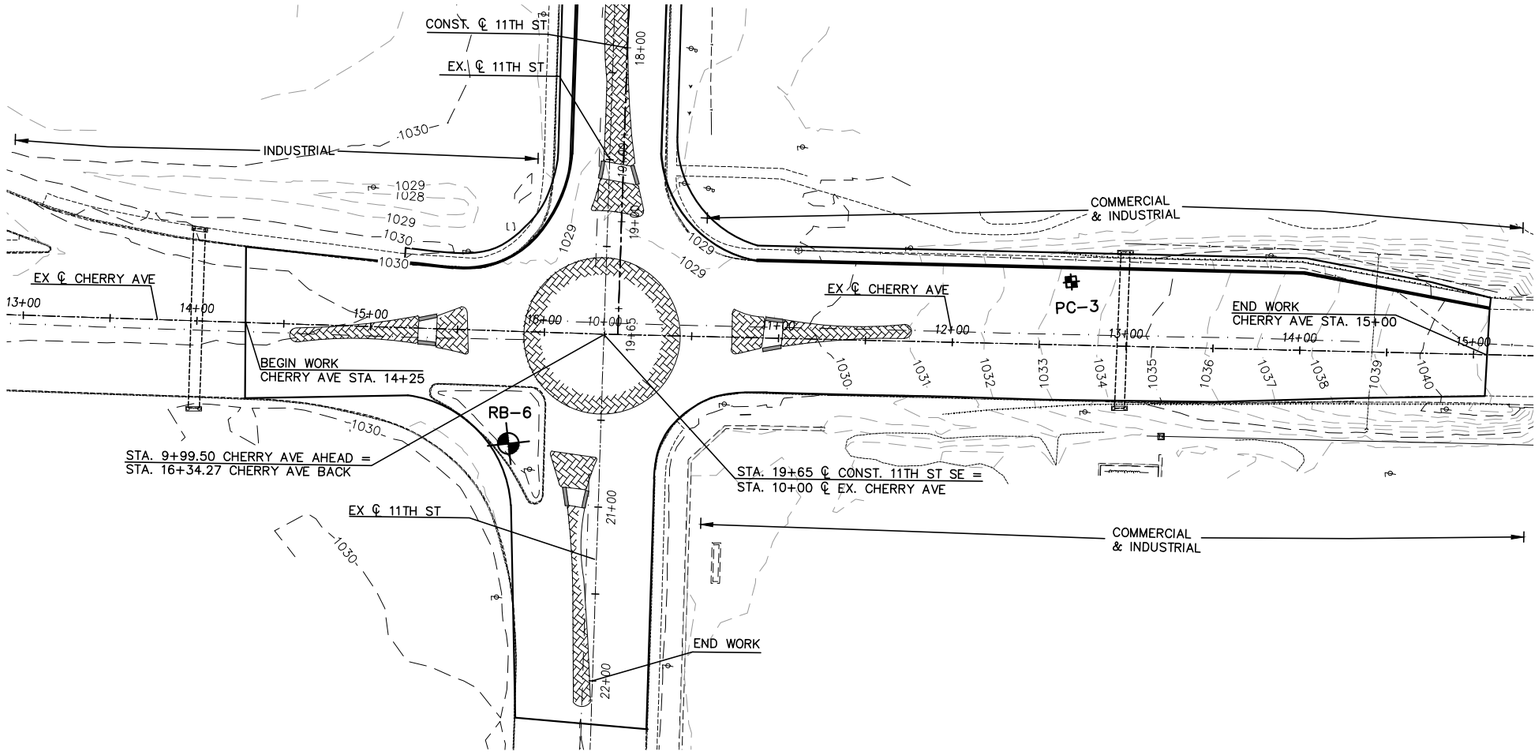
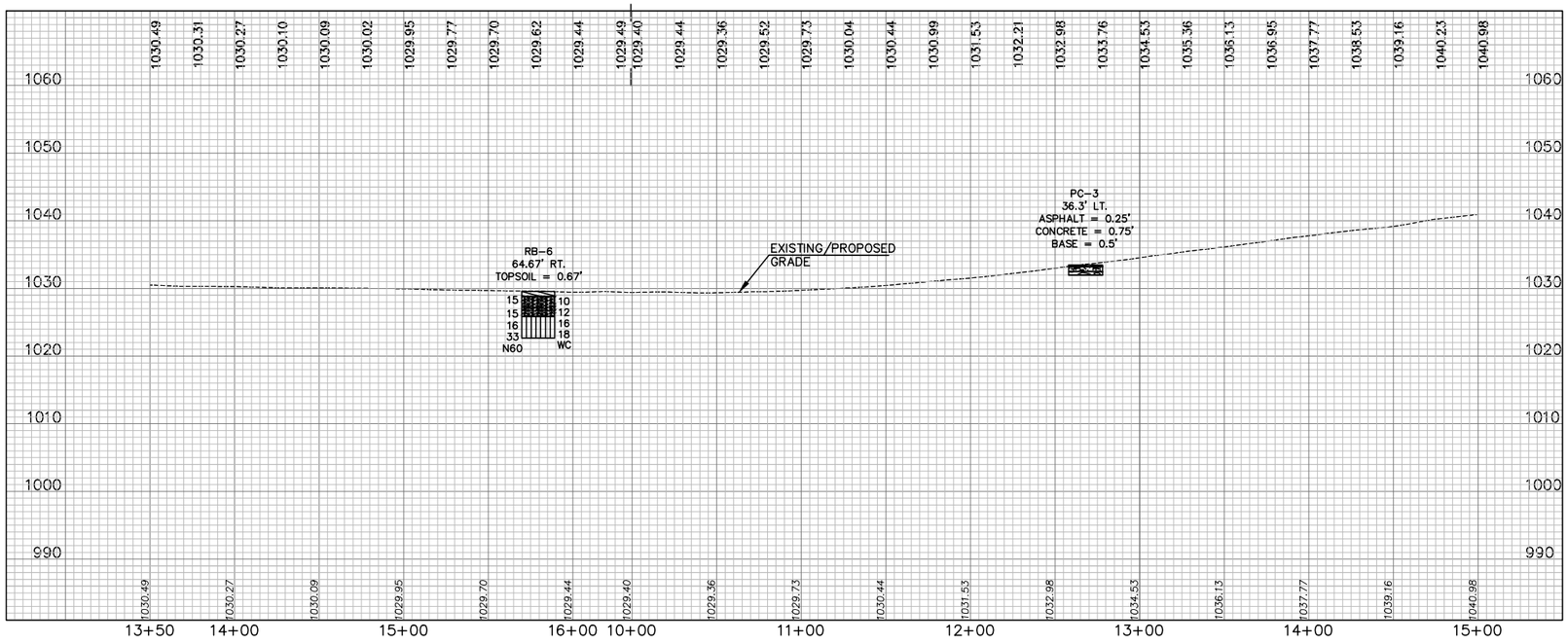




4 / 5	1 / 1	**CANTON-11TH STREET IMPROVEMENTS**	**SOIL PROFILE STA. 14+00 TO 24+00 MARKET AVENUE**	CALCULATED CAD / CHECKED JLM	0 20 40 80 HORIZONTAL SCALE IN FEET





HORIZONTAL SCALE IN FEET
0 20 40 80

CALCULATED CAD
CHECKED JLM

SOIL PROFILE
STA. 14+00 TO 15+50 CHERRY AVENUE

CANTON-11TH STREET IMPROVEMENTS

1 / 1

5 / 5

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APPENDIX B

Soil Boring Logs

PROJECT: 11TH STREET IMPROVEMENTS
TYPE: ROADWAY
PID: 90465 BR ID: N/A

BORING LOG KEY

MATERIAL DESCRIPTION AND NOTES	ELEV	DEPTHS	SPT/ RQD	N60	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	INST
								GR	CS	FS	SI	CL	LL	PL	PI			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

COLUMN DESCRIPTIONS

1 **Material Description and Notes:** Description of material encountered and includes a graphic column; may include color moisture, grain size and density/consistency.

2 **Elev.:** Elevation in feet, referenced to mean sea level (msl) or site datum.

3 **Depths:** Depth in feet below the ground surface.

4 **SPT/RQD:** SPT (Standard Penetration Test)– Number of blows required to advance a driven sampler a 6–inch interval or distance noted, using an 140–lb hammer with a 30–inch drop; RQD (Rock Quality Designation) – amount, in percent, of intact core greater than 4–inches in length obtained from a coring interval– calculated as the sum of the lengths of intact core divided by the length of the core run.

5 **N60:** The normalized SPT value corrected for overburden pressure and field procedures.

6 **Recovery:** Amount, in percent, of sample length recovered–calculated as the amount recovered divided by the sample length.

7 **Sample ID:** Sample identification number. Typically– Split Spoon (SS–#) or rock core type (NW–#).

8 **HP:** Pocket Penetrometer, or torvane (TV) readings measured in tons per square foot (tsf). Readings were taken for soils defined as cohesive in the ODOT SGE.

9 **GR:** Percentage of Gravel in tested sample.

10 **CS:** Percentage of Coarse Sand in tested sample.

11 **FS:** Percentage of Fine Sand in tested sample.

12 **SI:** Percentage of Silt in tested sample.

13 **CL:** Percentage of Clay in tested sample.

14 **LL:** Liquid Limit of tested sample– NP= non–plastic.

15 **PL:** Plastic Limit of tested sample– NP= non–plastic.

16 **PI:** Plasticity Index of tested sample = LL– PL

17 **WC:** Water content of tested sample, measured as percentage of dry weight of sample.

18 **ODOT Class:** ODOT classification and group index (GI), made by either sample results or by visual (v) description..

19 **Inst:** Well installation or borehole backfill details.

TYPICAL MATERIAL GRAPHIC SYMBOLS


TOPSOIL


ASPHALT and/or PAVEMENT BASE


CONCRETE


GRAVEL AND/OR STONE FRAGMENTS


GRAVEL AND/OR STONE FRAGMENTS WITH SAND


SANDY SILT


COARSE AND FINE SAND


SILT AND CLAY

MINOR SOIL TYPE(s)

"Trace"	When the soil type's percentage is estimated, using visual/manual procedures, to be between 1 and 10 percent of the total sample.
"Little"	When the soil type's percentage is estimated, using visual/manual procedures, to be greater than 10 percent and less than 20 percent of the total sample.
"Some"	When the soil type's percentage is estimated, using visual/manual procedures, to be greater than 20 percent and less than 35 percent of the total sample.
"and"	When the soil type's percentage is estimated, using visual/manual procedures, to be greater than 35 percent and less than 50 percent of the total sample

MOISTURE DESCRIPTORS

"dry"	No sign of moisture when pressed between fingers and water content is below the plastic limit
"damp"	Leaves very little moisture when pressed between fingers and water content is below the plastic limit
"moist"	Leaves small amount of moisture when pressed between fingers and water content is above the plastic limit –3% of the liquid limit
"wet"	For cohesive soils, the water content is near or above the liquid limit For granular soils, the pore space is filled with water and water can be poured from the sample with ease.

OTHER GRAPHIC SYMBOLS

– –	Inferred or gradational lithologic contact	W	Water
NR	Not Recorded	EOB	End of Boring
NA	Not Applicable		
TR	Top of Rock		

Soil classifications are based on the ODOT Classification System. Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced, they are not warranted to be representative of subsurface conditions at other locations or times.

URS

PROJECT: 11TH STREET IMPROVEMENTS	DRILLING FIRM / OPERATOR: OHIO TESTBOR / FAY	DRILL RIG: MOBILE B-57	STATION / OFFSET:	EXPLORATION ID RB-1
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: URS / C. DICKE	HAMMER: AUTOMATIC HAMMER	ALIGNMENT:	
PID: 90465 BR ID: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 1034.1 (MSL) EOB: 6.5 ft.	PAGE 1 OF 1
START: 4/4/13 END: 4/4/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.3	COORD: 410976.590 N, 2279158.452 E	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N60	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
	1034.1																	
TOPSOIL	1033.7						–	36	17	21	23	3	NP	NP	NP	12	A-2-4 (0)	
LOOSE, DAMP, BROWN GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT [FILL]	1033.1 / 1032.1	1	4 3 3	8	56	SS-1	2.00 2.25	–	–	–	–	–	–	–	–	–	A-4a (V)	
STIFF, MOIST, BROWN, SANDY SILT, LITTLE CLAY, TRACE GRAVEL [FILL]		2	2 2 1	4	28	SS-2	0.75 0.75	2	10	36	39	13	22	15	7	15	A-4 (3)	
MEDIUM STIFF, DAMP TO MOIST, LIGHT BROWN SANDY SILT, LITTLE CLAY, TRACE GRAVEL		3																
BECOMES STIFF, DAMP TO MOIST		4	1 2 3	7	72	SS-3	1.25 1.00 1.25	–	–	–	–	–	–	–	–	18	A-4a (V)	
		5																
BECOMES WITH SANDSTONE COBBLES	1027.6	6	4 7 7	19	33	SS-4	1.00 1.00	–	–	–	–	–	–	–	–	14	A-4a (V)	
		EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH CEMENT

PROJECT: 11TH STREET IMPROVEMENTS	DRILLING FIRM / OPERATOR: OHIO TESTBOR / FAY	DRILL RIG: MOBILE B-57	STATION / OFFSET:	EXPLORATION ID RB-2
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: URS / C. DICKE	HAMMER: AUTOMATIC HAMMER	ALIGNMENT:	
PID: 90465 BR ID: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 1031.4 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 4/4/13 END: 4/4/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.3	COORD: 410993.940 N, 2279507.768 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1031.4	DEPTHS	SPT/ RQD	N60	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL WITH SAND AND GRAVEL	1030.9																	
LOOSE, MOIST, BROWN COARSE AND FINE SAND, SOME SILT, LITTLE GRAVEL WITH RED BRICK FRAGMENTS, TRACE CLAY [FILL]		1	4 8 3	15	78	SS-1	–	19	19	30	29	3	NP	NP	NP	15	A-3a (0)	
3" BLACK SAND LAYER	1028.2	2																
MEDIUM STIFF, DAMP, BROWN SILT, SOME SAND, TRACE CLAY, TRACE GRAVEL, TRACES OF ODOR AND BLACK STREAKS [FILL]		3	2 1 5	8	89	SS-2	–	–	–	–	–	–	–	–	–	–	A-3a (V)	
		4					1.00 1.25	3	9	20	64	4	25	17	8	8	A-4b (8)	
	1026.4	5	1 4 5	12	94	SS-3	0.75 0.50	–	–	–	–	–	–	–	–	12	A-4a (V)	
LOOSE, MOIST, BROWN GRAVEL AND/OR STONE FRAGMENTS WITH SAND, TRACE SILT AND CLAY [FILL]		6	5 2 2	5	89	SS-4	–	–	–	–	–	–	–	–	–	–	A-1-b (V)	
		7						27	38	29	– 6 –		NP	NP	NP	10	A-1-b (0)	
		8																
BECOMES WITH BLACK STREAKS AND ODOR [POSSIBLE CONTAMINATES]	1021.4	9	3 4 3	9	67	SS-5	–	–	–	–	–	–	–	–	–	12	A-1-b (V)	
	EOB	10																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH CEMENT

PROJECT: 11TH STREET IMPROVEMENTS	DRILLING FIRM / OPERATOR: OHIO TESTBOR / FAY	DRILL RIG: MOBILE B-57	STATION / OFFSET:	EXPLORATION ID RB-4
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: URS / C. DICKE	HAMMER: AUTOMATIC HAMMER	ALIGNMENT:	
PID: 90465 BR ID: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 1028.0 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 4/4/13 END: 4/4/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.3	COORD: 411030.023 N, 2280071.786 E	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N60	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
	1028.0																	
MOIST, BROWN AND DARK BROWN GRAVEL AND/OR STONE AND BRICK FRAGMENTS WITH SAND, TRACE SILT AND CLAY [FILL]	1026.3	1	4 4 2	8	72	SS-1	–	35	20	27	– 18 –		NP	NP	NP	10	A-1-b (0)	
MEDIUM STIFF TO VERY STIFF, MOIST, BROWN WITH DARK BROWN STREAKS, SILT AND CLAY, SOME SAND, TRACE GRAVEL [FILL]	1024.2	2 3	2 3 5	11	89	SS-2	1.00 0.75 2.25 2.50 2.00	– 3	– 8	– 19	– 43	– 27	– 32	– 18	– 14	– 20	A-6a (V) A-6a (9)	
MEDIUM DENSE, MOIST, BROWN COARSE AND FINE SAND, LITTLE SILT, LITTLE GRAVEL, TRACE CLAY [POSSIBLE FILL]	1020.5	4 5	4 5 4	12	94	SS-3	–	25	38	22	13	2	NP	NP	NP	12	A-3a (0)	
		6	4 5 4	12	72	SS-4	–	–	–	–	–	–	40	24	16	24	A-3a (V)	
LOOSE, MOIST, BROWN, FINE AND COARSE SAND, LITTLE GRAVEL BECOMES WET	1018.8	8 W 9	4 4 5	12	89	SS-5	–	–	–	–	–	–	–	–	–	23	A-3a (V)	
STIFF, WET, BROWN TO GRAY, SANDY SILT, TRACE CLAY	1018.0	EOB 10					1.75 1.50	–	–	–	–	–	–	–	–	–	A-4a (V)	

NOTES: GROUND WATER FIRST ENCOUNTERED AT 9 FT BGS, AT COMPLETION: 9.25 FT BGS

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH CEMENT

PROJECT: 11TH STREET IMPROVEMENTS	DRILLING FIRM / OPERATOR: OHIO TESTBOR / FAY	DRILL RIG: MOBILE B-57	STATION / OFFSET:	EXPLORATION ID RB-5
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: URS / C. DICKE	HAMMER: AUTOMATIC HAMMER	ALIGNMENT:	
PID: 90465 BR ID: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 1027.4 (MSL) EOB: 8.0 ft.	PAGE 1 OF 1
START: 4/4/13 END: 4/4/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.3	COORD: 411039.968 N, 2280407.165 E	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N60	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
	1027.4																	
ASPHALT	1027.2																	
CONCRETE	1026.4																	
SAND AND GRAVEL BASE	1025.7																	
LOOSE, MOIST, BROWN COARSE AND FINE SAND, LITTLE CLAY, TRACE SILT [POSSIBLE FILL]	1023.9	1	5 4 3	9	78	SS-1	–	0	8	76	5	11	NP	NP	NP	11	A-3a (0)	
MEDIUM DENSE, MOIST, BROWN COARSE AND FINE SAND, TRACE GRAVEL, SILT, AND CLAY		2	4 4 4	11	89	SS-2	–	–	–	–	–	–	–	–	–	12	A-3a (V)	
		3	4 7 9	22	67	SS-3	–	19	54	20	– 7 –		NP	NP	NP	5	A-3a (0)	
BECOMES DENSE WITH SANDSTONE COBBLES	1019.4	4 EOB	13 15 18	45	89	SS-4	–	–	–	–	–	–	–	–	–	7	A-3a (V)	
		5																
		6																
		7																
		8																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH CEMENT AND BENTONITE

PROJECT: 11TH STREET IMPROVEMENTS	DRILLING FIRM / OPERATOR: OHIO TESTBOR / FAY	DRILL RIG: MOBILE B-57	STATION / OFFSET:	EXPLORATION ID RB-6
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: URS / C. DICKE	HAMMER: AUTOMATIC HAMMER	ALIGNMENT:	
PID: 90465 BR ID: N/A	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 1029.8 (MSL) EOB: 6.5 ft.	PAGE 1 OF 1
START: 4/4/13 END: 4/4/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.3	COORD: 410917.128 N, 2280759.344 E	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N60	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL	1029.8 / 1029.2																	
MEDIUM DENSE, MOIST, BROWN COARSE AND FINE SAND, LITTLE GRAVEL, LITTLE SILT, TRACE CLAY [FILL]		1	3 5 6	15	61	SS-1	–	–	–	–	–	–	–	–	–	10	A-3a (V)	
		2																
		3	3 5 6	15	89	SS-2	–	28	23	20	– 29 –		NP	NP	NP	12	A-3a (0)	
	1026.3																	
VERY STIFF, DAMP, GRAY SANDY SILT, LITTLE CLAY, TRACE GRAVEL, TRACES OF ORGANICS WITH ROCK AND COAL FRAGMENTS [FILL]		4	5 6 6	16	72	SS-3	2.25 2.75 2.75	4	7	24	47	18	26	17	9	16	A-4a (7)	
BECOMES WITH BRICK COBBLES		5																
BOTTOM 3" OF SAMPLE BRICK COBBLE	1023.3	6 EOB	3 8 16	33	72	SS-4	2.75 2.75	–	–	–	–	–	–	–	–	18	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS MIXED WITH CEMENT AND BENTONITE

APPENDIX C

Laboratory Test Results

CTL Engineering, Inc.
3085 Interstate Parkway
Brunswick, Ohio 44212
Phone: 330/220-8900 Fax: 330/220-8944
e-mail: ctlcleve@ctleng.com

Client: URS Corporation
1375 Euclid Avenue, Suite 600
Cleveland, Ohio 44115-1808
Attention: Mr. Chet Dicke

Date Received: April 8, 2013
Date Reported: April 16, 2013
Lab Code No.: 890

Project: City of Canton - 11th Street Improvements

CTL Project No.: 13020007CLE-C
URS Project No.: 15017791.00000

WATER (MOISTURE) CONTENT OF SOIL
ASTM D2216

Boring Number	Sample Number	Depth	Moisture Content (%)
RB-01	SS-1A	0.5 - 2.0	12
RB-01	SS-2	2.0 - 3.5	15
RB-01	SS-3	3.5 - 5.0	18
RB-01	SS-4	5.0 - 6.5	14
RB-02	SS-1	1.0 - 2.5	15
RB-02	SS-2B	3.25 - 4.0	8
RB-02	SS-3A	4.0 - 5.0	12
RB-02	SS-4	5.5 - 7.0	10
RB-02	SS-5	8.5 - 10.0	12
RB-04	SS-1A	1.0 - 2.5	10
RB-04	SS-2	2.5 - 4.0	20
RB-04	SS-3	4.0 - 5.5	12
RB-04	SS-4	5.5. - 7.0	24
RB-04	SS-5A	8.5 - 10.0	23
RB-05	SS-1	2.0 - 3.5	11
RB-05	SS-2	3.5 - 5.0	12
RB-05	SS-3	5.0 - 6.5	5
RB-05	SS-4	6.5 - 8.0	7

URS Corporation April 16, 2013

Reference: City of Canton - 11th Street Improvements
CTL Project No. 13020007CLE-C
URS Project No. 15017791.00000

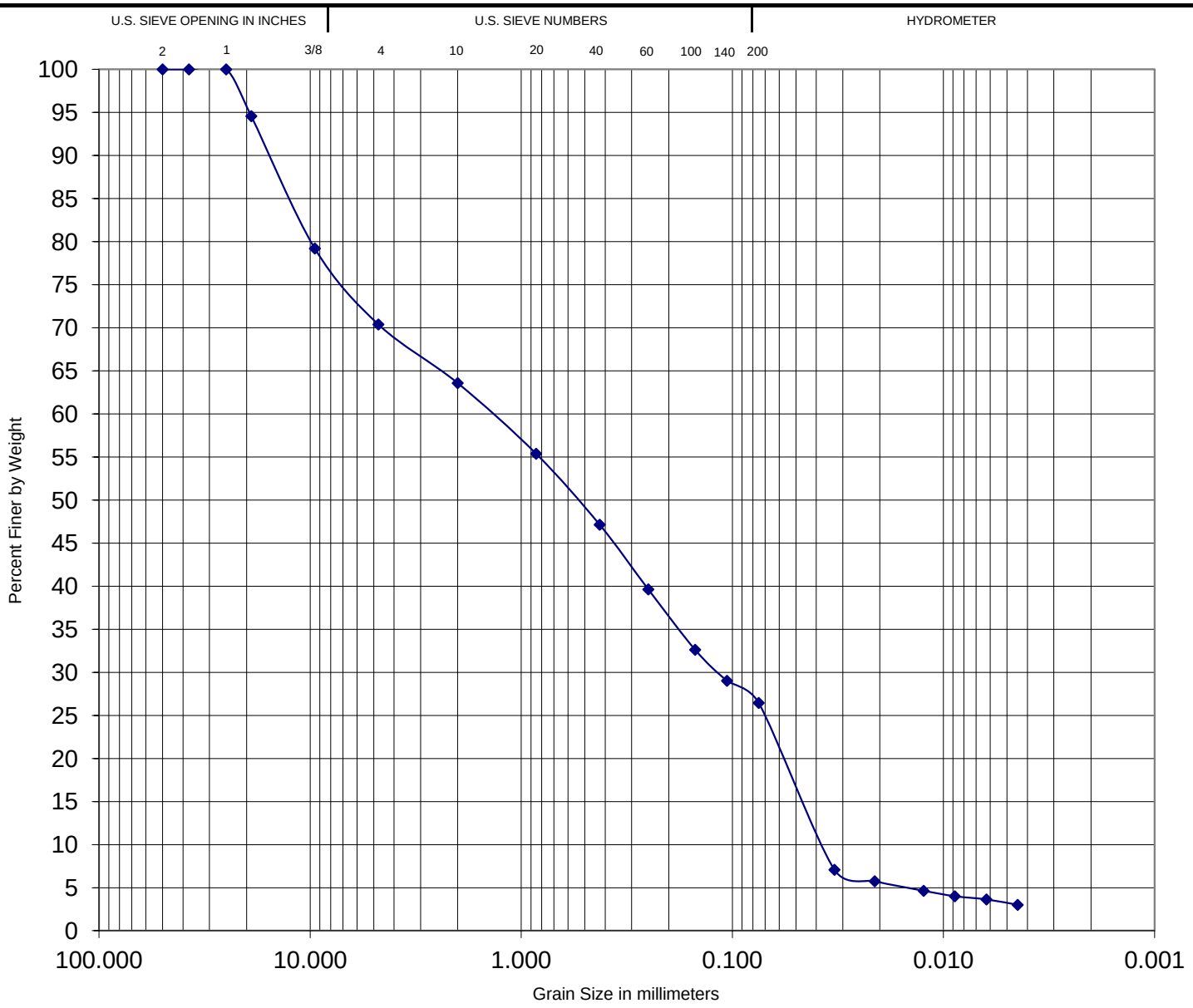
Boring Number	Sample Number	Depth	Moisture Content (%)
RB-06	SS-1	0.5 - 2.0	10
RB-06	SS-2	2.0 - 3.5	12
RB-06	SS-3	3.5 - 5.0	16
RB-06	SS-4	5.0 - 6.5	18

Respectfully submitted
CTL ENGINEERING, INC.

Maurika Lake
Laboratory Manager

Brian L. Shields, P.E.
Project Engineer

mll



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

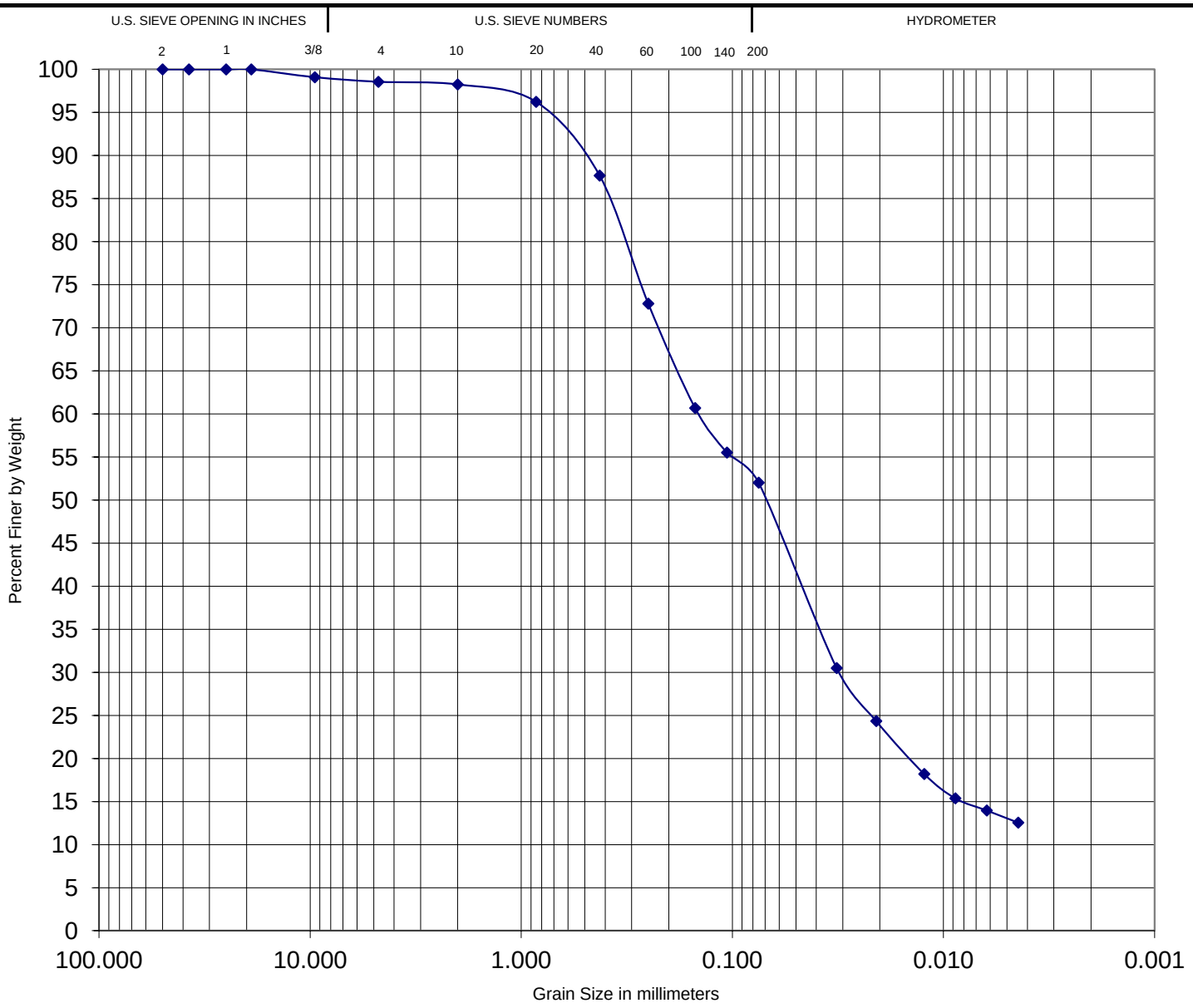
Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-01	SS-1A	A-2-4 (0)	12	NP	NP	NP	0.2	38.5
		Silty sand with gravel (SM)						

							USCS			
Specimen	**Sample**	**D_{100}**	**D_{60}**	**D_{50}**	**D_{30}**	**D_{10}**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**
RB-01	SS-1A	25	1.5	0.55	0.12	0.039	30	44	23	3
							ODOT			
							36	38	23	3

CTL Engineering, Inc.
3085 Interstate Parkway
Brunswick, Ohio 44212
Telephone: (330) 220-8900
Fax: (330) 220-8944

GRAIN SIZE DISTRIBUTION

Client: URS Corporation
Project: City of Canton - 11th St. Improvements
CTL Project No.: 13020007CLE-C
URS Project No.: 15017791
Date: 4/19/2013



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-01	SS-2	A-4a (4)	15	22	15	7		
		Sandy silty clay (CL-ML)						

Specimen	Sample	D_{100}	D_{60}	D_{50}	D_{30}	D_{10}	USCS % Gravel	USCS % Sand	USCS % Silt	USCS % Clay
RB-01	SS-2	19	0.16	0.07	0.032		1	47	39	13
							ODOT			
							2	46	39	13

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Project: City of Canton - 11th St. Improvements
CTL Project No.: 13020007CLE-C
URS Project No.: 15017791
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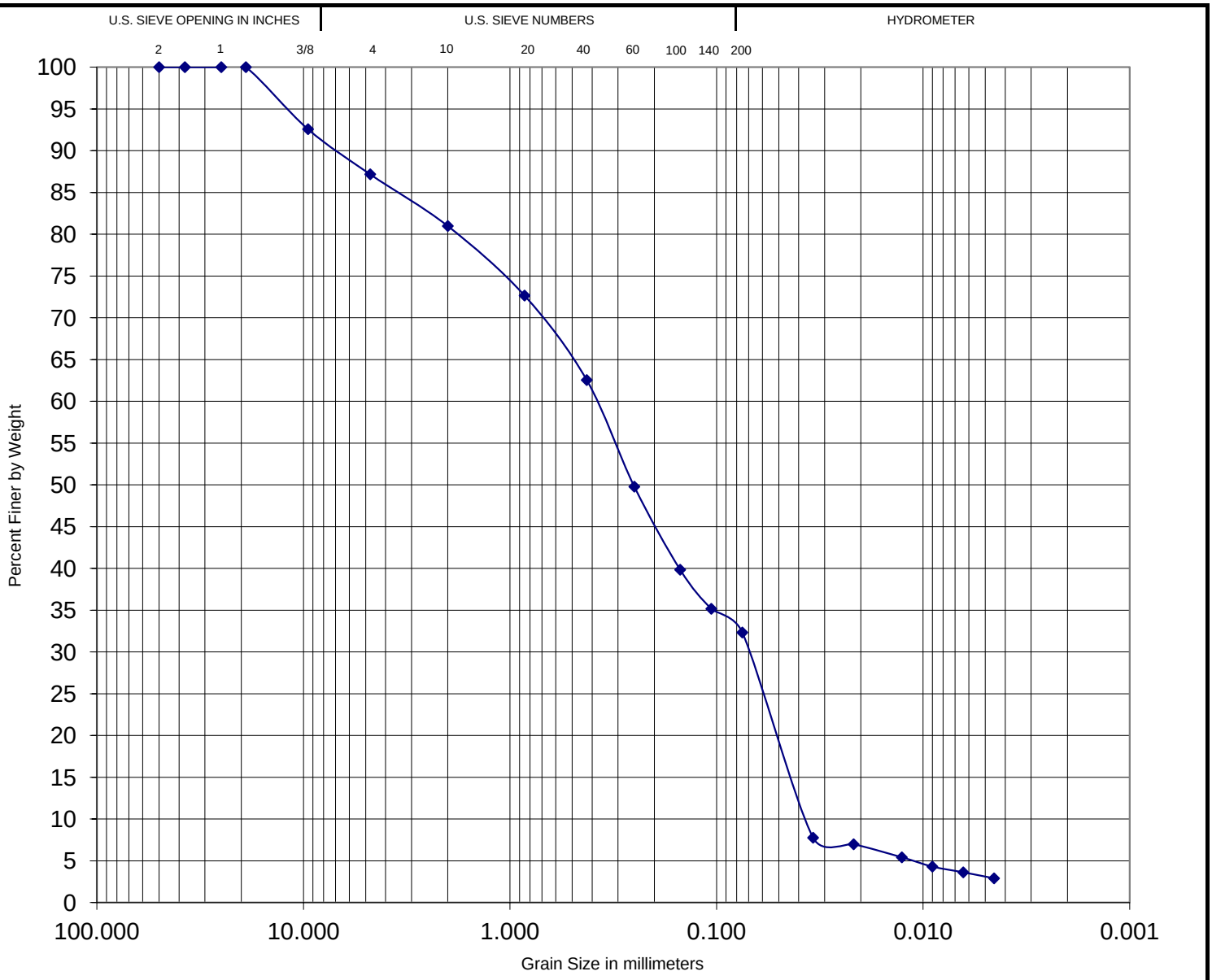

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-02	SS-1	A-2-4 (0)	15	NP	NP	NP	0.3	10.0
		Silty sand (SM)						

							USCS			
Specimen	**Sample**	**D_{100}**	**D_{60}**	**D_{50}**	**D_{30}**	**D_{10}**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**
RB-02	SS-1	19	0.38	0.25	0.07	0.038	13	55	29	3
							ODOT			
							19	49	29	3

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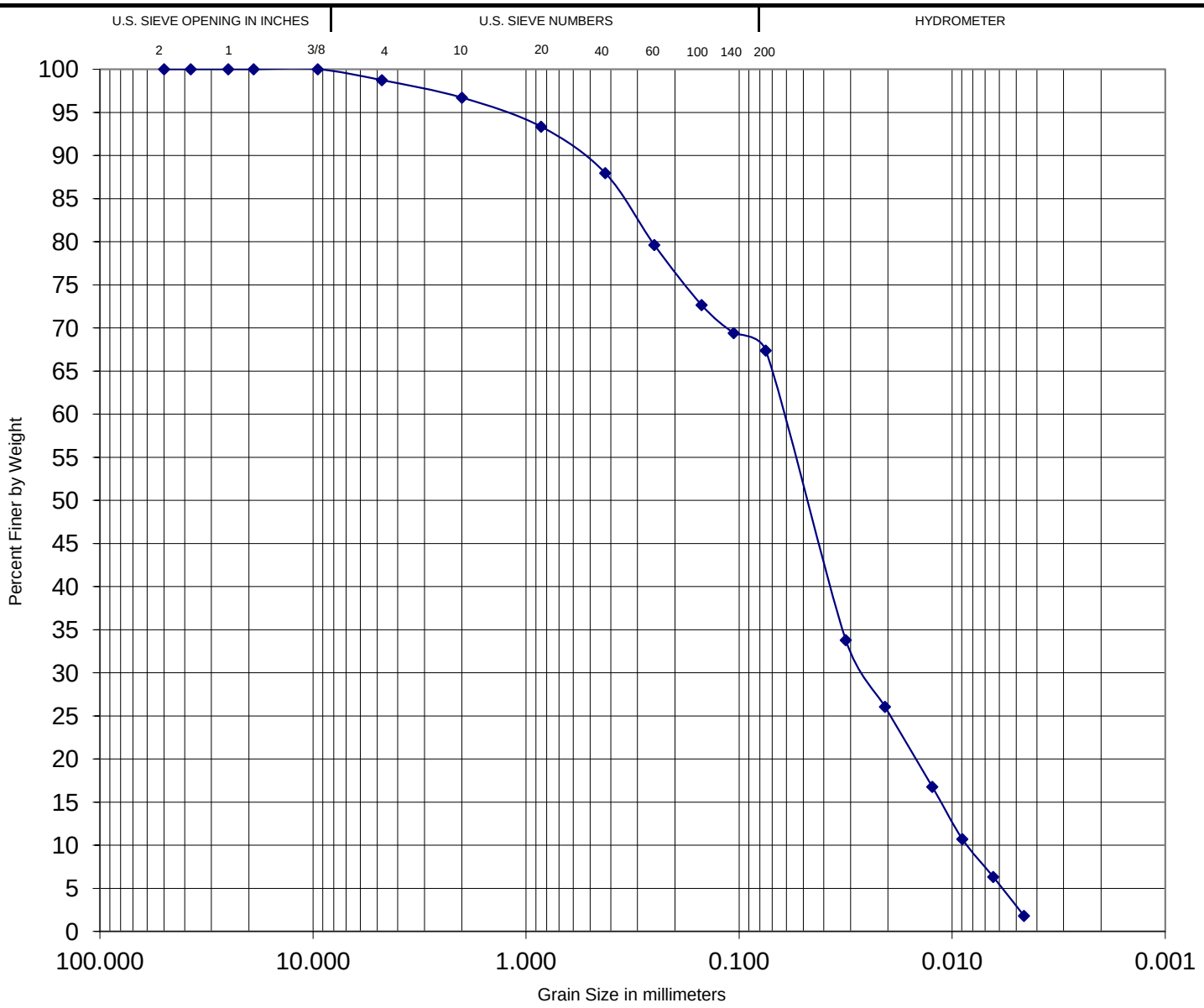
Project: City of Canton - 11th St. Improvements
CTL Project No.: 13020007CLE-C
URS Project No.: 15017791
Date: 4/19/2013



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-02	SS-2B	A-4b (8)	8	25	17	8	2.6	7.2
		Sandy lean clay (CL)						

							USCS			
Specimen	**Sample**	**D_{100}**	**D_{60}**	**D_{50}**	**D_{30}**	**D_{10}**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**
RB-02	SS-2B	9.5	0.062	0.049	0.037	0.0086	1	31	64	4
							ODOT			
							3	29	64	4

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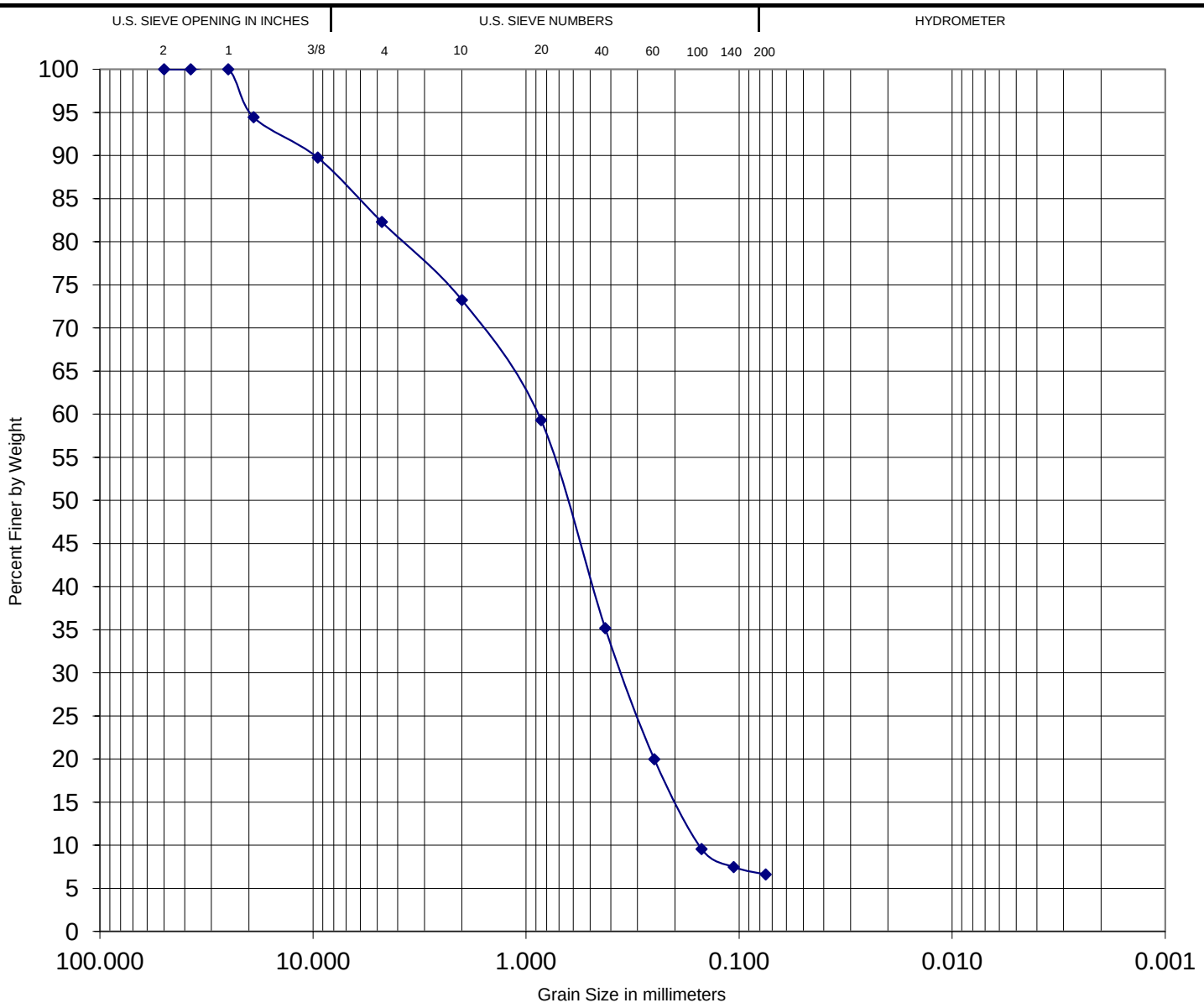
CTL Project No.: 13020007CLE-C
URS Project No.: 15017791
Date: 4/19/2013



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-02	SS-4	A-1-b (0)	10	NP	NP	NP	1.5	5.5
		Poorly graded sand with silt (SP-SM)						

Specimen	Sample	D_{100}	D_{60}	D_{50}	D_{30}	D_{10}	USCS % Gravel	USCS % Sand	USCS % Silt	USCS % Clay
RB-02	SS-4	25	0.88	0.64	0.46	0.16	18	76	6	
							ODOT			
							27	67	6	

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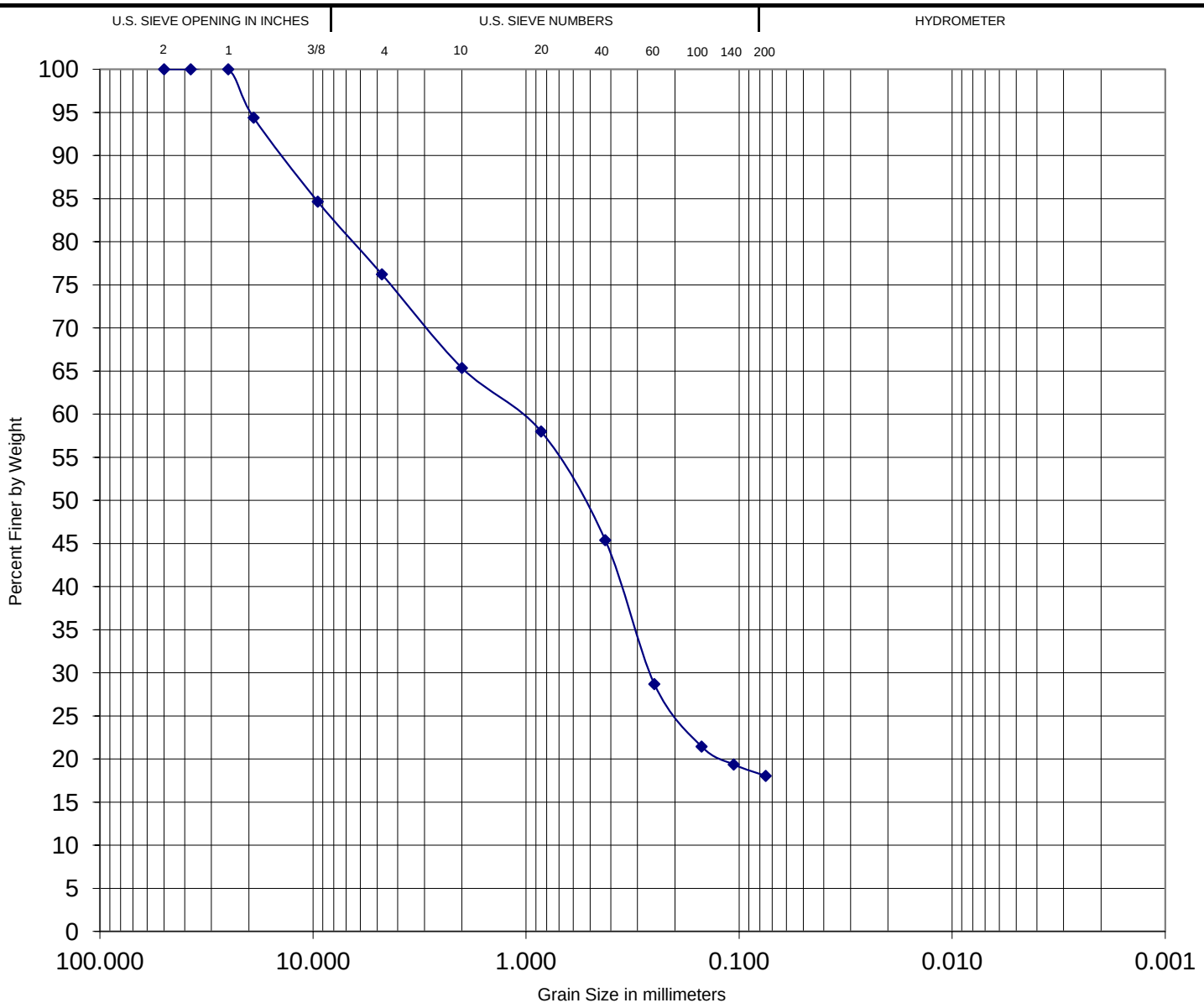
Date: 4/19/2013



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-04	SS-1	A-1-b (0)	10	NP	NP	NP		
		Silty sand with gravel (SM)						

							USCS			
Specimen	**Sample**	**D_{100}**	**D_{60}**	**D_{50}**	**D_{30}**	**D_{10}**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**
RB-04	SS-1	25	1	0.52	0.27		24	58	18	
							ODOT			
							35	47	18	

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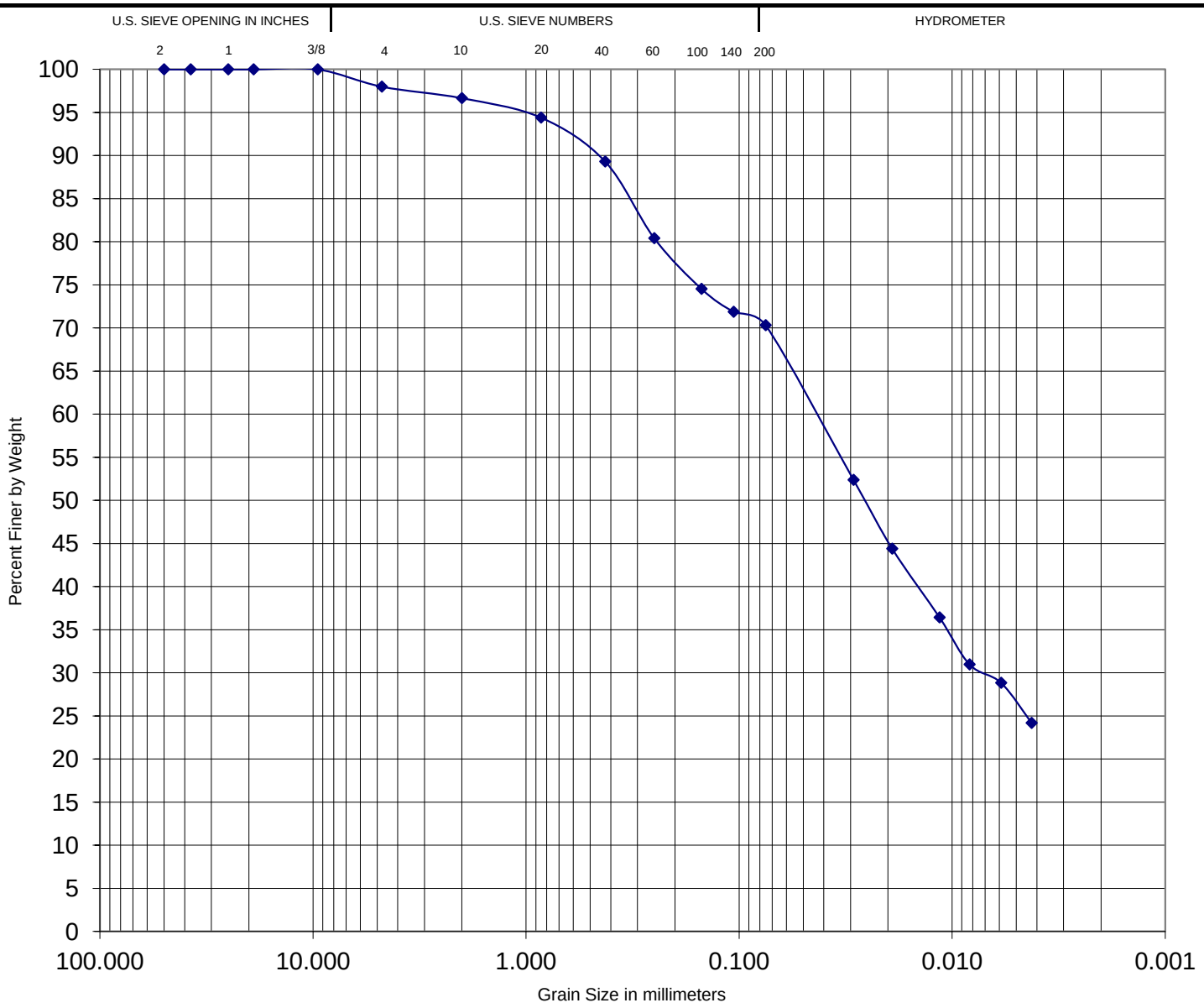
Project: City of Canton - 11th St. Improvements
CTL Project No.: 13020007CLE-C
URS Project No.: 15017791
Date: 4/19/2013



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-04	SS-2	A-6a (10)	20	32	18	14		
		Sandy lean clay (CL)						

							USCS			
Specimen	**Sample**	**D_{100}**	**D_{60}**	**D_{50}**	**D_{30}**	**D_{10}**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**
RB-04	SS-2	9.5	0.043	0.026	0.007		2	28	43	27
							ODOT			
							3	27	43	27

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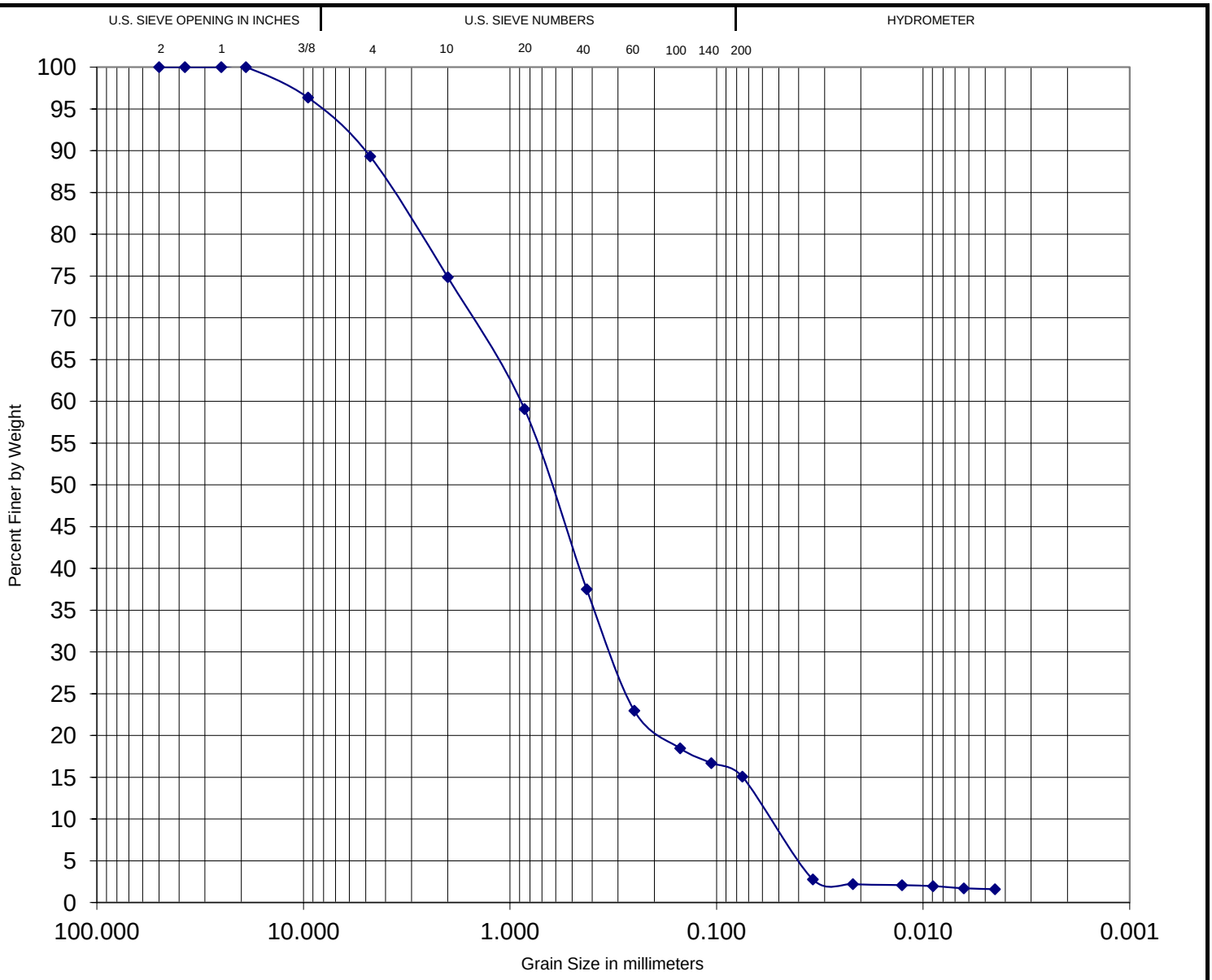

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-04	SS-3	A-1-b (0)	12	NP	NP	NP	2.4	16.2
		Silty sand (SM)						

							USCS			
Specimen	**Sample**	**D_{100}**	**D_{60}**	**D_{50}**	**D_{30}**	**D_{10}**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**
RB-04	SS-3	19	0.89	0.61	0.34	0.055	11	74	13	2
							ODOT			
							25	60	13	2

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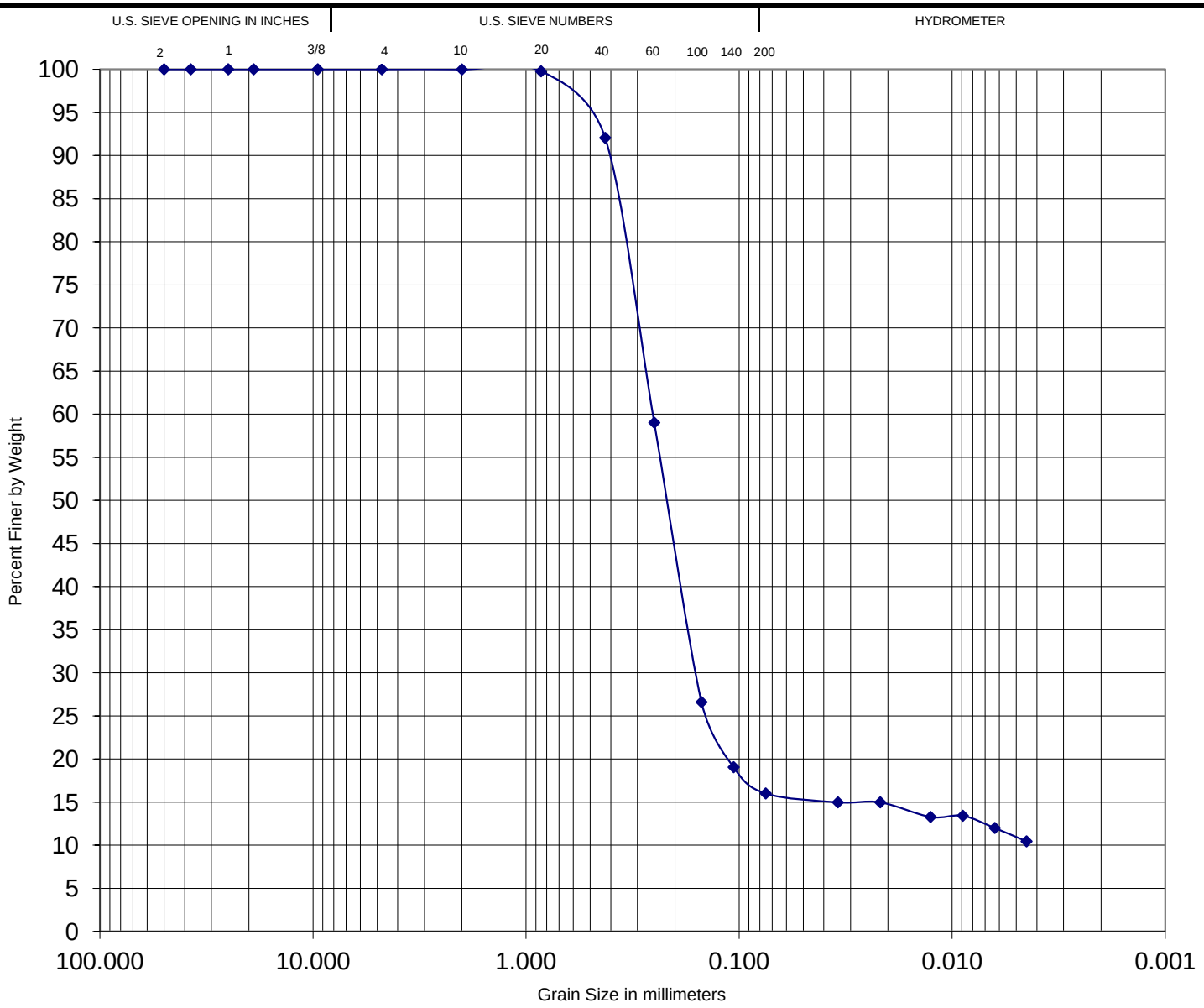

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-05	SS-1	A-3a (0)	11	NP	NP	NP	2.5	5.9
		Silty sand (SM)						

							USCS			
Specimen	Sample	D_{100}	D_{60}	D_{50}	D_{30}	D_{10}	% Gravel	% Sand	% Silt	% Clay
RB-05	SS-1	2	0.26	0.22	0.17	0.044	0	84	5	11
							ODOT			
							0	84	5	11

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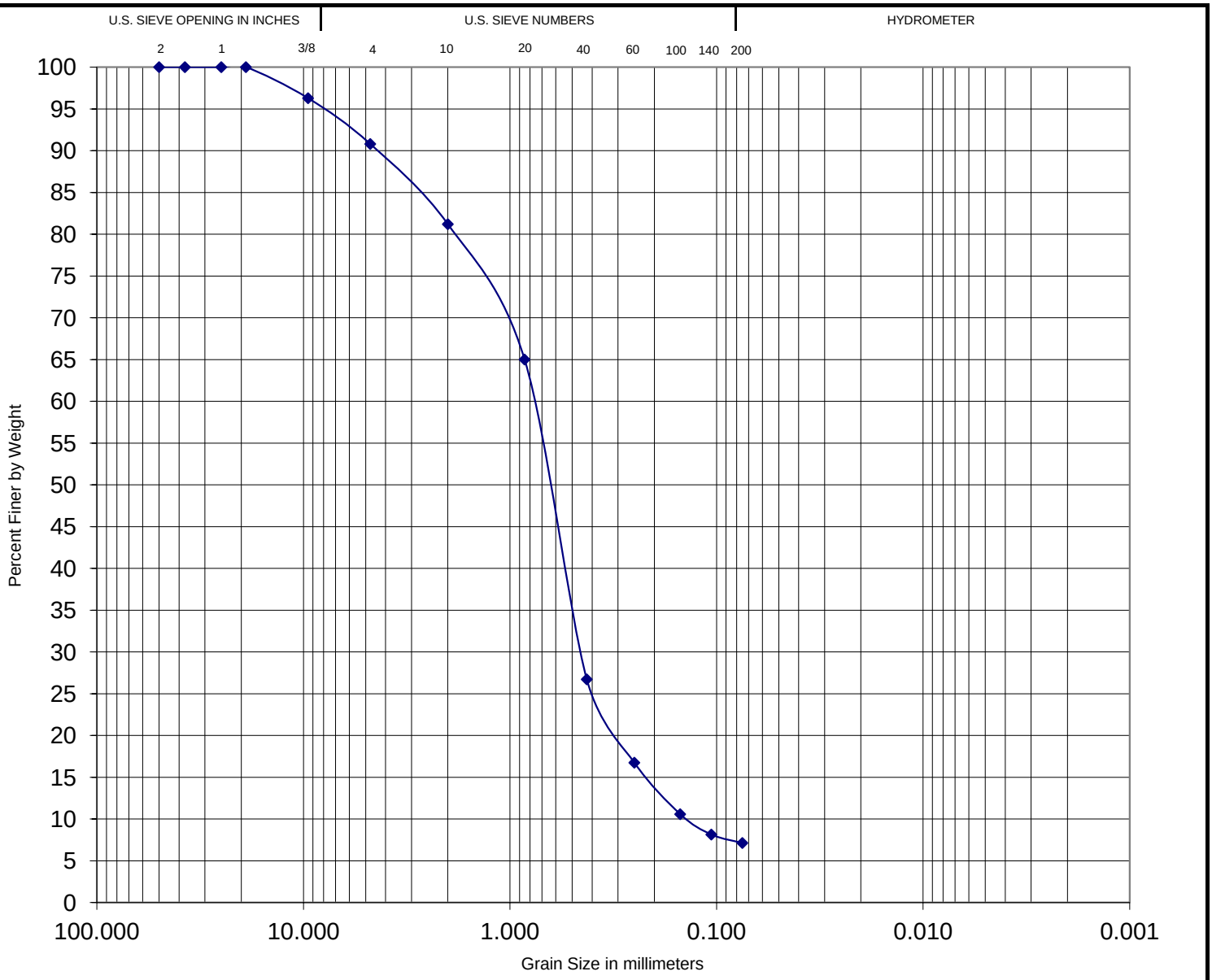

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-05	SS-3	A-1-b (0)	5	NP	NP	NP	1.8	5.1
		Poorly graded sand with silt (SP-SM)						

							USCS			
Specimen	**Sample**	**D_{100}**	**D_{60}**	**D_{50}**	**D_{30}**	**D_{10}**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**
RB-05	SS-3	19	0.77	0.64	0.45	0.15	9	84	7	
							ODOT			
							19	74	7	

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URS Project No.: 15017791
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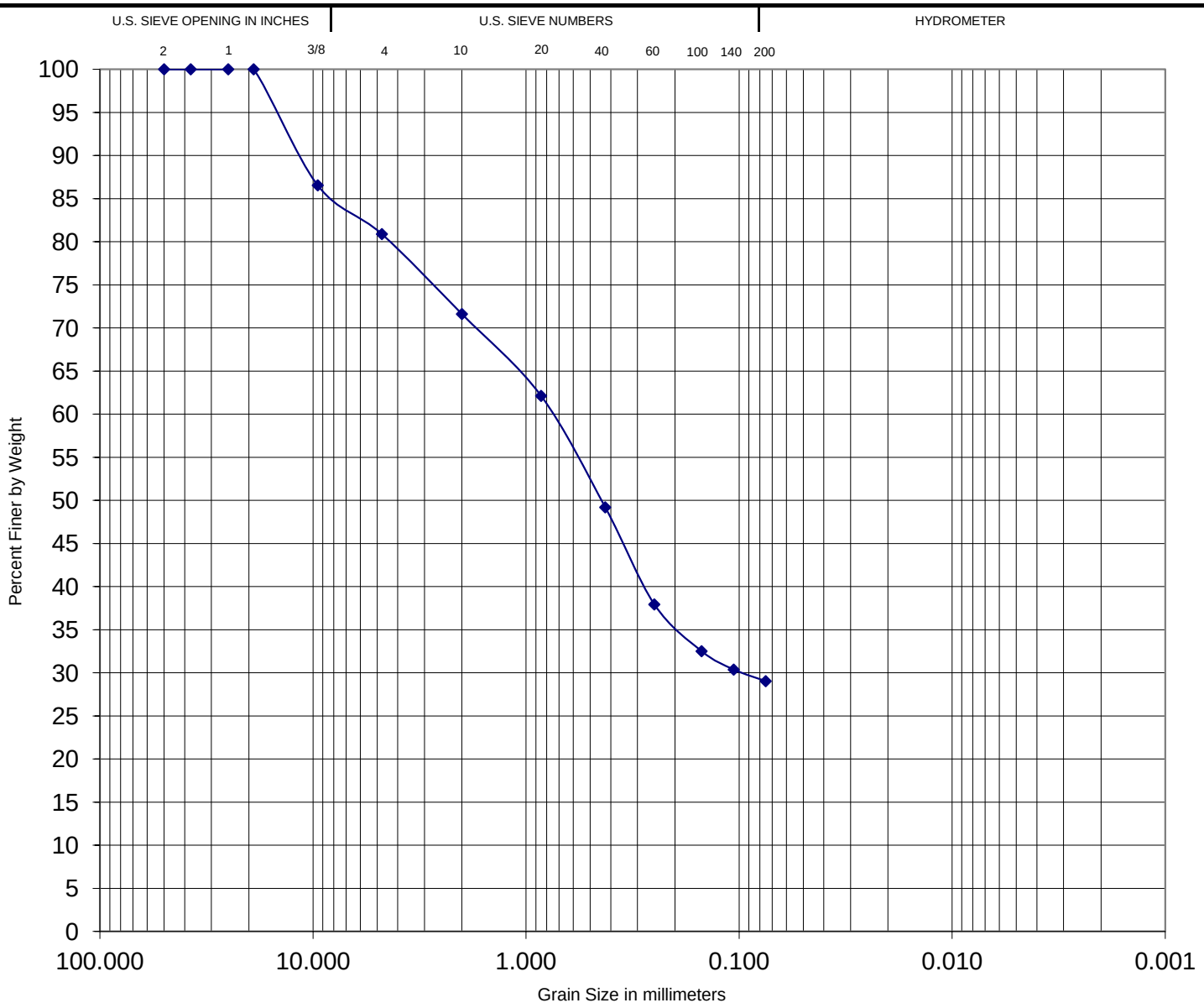

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-06	SS-2	A-2-4 (0)	12	NP	NP	NP		
		Silty sand with gravel (SM)						

							USCS			
Specimen	**Sample**	**D_{100}**	**D_{60}**	**D_{50}**	**D_{30}**	**D_{10}**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**
RB-06	SS-2	19	0.75	0.45	0.10		19	52	29	
							ODOT			
							28	43	29	

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Fax: (330) 220-8944

GRAIN SIZE DISTRIBUTION

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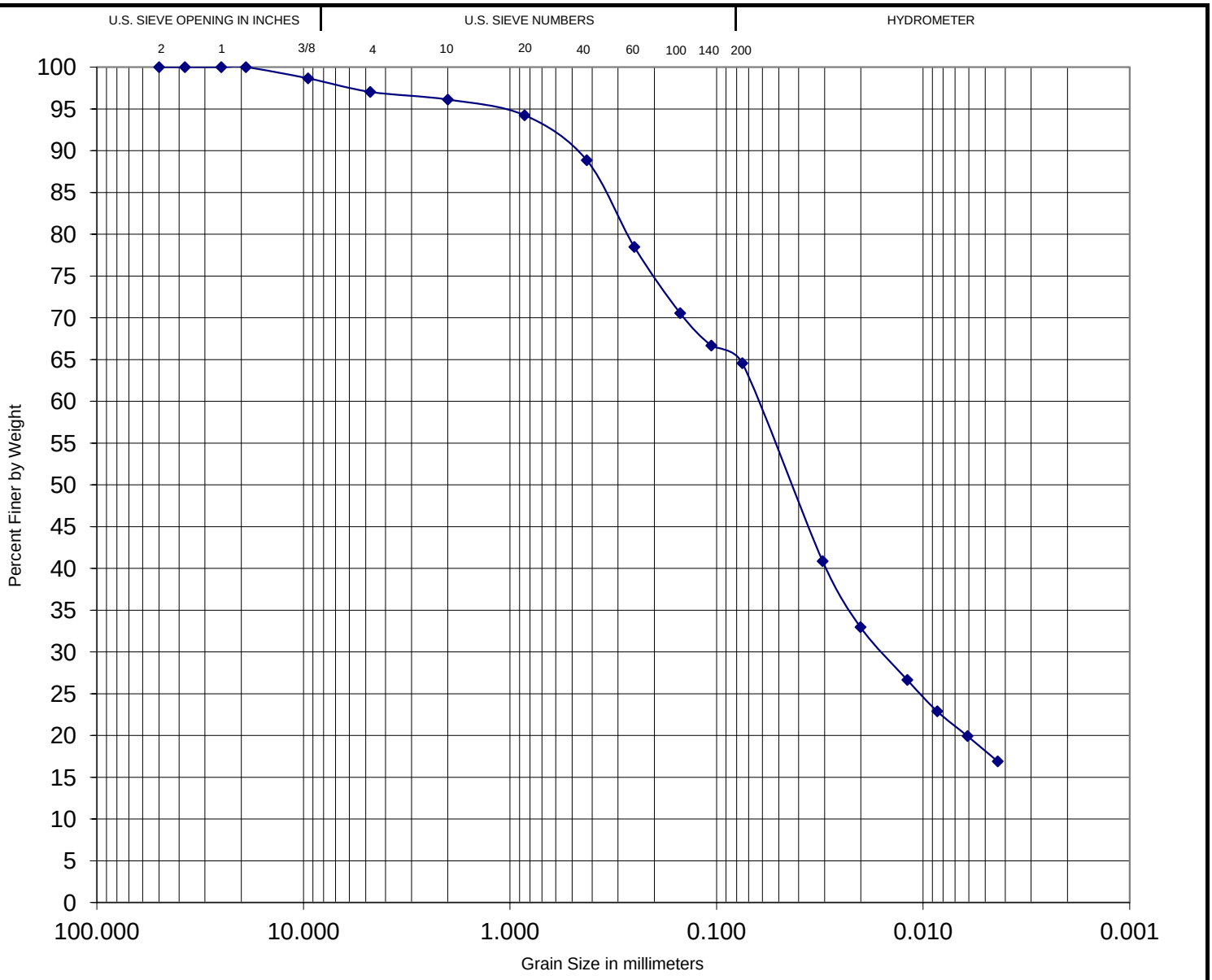
Project: City of Canton - 11th St. Improvements
CTL Project No.: 13020007CLE-C
URS Project No.: 15017791
Date: 4/19/2013



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Specimen	Sample	Classification	% MC	LL	PL	PI	Cc	Cu
RB-06	SS-3	A-4a (7)	16	26	17	9		
		Sandy lean clay (CL)						

							USCS			
Specimen	**Sample**	**D_{100}**	**D_{60}**	**D_{50}**	**D_{30}**	**D_{10}**	**% Gravel**	**% Sand**	**% Silt**	**% Clay**
RB-06	SS-3	19	0.063	0.044	0.017		3	32	47	18
							ODOT			
							4	31	47	18

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Fax: (330) 220-8944

GRAIN SIZE DISTRIBUTION

Client: URS Corporation
Project: City of Canton - 11th St. Improvements
CTL Project No.: 13020007CLE-C
URS Project No.: 15017791
Date: 4/19/2013

APPENDIX D

Pavement Core Photos

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
City of Canton	Canton, Stark County, Ohio	15017791

Photo No. 1

Description:

Pavement Core PC – 1

Core Location: Market Ave

Photo No. 2

Description:

Pavement Core PC - 2

Core Location: Market Ave

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
City of Canton	Canton, Stark County, Ohio	15017791

Photo No. 3

Description:

Pavement Core PC - 3

Core Location: Cherry Ave

APPENDIX E

GB-1 Results

Subgrade Analysis

V. 11.00 07/07/10

Design CBR 10

Global Options		
320	R&R	No
206	CS	Option
	LS	No
	LKD	No
206	Depth	14

Classification Counts by Sample																	
R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	0	2	0	10	1	0	0	0	5	1	0	1	0	0	0	0	0
		10%		50%	5%				25%	5%		5%					
0%	65%								35%								

Surface Class	
2-5	0
4b	0
5	0
7-5	0
7-6	0
8a	0
8b	0
R	0

% Borings	
N_{60L}<= 5	40%
<=10	80%
>=20	0%
M+	100%
R	0%

% Surface	
20%	
0%	20%

Rig	ER
A	81.3
B	
C	
D	
E	
F	
G	
H	

Total Borings	5
PID	92528
Location	11th Street, Stark Co, OH

	N_{60}	N_{60L}			PI		Clay		M	M_{OPT}		GI
Average	14.4	8.2			8.7		10.1		13.2	9.1		2.18
Maximum	45	15	32	18	14	64	27	70	24	14		9
Minimum	4	4	22	15	7	5	2	15	5	6		0

UC @ Surface
18.0
18
18

Boring					Cut	Subgrade		Standard Penetration						Physical Characteristics						Moisture		Class		Comments	Problem		Undercuts		Analysis
#	B #	Boring Location	Depth	To	Fill	Depth	To	n_2	n_3	N	Rig	N_{60}	N_{60L}	LL	PL	PI	% Silt	% Clay	P 200	M	M_{OPT}	Ohio DOT	GI		w/ Class	w/ MN	UC Class	UC MN	
1	RB-01	West side - at the intersection of Market Ave and 11th Street	0.5	2.0	0.0	0.5	2.0	3	3	6	A	8		NP	NP	NP	23	3	26	12	10	2-4	0			N		18	
			2.0	3.5		2.0	3.5	2	1	3		4		22	15	7	39	13	52	15	10	4a	3			N		30	
			3.5	5.0		3.5	5.0	2	3	5		7		22	15	7	39	13	52	18	10	4a	3			N		21	
			5.0	6.5		5.0	6.5	7	7	14		19	4	22	15	7	39	13	52	14	10	4a	3						
2	RB-02	Western End of Beginning of new alignment	1.0	2.5	0.0	1.0	2.5	8	3	11	A	15		NP	NP	NP	29	3	32	15	8	3a	0			M			
			2.5	4.0		2.5	4.0	1	5	6		8		NP	NP	NP	29	3	32	15	8	3a	0			N		---	
			4.0	5.5		4.0	5.5	4	5	9		12		25	17	8	64	4	68	8	12	4b	7		4b		36		
			5.5	7.0		5.5	7.0	2	2	4		5	5	NP	NP	NP				10	6	1b				N		---	
3	RB-04	Eastern end of new roadway alignment	1.0	2.5	0.0	1.0	2.5	4	2	6	A	8		NP	NP	NP				10	6	1b	0			N		---	
			2.5	4.0		2.5	4.0	3	5	8		11		32	18	14	43	27	70	20	14	6a	9			N		14	
			4.0	5.5		4.0	5.5	5	4	9		12		NP	NP	NP	13	2	15	12	8	3a	0			MN		---	
			5.5	7.0		5.5	7.0	5	4	9		12	8	NP	NP	NP	13	2	15	24	8	3a				MN		---	
4	RB-05	Northern Side of 11th Street on westbound 11th street lane	2.0	3.5	0.0	2.0	3.5	4	3	7	A	9		NP	NP	NP	5	11	16	11	8	3a	0			N		---	
			3.5	5.0		3.5	5.0	4	4	8		11		NP	NP	NP	5	11	16	12	8	3a	0			N		---	
			5.0	6.5		5.0	6.5	7	9	16		22		NP	NP	NP				5	8	3a	0						
			6.5	8.0		6.5	8.0	15	18	33		45	9	NP	NP	NP				7	8	3a							
5	RB-06	Eastern side of the intersection of Cherry Ave and 11th St	0.5	2.0	0.0	0.5	2.0	5	6	11	A	15		NP	NP	NP				10	8	3a	0						
			2.0	3.5		2.0	3.5	5	6	11		15		NP	NP	NP				12	8	3a	0						
			3.5	5.0		3.5	5.0	6	6	12		16		26	17	9	47	18	65	16	12	4a	6						
			5.0	6.5		5.0	6.5	8	16	24		33	15	26	17	9	47	18	65	18	12	4a	6			M			