SUBSURFACE INVESTIGATION
SR 161 & RIVERSIDE DRIVE INTERSECTION IMPROVEMENTS
DUBLIN, FRANKLIN COUNTY, OHIO

S&ME Project No. 1171-13-042A

Report to:

EMH&T, Inc.
Columbus, Ohio

Prepared by:

6190 Enterprise Ct.
Dublin, Ohio 43016

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1171-13-042A

EMH&T, Inc.
5500 New Albany Road
Columbus, Ohio 43054

Attention: Mr. Michael Brehm, P.E.

Reference: **Subsurface Investigation – Revised**
SR 161 & Riverside Drive Intersection Improvements
Dublin, Franklin County, Ohio

Dear Mr. Brehm:

In accordance with our proposal dated July 15, 2013, which was authorized with EMH&T's Standard Sub-Contract agreement signed on August 28, 2013, S&ME, Inc. (S&ME) has completed the Geotechnical Investigation for the State Route 161 and Riverside Drive Intersection Improvements project in Dublin, Ohio. This report contains the information obtained from the borings, as well as a pavement subgrade evaluation for design and construction of the roadway.

This report is being reissued to reflect the following revisions:

- Updated boring elevations for 11 of the 20 borings based on survey performed by EMH&T following submission of the report; and,
- Boring B-214 was incorrectly labeled as being located at the proposed pedestrian underpass. Based on historic Boring B-28, recommendations for this structure remain unchanged.

We appreciate having been given the opportunity to be of service. Please do not hesitate to contact our office if you have any questions concerning our report.

Respectfully submitted,

S&ME, Inc.
Columbus, Ohio

Christopher J. Nye, P.E.
Project Engineer

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Senior Reviewer

Submitted: 1 Electronic Copy (pdf) to Mr. Michael Brehm, P.E. (mbrehm@emht.com)

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APPENDIX

1. INTRODUCTION

S&ME, Inc. (S&ME) has completed the subsurface investigation for the proposed State Route 161 and Riverside Drive intersection improvements in Dublin, Ohio. These improvements are part of the City of Dublin's Bridge Street Corridor development. The work was performed in general accordance with our proposal dated July 15, 2013. The purpose of this investigation was to obtain subsurface information to allow us to characterize the subsurface conditions and to evaluate pavement subgrade conditions for pavement design to be performed by others. This report describes our understanding of the project, presents the results of the field exploration and laboratory testing, and discusses our conclusions and recommendations.

As requested by EMH&T, this investigation was not performed in strict accordance with ODOT's Specifications for Geotechnical Explorations (SGE). S&ME understands that the project documents will reference ODOT specifications for roadway construction; therefore we have included reference to ODOT Construction and Materials Specifications (CMS) in our report.

2. SITE AND PROJECT DESCRIPTION

Based on the Survey Scope Exhibit provided by EMH&T and showing requested boring and core locations, S&ME understands that the project will include:

- Construction of a new round-a-bout at the intersection of SR 161 and Riverside Drive. The new round-a-bout will be located approximately 125 feet to the east of the existing intersection;
- Realignment of Riverside Drive between SR 161 and Tuller Drive up to 250 feet to the east;
- Intersection modification of Riverside Drive with Dale Drive and Tuller Drive; and,
- A possible pedestrian tunnel beneath the realigned Riverside Drive.

The Bridge Street Corridor project includes substantial development within the project vicinity. As part of this investigation, S&ME was requested to perform preliminary borings for the following proposed developments. However, these explorations were for data collection only, and specific recommendations pertaining to design and construction of the proposed park facilities were not included in our authorized scope of work.

- Construction of new public park facilities along the existing Riverside Drive alignment, including a pedestrian bridge crossing the Scioto River and an overlook; and,
- Cul-de-sac extension to the north and south of North Riverview Street.

Based on preliminary plan and profile information provided by EMH&T for the realigned Riverside Drive between Dale Drive and Tuller Road (approximate STA 108+70 to STA 133+50), new vertical roadway alignment will require up to 10 feet of new fill to obtain

the anticipated roadway grades. Plan and profile information for the proposed roundabout was not available at the time of this report; however, it is our present understanding that the intersection will move to the east and be significantly higher in elevation than the present intersection.

The existing Riverside Drive and SR 161 within the project limits generally consists of four lanes. The new public park area presently consists of heavily wooded and steep banks along the Scioto River and includes a portion of the existing Riverside Drive. Existing development along the realigned portion of Riverside Drive includes, from the south to the north: the Bridge Point Shopping center with retail buildings and parking lot; commercial office buildings and associated parking; a former golf driving range with restaurant; and vacant lots with concrete parking lots.

3. REGIONAL GEOLOGY

Geologic references indicate that this site is located in a portion of Ohio which has been glaciated. The Columbus Lowland area is surrounded in all directions by relative uplands, having a broad regional slope toward the Scioto Valley with many larger streams. The overburden soils consist of predominantly loamy Wisconsinan-age till and extensive outwash in the Scioto Valley over deep Devonian to Mississippian-age carbonate rocks, shales, and siltstones. Shale bedrock is located at relatively shallow depths in this region at higher elevations and limestone bedrock is located at relatively shallow depths in the lower elevations near the Scioto River.

4. EXISTING INFORMATION

S&ME (formerly BBC&M) has significant experience in this area and has drilled borings for a number of projects in the vicinity of the site. These include investigations performed for FRA-270-22842, Emerald Parkway extension, Wendy's/Riverside Drive storm water improvements, Dale Center development, Old Dublin Stormwater Sewer project, A Touch of Class car wash, and Riverside Drive Area Improvements. The existing boring information indicates that limestone bedrock is present at depths ranging from 3.5 feet to greater than 15 feet below existing grade. Selected boring logs from previous investigations near the project site were used to supplement the current investigation. Copies of these boring logs are provided as Plates 51 through 61 in the Appendix.

S&ME also accessed the ODOT Office of Geotechnical Engineering's on-line Geotechnical Document Management System to search for any existing historical geotechnical explorations within the limits of this project; however, no existing additional information could be located.

5. EXPLORATION

5.1 Field Investigation

Between September 9 and September 22, 2013, S&ME was on-site and performed a total of twenty (20) borings and four (4) pavement cores. The approximate locations of the

borings are shown on the Plan of Borings submitted as Plate 2 in the Appendix of this report. The boring program consisted of the following:

Base Investigation

- Eight (8) borings (B-202, B-203, B-204, B-205, B-206, B-209, B-217, and B-218) along the existing SR 161 or Riverside Drive alignments;
- Seven (7) borings (B-208, B-210, B-211, B-213, B-214, B-215, and B-216) along the new, realigned portion of Riverside; and,
- Four (4) pavement cores (X-201, X-207, B-212, and X-219) within SR 161 and Riverside Drive obtained using a hand operated, generator-driven core machine.

Preliminary Park Investigation

- Two (2) borings (B-220 and B-221) for the North Riverview Street cul-de-sac extensions;
- Two (2) borings (B-222 and B-223) for the proposed pedestrian bridge crossing the Scioto River; and,
- One (1) boring (B-212) near the proposed overlook structure.

EMH&T staked locations for Borings B-212, B-214, B-216, and B-222, along with centerline stakes for the proposed Riverside Drive realignment. The remaining borings were located in the field by S&ME. The final boring locations were staked in the field by S&ME and adjusted based on existing utilities and drill rig accessibility; therefore the locations should be considered approximate. Following submission of our report, EMH&T performed additional surveying at the site and provided S&ME with surveyed ground surface elevations for 11 of the 20 borings, specifically Borings B-205, B-208, B-210, B-211, B-213, B-214, B-215, B-216, B-217, B-218, and B-223. The remaining boring elevations were estimated from available topographic information.

With the exception of Boring B-222, a truck-mounted drill rig using a 4½-inch outside diameter (O.D.) continuous-flight auger was used to advance the borings between sampling attempts. Due to accessibility challenges, a drill rig mounted on an All-Terrain Vehicle (ATV) chassis using a 3¼-inch inside diameter (I.D.) hollow-stem auger was used to perform Boring B-222. At regular intervals, disturbed but representative soil samples were obtained by lowering a 2-inch O.D. split-barrel sampler to the bottom of the boring and then driving the sampler into the soil with blows from a 140-pound hammer freely falling 30 inches (Standard Penetration Test, ASTM D1586).

Once auger refusal was encountered on the apparent bedrock surface in selected borings, a changeover to rotary drilling techniques was made in Borings B-210, B-214, B-222 and B-223. Five (5) to ten (10) feet of bedrock core was obtained in these borings using an N-sized wire line (Q) rock core barrel and diamond core bit using water as a circulating/ cooling fluid.

In the field, experienced personnel performed the following: 1) examined all samples recovered from the borings; 2) preserved representative portions of all samples in airtight glass jars or compartmented boxes; 3) prepared a log of each boring; 4) made seepage

and groundwater observations; 5) made hand-penetrometer measurements in specimens exhibiting cohesion; and, 6) provided liaison between the field work and the undersigned Project Engineer so that the exploration program could be modified in the event unusual or unexpected subsurface conditions were encountered.

At the completion of drilling, the borings the borings were backfilled with soil cuttings, and where borings were performed within pavement, the existing pavement surface was repaired with an equivalent thickness of cold-patch asphalt. All recovered samples were transported to S&ME's soils laboratory for further examination and testing.

5.2 Laboratory Testing

In the laboratory, the samples were visually identified and on a few representative samples, moisture contents, liquid and plastic limit determinations, and grain size analyses were performed. Results of these tests permit an evaluation of strength and subgrade support characteristics of the soil by comparison with similar soils for which these characteristics have been previously determined.

Based upon the results of the laboratory testing program, soil descriptions contained on the field logs were modified, if necessary, and laboratory-corrected logs are submitted as Plates 5 through 24 of the Appendix. Results of the laboratory tests are shown graphically on the individual boring logs and a summary of test results is presented on Plates 27 through 29 of the Appendix. Results of grain size analyses are presented on Plates 30 through 47.

In addition to the above index tests, three (3) unconfined compressive strength (UCS) tests were also performed on portions of the recovered limestone rock cores, with photographs of the recovered cores included as Plate 26 of the Appendix, and the results of the UCS tests included as Plates 48 through 50.

Soils described in this report have been classified generally in accordance with the Unified Soil Classification System. However, the system has been augmented by the use of special adjectives to designate the approximate percentages of minor soil components. An explanation of the symbols and terms used on the boring logs and definitions of the special adjectives used to denote the minor soil and rock components are presented on Plates 3 and 4 of the Appendix.

5.2.1 Results of Soil Classification Testing

Atterberg limit testing was performed to provide engineering classifications of the on-site soils exhibiting cohesion. A total of seventeen (17) Atterberg limits were performed with liquid limits ranging from 21 to 67 percent, and plasticity indices ranging from 4 to 45 percent for the soils tested. One additional sample was determined to be non-plastic. In addition, grain size distribution analyses were performed on the same eighteen (18) samples, with percentage of material finer than the No. 200 sieve ranging from 24.9 to 89.5 percent.

5.2.2 Results of Moisture Testing

Natural moisture content testing was performed on a total of eighteen (18) soil samples. The moisture contents of the on-site soils tested ranged from 5 to 28 percent. These values varied from 10 percent below to 5 percent above their corresponding plastic limit.

6. FINDINGS

Please refer to the boring logs submitted in the Appendix for information on the soil and groundwater/seepage conditions encountered at the boring locations. Inferences should not be made to the subsurface conditions in the areas between or away from the borings without performance of additional borings as well as field verification.

6.1 Existing Pavement

The existing pavement sections encountered in the borings and pavement cores are summarized in Table 1 below. Photographs of the asphalt cores are included in the Appendix on Plate 25.

Table 1: Existing Pavement Thicknesses

Boring No.	Existing Asphalt Thickness (in)	Existing Granular Base Thickness (in)
X-201	11½	--
B-202	11	6
B-205	5	6
B-206	13	5
X-207	13	--
B-209	7	5
B-210	3	8
B-211	6	6
B-212*	8½	2
B-217	12	6
B-218	12	4
X-219	15½	--
B-220	4	5
B-221	3	7
B-223	7	5

* Pavement Core X-212 was performed in combination with Boring B-212.

6.2 General Subsurface Stratigraphy

6.2.1 Base Investigation

SR 161 / Riverside Drive Intersection

Borings performed near the intersection of SR 161 and Riverside encountered either existing pavement consisting of 5 to 13 inches of asphalt and 5 to 6 inches of granular

base, or topsoil ranging in thickness from 2 to 4 inches. Beneath the surficial materials, natural soils generally consisted of medium-dense to very-dense gravel with Borings B-202, B-205, and B-209 containing layers of medium-stiff to very-stiff cohesive soil (silty clay). With the exception of Boring B-205, the borings terminated at auger refusal on limestone bedrock at depths ranging from 2.2 to 8.6 feet below existing grades. Boring B-205 was terminated at the planned depth of 10.0 feet after penetrating 2.0 feet into medium-stiff to stiff silty clay.

Riverside Drive Realignment

Beneath existing pavement of 3 to 12 inches of asphalt and 4 to 8 inches of granular base, or beneath 2 to 3 inches of topsoil, the borings along the Riverside Drive realignment encountered natural soils consisting of discontinuous layers of granular and cohesive material. The granular material was generally described as medium-dense to very-dense sand and/or gravel, with very-loose to loose zones encountered in Borings B-208, and B-218. The cohesive (silty clay) soils were very-stiff to hard, with medium-stiff zones encountered near the surface in Borings B-215 and B-217. Bedrock was encountered at depths ranging from 2.2 to 9.8 feet below grade, and samples of recovered bedrock core in Borings B-210 and B-214 were described as medium-hard, highly fractured gray-brown limestone.

Pedestrian Underpass

Historic boring B-28 was performed near the proposed pedestrian underpass and encountered 6 inches of topsoil overlying 7 feet of existing fill, which was described as stiff to hard silty clay. Beneath the surficial materials, the boring penetrated 2 feet of natural very-stiff silty clay before encountering hard limestone bedrock at an elevation of El. 796.4.

6.2.2 Preliminary Park Investigation

Park Overlook

Boring B-212 was located in the vicinity of the proposed park overlook. This boring was performed in combination with pavement core X-212. Beneath 8.5 inches of asphalt and 2 inches of granular base, 1.2 feet of very-stiff silty clay was underlain by 3.2 feet of very-dense fine to coarse gravel. The boring terminated at auger refusal on limestone bedrock at a depth of 5.5 feet (El. 793.0).

North Riverview Cul-de-sac

Borings B-220 and B-221 were performed near the proposed cul-de-sacs at the south and north ends of North Riverview Street, respectively. Existing asphalt consisted of 3 and 4 inches of asphalt with 7 and 5 inches of granular base, respectively. Each boring encountered approximately 7 feet of existing fill, which was described as either stiff to very-stiff cohesive (silty clay) or very-loose to medium-dense granular (sand and gravel) materials. Beneath the existing fill, Boring B-220 penetrated 0.7 feet of weathered limestone prior to encountering auger refusal on limestone bedrock at a depth of 8.7 feet (El. 794.3). Boring B-221 terminated at the planned depth of 10.0 feet after penetrating 2.0 feet into medium-dense gravel.

Pedestrian Bridge

One boring, B-222, was located near the proposed bridge pier near the Scioto River main channel. This boring encountered 6 inches of topsoil, then 3.2 feet of medium-stiff organic clayey silt, then 5.2 feet of medium-dense to very-dense gravel. Hard limestone bedrock was encountered at a depth of 8.9 feet (El. 753.1). Boring B-223 was located within Riverside Drive near the proposed pedestrian bridge's west abutment and encountered existing pavement consisting of 7 inches of asphalt and 5 inches of granular base. Five (5) feet of very-dense gravel was penetrated before encountering auger refusal at a depth of 6.0 feet on hard limestone containing many horizontal and vertical fractures.

6.3 Groundwater Observations

Groundwater observations were made as each boring was being advanced and measurements were made at the completion of drilling. Groundwater and/or seepage was encountered during drilling in Boring B-222 at the approximate Scioto River elevation. The remaining borings were noted as being "dry," that is to say no measurable amount of water had collected in the borehole prior to backfilling.

7. ANALYSIS AND RECOMMENDATIONS

The following recommendations pertain to the design and construction of the proposed roundabout at SR 161 and Riverside Drive, as well as the proposed realignment of Riverside Drive between SR 161 and Tuller Road. The boring performed as part of the Preliminary Park Investigation were for informational purposes only, and no recommendations were requested for the planned park facilities.

7.1 Roadway Embankment Construction

Preliminary profile information provided by EMH&T indicates that as much as 10 feet of new fill will be necessary to attain the desired profile for the realigned portion of Riverside Drive. Stability analyses were not performed for the proposed embankments.

7.1.1 Embankment Foundation/Subgrade Preparation

Prior to commencing earthwork operations, it is recommended that all existing pavement, structures, sod and topsoil, existing trees including their entire root mass, vegetation, and other miscellaneous materials be completely removed from the entire footprint of the proposed roadway/embankment. Prior to the placement of any new fill for embankment widening, it is recommended that the entire footprint of the widened embankment be exposed and proofrolled in accordance with 2010 ODOT Construction and Material Specifications (CMS) Item 204.06, and Item 204 of the 2009 ODOT Construction Inspection Manual of Procedures, to detect any soft, wet or weak zones that might be present. This is of particular importance in the vicinity of Borings B-215 and B-217 where medium-stiff to stiff soils were encountered at the approximate subgrade level.

If any such zones are present, the materials contained in these zones should be either scarified, dried, and thoroughly recompacted in place in accordance with ODOT Item 203.07, or be removed and the overexcavation filled in a controlled manner with compacted, suitable embankment material (Item 203.02) and the recommendations

presented in this report. S&ME recommends that the Geotechnical Engineer of Record or his/her designated representative be present at the time of proofrolling, as visual observation of these procedures may result in a partial reduction of undercutting of unsuitable soils.

7.1.2 "Fill" Areas

After all unsuitable materials have been removed during the site preparation process, and prior to commencing fill placement, it is recommended that horizontal benches be cut into all existing sloping surfaces to permit placement and compaction of new fill in horizontal lifts. In areas where new fill is to be placed on the side of an existing embankment which is steeper than 4H:1V, S&ME recommends that "Special Benching" procedures as outlined in the ODOT Geotechnical Bulletin GB2, *Special Benching and Sidehill Embankment Fills* (ODOT GB2), dated November 4, 2008, and the 2009 ODOT Construction Inspection Manual of Procedures be utilized.

Sketches illustrating several "typical" Special Benching configurations for sidehill fills on various slopes are included in Figures 1, 2 and 3 on pages 3 and 6 of the ODOT GB2 document. These configurations require a minimum distance of 8 feet between the crest of the bench back-slopes and the face of the new slope to permit compaction and grading equipment to work on a horizontal surface.

During Special Benching procedures, S&ME also recommends the following: 1) only one bench be exposed at any given time and that excavation of the next bench should not be permitted until embankment fill placement and compaction has been completed to the top of the backslope of the previous bench; and, 2) the length of any given bench that is exposed should not exceed the quantity of embankment fill which may be properly placed and compacted in one day. Additionally, S&ME recommends that the final, completed side slopes of embankments be constructed no steeper than 2H:1V.

As stated in the ODOT GB2, wherever "Special Benching" is used, Plan Note G110 from the ODOT L&D Manual, Vol. 3, should be included in the General Notes.

7.1.3 "At-Grade" and "Cut" Areas

- Soil Subgrade

Once the desired subgrade elevation has been attained in "cut" and "at-grade" areas, and after any unsuitable subgrade materials have been overexcavated and properly backfilled, the subgrade soil beneath the entire roadway and shoulder pavement area should be scarified and recompacted to a depth of 12 inches below the subgrade level in accordance with ODOT Item 204.03. During recompaction, the moisture content of the subgrade soil should be maintained or adjusted in accordance with ODOT Item 203.07.A.

Final subgrade proofrolling should be performed in accordance with Item 204.06 of the ODOT Construction and Material Specifications, and Section 204 of the 2006 ODOT Construction Inspection Manual of Procedures. If weak, wet, or soft zones are present, it

is recommended that the materials contained in these zones should be removed and replaced in accordance with Item 204.04. It is recommended, however, that the maximum depth of any necessary overexcavation be limited to 5 feet, even where the bottom remains unstable. In these cases, it is recommended that a geotextile (ODOT Item 712.09, Type D) be placed at the bottom of the overexcavation and then the undercut area backfilled with compacted granular material (ODOT Item 703.16.C Type C or D Granular Material). To assist the paving process, it may be desirable to top this granular backfill with a few inches of Item 703.16.C.2 (Type B).

Following the completion of the scarification, recompaction, and proofrolling of the subgrade in these cut and at-grade areas, it is strongly recommended that construction traffic be restricted from traveling on the compacted subgrade. Cohesive subgrade soils subjected to repetitious construction load and moisture fluctuations, which may occur as a result of exposure to rainfall and/or surface water runoff, may exhibit subgrade instability.

- Bedrock Subgrade

Although none of the boring performed for this investigation encountered bedrock within 2 feet of the proposed Riverside Drive subgrade level, Borings B-206 and B-211 encountered limestone bedrock a depth of 2.2 feet. Preliminary profile information for the proposed roundabout was not available at the time of this report. Because of the wide spacing of the borings, consideration should be given to the possibility that bedrock may be encountered at, or within 2 feet of, the proposed subgrade level.

In accordance with Item 204.05 of the ODOT Construction and Materials Specifications (CMS) the proposed pavement subgrade should be undercut to a depth of two feet below the bottom of the asphalt or concrete pavement. The overexcavation should also extend laterally to at least one foot outside the proposed pavement shoulder. This overexcavated material must be replaced with compacted, suitable embankment material (ODOT CMS Item 204.02) which possesses subgrade support characteristics consistent with the design CBR for the pavement section. S&ME recommends that consideration be given to using ODOT Item 703.16.C.2 Granular Material B (Item 304).

S&ME also recommends that consideration be given to placing a geotextile fabric (ODOT Item 712.09, Type D) at the bottom of subgrade overexcavations in rock prior to backfilling to reduce the potential for loss of backfill material and granular base course into any large fractures or voids that may be present in the limestone bedrock.

Additionally, it must be emphasized that **a direct correlation should not be made between the performance of the drilling rigs and the ability of conventional construction equipment to excavate bedrock at this site.**

7.1.4 Borrow Soil and Backfill Compaction Recommendations

Soil used to backfill any overexcavated subgrade materials or used as fill to attain the design subgrade level should consist of clean inorganic soils free of debris and cobbles,

and should be thoroughly compacted in accordance with ODOT specifications (Item 203, and when within 12 inches of subgrade level, Item 204). Additionally, S&ME recommends that the moisture content of all soil used as fill be maintained within -2% to +2% of the optimum moisture content during all compaction operations. Borrow materials should not be placed in a frozen condition or upon a frozen surface, and any sloping surfaces on which new fill is to be placed should first be benched in accordance with either Item 203.05 or ODOT GB2, depending on the slope of the existing ground surface at each location.

Compaction requirements for the construction of earthen embankments are based on ODOT CMS Item 203.07.B (or Item 204.03 when within 12 inches of subgrade level), which specifies a minimum percent compaction based on the dry unit weight of the type of soil fill being placed as borrow. S&ME recommends that sampling and testing of all proposed borrow material be performed prior to construction to verify that the borrow soils are suitable for the planned construction. Additionally, **all soil used as new fill or backfill within 3 feet of the proposed subgrade level must be capable of providing subgrade support characteristics in a final compacted state that are no less than the value used for the design of new pavement (see "Pavement Subgrade Evaluation" section of this report).**

It should be noted that the cohesive soils encountered in the borings, if exposed to inclement weather or rainfall, may rapidly absorb additional moisture and weaken. It is imperative that these soil types not be exposed to rainfall while in a loosened state (such as during disking and drying for moisture conditioning). Should these materials become sufficiently saturated that additional moisture conditioning is impractical, the material should be removed and wasted. Therefore, it is recommended that moisture conditioning only be performed when extended periods of suitable weather are anticipated, and that only the amount of borrow soil be exposed that may be moisture conditioned and properly compacted during suitable weather periods.

7.1.5 Yielding Subgrade

Laboratory tests performed on the near-surface soils at this site indicate that the anticipated subgrade soils may be considered moderately to highly plastic and sensitive to the effects of moisture and repetitive construction loads. Soil of this type may "fail" (i.e., rut or pump unacceptably) during proofrolling, especially if the subgrade soils become wet and the moisture contents increase. If such yielding does occur, it is imperative that the subgrade be stabilized before a full-depth pavement is constructed, even if an aggregate base is to be used.

Restricting construction activity and permitting the subgrade to dry will frequently eliminate yielding if weather conditions are favorable. If exceptionally good drying weather is not expected or does not occur, however, it will likely be necessary to scarify the subgrade to a depth of eight to twelve inches and to recompact the loosened soil subsequent to a period of drying and aerating. The process of drying and aerating is dependent entirely upon weather conditions, and it would be advisable to limit the work area to a size which can be scarified and compacted the same day to avoid exposure to

precipitation. If scarification and aeration do not result in significant drying so that compaction can be accomplished the same day, it must be concluded that the weather is not favorable for the procedure.

Another procedure that can be used to improve a yielding subgrade would be to remove or "undercut" severely disturbed areas to a depth of twelve inches or greater and to fill these areas with a more suitable, compacted soil. This procedure is usually performed during the original site preparation but, if yielding does not become evident until after the subgrade has been exposed to repetitive preliminary paving operations, this procedure would have to be repeated prior to performing the paving work.

Other procedures for improving an unusually weak, wet or severely yielding subgrade include the use of chemical stabilization (lime, lime/fly-ash, cement, etc.). At times, it is possible to use a geogrid or geotextile in conjunction with the aggregate to provide the added support necessary to place the pavement without improving the subgrade. It is not necessarily predicted that the natural soils at this site will yield and become unstable. It is believed, however, that you should be made aware of this phenomenon which can occur even in soils which appear to be exceptionally strong when initially exposed in cuts, and of the advisability of improving a yielding subgrade before constructing pavements.

7.2 Pavement Subgrade Evaluation

It is anticipated that the subgrade for the pavements within the site will consist of natural medium-stiff to hard silty clay deemed suitable for pavement support following favorable proofrolling, or newly placed controlled fill. Given the variable nature of the subgrade soil and based on laboratory tests performed on the near surface soils, along with ODOT Group Index correlations, it is recommended that the following values be used for to design the new pavement sections:

California Bearing Ratio (CBR):	3%
Resilient Modulus (MR):	3,600 psi
Modulus of Subgrade Reaction (k):	100 pci

These subgrade support values may be used during the pavement design for this project provided that the entire proposed pavement subgrade is prepared in strict accordance with Item 204 of the 2010 ODOT ”Construction and Materials Specifications” (CMS), and the recommendations presented in this report. **Based on the conditions encountered in the borings, it should be anticipated that portions of the existing subgrade may not provide a CBR value equal to or greater than 3% and will need to be removed and wasted.**

This subgrade evaluation also assumes that the subgrade for the new roadways is composed of the materials encountered in the borings. If, at the time of construction, it is determined that the subgrade may consist of materials significantly different than those encountered, the pavement design subgrade criteria should be reviewed and, if necessary, modified.

Implementing these subgrade support parameters will also require that all borrow soil placed within 3 feet of the final subgrade level is capable of providing subgrade support parameters no lower than the above values. For this reason, S&ME suggests inclusion of the following notes in the General Notes of the project plans under the subheading associated with embankment construction:

> *All borrow soil placed within 3 feet of the final subgrade level must be capable of providing subgrade support parameters no lower than the values used to design the new pavement. Prior to commencing the construction of new fill embankments, representative bulk samples of each type of proposed earthen borrow soil shall be obtained and tested in the laboratory (ASTM D 1883/AASHTO T 193) to verify that the potential borrow soil is capable of providing a California Bearing Ratio (CBR) value equal to or greater than 3% in a properly compacted state.*

In addition to proper subgrade preparation, we recommend that the pavement design and construction include surface and subsurface drainage measures. Water which infiltrates the pavement and remains trapped within the pavement components during traffic loading is one of the leading causes of premature pavement failure. Effective design measures include the use of perimeter swales, perimeter edge drains, curbs, or a combination of these features to collect surface water runoff from areas adjacent to the pavement. Cohesive subgrade soils should be crowned or sloped to promote drainage of infiltrating water towards subsurface drainage collection systems.

7.3 Pedestrian Underpass Recommendations

At the time of this report the specific type of culvert for the proposed pedestrian underpass was not finalized; therefore, structural loading, foundation sizes and bearing elevations were not provided to S&ME. It is anticipated that foundations for the three- or four-sided culvert and wingwalls will bear at approximately Elevation 794.

7.3.1 Shallow Foundation Bearing Resistance

Based on historic Boring B-28, excavations for the culvert and wingwall foundations will extend into medium-hard to hard limestone. To distribute the loading over uneven rock surfaces and to minimize differential or point loading of the precast structural elements, such as the bottom of a four-sided box culvert, S&ME recommends that a 12-inch layer of crushed aggregate, such as ODOT CMS Item 304 and No. 57 stone, be placed between the box culvert bottom and the bedrock surface.

Table 2 on the following page summarizes the recommended nominal and factored unit bearing resistances (q_n and q_R) at the service and strength limit states for spread foundations bearing in medium-hard to hard limestone. In order to achieve the recommended factored bearing resistance provided in Table 2, the bearing surface should be carefully cleaned, with any weathered or fractured rock being removed, prior to placement of concrete. In addition, the bedrock exposed at the foundation bearing

elevation should be evaluated by a qualified Geotechnical Engineer to confirm that the footings bear on suitable material.

Table 2: Recommended Bearing Capacities (Nominal and Factored) for Spread Footings at the Pedestrian Underpass – Service and Strength Limit States

Limit State	Anticipated Bearing Elevation (ft)	Recommended Nominal Bearing Resistance, q_n (ksf)*	Resistance Factor, φ_b	Recommended Factored Bearing Resistance, q_R (ksf)*
Service	~ 794	30.0	1.0**	30.0
Strength		35.0	0.45***	15.8

*** For vertical loading only. Foundations may need to extend deeper to generate passive pressure to resist lateral loads.**
**** Article 10.5.5.1 of the 2010 AASHTO LRFD.**
***** Table 10.5.5.2.2-1 of 2010 AASHTO LRFD, footings on rock.**

Foundation sizes were not available at the time of this report; however, considering similar culvert projects, settlements are expected to be less than ½-inch provided the site preparation and foundation construction are performed in accordance with the recommendations provided in this report.

The portion of the sidewalls of the foundation excavations in the soil above the bedrock should be either sloped back or braced in accordance with the most recent OSHA excavation guidelines. Any surface water will need to be diverted away from the foundation excavation area during excavation and construction of the culvert foundations. The foundation bearing surfaces should be kept dry and free from standing water during all construction activities, and loose rock should be removed prior to placing concrete.

As these recommendations have been based on the currently available preliminary information, S&ME requests the opportunity to review the final proposed foundation design to verify that the intent of our recommendations has been followed.

7.3.2 Eccentricity (Overturning)

Proposed spread foundations for the structure which are subjected to eccentric loadings should be designed in accordance with Articles 10.6.1.3, 10.6.3.3 and 11.6.3 of the latest AASHTO LRFD specifications. Once the footing design has been finalized, the structural design should confirm that the eccentricity of the foundation is less than three-eighths (3/8) of the appropriate footing dimension (width and/or length) (AASHTO Article 10.6.3.3 – Footing on Rock).

7.3.3 Sliding Resistance

Sliding resistance to lateral loads is provided by the weight of the structure in combination with the friction developed along the bottom of the foundations at the footing/aggregate interface as well as from passive resistance from the bedrock. The factored resistance against failure by sliding (R_R) should be determined using Eq.

10.6.3.4-1 of the AASHTO LRFD Bridge Design Specifications, 2010 Interim Revisions. Because the proposed foundations will likely bear on either a prepared aggregate base or on highly weathered limestone bedrock, S&ME recommends that the nominal sliding resistance (R_R) be calculated by multiplying the total vertical force (V) acting on the foundation by 0.80 (tan φ_f) as shown in Eq. 10.6.3.4-2 of the AASHTO LRFD specifications. The factored resistance to sliding may then be computed using a resistance factor for shear resistance (φ_τ) of 0.80.

Additional resistance to sliding of spread footings could be derived from increasing the width of the footing or from passive pressure developed along the inside toe of the footing or a shear key. A nominal passive resistance of 600 psf per foot of effective embedment depth into the limestone bedrock should be used for the footings provided that the footings will bear at or below the anticipated bearing elevation shown in Table 2 of this report, and provided the footing concrete is placed flush ("neat") against the rock face of the excavation. Passive resistance should be neglected above the anticipated depth of scour and/or frost. S&ME recommends a resistance factor for passive resistance (φ_{ep}) of 0.50 be used to compute the factored passive resistance. It is important that all loosened rock be removed from the face of the foundation excavation that will provide the passive resistance.

7.3.4 Construction and Groundwater Considerations

During this investigation, significant groundwater was not encountered. However, S&ME recommends that the sides and bottoms of all excavations be monitored during the construction of the structure. In addition, it is recommended that all excavations for the proposed structure foundations be protected from surface runoff and storm water flow. Groundwater seepage may also emanate from fractures within the bedrock or from granular seams or zones in the soil encountered above the bedrock; however, the quantity of water is anticipated to be limited and may likely be controlled by bailing or with portable pumps.

Additionally, all excavations should be either sloped back or braced in accordance with the most recent OSHA excavation guidelines.

7.3.5 Lateral Earth Pressures

The proposed culvert and wingwalls must be designed to withstand lateral earth pressures, as well as hydrostatic pressures, that may develop behind the structure. The magnitude of the lateral earth pressures varies on the basis of soil type, permissible wall movement, and the configuration of the backfill.

To minimize lateral earth pressures, the zone behind the headwalls and culvert should be backfilled with granular soil, and the backfill should be effectively drained. For effective drainage, a zone of free-draining gravel (ODOT CMS Item 518.03) should be used directly behind the structures for a minimum thickness of 18 inches in accordance with ODOT CMS Item 518.05. This granular zone should drain to either weepholes or a pipe, so that hydrostatic pressures do not develop against the walls.

The type of backfill beyond the free-draining granular zone will govern the magnitude of the pressure to be used for structural design. Pressures of a relatively low magnitude will be developed by the use of granular backfill, whereas a cohesive (clay) backfill will result in the development of much higher pressures.

It is recommended that granular backfill be used behind the culvert. The backfill should be placed in a wedge formed by the back of the structure and a line rising from the base of the structure base at an angle no greater than 60 degrees from the horizontal. Granular backfill behind the structure should be compacted in accordance with ODOT Item 203, "Roadway Excavation and Embankment," of the most recent CMS. Overcompaction in areas directly behind the walls should be avoided as this might cause damage to the structure.

If proper drainage (ODOT CMS Item 518.05) is used and the granular backfill is placed and compacted in the wedge described previously, an equivalent fluid unit weight of 55 pounds per cubic foot (pcf) may be used considering an “at rest” earth pressure condition, meaning wall movements less than 0.25 percent of the wall height is permitted. If proper drainage is not provided, an “at rest” equivalent fluid unit weight of 90 pcf is recommended for use during design.

If proper drainage is incorporated and granular backfill is provided and compacted as specified, an equivalent fluid unit weight of 35 pcf may be used if a wall movement equivalent to 0.25 percent the height of the wall (H) is allowed to occur. Such movement is considered sufficient to mobilize an active earth pressure condition. Without proper drainage, but with granular backfill and permissible wall movement, an equivalent fluid unit weight of 80 pcf should be used.

Compacted cohesive materials tend alternatively to shrink, expand and creep over periods of time and create significant lateral pressures on any adjacent structures. Cohesive materials also require a greater amount of movement to mobilize an active earth pressure condition. Because of the long-term adverse effects, it is recommended that, if proper drainage (ODOT Item 518.03) is provided, an equivalent fluid unit weight of 90 pcf (at-rest) and 65 pcf (active) be used for design of the structure resisting the lateral loads imparted by drained, cohesive backfill. Without proper drainage, S&ME recommends that the structural design be performed using equivalent fluid unit weights of 110 pcf (at-rest) and 95 pcf (active).

The structure must also be designed to withstand the vertical load resulting from the weight of any fill and pavement that may be placed over the structure in addition to traffic surcharge loads. To estimate vertical loading, a total unit weight of 130 pcf may be used for soil and granular fill materials.

7.4 Groundwater Considerations

Based on observations made during the field work, it is not anticipated that significant quantities of groundwater will be encountered during construction activities. Shallow excavations, such as subgrade over-excavations, extending through only cohesive soil

may encounter small amounts of seepage. Deeper excavations, such as excavations for any utilities, extending through granular seams, pockets/lenses, or layers may encounter larger groundwater flows. The quantities of groundwater encountered are anticipated to be controllable by bailing or pumping from temporary sumps. If pumping from sump pits is not effectively keeping the groundwater below excavation levels, then S&ME should be retained to provide additional recommendations.

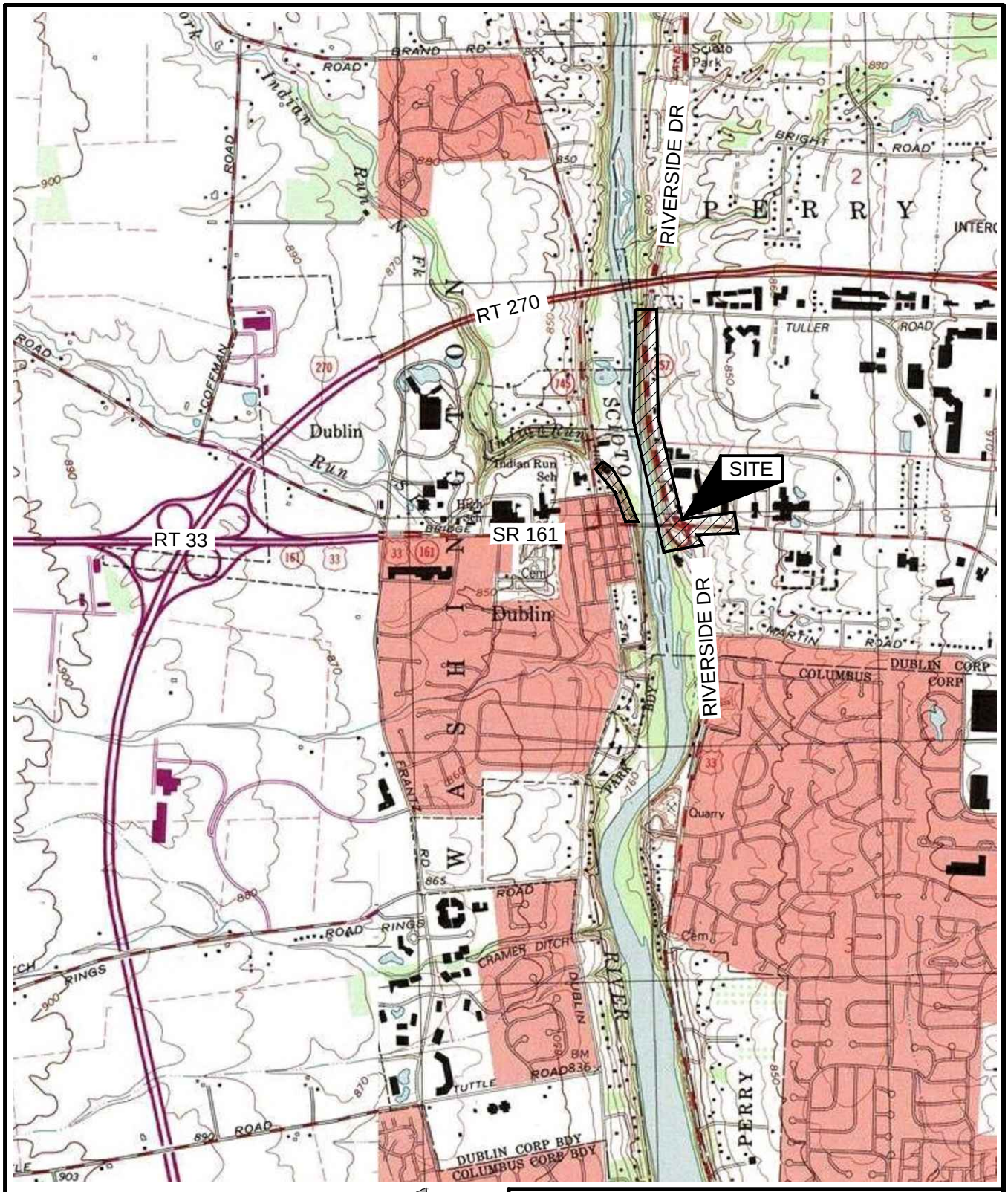
During construction, surface runoff and precipitation should not be permitted to collect and stand in excavations as the soil will absorb water. Soils softened by standing water or disturbed by construction activities should be removed from excavations before pavement is placed. Additionally, all excavations should be either sloped back or braced in accordance with the most recent OSHA excavation guidelines.

8. FINAL CONSIDERATIONS

The analyses, conclusions and recommendations presented in this report are based on project information provided by EMH&T. S&ME should be retained to review the final design plans and specifications to verify that the intent of our engineering recommendations have been properly incorporated into the design documents. It is also recommended that S&ME be retained to observe the subgrade proofrolling, perform fill/backfill testing, and observe construction to confirm that our recommendations are valid or to modify them accordingly. S&ME cannot assume responsibility or liability for the adequacy of recommendations if we are not retained to observe construction.

The contents of this report are also based on the subsurface conditions as they existed at the time of our field investigation, and further on the assumption that the exploratory borings are representative of actual subsurface conditions throughout the area investigated. It should be noted that actual subsurface conditions between and beyond the borings might differ from those encountered at the boring locations. If subsurface conditions are encountered during construction that vary from those discussed in this report, S&ME should be notified immediately so that we may evaluate the effects, if any, on design and construction.

APPENDIX



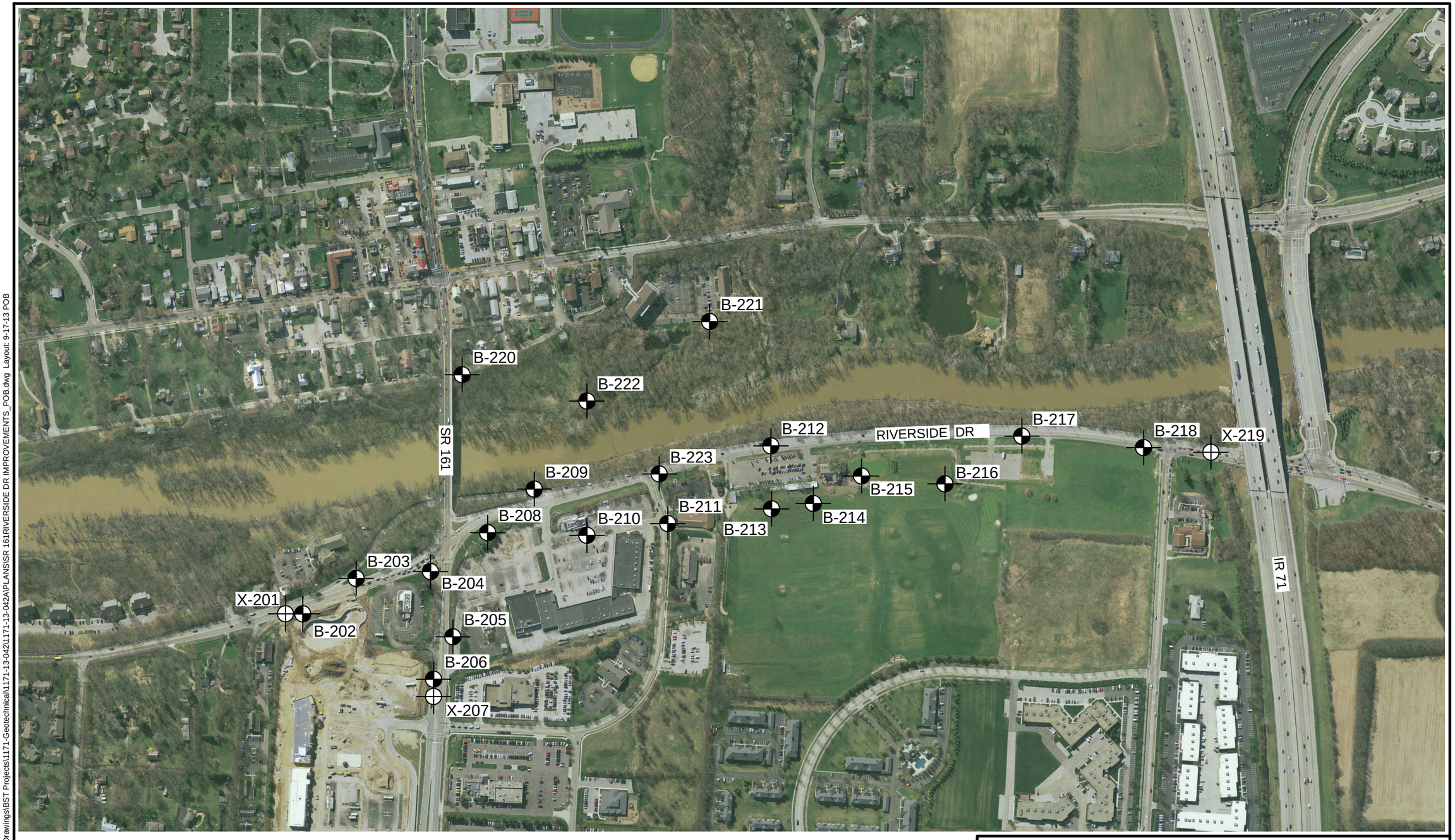
VICINITY MAP

SR 161/RIVERSIDE DR. IMPROVEMENTS
FRANKLIN COUNTY, DUBLIN, OHIO

Project: 1171-13-042A		S&ME
Drawing Date: 10-3-2013		WWW.SMEINC.COM
Last Updated: 10-10-2013		
Drawn By: PRR		
Approved By: WML		
Scale: GRAPHIC	1:1	ENGINEERING FIRM. 03530

PLATE 1

Images: ~AERIAL FOR REF..tif ~COFFMAN PARK.jp2 ~TOPO\map.JPG
Xrefs:
File Last Updated: Oct 10, 2013
Plot Info: 10-10-2013 @ 1:26pm By: prock
S&ME Filename: I:\DEPTS\cadd\Drawings\BST Projects\1171-Geotechnical\1171-13-042\1171-13-042A\PLANS\SR 161RIVERSIDE DR IMPROVEMENTS_VICINITY MAP.dwg Layout: V-Map



0 400 800

SCALE INFEET

PAVEMENT CORE X-212 PERFORMED IN COMBINATION WITH BORING B-212

LEGEND

B-1 BORING NUMBER AND LOCATION

X-1 PAVEMENT CORE NUMBER AND LOCATION

PLAN OF BORINGS

SR 161/RIVERSIDE DR. IMPROVEMENTS
DUBLIN, OHIO

Project: 1171-13-042A	Drawn By: PRR		
Drawing Date: 9-17-2013	Approved By: WML		
Last Updated: 11-11-2013	Scale: GRAPHIC	1:1	

S&ME
WWW.SMEINC.COM
ENGINEERING FIRM. 03530

PLATE 2

Images: ~Riverside Drive Aerial.jp2 ~TOPOImap.JPG
Xrefs:
File Last Updated: Nov 11, 2013
Plot Info: 11-11-2013 @ 11:03am By: prock
S&ME Filename: I:\DEPTS\cadd\Drawings\BST Projects\1171-Geotechnical\1171-13-042\1171-13-042A\PLANS\SR 161RIVERSIDE DR IMPROVEMENTS_POB.dwg Layout: 9-17-13 POB

EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS FOR SAMPLING AND DESCRIPTION OF SOIL

SAMPLING DATA

 - Blocked-in "SAMPLES" column indicates sample was attempted and recovered within this depth interval.

 - Sample was attempted within this interval but not recovered.

2/5/9 - The number of blows required for each 6-inch increment of penetration of a "Standard" 2-inch O.D. split-barrel sampler, driven a distance of 18 inches by a 140-pound hammer freely falling 30 inches. The raw "blowcount" or "N" is equal to the sum of the second and third 6-inch increments of penetration. Addition of one of the following symbols indicates the use of a split-barrel other than the 2" O.D. sampler:

- 2S - 2½"O.D. split-barrel sampler
- 3S - 3" O.D. split-barrel sampler

N_{60} - Corrected Blowcount = [(S&ME Drill Rod Energy Ratio) / (0.60 Standard)] X N_{raw}

P - Shelby tube sampler, 3" O.D., hydraulically pushed.

R - Refusal of sampler in very-hard or dense soil, or on a resistant surface.

50-2" - Number of blows (50) to drive a split-barrel sampler a certain number of inches (2), other than the normal 6-inch increment.

SD - Split-barrel sampler (S) advanced by weight of drill rods (D).

SH - Split-barrel sampler (S) advanced by combined weight of rods and drive Hammer (H).

SOIL DESCRIPTIONS

All soils have been classified basically in accordance with the Unified Soil Classification System, but this system has been augmented by the use of special adjectives to designate the approximate percentages of minor components, as follows:

Adjective	Percent by Weight
trace	1 to 10
little	11 to 20
some	21 to 35
"and"	36 to 50

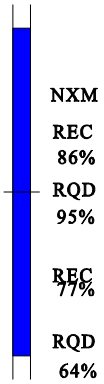
The following terms are used to describe density and consistency of soils:

Term (Granular Soils)	Blows per foot (N_{60})
Very-loose	Less than 5
Loose	5 to 10
Medium-dense	11 to 30
Dense	31 to 50
Very-dense	Over 50

Term (Cohesive Soils)	Qu (tsf)
Very-soft	Less than 0.25
Soft	0.25 to 0.5
Medium-stiff	0.5 to 1.0
Stiff	1.0 to 2.0
Very-stiff	2.0 to 4.0
Hard	Over 4.0

EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS FOR SAMPLING AND DESCRIPTION OF ROCK

SAMPLING DATA



When bedrock is encountered and rock core samples are attempted, the "SAMPLING EFFORT" column is used to record the type of core barrel used (NXM), the percentage of core recovered (REC) for each run of the sampler, and the Rock Quality Designation (RQD) value. Rock-core barrels can be of either single- or double-tube construction, and a special series of double-tube barrels, designated by the suffix M, is commonly used to obtain maximum core recovery in very-soft or fractured rock. Three basic groups of barrels are used most often in subsurface investigations for engineering purposes, and these groups and the diameters of the cores obtained are as follows:

AX, AW, AXM, AWM	-	1-1/8 inches
BX, BW, BXM, BWM	-	1-5/8 inches
NX, NW, NXM, NWM	-	2-1/8 inches

Rock Quality Designation (RQD) is expressed as a percentage and is obtained by summing the total length of all core pieces which are at least 4 inches long and then dividing this sum by the total length of core run. It has been found that there is a reasonably good relationship between the RQD value and the general quality of rock for engineering purposes. This relationship is shown as follows:

RQD - %	General Quality
0 - 25	Very-poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

ROCK HARDNESS

THE FOLLOWING TERMS ARE USED TO DESCRIBE ROCK HARDNESS:

Term	Meaning	Mohs' Hardness
Very-soft	Rock such as shale can be easily picked apart by the fingers. Sandstone is poorly cemented and very friable. The rock resembles hard clay or dense sand, but has rock structure.	Less than 1
Soft	Rock such as shale, siltstone or limestone can be scratched or powdered by fingernail pressure. Sandstone is mostly poorly cemented, and individual sand grains can be separated from the main rock mass by a fingernail.	1 to 1½
Medium-hard	Rock cannot be scratched by a fingernail, but can be powdered by a knife. Sandstone is mostly well cemented, but individual grains can be removed by scratching with a knife.	2½ to 5½
Hard	Rock is well cemented and cannot be powdered by a knife. Rock can be powdered by a steel file.	5½ to 6½
Very-hard	Rock cannot be scratched by a steel file and the core sample rings when struck with a hammer.	Greater than 6½

LOG OF BORING NO. B-202
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **793 ±** DATE: **9/9/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **6.9'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
792.1	0						ASPHALT - 11 INCHES		
791.5							GRANULAR BASE - 6 INCHES		
790.5		1		7 / 4 / 4	10	40	Stiff gray mottled with brown silty clay, some fine to coarse sand, some fine to coarse gravel.		H=1.0-2.0 G
789.6		2		4 / 5 / 7	15	67	Very-stiff gray silty clay, trace fine to coarse sand.		
	5	3		3 / 5 / 6	14	60	Very-stiff brown silty clay, trace to little fine to coarse sand, trace fine to coarse gravel.		H=2.0-2.5
786.5		4		10 / 50-5"R					H=2.0
786.1							Very-dense gray fine to coarse gravel, some fine to coarse sand, trace silt (weathered limestone).		
	10						- No seepage encountered. - Encountered auger refusal on limestone bedrock at 6.9'. - Boring located using field pacing and taping methods and should be considered approximate. - Elevations estimated from Google Earth® and should be considered approximate.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/9/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. } See Separate Curves

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 5

LOG OF BORING NO. B-203
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **793 ±** DATE: **9/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **4.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
792.8	0						TOPSOIL - 2 INCHES	10 20 30 40	
		1		11 / 4 / 6	13	100	Medium-dense gray and brown fine to coarse gravel, some fine to coarse sand, some to "and" silty clay.		
		2		6 / 9 / 11	25	33			G
789.0		3		50-0"R					
	5						- No seepage encountered. - Encountered auger refusal on limestone bedrock at 4.0'. - Boring located using field pacing and taping methods and should be considered approximate. - Elevations estimated from Google Earth® and should be considered approximate.		
	10								
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ **"Dry"** ▼

WATER NOTE: **At Completion**

DATE: **9/11/13**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .75
Last Calibration Date : 02/20/13
Drill Rig Number : S&ME 550(AW)

JOB: 1171-13-042A

PLATE 6

LOG OF BORING NO. B-204
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **798 ±** DATE: **9/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **7.2'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
797.6	0						TOPSOIL - 4 INCHES	10 20 30 40	
		1		10 / 9 / 7	20	67	Medium-dense gray and brown fine to coarse gravel, some fine to coarse sand, little to some clayey silt.		
		2		2 / 4 / 5	11	67			G
	5	3		5 / 4 / 5	11	100			
		4		5 / 7 / 50-4"R		100			
790.8							- No seepage encountered. - Encountered auger refusal on limestone bedrock at 7.2'. - Boring located using field pacing and taping methods and should be considered approximate. - Elevations estimated from available topographic mapping and should be considered approximate.		
	10								
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/11/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .75
Last Calibration Date : 02/20/13
Drill Rig Number : S&ME 550(AW)

JOB: 1171-13-042A

PLATE 7

LOG OF BORING NO. B-205
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **809.6** DATE: **9/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **7.5'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
809.2	0						ASPHALT - 5 INCHES	10 20 30 40	
808.7							GRANULAR BASE - 6 INCHES		
		1		6 / 7 / 9	20	100	Medium-dense gray and brown fine to coarse gravel, some fine to coarse sand, some silty clay.		G
805.6		2		8 / 7 / 6	16	67			
	5						Loose gray fine to coarse gravel, some fine to coarse sand, "and" silty clay.		
804.1		3		4 / 3 / 5	10	100			
							Medium-stiff to stiff brown silty clay, little fine to coarse sand, trace fine gravel.		
		4		3 / 4 / 5	11	67			H=0.5-1.5
802.1									
							- No seepage encountered. - Boring located using field pacing and taping methods and should be considered approximate. - Boring elevation provided by EMH&T.		
	10								
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: "Dry"
WATER NOTE: At Completion
DATE: 9/11/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .75
Last Calibration Date : 02/20/13
Drill Rig Number : S&ME 550(AW)

JOB: 1171-13-042A

PLATE 8

LOG OF BORING NO. B-206
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **819 ±** DATE: **9/9/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **2.2'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
	0						ASPHALT - 13 INCHES	10 20 30 40	
817.9									
817.5							GRANULAR BASE - 5 INCHES		
817.0		1	■	4 / 50-2"R		47	Very-stiff brown mottled with gray silty clay, some fine to coarse sand, trace fine gravel.		H=2.5 G
816.8							Weathered limestone.		
	5								
	10								
	15								
	20								
	25								

- No seepage encountered.
- Encountered auger refusal on limestone bedrock at 2.2'.
- Boring located using field pacing and taping methods and should be considered approximate.
- Elevations estimated from available topographic mapping and should be considered approximate.

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/9/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 9

LOG OF BORING NO. B-208
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **798.1** DATE: **9/9/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **8.6'**

SAMPLER(S): **2" and 2-1/2" O.D. Split-barrel Samplers**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT / PLASTIC LIMIT / LIQUID LIMIT (10 20 30 40)	TEST RESULTS
797.9	0						TOPSOIL - 2 INCHES		
		1		19/20/22	53	67	Very-dense gray and brown fine to coarse gravel, some fine to coarse sand, some silty clay, contains few cobbles.		
795.1									
		2		4/4/4	10	67	Loose gray and brown fine to coarse gravel, little to some fine to coarse sand, some to "and" silty clay.		G
	5								
		3		3/3/3	8				
		2S		7		27			
789.6									
789.5		4		50-1"R		100	Weathered limestone.		
	10						- No seepage encountered. - Encountered cobbles at 1.5'. - Encountered auger refusal on limestone bedrock at 8.6'. - Boring located using field pacing and taping methods and should be considered approximate. - Boring elevation provided by EMH&T.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ **"Dry"** ▼

WATER NOTE: **At Completion**

DATE: **9/9/13**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 10

LOG OF BORING NO. B-209
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **796 ±** DATE: **9/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **5.5'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
795.3	0						ASPHALT - 7 INCHES	10 20 30 40	
795.0							GRANULAR BASE - 5 INCHES		
		1		14/16/10	33	100	Dense gray fine to coarse gravel, some fine to coarse sand, some silty clay.	● × ×	G
793.5									
		2		8/9/5	18	100	Very-stiff gray mottled with brown silty clay, some fine to coarse sand, some fine to coarse gravel.		H=2.5-3.0
792.0									
		3		7/8/15	29	33	Medium-dense gray and brown fine to coarse gravel, some fine to coarse sand, some silty clay.		
790.5	5								
							- No seepage encountered. - Encountered auger refusal on limestone bedrock at 5.3'. - Boring located using field pacing and taping methods and should be considered approximate. - Elevations estimated from available topographic mapping and should be considered approximate.		
	10								
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ **"Dry"** ▼
WATER NOTE: **At Completion**
DATE: **9/11/13**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .75
Last Calibration Date : 02/20/13
Drill Rig Number : S&ME 550(AW)

JOB: 1171-13-042A

PLATE 11

LOG OF BORING NO. B-210
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **797.8** DATE: **9/10/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **11.1'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, NQ Rock Core Barrel**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
797.5	0						ASPHALT - 3 INCHES	10 20 30 40	
796.9							GRANULAR BASE - 8 INCHES		
		1		3 / 4 / 8	15	100	Hard brown mottled with gray silty clay, some fine to coarse sand, little fine to coarse gravel.		H=4.0-4.5 G
794.8									
		2		11 / 6 / 14	25	100	Medium-dense brown fine to coarse sand, "and" fine to coarse gravel, some clayey silt.		
793.3									
	5	2A				100	Very-stiff gray silty clay, little fine to coarse sand, some fine to coarse gravel.		H=2.5
792.0									
791.7		3		50-1"R		100	Weathered limestone.		
							Medium-hard gray-brown limestone, thickly bedded, ferriferous, crystalline, fossiliferous, vuggy, fractured to highly fractured.		
		4		REC 72% RQD 0%					
	10								
786.7									
							- No seepage or groundwater encountered prior to adding water for rock core. - Boring located using field pacing and taping methods and should be considered approximate. - Boring elevation provided by EMH&T.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ ▼

WATER NOTE:

DATE:

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. } See Separate Curves

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 12

LOG OF BORING NO. B-211
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **797.0** DATE: **9/10/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **2.2'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
796.4	0						ASPHALT - 6 INCHES	10 20 30 40	
796.0							GRANULAR BASE - 6 INCHES		
		1	■	50-4"R		20	Very-dense gray and brown fine to coarse gravel, some fine to coarse sand, little silty clay.		
794.8									
							- No seepage encountered. - Encountered auger refusal on limestone bedrock at 2.2'. - Boring located using field pacing and taping methods and should be considered approximate. - Boring elevation provided by EMH&T.		
	5								
	10								
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ **"Dry"** ▼

WATER NOTE: **At Completion**

DATE: **9/10/13**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 13

LOG OF BORING NO. B-212
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **798.5** DATE: **9/10/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **5.5'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
797.8	0						ASPHALT - 8.5 INCHES	10 20 30 40	
797.6							GRANULAR BASE - 2 INCHES		
		1		3/4/18	28	100	Very-stiff brown silty clay, little fine to coarse sand, trace fine gravel.	× ●	H=2.5-3.0 G LL=67%
796.2							Very-dense gray fine to coarse gravel, some fine to coarse sand, trace silt.		
		2		25/27/50	98	100			
793.0	5								
							- No seepage encountered. - Encountered auger refusal on limestone bedrock at 5.5'. - Boring located by EMH&T and relocated by S&ME using field pacing and taping methods and should be considered approximate. - Elevations estimated from available topographic mapping and should be considered approximate.		
	10								
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/10/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 14

LOG OF BORING NO. B-213
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **798.7** DATE: **9/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **5.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
798.5	0						TOPSOIL - 2 INCHES	10 20 30 40	
		1		4 / 4 / 7	14	100	Hard gray mottled with brown silty clay, trace fine to coarse sand, trace fine to coarse gravel.		H=4.0-4.5 G LL=56%
795.7							Very-dense gray fine to coarse gravel, some fine to coarse sand, trace silty clay and silt.		
		2		12 / 23 / 32	69	100			
793.7	5						- No seepage encountered. - Encountered auger refusal on limestone bedrock at 5.0'. - Boring located using field pacing and taping methods and should be considered approximate. - Boring elevation provided by EMH&T.		
	10								
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/11/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .75
Last Calibration Date : 02/20/13
Drill Rig Number : S&ME 550(AW)

JOB: 1171-13-042A

PLATE 15

LOG OF BORING NO. B-214
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **799.8** DATE: **9/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **14.2'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, NQ Rock Core Barrel**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
799.5	0						TOPSOIL - 3 INCHES	10 20 30 40	
		1		4 / 11 / 50-4"R		93	Hard brown mottled with gray silty clay, trace fine to coarse sand, trace fine gravel.		H=4.0-4.5 G LL=56%
797.3							Medium-hard gray-brown limestone, highly weathered, thickly bedded, ferriferous, slightly crystalline, fossiliferous, vuggy, fractured to highly fractured.		
	5	2		REC 98% RQD 0%					
	10	3		REC 99% RQD 0%					
785.6									
	15						- No seepage or groundwater encountered prior to adding water for rock core. - Boring located by EMH&T. - Boring elevation provided by EMH&T.		
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ ▼

WATER NOTE:

DATE:

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .75
Last Calibration Date : 02/20/13
Drill Rig Number : S&ME 550(AW)

JOB: 1171-13-042A

PLATE 16

LOG OF BORING NO. B-215
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **802.9** DATE: **9/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **6.8'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
802.7	0						TOPSOIL - 2 INCHES		
		1		SH / SH / 1	0	67	Medium-stiff to stiff brown mottled with gray silty clay, some fine to coarse sand, trace fine gravel.		H=0.5-1.5 G
799.9									
		2		2 / 2 / 3	6	100	Very-stiff brown silty clay, some fine to coarse sand, trace fine to coarse gravel.		H=3.0
797.4	5								
796.1		3		3 / 50-3"R		100	Very-stiff dark-gray and brown silty clay, little fine to coarse sand, little fine to coarse gravel.		H=2.5-3.0
	10						- No seepage encountered. - Encountered auger refusal on limestone bedrock at 6.8'. - Boring located using field pacing and taping methods and should be considered approximate. - Boring elevation provided by EMH&T.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/11/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .75
Last Calibration Date : 02/20/13
Drill Rig Number : S&ME 550(AW)

JOB: 1171-13-042A

PLATE 17

LOG OF BORING NO. B-216
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **806.8** DATE: **9/10/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **9.8'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
806.6	0						TOPSOIL - 2 INCHES		
		1		2 / 2 / 2	5	67	Very-stiff to hard gray silty clay, little fine to coarse sand, trace fine gravel, slightly organic.		H=2.5-4.0 G LL=50%
802.3		2		3 / 4 / 3	9	67			H=1.5-3.0
	5						Stiff to very-stiff gray mottled with brown silty clay, little fine to coarse sand, little fine to coarse gravel.		
800.3		3		1 / 1 / 4	6	67	Very-stiff brown silty clay, trace fine to coarse sand, trace fine gravel.		H=2.3-3.5
797.8		4		9 / 13 / 50-4"R		87	Very-dense gray and brown fine to coarse gravel, some fine to coarse sand, some silty clay.		
797.0	10						- No seepage encountered. - Boring located by EMH&T. - Boring elevation provided by EMH&T.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/10/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 18

LOG OF BORING NO. B-217
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **798.5** DATE: **9/10/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **7.3'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
	0						ASPHALT - 12 INCHES	10 20 30 40	
797.5									
797.0							GRANULAR BASE - 6 INCHES		
796.0		1		4 / 3 / 3	8	100	Medium-stiff to stiff dark-gray silty clay, trace fine to coarse sand, little fine to coarse gravel.		H=0.5-1.5
		1A				100	Medium-stiff to stiff brown silty clay, little fine to coarse sand, trace fine gravel.		H=0.5-1.5 G LL=54%
794.0		2		4 / 2 / 4	8	100			
793.0	5						Stiff to very-stiff brown silty clay, little fine to coarse sand, some fine to coarse gravel.		H=1.0-2.5
791.2		3		2 / 23 / 50-3"R		67	Very-stiff brown silty clay, little fine to coarse sand, little fine to coarse gravel, contains few silt lenses.		H=2.5-3.0
	10						- No seepage encountered. - Encountered auger refusal on limestone bedrock at 7.3'. - Boring located using field pacing and taping methods and should be considered approximate. - Boring elevation provided by EMH&T.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/10/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. } See Separate Curves

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 19

LOG OF BORING NO. B-218
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **798.9** DATE: **9/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **10.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
	0						ASPHALT - 12 INCHES	10 20 30 40	
797.9									
797.5							GRANULAR BASE - 4 INCHES		
		1		9 / 10 / 10	25	100	Medium-dense gray and brown fine to coarse sand, "and" fine to coarse gravel, little silt, trace clay.	● ×	G
795.6									
		2		6 / 2 / 2	5	67	Very-loose gray fine to coarse gravel, some fine to coarse sand, little silty clay.		
793.4	5								
		3		1 / 2 / 7	11	100	Loose to medium-dense brown and gray fine to coarse gravel, some to "and" fine to coarse sand, little to some silty clay.		
		4		2 / 2 / 4	8	100			
788.9	10						- No seepage encountered. - Caved at 6.0'. - Boring located using field pacing and taping methods and should be considered approximate. - Boring elevation provided by EMH&T.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion Caved at 6.0'
DATE: 9/11/13 9/11/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .75
Last Calibration Date : 02/20/13
Drill Rig Number : S&ME 550(AW)

JOB: 1171-13-042A

PLATE 20

LOG OF BORING NO. B-220
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **803 ±** DATE: **9/9/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **8.7'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
802.6	0						ASPHALT - 4 INCHES	10 20 30 40	
802.1							GRANULAR BASE - 5 INCHES		
		1		7 / 7 / 6	16	100	FILL: Medium-dense gray fine gravel, some fine to coarse sand, trace silt.		
800.0									
		2		2 / 2 / 3	6	100	FILL: Loose gray fine to coarse sand, "and" fine to coarse gravel, trace silt, trace clay.	●	G
797.5	5								
		3		1 / 2 / 1	4	67	FILL: Very-loose gray and brown fine gravel, some fine to coarse sand, trace silt.		
795.0									
794.3		4		50-2"R		100	Weathered limestone		
	10						- No seepage encountered. - Encountered auger refusal on limestone bedrock at 8.7'. - Boring located using field pacing and taping methods and should be considered approximate. - Elevations estimated from Google Earth® and should be considered approximate.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/9/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 21

LOG OF BORING NO. B-221
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **774 ±** DATE: **9/9/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **10.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
773.7	0						ASPHALT - 3 INCHES		
773.1							GRANULAR BASE - 7 INCHES		
		1		4 / 4 / 4	10	67	FILL: Stiff to very-stiff brown and gray silty clay, little fine to coarse sand, little fine to coarse gravel.		H=1.5-2.5 G
771.2							FILL: Stiff to very-stiff gray silty clay, little fine to coarse sand, trace fine gravel.		
		2		3 / 3 / 4	9	100			H=1.0-2.5
768.5	5						FILL: Medium-dense gray fine to coarse gravel, some fine to coarse sand, "and" organic clayey silt, contains few cobbles.		
		3		4 / 7 / 5	15	100			
766.0							Medium-dense gray and brown fine to coarse gravel, some fine to coarse sand, some silty clay.		
		4		5 / 6 / 9	19	100			
764.0	10						- No seepage encountered. - Encountered cobbles at 6.5'. - Boring located using field pacing and taping methods and should be considered approximate. - Elevations estimated from available topographic mapping and should be considered approximate.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ "Dry" ▼
WATER NOTE: At Completion
DATE: 9/9/13

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 22

LOG OF BORING NO. B-222
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **762 ±** DATE: **9/16/13**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **18.9'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, NQ Rock Core Barrel**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
761.5	0						TOPSOIL - 6 INCHES		
		1		1 / 2 / 4	8	100	Medium-stiff dark-gray organic clayey silt, little fine to coarse sand, trace fine gravel.		H=0.5-1.0
758.3		2		4 / 8 / 8	21	100	Medium-dense to very-dense brown fine to coarse gravel, some fine to coarse sand, some silt, little clay.		G
	5	3		3 / 50-5"R		60			
753.1		4		50-3"R		20			
		5		REC 100% RQD 100%			Hard gray-brown limestone, slightly weathered, very thickly bedded, ferriferous, slightly crystalline, stylolitic, cherty, fossiliferous. - Qu= 9,717 psi from 9.6' to 10.1'		
	10	6		REC 100% RQD 62%					
	15	7		REC 98% RQD 98%			- Qu= 11,365 psi from 15.6' to 16.1'		
743.1									
	20						- Groundwater measured at 1.5' prior to adding water for rock core. - Boring located by EMH&T. - Elevations estimated from available topographic mapping and should be considered approximate.		
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ ▼

WATER NOTE:

DATE:

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .795
Last Calibration Date : 10/14/11
Drill Rig Number : D50

JOB: 1171-13-042A

PLATE 23

LOG OF BORING NO. B-223
SR161/RIVERSIDE DRIVE IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2 of Appendix.** ELEVATION: **795.7** DATE: **9/10/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **16.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, NQ Rock Core Barrel**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT / PLASTIC LIMIT / LIQUID LIMIT (10 20 30 40)	TEST RESULTS
795.0	0						ASPHALT - 7 INCHES		
794.7							GRANULAR BASE - 5 INCHES		
		1		50-1"R		100	Very-dense gray fine to coarse gravel, little fine to coarse sand, trace silt, contains many limestone fragments.		
		2		50-2"R		100			
	5								
789.7		3		50-0"R		100	Hard gray-brown limestone, highly weathered, very thickly bedded, stylolitic, fossiliferous, vuggy, many horizontal and vertical fractures.		
		4		REC 94% RQD 0%					
	10								
		5		REC 100% RQD 6%			- Qu=8,415 psi from 12.3' to 12.6'.		
	15								
779.7							- No seepage or groundwater encountered prior to adding water for rock core. - Boring located using field pacing and taping methods and should be considered approximate. - Boring elevation provided by EMH&T.		
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ ▼

WATER NOTE:

DATE:

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .76
Last Calibration Date : 02/19/13
Drill Rig Number : Truck 55(AW)

JOB: 1171-13-042A

PLATE 24

1 Pavement Core X-201

2 Pavement Core X-207

3 Pavement Core X-212

4 Pavement Core X-219

PLATE 25

S&ME	SR 161 & Riverside Drive Intersection Improvements Dublin, Ohio	1171-13-042A SR 161/Riverside Dr. Improvements	
		Taken by: PMJ	Date Taken: 9/15/13

1 Photograph of B-210 bedrock core from 6.1' to 11.1'

2 Photograph of B-214 bedrock core from 4.2' to 14.2'

3 Photograph of B-222 bedrock core from 8.9' to 18.9'

4 Photograph of B-223 bedrock core from 6.0' to 16.0'

PLATE 26

S&ME	SR 161 & Riverside Drive Intersection Improvements Dublin, Ohio	1171-13-042A SR 161/Riverside Dr. Improvements	
		Taken by: PMJ	Date Taken: 9/18/13

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL				DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT WEIGHT DRY	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	ROCK CORE	SHELBY TUBE	pH
						sieve	Hydrometer short	Hydrometer long	standard	modified	uncons. undrain	consolid undrain	w/ pores	drained	drained	undrain	residual						cohesive	non/cohes	wall rigid	wall flexible					
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES															PCF						%	%			
B-202	**2.25**	**17**	**39**	**19**	**20**	*	*																								
B-203	**3.25**	**14**	**42**	**21**	**21**	*	*																								
B-204	**3.25**	**8**	**28**	**18**	**10**	*	*																								
B-205	**2.25**	**10**	**35**	**17**	**18**	*	*																								
B-206	**2.25**	**16**	**28**	**14**	**14**	*	*																								
B-208	**4.25**	**12**	**35**	**19**	**16**	*	*																								
B-209	**1.75**	**8**	**30**	**17**	**13**	*	*																								
B-210	**1.75**	**13**	**31**	**18**	**13**	*	*																								
B-210	**6.10**																												*		
B-212	**1.75**	**25**	**67**	**22**	**45**	*	*																								
B-213	**1.75**	**22**	**56**	**24**	**32**	*	*																								
B-214	**1.75**	**21**	**56**	**24**	**32**	*	*																								
B-214	**4.20**																												*		
B-215	**1.75**	**20**	**31**	**18**	**13**	*	*																								
B-216	**1.75**	**19**	**50**	**24**	**26**	*	*																								
B-217	**2.75**	**28**	**54**	**23**	**31**	*	*																								
B-218	**2.25**	**9**	**21**	**17**	**4**	*	*																								
B-220	**4.25**	**5**	**NP**	**NP**	**NP**	*	*																								
B-221	**1.75**	**17**	**37**	**18**	**19**	*	*																								
B-222	**4.25**	**21**	**32**	**22**	**10**	*	*																								

SUM REG

PLATE 27

S&ME

TESTING SUMMARY - STANDARD

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A DATE 10/14/13

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL				DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	ROCK CORE	SHELBY TUBE	pH
						sieve	Hydrometer		standard	modified	unconsol. undrain	consolid undrain w/ pores		drained	drained	undrain	residual						cohesive	non/cohes	wall rigid	wall flexible					
							short	long																							
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES															PCF						%	%			
B-222	**9.60**																	*											*		
B-222	**15.60**																	*													
B-223	**12.30**																	*											*		

SUM REG

PLATE 28

S&ME

TESTING SUMMARY - STANDARD

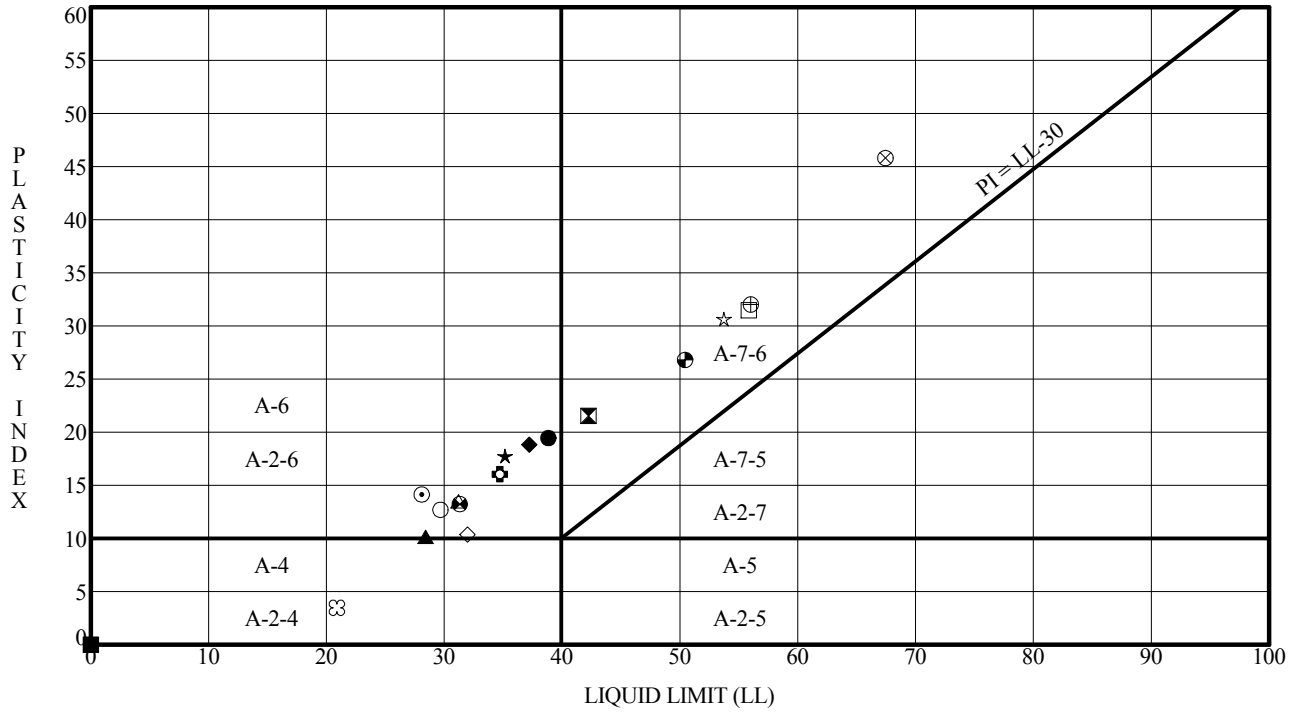
PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS

LOCATION DUBLIN, OHIO

JOB NO. 1171-13-042A DATE 10/14/13

ATTERBERG LIMITS' RESULTS

AASHTO CLASSIFICATION



ALPI-HRB

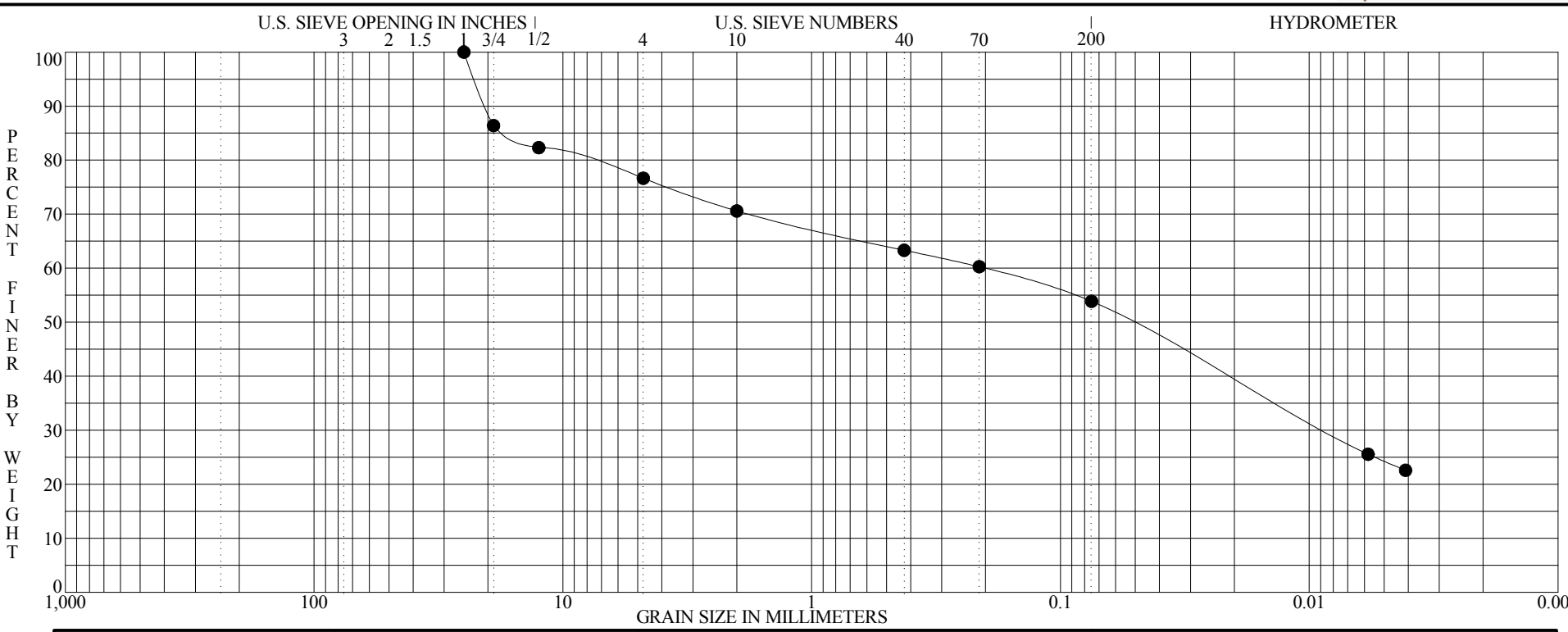
	Specimen Id.	Depth	MC	LL	PL	PI	Fines	ODOT Classification
●	B-202	2.25	16.8	38.8	19.4	20.0	53.9	A-6b(8)
⧓	B-203	3.25	13.8	42.2	20.7	21.0	36.9	A-7-6(3)
▲	B-204	3.25	7.7	28.4	18.3	10.0	24.9	A-2-4(0)
★	B-205	2.25	10.2	35.2	17.4	18.0	26.6	A-2-6(1)
⊙	B-206	2.25	15.8	28.1	14.0	14.0	60.6	A-6a(7)
✿	B-208	4.25	12.4	34.7	18.7	16.0	45.8	A-6b(4)
○	B-209	1.75	8.4	29.7	17.0	13.0	27.6	A-2-6(0)
△	B-210	1.75	13.3	31.2	17.7	13.0	59.8	A-6a(6)
⊗	B-212	1.75	25.1	67.4	21.6	45.0	88.3	A-7-6(20)
⊕	B-213	1.75	22.5	56.0	24.0	32.0	87.4	A-7-6(19)
□	B-214	1.75	20.8	55.9	24.4	32.0	89.5	A-7-6(19)
⊛	B-215	1.75	19.8	31.3	18.1	13.0	65.3	A-6a(7)
◒	B-216	1.75	19.5	50.4	23.6	26.0	82.3	A-7-6(16)
☆	B-217	2.75	27.6	53.7	23.1	31.0	80.2	A-7-6(19)
⊠	B-218	2.25	9.2	20.9	17.4	4.0	25.8	A-2-4(0)
■	B-220	4.25	4.9	NP	NP	NP	12.6	A-1-a(0)
◆	B-221	1.75	16.9	37.2	18.4	19.0	61.2	A-6b(9)
◇	B-222	4.25	20.5	32.0	21.6	10.0	48.9	A-4a(3)

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS

LOCATION DUBLIN, OHIO

JOB NO. 1171-13-042A **DATE** 10/14/13

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-202 S-1 1.5' to 2.1'**	**Dark-gray mottled with dark-brown silty clay, some fine to coarse sand, some fine to coarse gravel.**	**17**	**39**	**19**	**20**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-202 S-1 1.5' to 2.1'**	**25.0000**	**22.6008**	**0.2026**	**0.0528**		**23.3**	**22.8**	**29.6**	**24.3**

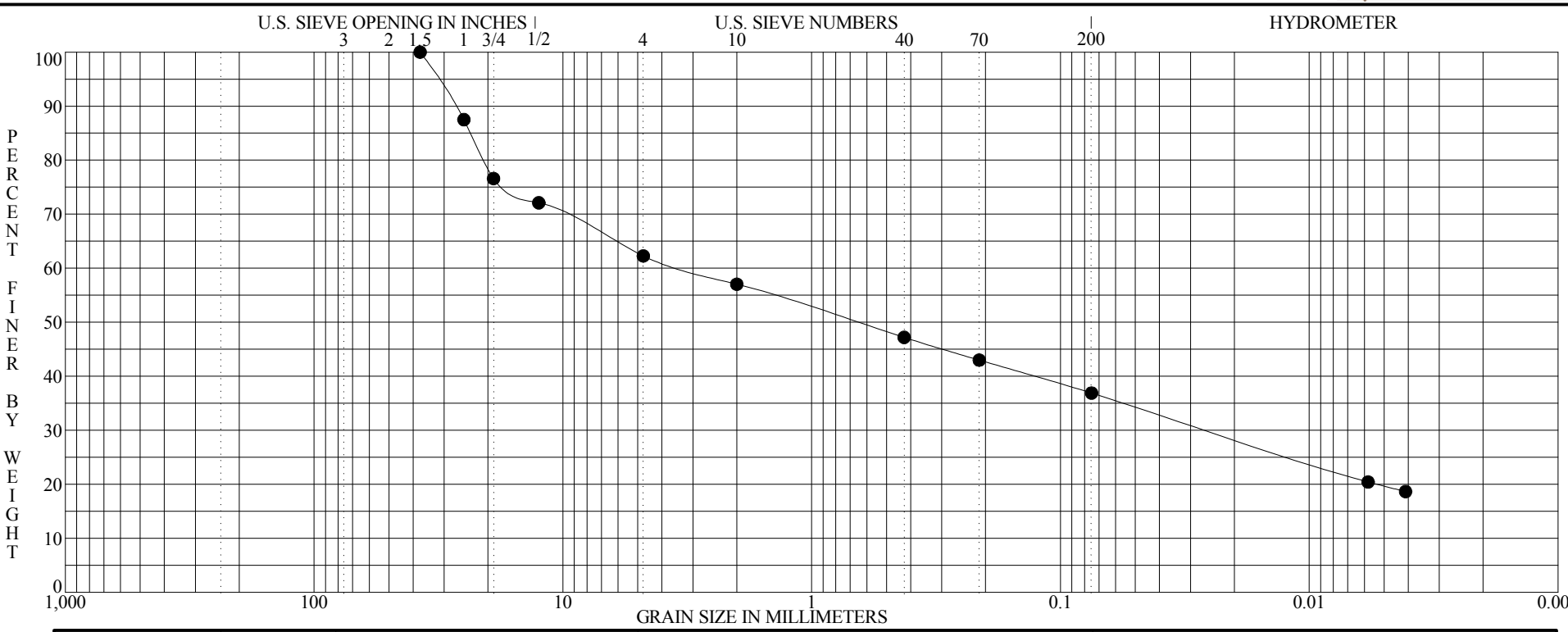
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 30

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-203 S-2 2.5' to 3.0'**	**Gray, brown and dark-brown fine to coarse gravel, some fine to coarse sand, "and" silty clay.**	**14**	**42**	**21**	**21**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-203 S-2 2.5' to 3.0'**	**37.5000**	**31.8850**	**3.2683**	**0.6614**		**37.7**	**25.4**	**17.2**	**19.7**

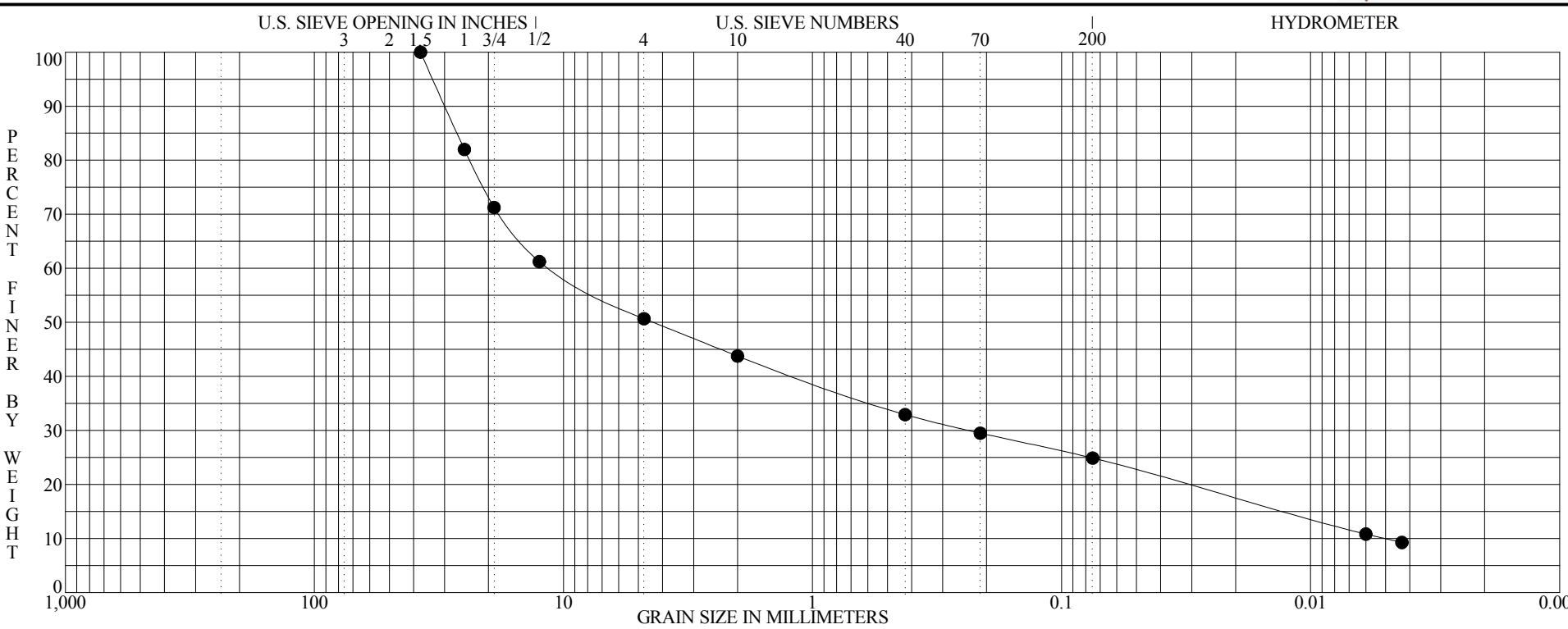
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 31

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-204 S-2 2.5' to 3.5'**	**Gray and brown fine to coarse gravel, some fine to coparse sand, some clayey silt.**	**8**	**28**	**18**	**10**	**0.983**	**2218.608**

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-204 S-2 2.5' to 3.5'**	**37.5000**	**33.5064**	**11.1667**	**4.3696**	**0.0050**	**49.3**	**25.8**	**14.9**	**10.0**

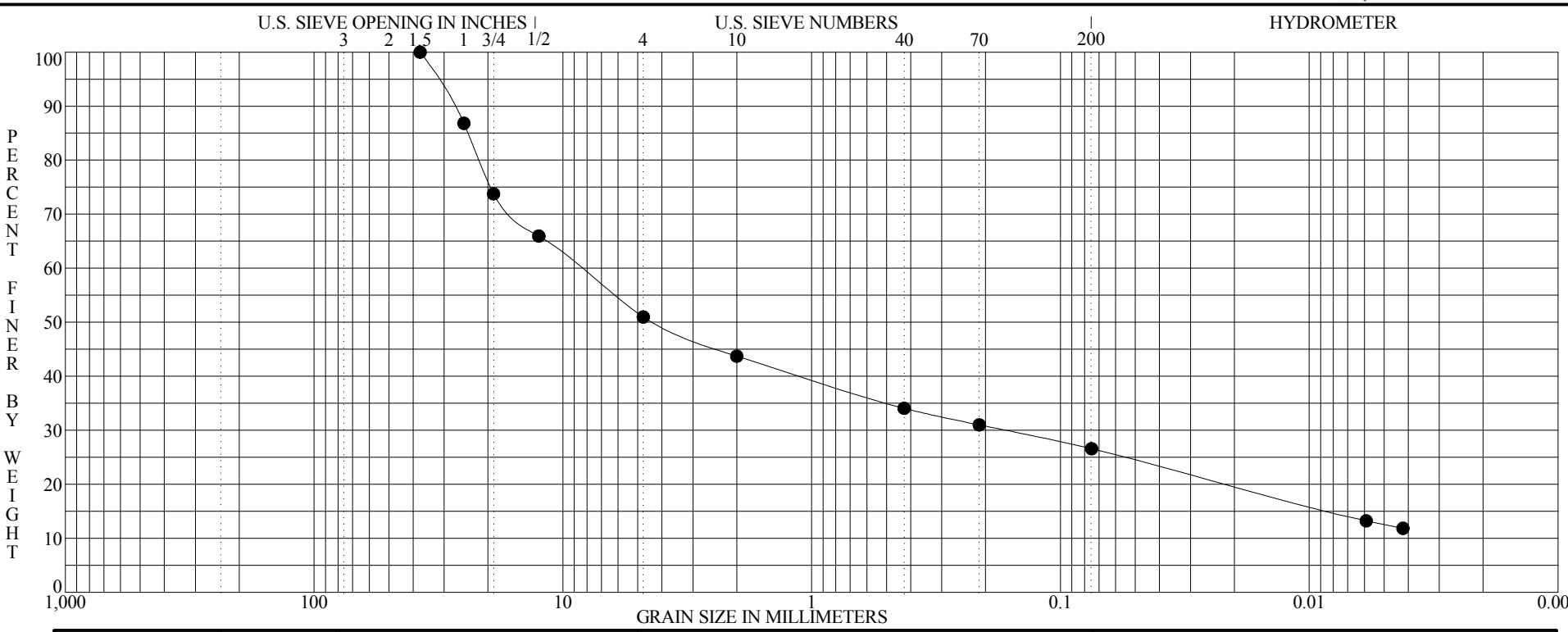
ASTM D422

GRADATION CURVE

PROJECT: **SR161/RIVERSIDE DRIVE IMPROVEMENTS**
LOCATION: **DUBLIN, OHIO**
JOB NO.: **1171-13-042A**
DATE: **10/14/13**

PLATE 32

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-205 S-1 1.5' to 3.0'**	**Gray and dark-brown fine to coarse gravel, some fine to coarse sand, some silty clay.**	**10**	**35**	**17**	**18**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-205 S-1 1.5' to 3.0'**	**37.5000**	**32.1513**	**8.5129**	**4.2317**		**49.0**	**24.4**	**14.0**	**12.6**

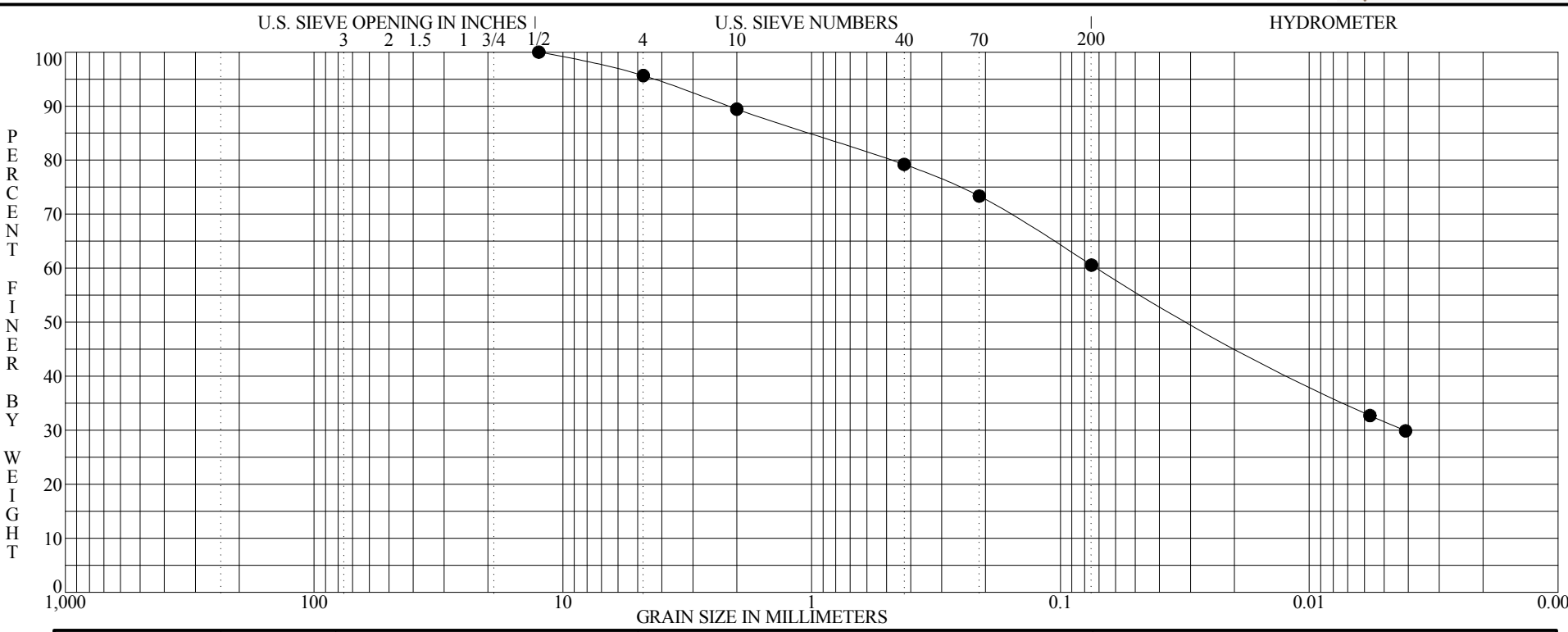
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 33

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-206 S-1 1.5' to 2.2'**	**Brown mottled with gray and dark-gray silty clay, some fine to coarse sand, trace fine gravel.**	**16**	**28**	**14**	**14**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-206 S-1 1.5' to 2.2'**	**12.5000**	**4.3347**	**0.0711**	**0.0282**		**4.3**	**35.1**	**29.0**	**31.6**

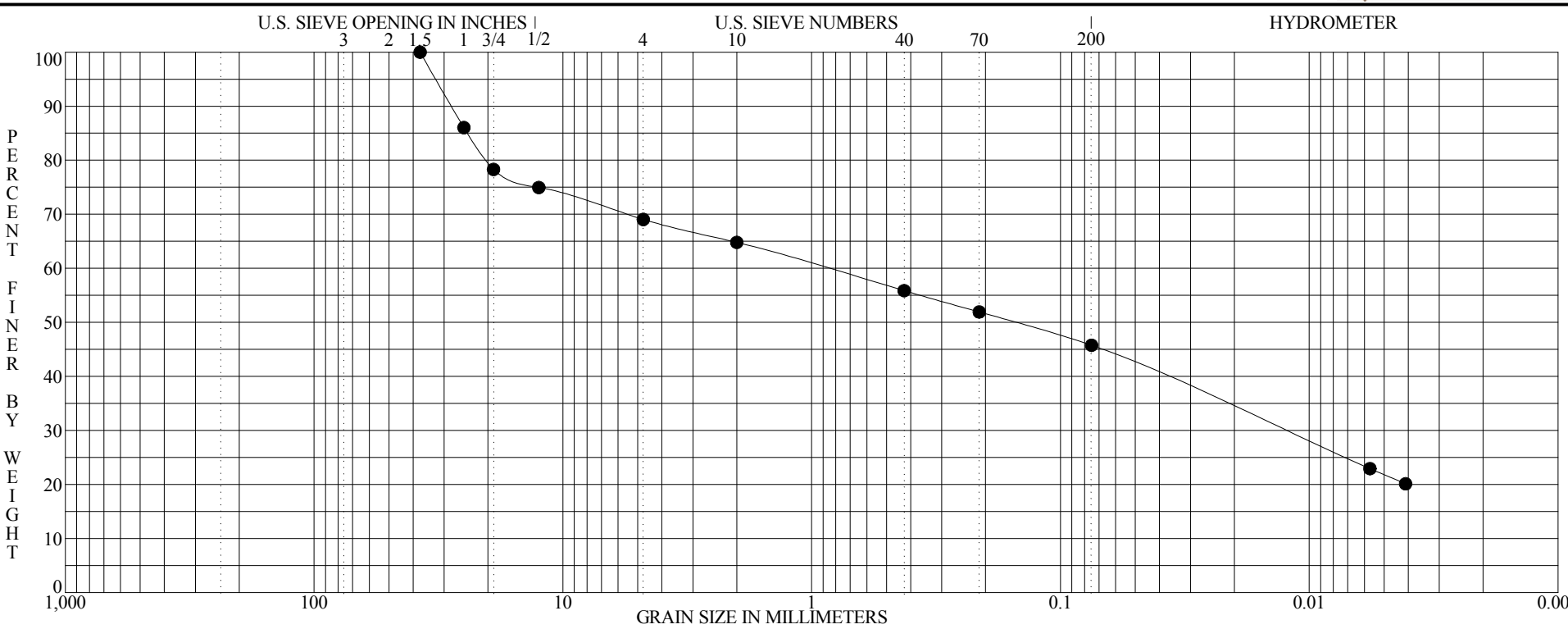
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 34

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-208 S-2 3.5' to 4.5'**	**Brown and gray fine to coarse gravel, some fine to coarse sand, "and" silty clay.**	**12**	**35**	**19**	**16**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-208 S-2 3.5' to 4.5'**	**37.5000**	**32.4315**	**0.8700**	**0.1534**		**31.0**	**23.3**	**23.9**	**21.8**

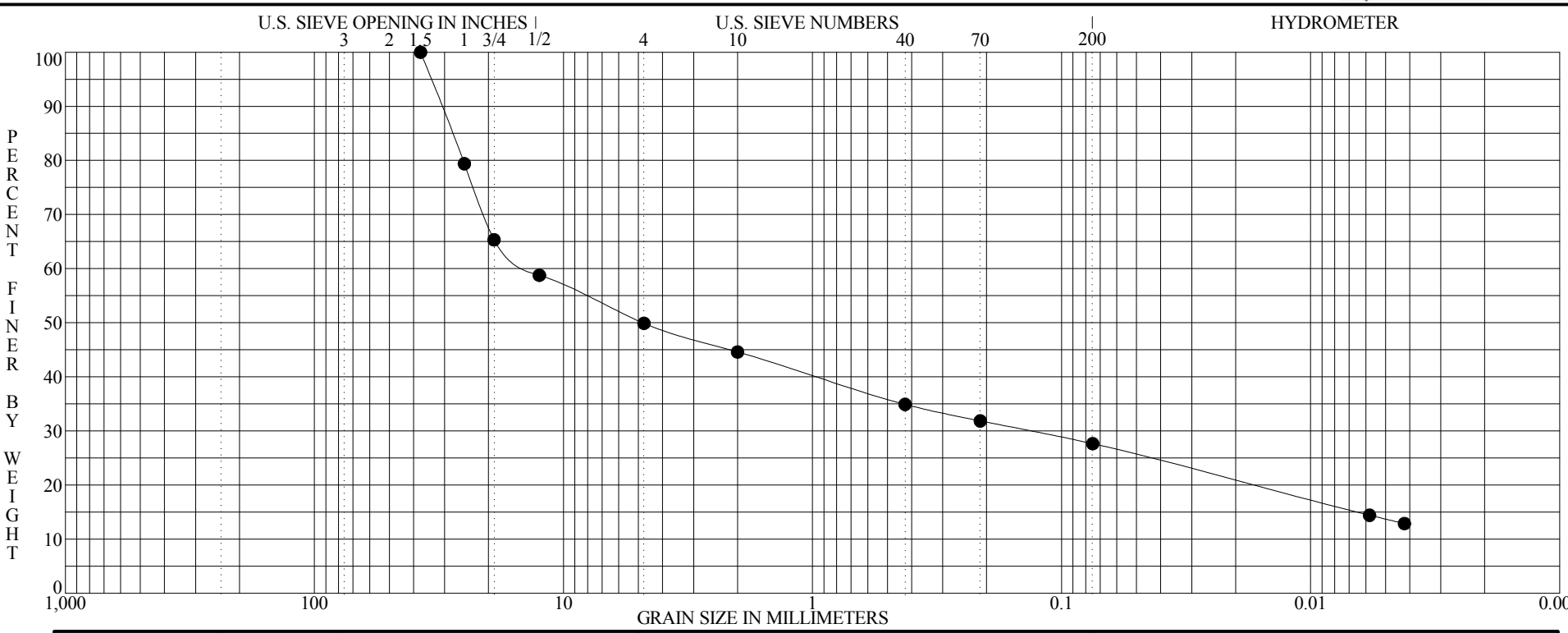
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 35

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-209 S-1 1.0' to 2.5'**	**Gray and dark-gray fine to coarse gravel, some fine to coarse sand, some silty clay.**	**8**	**30**	**17**	**13**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-209 S-1 1.0' to 2.5'**	**37.5000**	**33.9876**	**13.5219**	**4.8124**		**50.1**	**22.2**	**13.9**	**13.7**

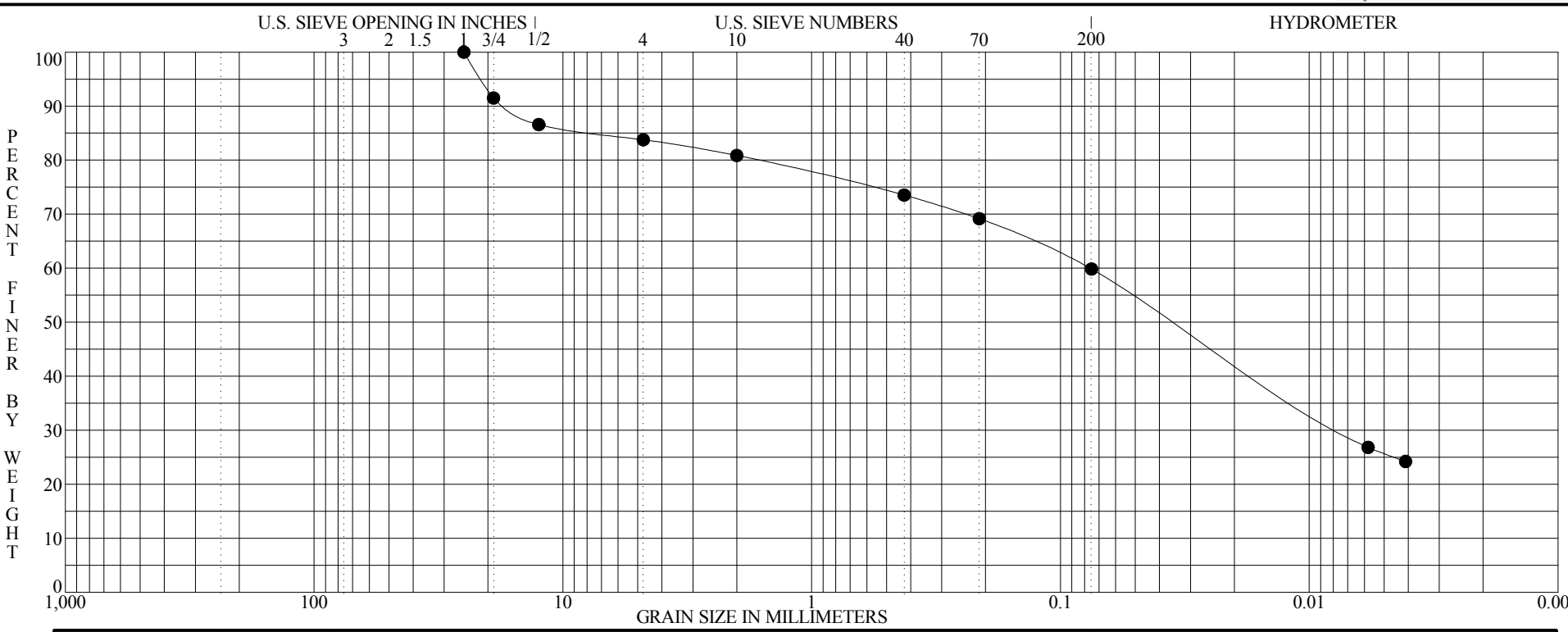
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 36

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-210 S-1 1.0' to 2.5'**	**Brown mottled with dark-gray silty clay, some fine to coarse sand, little fine to coarse gravel.**	**13**	**31**	**18**	**13**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-210 S-1 1.0' to 2.5'**	**25.0000**	**21.2689**	**0.0763**	**0.0350**		**16.2**	**23.9**	**34.1**	**25.7**

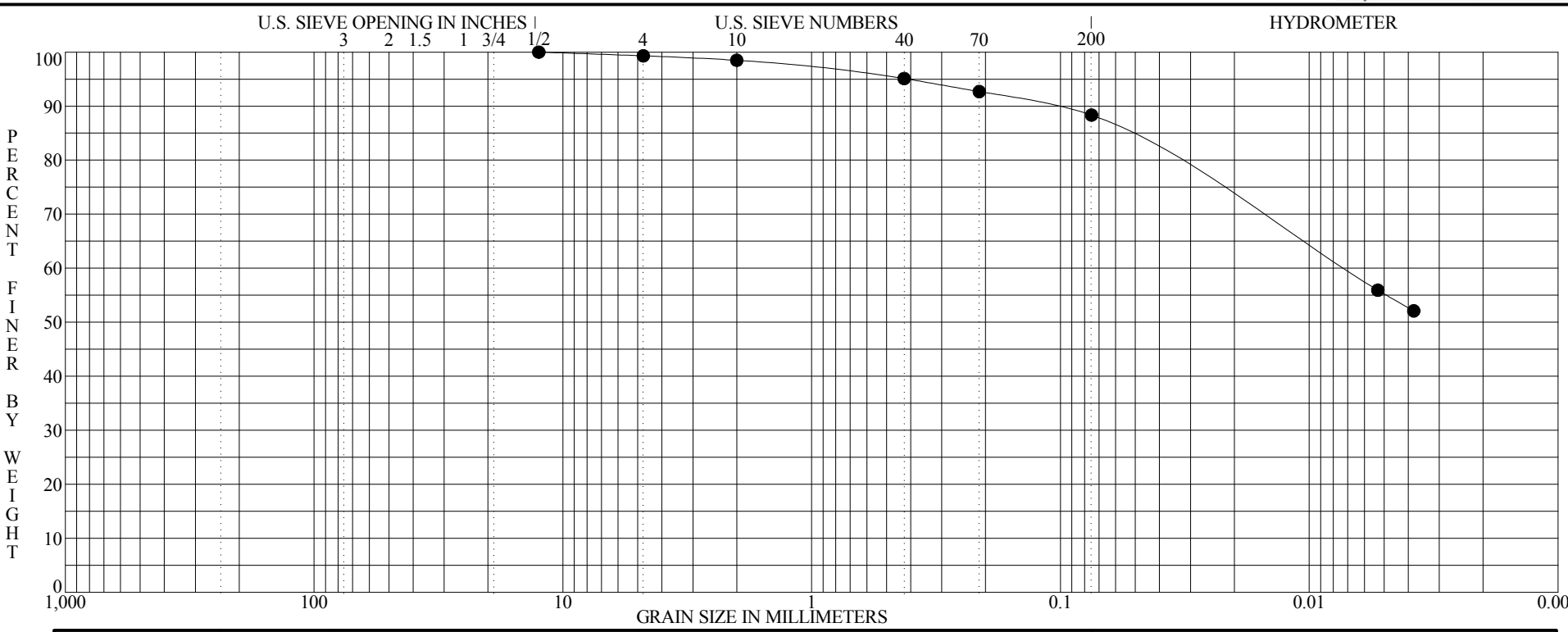
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 37

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-212 S-1 1.0' to 2.5'**	**Brown silty clay, little fine to coarse sand, trace fine gravel.**	**25**	**67**	**22**	**45**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-212 S-1 1.0' to 2.5'**	**12.5000**	**0.4116**	**0.0074**			**0.7**	**11.0**	**33.1**	**55.3**

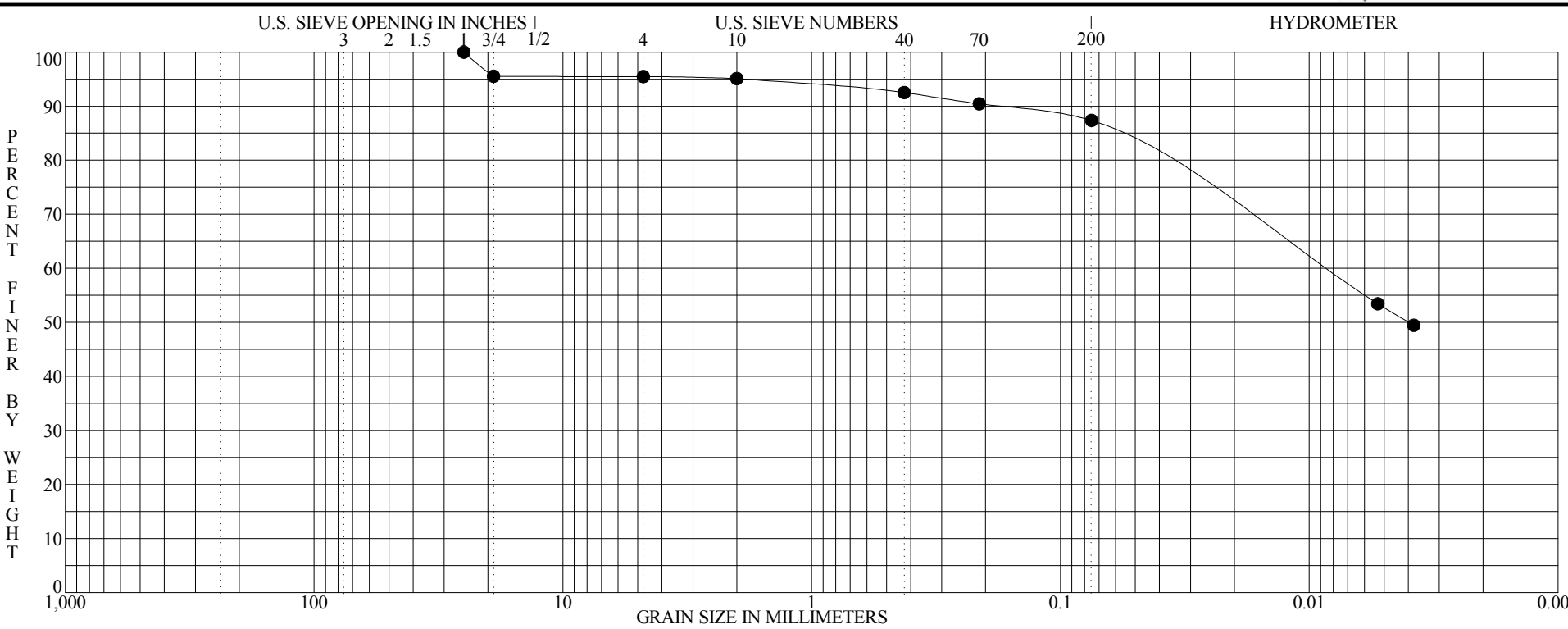
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 38

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-213 S-1 1.0' to 2.5'**	**Dark-gray mottled with brown silty clay, trace fine to coarse sand, trace fine gravel.**	**22**	**56**	**24**	**32**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-213 S-1 1.0' to 2.5'**	**25.0000**	**1.8669**	**0.0089**	**0.0040**		**4.5**	**8.1**	**34.6**	**52.7**

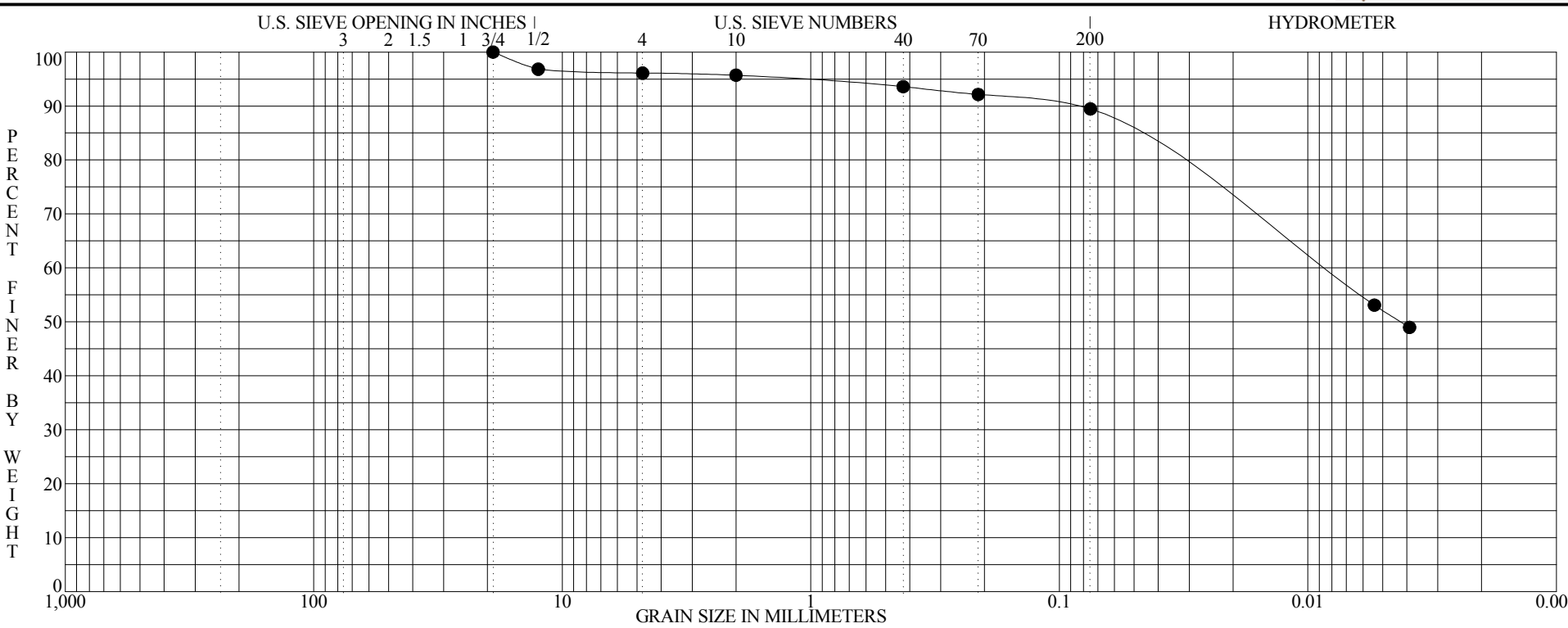
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 39

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-214 S-1 1.0' to 2.4'**	**Dark-brown mottled with dark-gray silty clay, trace fine to coarse sand, trace fine gravel.**	**21**	**56**	**24**	**32**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-214 S-1 1.0' to 2.4'**	**19.0000**	**1.1885**	**0.0089**	**0.0042**		**3.9**	**6.6**	**37.3**	**52.1**

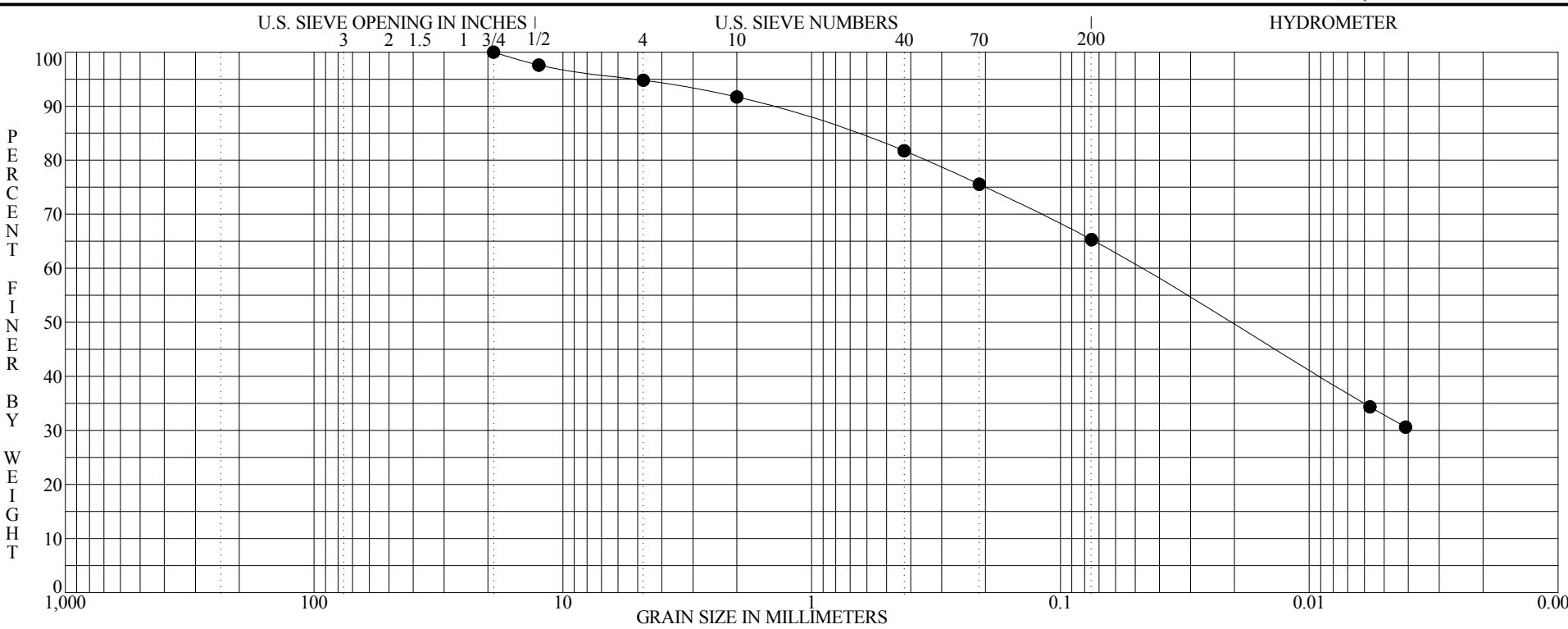
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 40

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-215 S-1 1.0' to 2.0'**	**Brown mottled with gray silty clay, some fine to coarse sand, trace fine gravel.**	**20**	**31**	**18**	**13**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-215 S-1 1.0' to 2.0'**	**19.0000**	**5.0911**	**0.0482**	**0.0210**		**5.2**	**29.5**	**32.4**	**32.9**

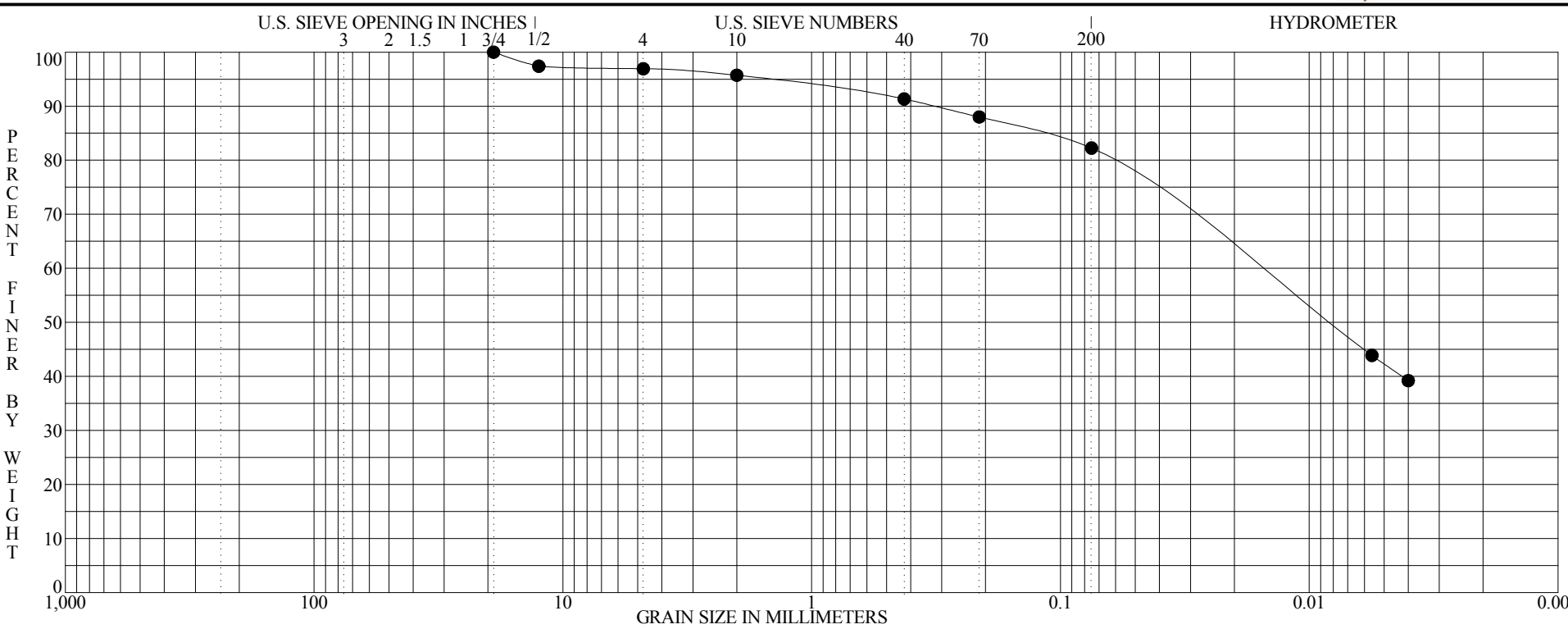
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 41

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-216 S-1 1.0' to 2.0'**	**Dark-gray silty clay, little fine to coarse sand, trace fine gravel.**	**19**	**50**	**24**	**26**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-216 S-1 1.0' to 2.0'**	**19.0000**	**1.5488**	**0.0166**	**0.0085**		**3.1**	**14.7**	**39.9**	**42.3**

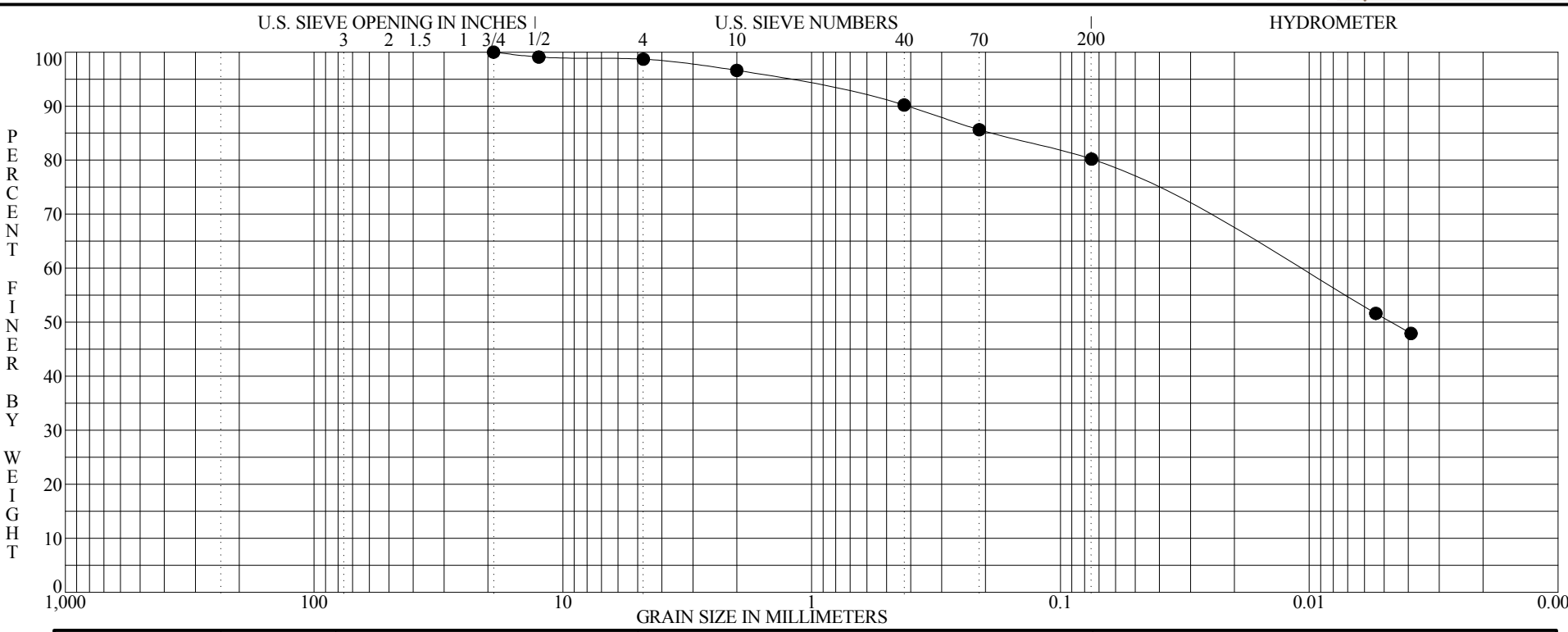
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 42

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-217 S-1A 2.5' to 3.0'**	**Brown silty clay, little fine to coarse sand, trace fine gravel.**	**28**	**54**	**23**	**31**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-217 S-1A 2.5' to 3.0'**	**19.0000**	**1.3527**	**0.0117**	**0.0047**		**1.3**	**18.5**	**29.4**	**50.8**

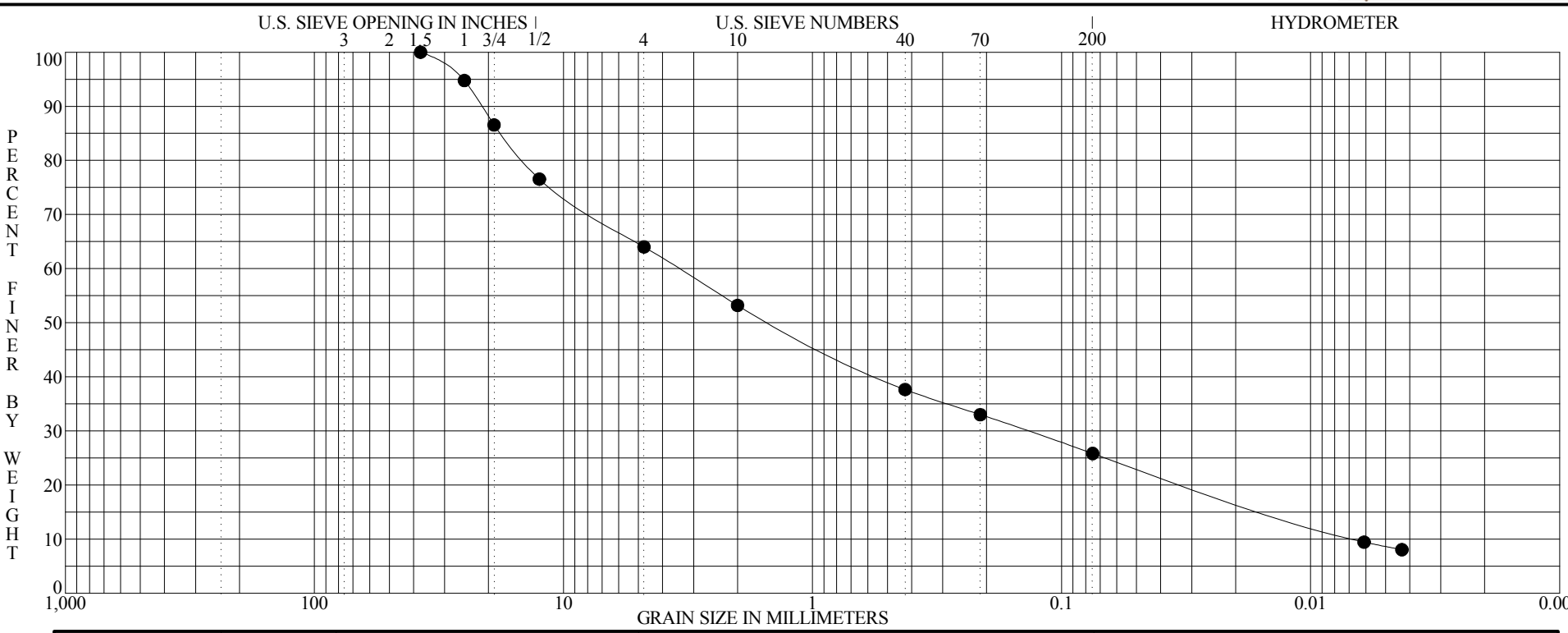
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 43

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-218 S-1 1.5' to 3.0'**	**Gray and dark-brown fine to coarse sand, "and" fine to coarse gravel, little silt, trace clay.**	**9**	**21**	**17**	**4**	**0.822**	**518.567**

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-218 S-1 1.5' to 3.0'**	**37.5000**	**25.4593**	**3.4475**	**1.4544**	**0.0066**	**36.0**	**38.2**	**17.2**	**8.6**

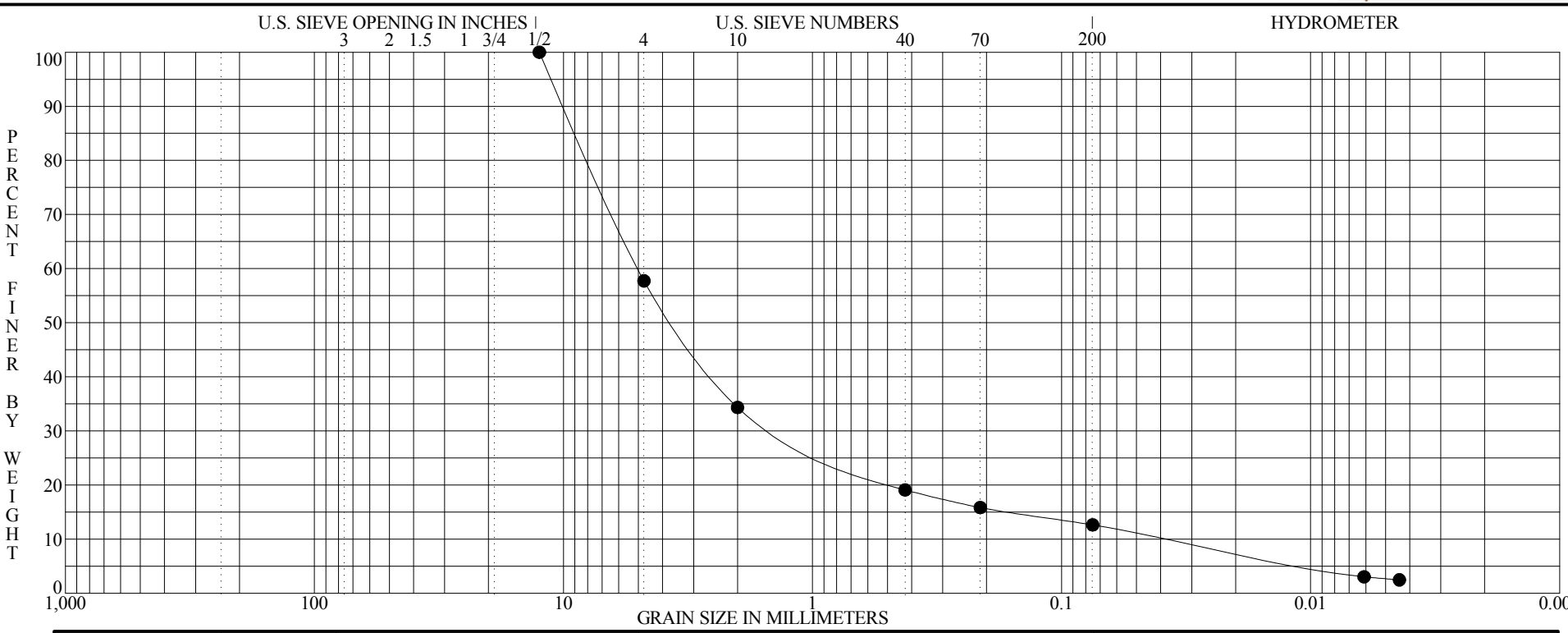
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 44

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-220 S-2 3.5' to 5.0'**	**FILL: Gray fine to coarse sand, "and" fine to coarse gravel, trace silt, trace clay.**	**5**	**NP**	**NP**	**NP**	**8.786**	**132.560**

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-220 S-2 3.5' to 5.0'**	**12.5000**	**11.1480**	**5.0027**	**3.5688**	**0.0377**	**42.3**	**45.1**	**9.9**	**2.7**

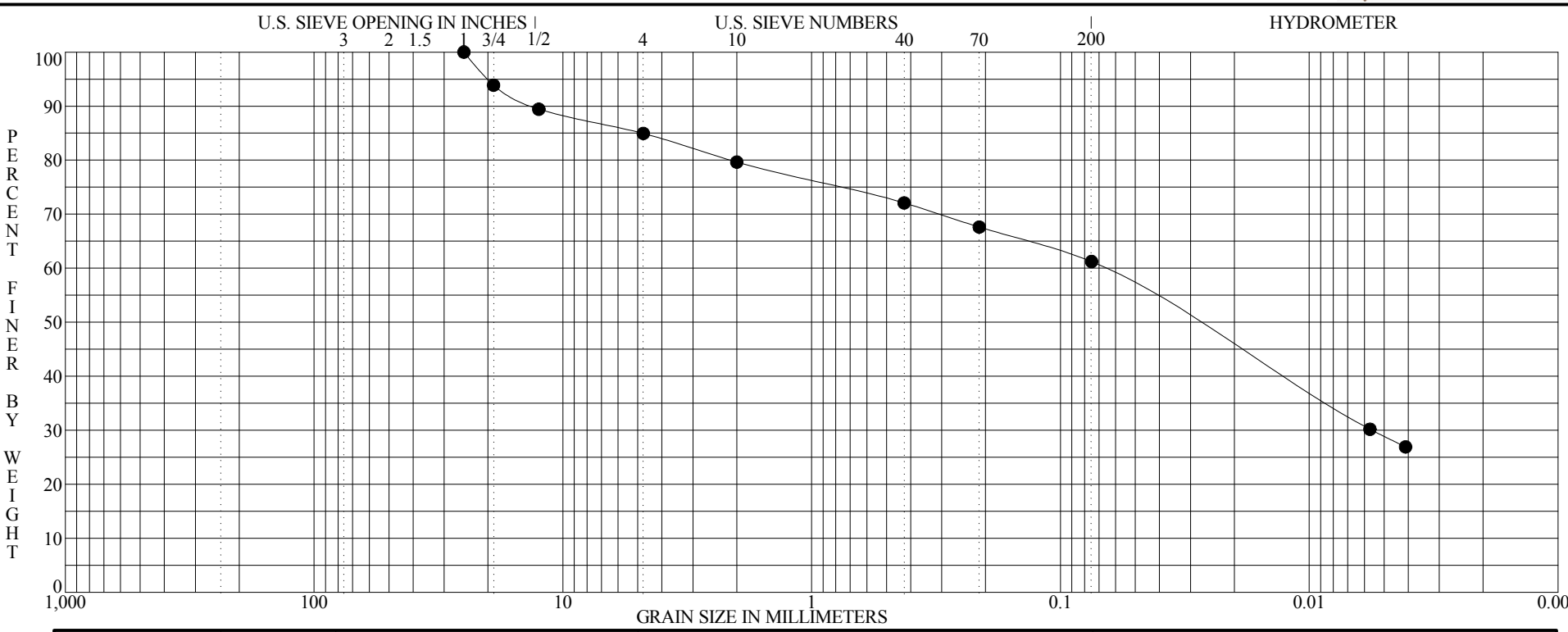
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 45

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-221 S-1 1.0' to 2.0'**	**FILL: Dark-brown and gray silty clay, little fine to coarse sand, little fine to coarse gravel.**	**17**	**37**	**18**	**19**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-221 S-1 1.0' to 2.0'**	**25.0000**	**19.9809**	**0.0677**	**0.0295**		**15.1**	**23.7**	**32.3**	**28.9**

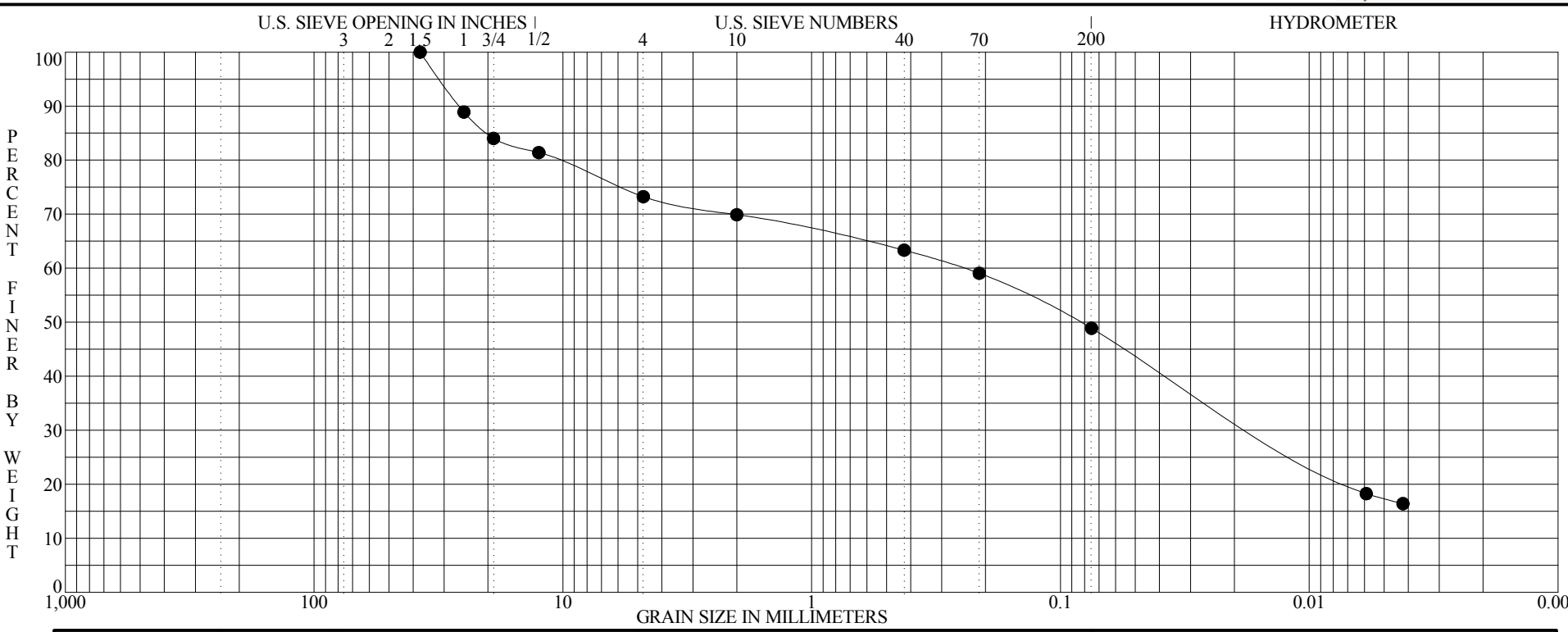
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 46

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-222 S-2 3.5' to 5.0'**	**Brown fine to coarse gravel, some fine to coasre sand, "and" clayey silt.**	**21**	**32**	**22**	**10**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-222 S-2 3.5' to 5.0'**	**37.5000**	**31.2332**	**0.2469**	**0.0840**		**26.8**	**24.4**	**31.5**	**17.4**

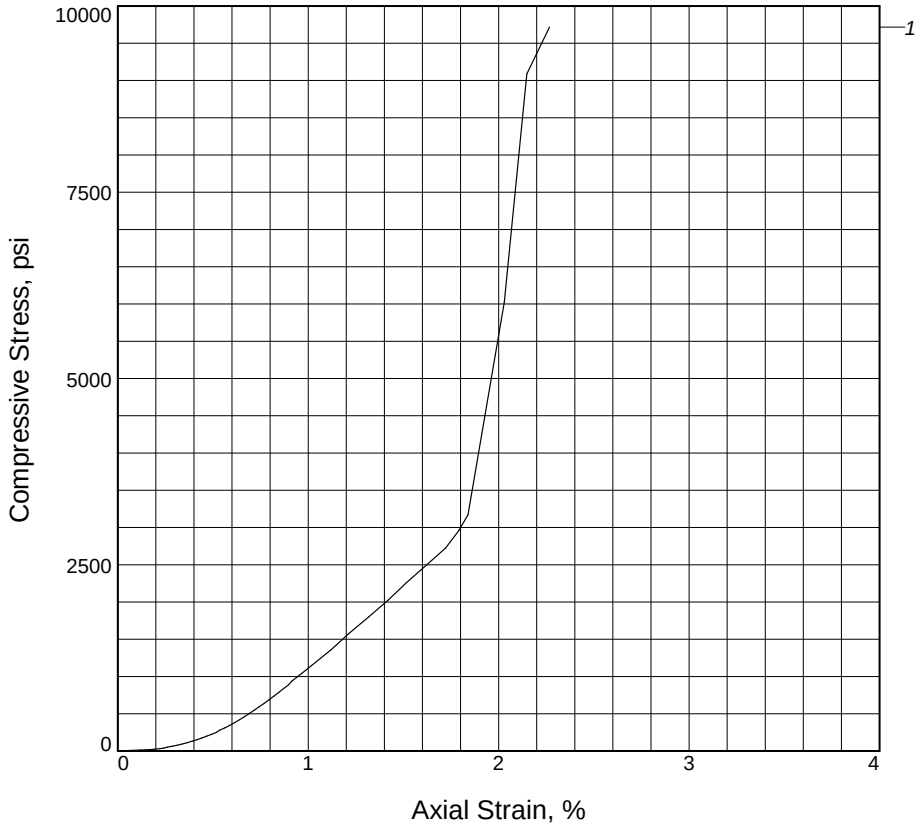
ASTM D422

GRADATION CURVE

PROJECT SR161/RIVERSIDE DRIVE IMPROVEMENTS
LOCATION DUBLIN, OHIO
JOB NO. 1171-13-042A **DATE** 10/14/13

PLATE 47

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	9717.12			
Undrained shear strength, psi	4858.56			
Failure strain, %	2.3			
Strain rate, in./min.	1.32			
Water content, %	1.0			
Wet density, pcf	156.0			
Dry density, pcf	154.4			
Saturation, %	29.9			
Void ratio	0.0917			
Specimen diameter, in.	1.99			
Specimen height, in.	4.20			
Height/diameter ratio	2.12			

Description: LIMESTONE, gray, hard

LL =	**PL =**	**PI =**	**GS=** 2.7	**Type:** Rock Core

Project No.: 1171-13-042A

Date Sampled: 9/19/2013

Remarks:

Client:

Project: SR 161 / Riverside Drive Improvements Dublin, Ohio

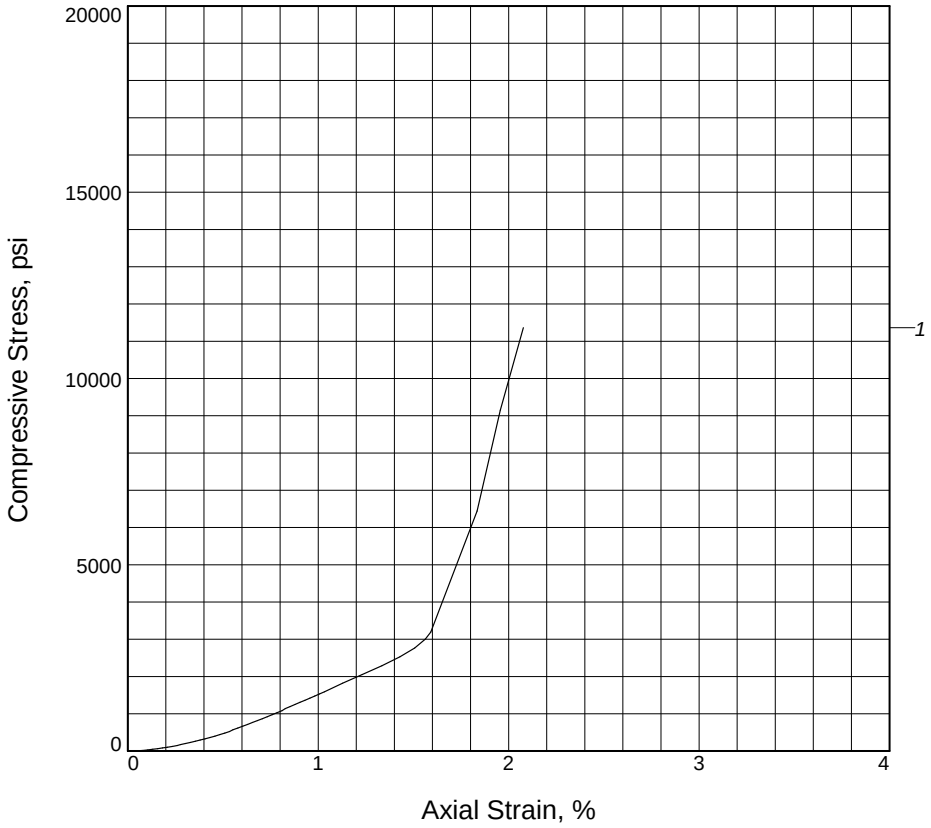
Location: B-222

Sample Number: S-6 **Depth:** 9.6' to 10.0'

UNCONFINED COMPRESSION TEST
S&ME, Inc.
Dublin, Ohio

Tested By: PJM/CBP **Checked By:** JJ

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	11364.81			
Undrained shear strength, psi	5682.41			
Failure strain, %	2.1			
Strain rate, in./min.	2.76			
Water content, %	0.5			
Wet density, pcf	164.2			
Dry density, pcf	163.4			
Saturation, %	42.5			
Void ratio	0.0316			
Specimen diameter, in.	1.98			
Specimen height, in.	4.12			
Height/diameter ratio	2.07			

Description: LIMESTONE, gray-brown, hard

LL =	**PL =**	**PI =**	**GS=** 2.7	**Type:** Rock Core

Project No.: 1171-13-042A

Date Sampled: 9/19/2013

Remarks:

Client:

Project: SR 161 / Riverside Drive Improvements Dublin, Ohio

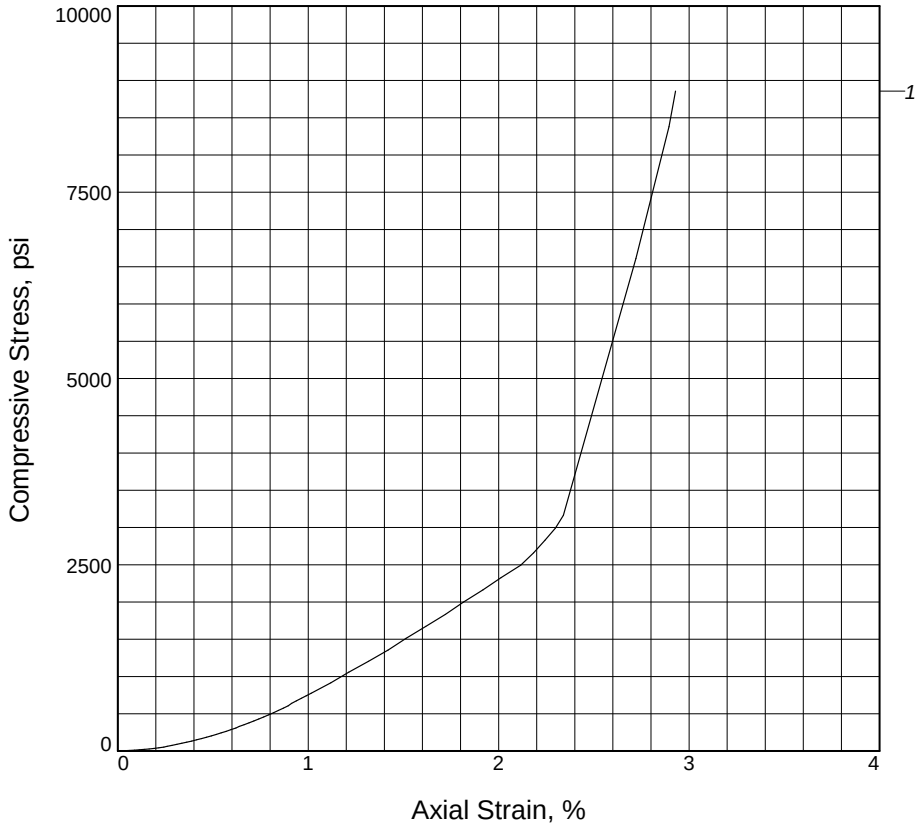
Location: B-222

Sample Number: S-7 **Depth:** 15.6' to 16.1'

UNCONFINED COMPRESSION TEST
S&ME, Inc.
Dublin, Ohio

Tested By: PJM/CBP **Checked By:** JJ

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	8858.41			
Undrained shear strength, psi	4429.20			
Failure strain, %	2.9			
Strain rate, in./min.	4.86			
Water content, %	0.4			
Wet density, pcf	161.8			
Dry density, pcf	161.2			
Saturation, %	24.1			
Void ratio	0.0459			
Specimen diameter, in.	1.97			
Specimen height, in.	2.88			
Height/diameter ratio	1.46			

Description: LIMESTONE, gray-brown, hard

LL =	**PL =**	**PI =**	**GS=** 2.7	**Type:** Rock Core

Project No.: 1171-13-042A

Date Sampled: 9/19/2013

Remarks:
The length-to-diameter ratio (L/D) was less than 2.0 as required by ASTM D7012. Therefore, a strength correction factor of 0.95 should be applied, which results in Qu = 8415.5 psi.

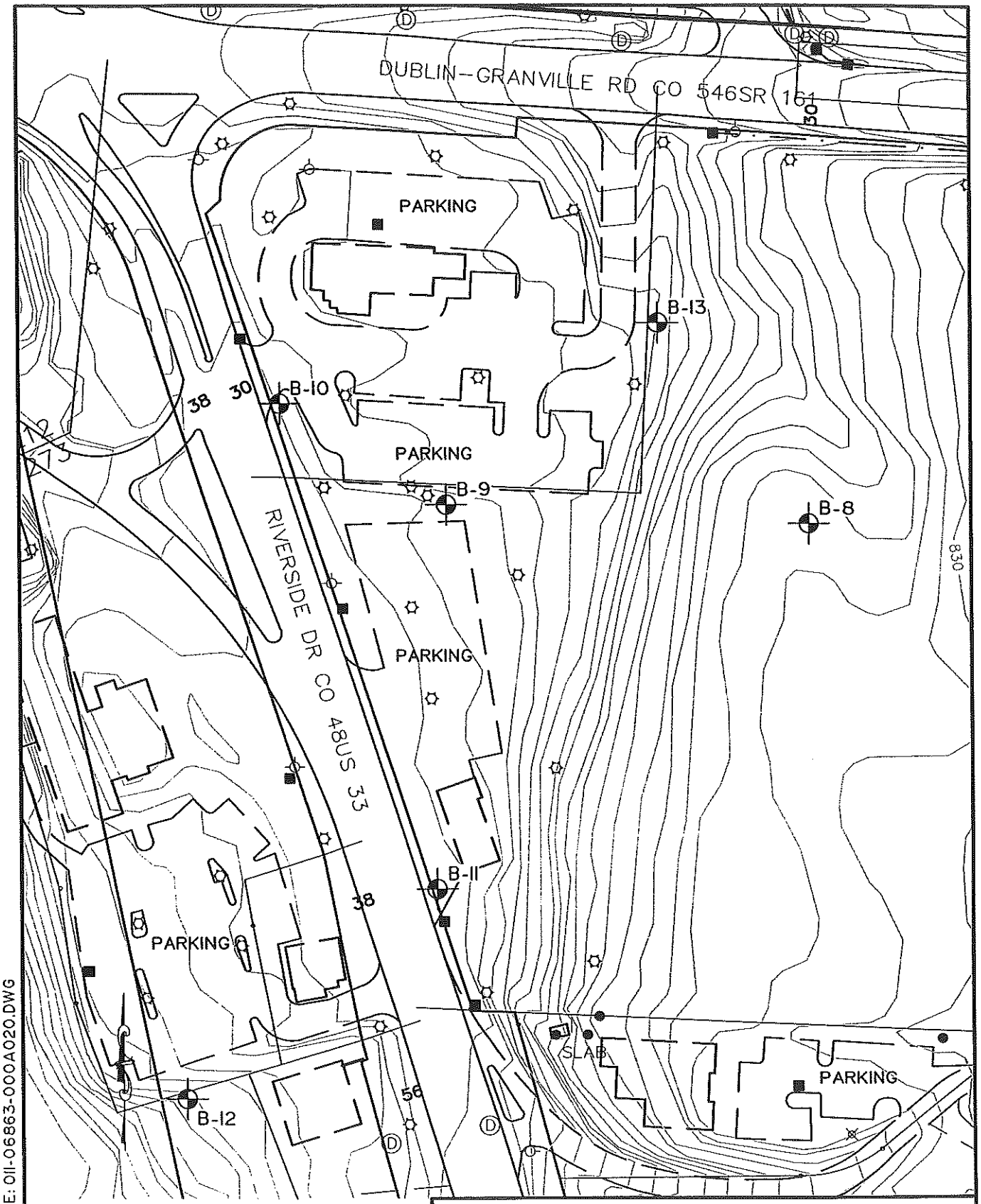
Client:

Project: SR 161 / Riverside Drive Improvements Dublin, Ohio

Location: B-223
Sample Number: S-5 **Depth:** 12.3' to 12.6'

UNCONFINED COMPRESSION TEST
S&ME, Inc.
Dublin, Ohio

Tested By: PJM/CBP **Checked By:** JJ



PLAN OF BORINGS

LEGEND

B-1 — BORING NUMBER AND LOCATION

WENDYS/RIVERSIDE DRIVE IMPROVEMENTS
STORMWATER IMPROVEMENT PROJECTS
DUBLIN, OHIO

Project: 01-06863-000	Drawn By: B.L.R.
Drawing Date: 3/30/00	Approved By: M.G.R.
Revision Date:	Scale: 1" = 100'

BBC&M
Columbus (614) 793-2226
Cleveland (440) 585-9995
Cincinnati (513) 771-8471

BBC&M DRAWING FILE: 01I-06863-000A020.DWG

BBC&M ENGINEERING, INC.

LOG OF BORING NO. B-10
DUBLIN STORM WATER IMPROVEMENTS
WENDY'S / RIVERSIDE DRIVE IMPROVEMENTS

LOCATION: See Plate 2D ELEVATION: 794.2 DATE: 2/23/00

DRILLING METHOD: 4-1/2" O.D. Continuous-flight Auger COMPLETION DEPTH: 10.0'

SAMPLER(S): 2" O.D. Split-barrel Sampler; NX Rock Core Barrel

DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
0				TOPSOIL - 4 INCHES		
	1		3/11/6	POSSIBLE FILL: Very-stiff to hard brown becoming dark-brown silty clay, little fine to coarse sand, trace fine to coarse gravel, slightly organic.		H=3.0-4.0
	2		3/3/4			H=3.0-4.1
5			NX REC 93% RQD 0%	Medium-hard light-gray and light-brown limestone, nearly horizontally bedded, many diagonal fractures, few solution cavities, contains fossils.		
	3					
10				- Encountered auger refusal at 5.0'.		
15						
20						
25						

WATER LEVEL: "Dry"
WATER NOTE: Before Coring
DATE: 2/23/00

SYMBOLS USED TO INDICATE TEST RESULTS

G - GRADATION
Q - UNCONFINED COMPR
T - TRIAXIAL COMPR
C - CONSOLIDATION
SEE SEPARATE CURVES

H - PENETROMETER (tsf)
W - UNIT DRY WEIGHT (pcf)
D - RELATIVE DENSITY (%)

BORLJ 16863000.GPJ JM.GDT 4/5/00

JOB: 01106863.000

PLATE 52

BBC&M ENGINEERING, INC.

LOG OF BORING NO. B-11
DUBLIN STORM WATER IMPROVEMENTS
WENDY'S / RIVERSIDE DRIVE IMPROVEMENTS

LOCATION: See Plate 2D
ELEVATION: 793.0
DATE: 2/23/00
DRILLING METHOD: 4-1/2" O.D. Continuous-flight Auger
COMPLETION DEPTH: 10.0'
SAMPLER(S): 2" O.D. Split-barrel Sampler; NX Rock Core Barrel

DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
0				ASPHALT - 3 INCHES		
				FILL: Loose light-gray and light-brown fine to coarse gravel, "and" fine to coarse sand, trace silt.		
	1		3 / 3 / 5			
	2		6 / 4 / 3			
5						
	3		3 / 50-4"R			
				Medium-hard light-gray and light-brown limestone, nearly horizontally bedded, many diagonal and vertical fractures, few solution cavities.		
	4		NX REC 100% RQD 0%			
10						
				- Spoon refusal at 6.3'.		
				- Auger refusal at 8.5'.		
15						
20						
25						

WATER LEVEL: ▽ "Dry" ▼ ▽
WATER NOTE: Before Coring
DATE: 2/23/00

SYMBOLS USED TO INDICATE TEST RESULTS

G - GRADATION
Q - UNCONFINED COMPR
T - TRIAXIAL COMPR
C - CONSOLIDATION
} SEE SEPARATE CURVES

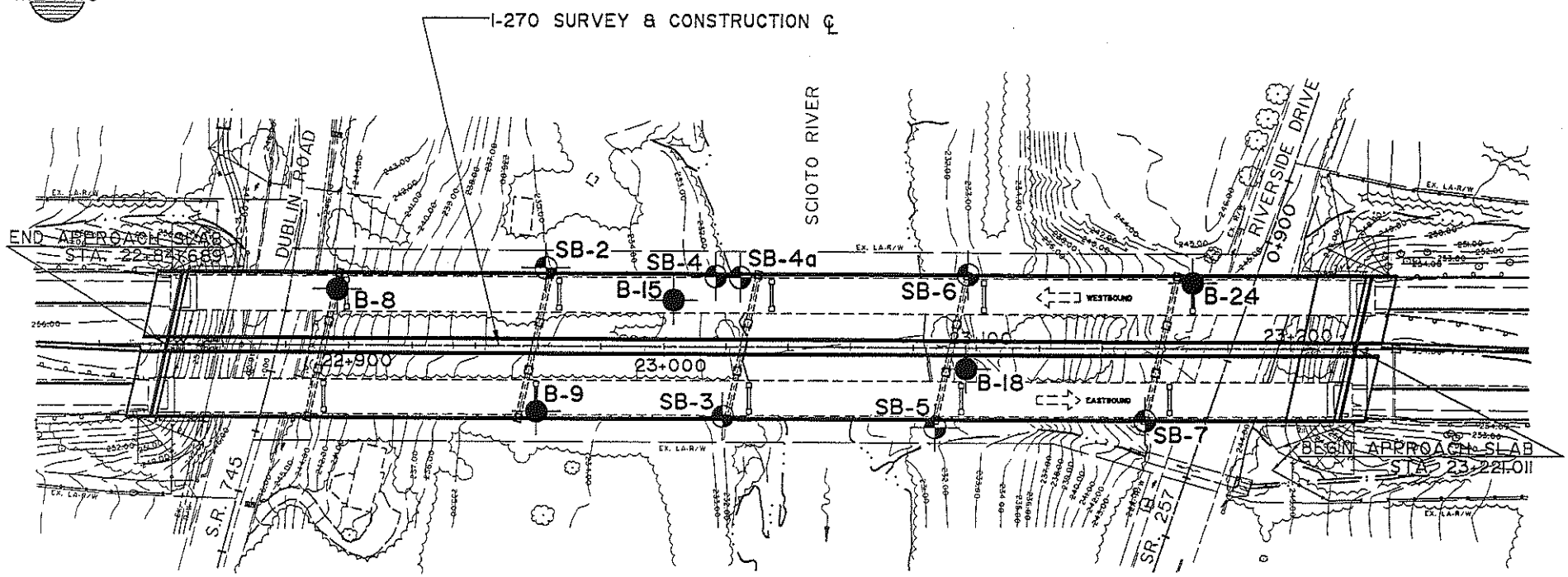
H - PENETROMETER (tsf)
W - UNIT DRY WEIGHT (pcf)
D - RELATIVE DENSITY (%)

BORLJ 16863000.GPJ CM.GDT 4/5/00

JOB: 01106863.000

PLATE 53

METRIC



LEGEND

SB-2 — BORING LOCATION AND NUMBER

B-8 — BORING PREVIOUSLY PREFORMED BY OTHERS

PLAN OF BORINGS

REPLACEMENT STRUCTURE No. FRA-270-22842 FRANKLIN COUNTY, OHIO

Drawing No: 5889A020.DWG		
Drawn By: S.P.S.	Approved By: R.S.W.	
Date: 08/13/97	Revision:	Scale: 1 : 2000

BBC&M
6190 Enterprise Court
Dublin, Ohio 43016-7297
Phone (614) 793-2226

PLATE 54

BBC&M ENGINEERING, INC.

LOG OF BORING NO. SB-7
REPLACEMENT STRUCTURE NO. FRA-270-22842
FRANKLIN COUNTY, OHIO

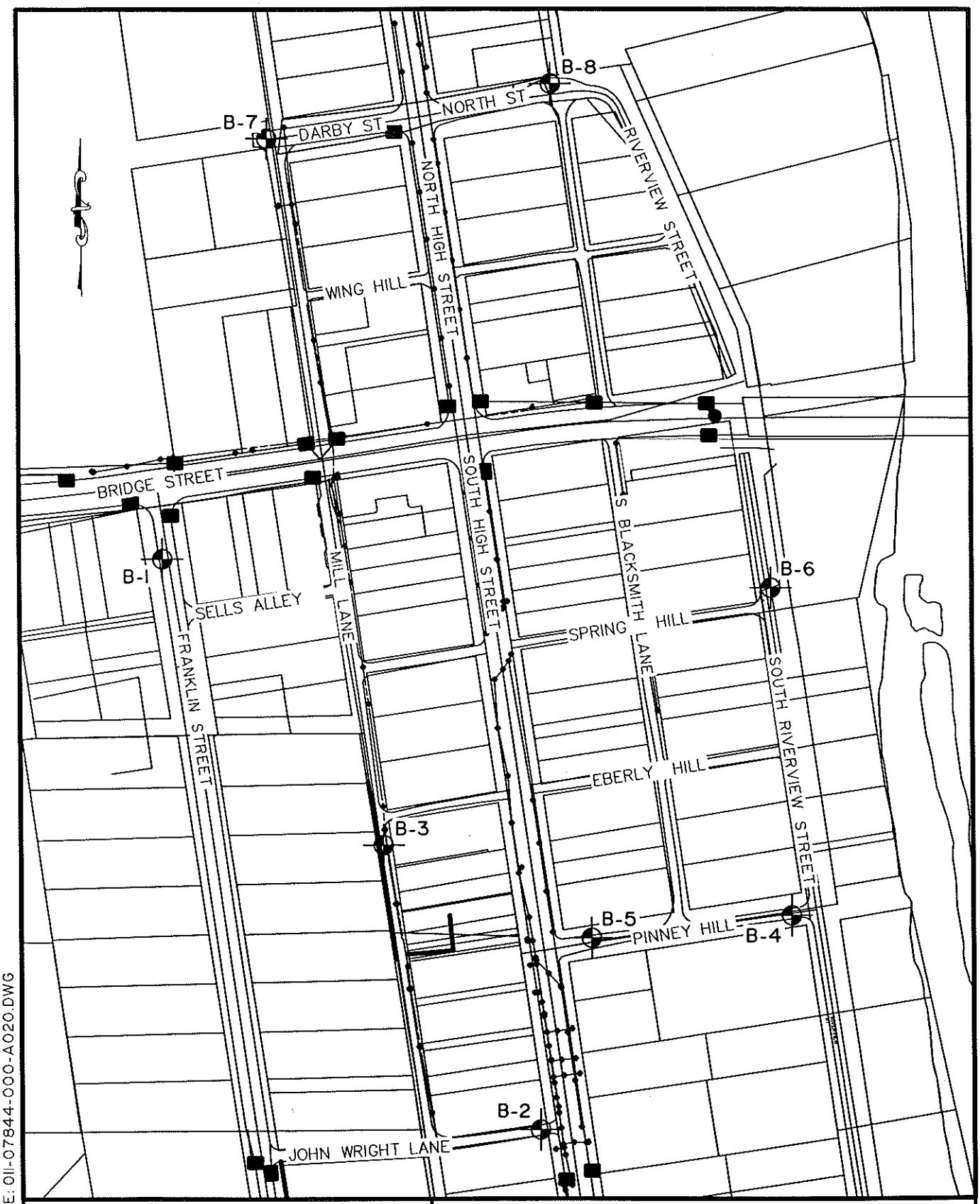
TYPE: 83mm I.D. Hollow-stem Auger; NX Rock Core Barrel
LOCATION: STA 23+153.58, 23.63m Rt. of Centerline
COMPLETION DEPTH: 7.38m ELEVATION: 243.91 DATE: 7/8/97

DEPTH, METERS	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER kPa	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
0													FILL: Brown silty clay, little fine to coarse sand, trace fine gravel. Visual
1													POSSIBLE FILL: Brown fine to coarse gravel, some fine to coarse sand, trace silt. Visual
1	1		REC 97%	RQD 0%									Medium-hard to hard brown and gray limestone, nearly horizontally bedded, numerous diagonal and vertical fractures, few calcite streaks, few very small solution cavities, few clay-filled fractures, slightly fossiliferous.
2	2		REC 100%	RQD 0%									
3	3		REC 100%	RQD 4%									
4													
5													
6	4		REC 100%	RQD 78%									Medium-hard to hard brown and gray limestone, nearly horizontally bedded, few diagonal and vertical fractures, occasional clay-filled fracture.
7													
8													- No seepage noted prior to coring. - Lost ~75% water return from 5.79m to 7.01m. - Lost 100% water return at 7.01m.
9													
10													

WATER LEVEL: ▽ ▽ ▽ ▽ ▽ ▽
WATER NOTE:
DATE:

JOB: 5889

PLATE 55



VICINITY MAP

LEGEND

B-1 BORING NUMBER AND LOCATION

OLD DUBLIN
STORMWATER SEWER STUDY
DUBLIN, OHIO

Project: 011-07844-000	Drawn By: J.L.P.
Drawing Date: 11/12/01	Approved By: S.A.H.
Revision Date:	Scale: 1" = 200'

BBC&M
Columbus (614) 793-2226
Cleveland (440) 585-9995
Cincinnati (513) 771-8471

BBC&M DRAWING FILE: 011-07844-000-A020.DWG

PLATE 56

BBC&M ENGINEERING INC.

LOG OF BORING NO. B-8
OLD DUBLIN STORMWATER SEWER STUDY
DUBLIN, OH

LOCATION: See Plate 2 ELEVATION: 808.5+/- DATE: 11/1/01

DRILLING METHOD: 3-1/4" I.D. Hollow-stem Auger COMPLETION DEPTH: 7.5'

SAMPLER(S): NX Rock Core Barrel

DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
0				ASPHALT - 6 INCHES		
				GRANULAR BASE - 12 INCHES		
				Stiff to very-stiff (est.) brown silty clay, little fine to coarse sand, trace fine to coarse gravel (based on cuttings).		
				Apparent weathered limestone (highly fractured).		
5	1		REC 64% RQD 15%	Medium-hard light-gray limestone, nearly horizontally bedded, many horizontal and vertical fractures, contains calcite crystals (core pieces broke along solution filled fractures).		
10						
15				- Encountered auger refusal at 4.5'. - No seepage or groundwater encountered prior to coring.		
20						
25						

WATER LEVEL: ▽ ▼ ▼

WATER NOTE:

DATE:

SYMBOLS USED TO INDICATE TEST RESULTS

G - GRADATION, Q - UNCONFINED COMPR, T - TRIAXIAL COMPR, C - CONSOLIDATION — SEE SEPARATE CURVES

H - PENETROMETER (tsf)
W - UNIT DRY WEIGHT (pcf)
D - RELATIVE DENSITY (%)

BORLJ 17844000.GPJ 4.GDT 11/12/01

JOB: 01107844.000

PLATE 57

Images: ~ Riverside Dr. Site Aerial 2009 Auditor.jp2 ~ TOPO!map.JPG
Xrefs:
File Last Updated: Jun 25, 2013
Plot Info: 6-25-2013 @ 4:40pm By: dverhulst
S&ME Filename: I:\DEPTS\cadd\Drawings\BST Projects\1171-Geotechnical\1171-13-042\1171-13-042C\PLANS\Site Topo from OSIP.dwg Layout: 8.5x11L

0 80 160
SCALE INFEET

LEGEND

B-1 BORING NUMBER AND LOCATION

PLAN OF BORINGS

ROUTE 161-RIVERSIDE DRIVE
AREA IMPROVEMENTS
DUBLIN, OHIO

Project: 1171-13-042C	Drawn By: DCV		
Drawing Date: 6-25-2013	Approved By: RTE		
Last Updated: 6-25-2013	Scale: GRAPHIC	1:1	

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ENGINEERING FIRM. 03530

PLATE 58

LOG OF BORING NO. B-9
ROUTE 161 - RIVERSIDE DR. AREA IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2A of Appendix A.** ELEVATION: **802 ±** DATE: **6/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **6.5'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
801.7	0						ASPHALT - 3 INCHES		
		1		6 / 10 / 20	40	47	POSSIBLE FILL: Hard brown and gray clayey silt, some fine to coarse sand, "and" fine to coarse gravel (limestone fragments).		H=4.5+
796.5	5	2		4 / 3 / 2	7	80			
795.5							Hard gray highly fractured limestone.		
	10						- No seepage encountered. - Encountered auger refusal at 6.5'. - Borings located using field pacing and taping methods and should be considered approximate. - Elevations estimated from available topomapping and should be considered approximate.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ **"Dry"** ▼
WATER NOTE: **Caved at 6.1**
DATE: **6/11/2013**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .808
Last Calibration Date : 08/25/11
Drill Rig Number : Truck 45B

JOB: 1171-13-042C

PLATE 59

0 200 400
SCALE INFEET

LEGEND

B-13 BORING NUMBER AND LOCATION

PLAN OF BORINGS

ROUTE 161-RIVERSIDE DRIVE
AREA IMPROVEMENTS
DUBLIN, OHIO

Project: 1171-13-042C	Drawn By: DCV		S&ME WWW.SMEINC.COM
Drawing Date: 6-25-2013	Approved By: RTE		
Last Updated: 6-25-2013	Scale: GRAPHIC	1:1	ENGINEERING FIRM. 03530

PLATE 60

Images: ~ Riverside Dr. Site Aerial 2009 Auditor.jp2 ~ TOPOImap.JPG
Xrefs:
File Last Updated: Jun 25, 2013
Plot Info: 6-25-2013 @ 4:44pm By: dverhulst
S&ME Filename: I:\DEPTS\cadd\Drawings\BST Projects\1171-Geotechnical\1171-13-042\1171-13-042C\PLANS\Site Topo from OSIP.dwg Layout: 11x17

LOG OF BORING NO. B-28
ROUTE 161 - RIVERSIDE DR. AREA IMPROVEMENTS
DUBLIN, OHIO

S&ME

LOCATION: **See Plate 2B of Appendix A.** ELEVATION: **805.9** DATE: **6/11/13**

DRILLING METHOD: **4-1/2" O.D. Continuous-flight Auger** COMPLETION DEPTH: **11.2'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
805.4	0						TOPSOIL - 6 INCHES		
		1		2 / 3 / 3	8	100	FILL: Stiff to hard dark-brown and gray silty clay, some fine to coarse sand, trace fine gravel and roots.		H=4.5+
	5	2		4 / 2 / 9	15	27			H=1.5
798.4							Very-stiff gray silty clay, little fine to coarse sand, trace fine gravel.		
796.4		3		4 / 5 / 50-3"R		46	Hard gray highly fractured limestone.		H=3.0
794.7	10						- No seepage encountered. - Encountered auger refusal at 11.2'. - Borings located using field pacing and taping methods and should be considered approximate. - Elevations estimated from available topomapping and should be considered approximate.		
	15								
	20								
	25								

2010 NEW DEFAULT BORING LOG-W/ N60

WATER LEVEL: ▽ **"Dry"** ▼

WATER NOTE: **Caved at 9.2**

DATE: **6/11/2013**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. } See Separate Curves

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : .808
Last Calibration Date : 08/25/11
Drill Rig Number : Truck 45B

JOB: 1171-13-042C

PLATE 61