GEOTECHNICAL EVALUATION

PROJECT NO. STP-9954( )
DES. NO. 0200821
CR 300S from US 231 to LADOGA ROAD
MONTGOMERTY COUNTY, INDIANA

Prepared for

UNITED CONSULTING ENGINEERS & ARCHITECTS
1625 NORTH POST ROAD
INDIANAPOLIS, INDIANA 46219

By

EARTH EXPLORATION, INC.
7770 WEST NEW YORK STREET
INDIANAPOLIS, INDIANA 46214-2988

December 7, 2004

Indiana Department of Transportation

Materials and Tests Division

120 South Shortridge Road P. O. Box 19389
Indianapolis, Indiana 46219-0389
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December 8, 2004

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UNITED CONSULTING ENGINEERS, INC.

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Mr. Bruno Canzian
Local Transportation Manager
Intermodal Transportation Division
Room N601 - IGCN

Subject: Des No: 0200821
Project No: STP-9954 ()
CR 300S from US 231 to Ladoga Road
County: Montgomery
District: Crawfordsville

Gentlemen:

The Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar A. Khan.
Chief Geotechnical Engineer

for S. S. Hiremath
Somanath S. Hiremath
Geotechnical Engineering Group Leader

SSH/SS
cc: Montgomery County Board of Commissioners - Attachment
✓ United Consulting Engineers, Inc. - Attn: Mr. C. L. Hammond– Attachment
Mr. J. Wright - Attachment
Mr. E. Gonzalez – Attn: Mr. B. Conrad – Attachment (2)
Mr. D. Cohen – Attachment
Ms. J. Somers – Attachment
File
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SUMMARY OF RECOMMENDATIONS[1]
GEOTECHNICAL EVALUATION
PROJECT NO. STP-9954 ( ), DES NO. 0200821
CR 300S from US 231 to LADOGA ROAD
MONTGOMERY COUNTY, INDIANA

Engineered Fill Placement and Compaction

In our opinion, the soils as observed at the test boring locations are suitable for reuse as engineered fill. However, the natural moisture content of the cohesive soils typically exceeds the optimum. Therefore, it is likely that some drying (by aeration or chemical treatment) of the fill will be required before placement in order to satisfy the ISS if these soils are utilized. Drying of the soils will also be required where encountered within the range of subgrade treatment. Under some climatic conditions, such as cold or rainy weather, or in confined areas, adequate moisture conditioning may be difficult to achieve, and in this case, granular fill could be required to expedite construction activities.

The plans indicate that a portion of the existing pond at Station 87+00 will be filled to accommodate the widened roadway section. The pond may remain at normal pool level during construction; however for ease of construction, consideration should be given to lowering the water level of the pond to expose the subgrade. The portion of the pond affected by the fill should be excavated to remove loose/soft material (i.e., sediment). For the placement of fill, we recommend that geogrid be placed at the bottom of the pond followed by INDOT No. 8 Stone. During the placement of the INDOT No. 8 Stone, it is recommenced that a Hoe-pac® be considered to help densify the material. The placement of INDOT No. 8 Stone should continue to an elevation of 1 ft above the pond elevation followed by an 8-in. layer of INDOT No. 53 Stone. Thereafter, a geotextile fabric shall be placed over the stone, and fill placement shall be performed in accordance with applicable sections of the ISS. A 3:1 (Horizontal to Vertical) side-slope should be maintained above and below the water line. If a 3:1 slope is not desirable, a steepened slope or an earth retention system could be considered.

Pavement Design Considerations

Based upon the test results and the projected traffic volume (1,060 VPD), we recommend using a Type II subgrade treatment (per ISS 207.04) with a CBR value of 3. In addition, we recommend that consideration be given to the use of subsurface pavement drains with screened outlets in the design of the pavement system. In our opinion, the drains should be surrounded by a permeable drainage medium consisting of a uniformly-graded aggregate. In addition, due to the presence of an appreciable amount of silt at some locations, permeable geotextile filter fabric should be used in conjunction with the underdrains to prevent the contamination of the permeable backfill around the drains.

Culvert Considerations

It is important to have proper support to prevent the pipe from becoming overstressed in bending or compression. In general, the conditions encountered at the proposed culvert elevations should be adequate for support with some undercutting likely in larger ditches and/or at Borings RB-1 and RB-10. Furthermore, it is anticipated that about 2 ft of undercutting may be necessary during the installation of the culvert structure at Boring RB-6. Where soft or loose soils are encountered at the base of the culverts, it is our opinion they should be removed and replaced with compacted granular structural fill material to achieve a stable base. If this is not feasible due to the depth of the unstable materials, the use of geogrid and/or compacted crushed aggregate may be required to stabilize the trench. In this case, a minimum of 24-in. of the soft soils should be removed prior to stabilization. The culvert excavation should be backfilled to grade with granular structural backfill. In our opinion, the granular structural backfill should be compacted to 100 percent of maximum dry density obtained in accordance with AASHTO T 99 and INDOT Specifications.

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[1] **The purpose of this summary is to provide an abbreviated discussion of our recommendations contained in the attached evaluation. In our opinion, the recommendations in this summary are the "most significant" geotechnical issues affecting the proposed construction. For additional discussion and recommendations, our geotechnical report should be consulted and/or Earth Exploration, Inc. should be contacted.**

EARTH EXPLORATION INC
7770 West New York Street
Indianapolis, IN 46214-2988
317-273-1690 (FAX) 317-273-2250

December 7, 2004

Mr. Christopher L. Hammond, P.E.
United Consulting Engineers & Architects
1625 North Post Road
Indianapolis, IN 46219

Re: Geotechnical Evaluation
Project No. STP-9954 ( )
Des. No. 0200821
CR 300S from US 231 to Ladoga Road
Montgomery County, Indiana
EEI Project No. 1-04-308

Dear Mr. Hammond:

We are pleased to submit our geotechnical evaluation for the above-referenced project. This report presents the results of our subsurface exploratory program and provides geotechnical recommendations for the proposed roadway improvements. The work for this project was authorized by your firm via a subconsultant agreement, and has been performed in accordance with Earth Exploration, Inc. (EEI) Proposal No. P1-02-420.

The opinions and recommendations submitted in this report are based, in part, on our interpretation of the subsurface information revealed by the test borings indicated on an attached plan. Understandably, this report does not reflect variations in subsurface conditions between or beyond these locations. Therefore, variations in these conditions can be expected, and fluctuation of the groundwater levels may occur with time. Other important limitations of this report are discussed in Appendix A.

PROJECT DESCRIPTION

We understand that the commissioners of Montgomery County, in assistance with federal funds, are planning to make improvements to CR 300S from US 231 to Ladoga Road. Refer to the Drawing No. 1-04-308.B1 in Appendix C for the general location of the project. From our understanding, the new construction is generally anticipated to include: removal and replacement of the existing pavement section, the excavation of roadside ditches, and replacement of several culverts.

Based on plans provided by United Consulting Engineers & Architects (UCEA), the project is proposed to follow Line "A," beginning near Station 50+15 and ending near Station 140+28. In addition, earth cuts and fills along the centerline of the roadway are anticipated to be on the order of 3 ft and 5 ft, respectively. However, maximum earth cuts and fills in offset locations are about 8 ft and 12 ft, respectively, and maximum sideslopes are planned to be 3 horizontal to 1 vertical (3H:1V). The roadway is anticipated to consist of bituminous paving materials. Furthermore, from information provided on the plans, the projected (i.e., year 2026) annual average daily traffic (AADT) is estimated to be 1,060 vehicles per day. The roadside ditches are generally planned on to consist of 4-ft wide bottom with 3H:1V sideslopes. The roadside ditches will transport effluent to nearby naturally-occurring ditches and creeks. The new pipe culverts range in size from 15 to 66 in. in diameter.

At this time, it is anticipated that construction will begin in 2006. In the event that the nature, design or location of the proposed construction changes, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the conclusions are modified or confirmed in writing.

FIELD EXPLORATION AND LABORATORY TESTING

Subsurface conditions for the improvements were explored by performing 15 road borings (designated RB-1 through RB-15) and 15 hand soundings (designated S-1 through S-15). Some of the road borings included soil-subgrade sampling procedures in accordance with guidelines provided by the Indiana Department of Transportation (INDOT), Division of Materials and Tests, Geotechnical Section. The number and location of the borings were selected by Earth Exploration, Inc. (EEI), in conjunction with Indiana Department of Transportation (INDOT), Division of Materials and Test, Geotechnical Section. Additionally, the borings were located in the field by EEI personnel referencing identifiable features shown on the previously mentioned plans. Ground surface elevations at the boring locations were interpolated to the nearest 1 ft based on topographic information provided on the plans. The boring locations and elevations should be considered accurate only to the degree implied by the methods used.

Exploratory field activities were performed by EEI on September 22 and 23, 2004. In general, these activities were performed using hollow stem augers to advance the boreholes. Representative samples of the soil conditions using Standard Penetration Test (SPT) procedures (AASHTO T 206) and thin-walled Shelby tube procedures (AASHTO T 207) were obtained at predetermined intervals. After obtaining final groundwater observations, each borehole was backfilled with auger cuttings, and a concrete patch was placed at the surface (i.e., in accordance with the "Aquifer Protection Guidelines" [revised October 30, 1996] developed by INDOT). Additional details of the

drilling and sampling procedures are provided in Appendix B. The soil subgrade investigation generally consisted of: 1) obtaining split-spoon samples on a continuous basis to a minimum depth of 4 ft below the proposed pavement subgrade; 2) obtaining thin-walled Shelby tube samples (if necessary, based on soil type and N-value criteria established by INDOT); and 3) obtaining bag samples of the fine-grained cohesive soils at the boring locations. Following the field activities, the thin-walled tube and bag samples were submitted for laboratory testing.

Following the exploratory activities, the soil samples were visually classified by an EEI engineering technician and later reviewed by an EEI geotechnical engineer. After visually classifying the soils, representative samples were selected and submitted for laboratory testing. These tests included: natural moisture content (AASHTO T 265); grain size analysis (AASHTO T 88); Atterberg limits (AASHTO T 89 and T 90); soil pH; unit density; and hand penetrometer readings. In addition, standard Proctor (AASHTO T 99) and California Bearing Ratio (CBR; AASHTO T 193) tests were performed on bulk samples of cohesive soils. The results of the tests are provided on the boring logs in Appendix C and/or respective summary sheets in Appendix D. For your information, soil descriptions on the boring logs are in general accordance with the AASHTO system [AASHTO designation, e.g., A-7-6(21)] and the INDOT Standard Specifications (ISS[1]) (textural classification, e.g., silty clay loam). The final boring logs represent our interpretation of the individual samples and field logs, and results of the laboratory tests. The stratification lines on the boring logs represent the approximate boundary between soil types; although, the transitions may actually be gradual.

SITE CONDITIONS

Surface Conditions

Based on our observations and the previously-mentioned topographic information, the ground surface along the project alignment is flat to gently sloping. The highest elevation of the existing ground surface along Line "A" is near Elevation 843 at Ladoga Road, and the lowest is Elevation 797 near Station 53+50 just east of US 231. The existing roadway consists of asphaltic concrete with no shoulders and shallow to non-existent roadside ditches in some locations. Several residential structures were noted in the eastern portion of the project, while the central and western portion of the project is surrounded by agricultural fields. The surface conditions along Line "A" consisted of about 6 to 11 in. of asphaltic concrete.

[1]References the Indiana Department of Transportation (INDOT) Standard Specifications, 1999 Edition.

Soil Conditions

The subsurface profile along Line "A" was similar and generally consisted of granular soil fill overlying naturally-occurring cohesive soil. The granular fill was described as sandy loam with some gravel and was observed to depths ranging from 1½ to 5½ ft beneath the surface. At Boring RB-8, two 8- to 12-in. thick layers of cinders were noted within the granular fill. Furthermore, it should be noted that the aforementioned soil fill was not observed at Boring RB-15. The underlying, naturally-occurring cohesive soils consisted of silty loam, sandy loam, silty clay loam, and clay loam overlying loam that extended to the maximum depth explored (i.e., about 15 ft). At Borings RB-1, RB-3, RB-9, and RB-10, thin layers of sand and silty loam (granular-type) were observed within the cohesive strata.

From our observations, the relative density of the granular soil fill was loose to dense with SPT N-values in the range of 6 to 46 blows/ft (bpf), averaging about 14 bpf. With the exception of the loam stratum, the consistency of the naturally-occurring cohesive soil was soft to stiff based on N-value criteria established by INDOT. Moisture contents were typically on the order of 13 to 28 percent, and hand penetrometer readings generally ranged from ¼ to 2 tons/sq. ft (tsf). However, the clay loam at Boring RB-8 was observed to be very soft based on the aforementioned N-value criteria, and the hand penetrometer reading was less than ¼ tsf. The consistency underlying loam stratum was medium stiff to very stiff based on N-value criteria. Moisture contents were in the range of 7 to 12 percent, and hand penetrometer readings typically ranged from 1¼ to 3 tsf. However, isolated penetrometer readings of ½ and greater than 4½ tsf were observed. The relative density of the naturally-occurring thin layers of granular soil was loose to medium dense with SPT N-values in the range of 6 to 20 bpf.

Based on a comparison of the moisture contents and Atterberg limits, the cohesive soils beneath the surficial conditions were of low to moderate plasticity with plasticity indices in the range of 5 to 24. In general, the higher plasticity soils were observed at a shallower depth. The lower plasticity and over-consolidated soils were observed with depth (i.e., sandy loam and loam). Furthermore, several samples were also tested for pH level, and these results indicated that the pH levels ranged from 6.9 to 7.3. All of the test results are provided in Appendix C on the logs or on the grain size distribution curves in Appendix D.

The 15 hand soundings were conducted off the edge of pavement, in the existing roadside ditches, natural ditches/creeks, or at the pond (near Station 87+00). The results of the hand soundings indicate that about 9 to 42 in. of soft/loose conditions should be anticipated in areas discussed in a later section.

Soil-Subgrade Investigation Summary

The predominant soil types in the upper 4 ft of the subgrade of the existing roadway consisted of silty loam, clay loam, and silty clay loam. A total of six thin-walled Shelby tube samples and four bag samples of subgrade soils were obtained at the boring locations. The laboratory testing on these samples consisted of unit density, moisture content and standard Proctor tests. Following completion of the laboratory testing, a comparison was performed between the in-situ dry density and the maximum dry density in accordance with AASHTO T 99 and the natural and optimum moisture contents. The results of these tests can be found on the Summary of Soil Subgrade Test Results in Appendix D.

Based on this information, the state of compaction of the existing subgrade soils are in the range of 90 to 99 percent of the maximum dry density while the moisture contents were in the range of 2 to 7 percent over the optimum moisture content for the given soil type.

Groundwater Conditions

Groundwater level observations made during and upon completion of the exploratory activities are shown at the bottom of the logs. Groundwater was not observed at most boring locations. Where encountered, groundwater was observed about 3 to 8 ft below the existing ground surface. In our opinion, these elevations likely represent a condition where water is perched above the underlying loam stratum, and the actual "piezometric" groundwater level is deeper than the maximum depth explored. It should be recognized that groundwater levels either static or perched can fluctuate due to changes in precipitation, infiltration, surface run-off, and other hydrogeological factors.

DISCUSSION AND RECOMMENDATIONS

General

Based upon our understanding of the improvements and information obtained from the test boring locations, it is our opinion that the subsurface conditions are generally conducive for the support of the pavement and culvert structures. However, given the type of subgrade soils (i.e., moisture-sensitive) and given the presence of soft soils in some areas, improvement techniques of the pavement subgrade will likely be required depending on the season/climate conditions at the time of construction. Also, as mentioned previously, 9 to 42 in. of soft/loose soil conditions should be anticipated as observed at the sounding locations. Additional discussion and recommendations regarding these issues are provided in the following paragraphs.

Earthwork

Site Preparation

We recommend in areas to receive pavement components or engineered fill that topsoil, wet or soft/loose near-surface soils, and existing pavement components be removed from within the construction limits. In addition, we recommend that existing underground utilities be appropriately relocated. Where utilities are relocated, we recommend that the resulting excavations be backfilled with "B" borrow in accordance with Section 203.09 of the ISS.

After removal and where feasible, we recommend that exposed soils in pavement areas and areas to receive fill be proof-rolled in accordance with the ISS, Section 203.26. Based on the test boring and sounding information, laboratory testing and soil subgrade investigation, we anticipate that relatively soft/loose conditions will be encountered to depths as described at the sounding locations and where very soft and soft soils are encountered beneath the existing roadway (such as those observed at a shallow depth at the location of Borings RB-3, RB-4, RB-11 and RB-15). Where these conditions are encountered during construction or if the field activities occur during poor weather conditions, subgrade stabilization will be required. Furthermore, where soil with organic matter is encountered, it should be removed to a depth of at least 2 ft beneath the pavement section. We recommend that soft or otherwise unstable soils (as previously described) encountered during the proof-rolling operations which will not readily compact, be aerated (if feasible) to reduce the moisture content and be recompacted. If construction takes place during fall, winter or early spring, reducing the moisture content may be difficult if not impossible, to achieve. If adverse weather conditions exist or if the underlying subgrade begins to "pump," other means of stabilization such as undercutting and replacement with granular fill (e.g., "B" Borrow), possibly in conjunction with Type I geogrid, or chemical modification may be required. However, if chemical modification is used, we recommend that slurry be considered particularly in the western portion of the project to prevent the dust from spreading to adjacent residential properties. For smaller areas, stabilization can likely be achieved by removal and replacement of the existing soils. In general, it is feasible to treat isolated areas with the use of INDOT No. 53 Stone or the use of Type I geogrid and "B" Borrow backfill. For larger areas, chemical modification is typically more conducive. The final decision regarding stabilization should be made at the time of construction, based on the observed actual conditions. Additionally, it is recommended that a line item for unspecified quantity be included in the plans and specifications.

Engineered Fill Placement and Compaction

We recommend that engineered fill, used to raise grades (if necessary) or backfill of undercut areas, be placed in loose lift thicknesses not exceeding 8 in. and be compacted to 95 percent of the maximum density obtained in accordance with AASHTO T 99 as specified in the ISS. In our opinion, the soils as observed at the test boring locations are suitable for reuse as engineered fill. However, the natural moisture content of the cohesive soils typically exceeds the optimum. Therefore, it is likely that some drying (by aeration or chemical treatment) of the fill will be required before placement in order to satisfy the ISS if these soils are utilized. Drying of the soils will also be required where encountered within the range of subgrade treatment. Under some climatic conditions, such as cold or rainy weather, or in confined areas, adequate moisture conditioning may be difficult to achieve, and in this case, granular fill could be required to expedite construction activities.

The plans indicate that a portion of the existing pond at Station 87+00 will be filled to accommodate the widened roadway section. The pond may remain at normal pool level during construction; however for ease of construction, consideration should be given to lower the water level of the pond to expose the subgrade. The portion of the pond affected by the fill should be excavated to remove loose/soft material (i.e., sediment). For the placement of fill, we recommend that geogrid be placed at the bottom of the pond followed by INDOT No. 8 Stone. During the placement of the INDOT No. 8 Stone, it is recommenced that a Hoe-pac® be considered to help densify the material. The placement of INDOT No. 8 Stone should continue to an elevation of 1 ft above the pond elevation followed by an 8-in. layer of INDOT No. 53 Stone. Thereafter, a geotextile fabric must be placed over the stone, and fill placement shall be performed in accordance with applicable sections of the ISS. A 3:1 (Horizontal to Vertical) side-slope should be maintained above and below the water line. If a 3:1 slope is not desirable, a steepened slope or an earth retention system could be considered.

Pavement Design Considerations

The pavement subgrades are anticipated to consist of naturally-occurring cohesive soils or engineered fill used to raise the grade. The results of a California Bearing Ratio (CBR) test performed on a sample of the critical fine-grained soil (i.e., silty clay loam) obtained from Boring RB-12A, indicated CBR values of 4.0 at 97 percent, 2.9 at 95 percent and 2.1 at 93 percent of the maximum dry density (Standard Proctor, AASHTO T 99). Based upon the test results and the projected traffic volume (1,060 VPD), we recommend using a Type II subgrade treatment (per ISS 207.04) with a CBR value of 3.

Water infiltration into cohesive subgrade soils can reduce the life of a pavement section. Since these soils have a low permeability, we would anticipate that any water which may

infiltrate the subgrade would affect the long term performance of the pavement. Under these conditions, we recommend that consideration be given to the use of subsurface pavement drains with screened outlets in the design of the pavement system. In our opinion, the drains should be surrounded by a permeable drainage medium consisting of a uniformly-graded aggregate. In addition, due to the presence of an appreciable amount of silt at many locations, permeable geotextile filter fabric should be used in conjunction with the underdrains to prevent the contamination of the permeable backfill around the drains.

Culvert Considerations

As mentioned earlier, new pipe culverts are anticipated at several locations along Line "A," and the culverts range in size from 15 to 66 in. in diameter. The following table summarizes the location of the culverts that are perpendicular to (i.e., will pass beneath) Line "A." Other culvert locations, (e.g., driveway crossings, are not included in the table.

TABLE 1 - SUMMARY OF SOIL CONDITIONS AT CULVERTS

Station Line "A"	Approx. Invert Elevation	Culvert Size (in.)	Test Boring	Soil Conditions Below/At Invert Elevations
53+63	790	66	RB-1	Loose Wet Sand and Very Soft Silty Loam
56+48	794	45 x 29 Ell.	RB-2	Medium Stiff to Soft Sandy Loam
86+95	804	48	RB-6	Medium Stiff Clay Loam with Trace of Organics at 6½'
94+72	814	34 x 22 Ell.	RB-8	Dense Sandy Loam with some Gravel (Fill)
105+35	830	34 x 22 Ell.	RB-10	Soft Silty Clay Loam
115+16	826	34 x 22 Ell.	RB-12	Medium Stiff Silty Clay Loam
119+89	825	54	RB-13	Medium Stiff Silty Loam (Possible Fill)

In general, the placement of the proposed culverts within the soil profile will not increase the load on the underlying soil. However, it is important to have proper support to prevent the pipe from becoming overstressed in bending or compression. In general, the conditions encountered at the proposed culvert elevations should be adequate for support with some undercutting likely in larger ditches and/or at Borings RB-1 and RB-10. Furthermore, it is anticipated that about 2 ft of undercutting may be necessary during the installation of the culvert structure at Boring RB-6. Where soft or loose soils are encountered at the base of the culverts, it is our opinion they should be removed and replaced with compacted granular structural fill material to achieve a stable base. If this is not feasible due to the depth of the unstable materials, the use of geogrid and/or compacted crushed aggregate may be required to stabilize the trench. In this case, a minimum of 24-in. of the soft soils should be removed prior to stabilization.

Since the culvert excavations will be primarily located beneath the proposed roadway, the area should be backfilled to grade with granular structural backfill. In our opinion, the

granular structural backfill should be compacted to 100 percent of maximum dry density obtained in accordance with AASHTO T 99 and INDOT Specifications. Hand- or remote-guided vibratory compactors are recommended for compacting the bedding material, if necessary, and material on either side of the pipe. The first several lifts of backfill over the culvert should also be compacted with small vibratory compactors to assure proper compaction is achieved and to prevent damage to the pipe from heavier, high-energy compactors.

In our opinion, the outer 10 ft of the "B" Borrow backfill, under the ends of the drainage structure, should be enveloped at the top, bottom, and outside ends, with a continuous length of permeable filter fabric. The purpose of the filter fabric is to act as a separator and reduce the likelihood of erosion from beneath the pipe. This filter fabric should also extend the full width of the excavation. In addition, riprap and a permeable filter fabric should be used at the ends of the structure to protect the exposed "B" Borrow backfill. A cut-off wall should also be considered at both ends of the structures to prevent undermining.

In addition, dewatering of the soil is anticipated, particularly at the ditch near Station 53+63. Based on the soil types, it is our opinion that dewatering can likely be accomplished by installing slotted casing into a pit excavated 2 to 3 ft outside of the culvert excavation. It will also be necessary to redirect the ditch to prevent the surface flow from entering the excavation.

CONCLUDING REMARKS

In closing, we recommend that EEI be provided the opportunity to review the final design and project specifications to confirm that earthwork and foundation requirements have been properly interpreted and implemented in the design and specifications. We also recommend that EEI be retained to provide construction observation services during the earthwork and foundation construction phases of the project. This will allow us to verify that the construction proceeds in compliance with the design concepts, specifications and recommendations. It will also allow design changes to be made in the event that subsurface conditions differ from those anticipated.

We appreciate the opportunity to provide our services to you on this project. Please contact our office if you have any questions or need further assistance with the project.

Sincerely,

EARTH EXPLORATION, INC.

Michael S. Wigger, P.E.
Geotechnical Engineer

Scott J. Ludlow, Ph.D., P.E.
Principal Engineer

Appendices

APPENDIX A - Important Information about Your Geotechnical Report
APPENDIX B - Field Methods for Exploring and Sampling Soils and Rock
APPENDIX C - Test Boring Location Plan (Drawing No. 1-04-308.B1)
Log of Test Boring - General Notes
Log of Test Boring (15)
Summary of Soundings
APPENDIX D - Summary of Special Laboratory Test Results
Summary of Soil Subgrade Test Results
Summary of Classification Test Results
Grain Size Distribution Curve (8)
Moisture-Density Relations (4)
Summary of CBR Test Results
California Bearing Ratio

APPENDIX A

IMPORTANT INFORMATION ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you*—should apply the report for any purpose or project except the one originally contemplated.

Read the full report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions *only* at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an *opinion* about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject To Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the repo' can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of these provisions indicate where geotechnical engineers responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE

8811 Colesville Road Suite G106 Silver Spring, MD 20910

Telephone: 301-565-2733 Facsimile: 301-589-2017

email: info@asfe.org www.asfe.org

UGER1000.10M

APPENDIX B

FIELD METHODS FOR EXPLORING AND SAMPLING SOILS AND ROCK

FIELD METHODS FOR EXPLORING AND SAMPLING SOILS AND ROCK

A. Boring Procedures Between Samples

The boring is extended downward, between samples, by a hollow stem auger (AASHTO* Designation T251-77), a continuous flight auger, driven and washed-out casing, or rotary boring with drilling mud or water.

B. Penetration Test and Split-Barrel Sampling of Soils

(AASHTO* Designation: T206-87)

This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140 pound weight falling freely through a distance of 30 inches. The sampler is first seated 6-inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance or N-Value. The blow counts are reported on the Test Boring Records per 6 inch increment. Recovered samples are first classified as to texture by the driller. Later, in the laboratory the driller's classification is reviewed by a soils engineer who examines each sample.

C. Thin-walled Tube Sampling of Soils

(AASHTO* Designation: T207-87)

This method consists of pushing a 2-inch or 3-inch outside diameter thin wall tube by hydraulic or other means into soils, usually cohesive types. Relatively undisturbed samples are recovered.

D. Soil Investigation and Sampling by Auger Borings

(AASHTO* Designation: T203-82)

This method consists of augering a hole and removing representative soil samples from the auger flight or bucket at 5-foot intervals or with each change in the substrata. Relatively disturbed samples are obtained and its use is therefore limited to situations where it is satisfactory to determine approximate subsurface profile.

E. Diamond Core Drilling for Site Investigation

(AASHTO* Designation: T225-83)

This method consists of advancing a hole in bedrock or other hard strata by rotating downward a single tube or double tube core barrel equipped with a cutting bit. Diamond, tungsten carbide, or other cutting agents may be used for the bit. Wash water is used to remove the cuttings. Normally, a 3-inch outside diameter by 2-inch inside diameter coring bit is used unless otherwise noted. The rock or hard material recovered within the core barrel is examined in the field and laboratory. Cores are stored in partitioned boxes and the length of recovered material is expressed as a percentage of the actual distance penetrated.

* American Association of State Highway and Transportation Officials, Washington D.C.

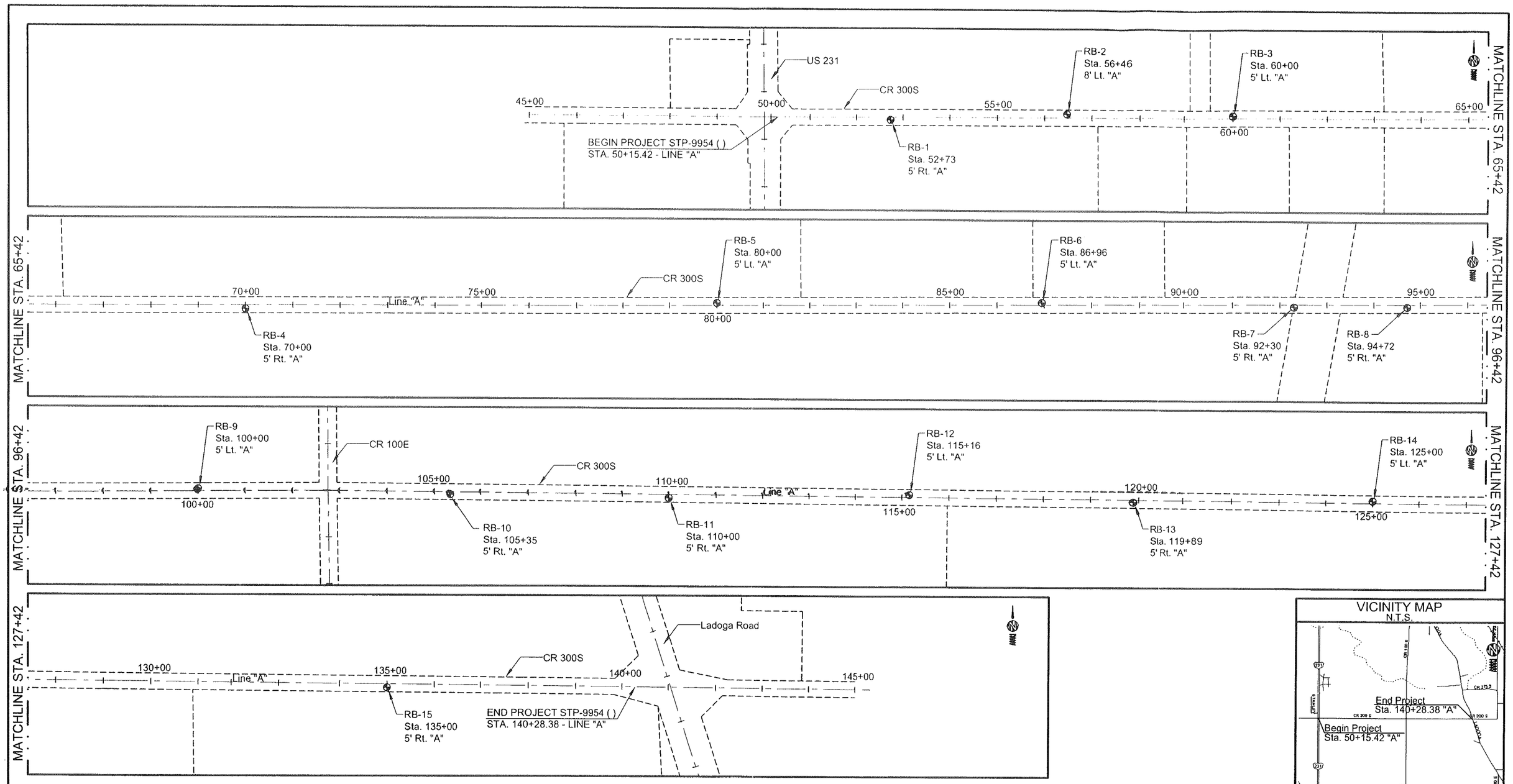
APPENDIX C

TEST BORING LOCATION PLAN
(Drawing No. 1-04-308.B1)

LOG OF TEST BORING - GENERAL NOTES

LOG OF TEST BORING (15)

SUMMARY OF SOUNDINGS



VICINITY MAP
N.T.S.

LEGEND

RB-1 — Test Boring Location, Designation, Station and Offset
Sta. 52+73
5' RT. "A"

NOTES

1. Base map developed from an electronic file provided by UCEA on October 5, 2004.
2. Vicinity map generated using commercially-available software by DeLorme (Street Atlas USA ver. 3.0/7.0).
3. Borings were located in the field by Earth Exploration, Inc.
4. Ground surface elevation at the test boring locations were interpolated to the nearest 1 ft based on the topographic information provided on the project plans.
5. Boring locations are approximate.
6. Soundings not shown for clarity.

TEST BORING LOCATION PLAN

PROJECT:	CR 300S from US 231 to Ladoga Road
DES NO.:	0200821
PROJECT NO.:	STP-9954 ( )
LOCATION:	Montgomery County, Indiana
CLIENT:	UCEA
EEI PROJECT NO.:	1-04-308
SCALE:	1" = 200'

PROJECT ENGINEER:	MSW
APPROVED BY:	SJL
DRAWN BY:	JDR
DATE AND TIME:	11-1-04 10:05:24
DRAWING NUMBER:	1-04-308.B1

EARTH EXPLORATION, INC.
7770 West New York Street
Indianapolis, IN 46214-2988
317-273-1690
(FAX) 317-273-2250

LOG OF TEST BORING - GENERAL NOTES

DESCRIPTIVE SOIL CLASSIFICATION

GRAIN SIZE TERMINOLOGY

Soil Fraction	Particle Size	US Standard Sieve Size
Boulders	Larger than 75 mm	Larger than 3"
Gravel	2.00 to 75 mm	#10 to 75 mm
Sand: Coarse	0.425 to 2.00 mm	#40 to #10
Fine	0.075 to 0.425 mm	#200 to #40
Silt	0.002 to 0.075 mm	Smaller than #200
Clay	Smaller than 0.002 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

GENERAL TERMINOLOGY

Physical Characteristics
- Color, moisture, grain shape, fineness, etc.

Major Constituents
- Clay, silt, sand, gravel

Structure
- Laminated, varved, fibrous, stratified, cemented, fissured, etc.

Geologic Origin
- Glacial, alluvial, eolian, residual, etc.

RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Term	Defining Range by % of Weight
Trace	1 - 10%
Little	11 - 20%
Some	21 - 35%
And	36 - 50%

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	LOI
w/ trace organic matter	1 - 6%
w/ little organic matter	7 - 12%
w/ some organic matter	13 - 18%
Organic Soil (A-8)	19 - 30%
Peat (A-8)	More than 30%

RELATIVE DENSITY

Term	"N" Value
Very loose	0 - 5
Loose	6 - 10
Medium dense	11 - 30
Dense	31 - 50
Very Dense	51+

CONSISTENCY

Term	"N" Value
Very soft	0 - 3
Soft	4 - 5
Med stiff	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	31+

PLASTICITY

Term	Plastic Index
None to slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High/Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6-in. penetrations of the 2-in. split-barrel sampler. The sampler is driven with a 140-lb weight falling 30 in. and is seated to a depth of 6 in. before commencing the standard penetration test.

SYMBOLS

DRILLING AND SAMPLING

- AS - Auger Sample
- BS - Bag Sample
- C - Casing: Size 2½", NW, 4", HW
- COA - Clean-Out Auger
- CS - Continuous Sampling
- CW - Clear Water
- DC - Driven Casing
- DM - Drilling Mud
- FA - Flight Auger
- FT - Fish Tail
- HA - Hand Auger
- HSA - Hollow Stem Auger
- NR - No Recovery
- PMT - Borehole Pressuremeter Test
- PT - 3" O.D. Piston Tube Sample
- PTS - Peat Sample
- RB - Rock Bit
- RC - Rock Coring
- REC - Recovery
- RQD - Rock Quality Designation
- RS - Rock Sounding
- S - Soil Sounding
- SS - 2" O.D. Split-Barrel Sample
- 2ST - 2" O.D. Thin-Walled Tube Sample
- 3ST - 3" O.D. Thin-Walled Tube Sample
- VS - Vane Shear Test
- WPT - Water Pressure Test

LABORATORY TESTS

- qp - Penetrometer Reading, tsf
- qu - Unconfined Strength, tsf
- W - Moisture Content, %
- LL - Liquid Limit, %
- PL - Plastic Limit, %
- PI - Plasticity Index
- SL - Shrinkage Limit, %
- LOI - Loss on Ignition, %
- γ - Dry Unit Weight, pcf
- pH - Measure of Soil Alkalinity/Acidity

WATER LEVEL MEASUREMENT

- BF - Backfilled upon Completion
- NW - No Water Encountered

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

LOG OF TEST BORING

EARTH EXPLORATION, Inc.

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-1
Elevation 797
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny 80° F	Driller	A.C.
Des. No.	0200821	Station	52+73	Offset	5' Rt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (8 in.)							
SS-1		90	6-7-7		795	**SANDY LOAM with Some Gravel**, medium dense, moist, brown, (fill), A-2-4(0), Lab No. 6367SL					NP	NP	NP
SS-2		100	3-4-4	5		**SILTY LOAM**, medium stiff, moist, brown, A-6(9), Lab No. 6368SL	1.5			---			
SS-3		100	4-4-3		790		1.0			24.6	33	19	14
						SAND, wet, brown, (visual)							
SS-4		100	2-2-3	10		**SILTY LOAM**, soft, very moist, brown and gray, with occasional sand partings, A-6, Lab No. 6370SL	0.25			23.5 11.9			
SS-5		100	5-15-15		785	**LOAM**, medium stiff to very stiff, moist, brown to gray below 11½', with sand seam near 14', A-4, Lab No. 6374SL	3.0			7.7			
SS-6		100	4-7-15	15			4.5			9.4			
						End of Boring at 15 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	⊻ After Drilling
To Water	7	NW	BF
To Cave-in		7½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/22/04 End 9/22/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

LOG OF TEST BORING

EARTH EXPLORATION, Inc.
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects

Boring No. RB-2
Elevation 800
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny 80° F	Driller	A.C.
Des. No.	0200821	Station	56+46	Offset	8' Lt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (8 in.)							
SS-1	X	100	20-19-10			**SANDY LOAM with Some Gravel**, medium dense, moist, brown, (fill), A-2-4, Lab No. 6367SL							
SS-2	X	100	4-4-6	5	795	**SANDY LOAM**, medium stiff to soft, moist, brown, A-4(0), Lab No. 6369SL		---		12.7	20	15	5
SS-3	X	100	3-3-2					---		---			
SS-4	X	100	4-6-7	10	790	**LOAM**, stiff, moist, gray, A-4, Lab No. 6374SL	>4.5			10.2			
						End of Boring at 10 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	⩛ After Drilling
To Water	NW	NW	BF
To Cave-in		8	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/22/04 End 9/22/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-3
Elevation 804
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny 80° F	Driller	A.C.
Des. No.	0200821	Station	60+00	Offset	5' Lt. "A"	Inspector	---

SAMPLE / DESCRIPTION/CLASSIFICATION and REMARKS / SOIL PROPERTIES

No.	Type	Rec %	Blow Counts	Depth ft	Elev	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
SS-1		100	4-2-2			1.75			23.0			
SS-2		100	7-8-12									

ASPHALTIC CONCRETE, (11 in.)

SANDY LOAM with Some Gravel, very loose, moist, dark brown, (fill), A-2-4, Lab No. 6367SL

SILTY LOAM, soft, moist, brown and gray, A-6, Lab No. 6368SL

800

SILTY CLAY LOAM, stiff, moist, brown and gray, A-7-6, Lab No. 6373SL

SILTY LOAM, medium dense, moist, brown to brown and gray, A-4, Lab No. 6371SL

End of Boring at 4 ft

Shelby tube sample obtained from 1½ to 3½ ft in offset boring. Recovery = 58%

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	NW	NW	BF
To Cave-in		3½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/22/04 End 9/22/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION INC

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-4
Elevation 811
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny 80° F	Driller	A.C.
Des. No.	0200821	Station	70+00	Offset	5' Rt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
					810	**ASPHALTIC CONCRETE**, (8 in.)							
SS-1		100	3-3-2			**SANDY LOAM with Some Gravel**, loose, moist, brown, (fill), A-2-4, Lab No. 6367SL	1.75			16.1 20.1			
SS-2		100	3-4-6			**CLAY LOAM**, soft to medium stiff, moist, brown, with sand partings, A-6, Lab No. 6372SL	0.25			13.5			
						LOAM, medium stiff, moist, brown, A-4, Lab No. 6374SL							
						End of Boring at 4 ft							
						Shelby tube sample obtained from 1½ to 3½ ft in offset boring. Recovery = 88%							

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	After Drilling
To Water	3	NW	BF
To Cave-in		3½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/22/04 End 9/22/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION, Inc.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-5
Elevation 815
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny 80° F	Driller	A.C.
Des. No.	0200821	Station	80+00	Offset	5' Lt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (6 in.)							
SS-1	X	90	3-2-2			**SANDY LOAM with Some Gravel**, very loose, moist, brown, (fill), A-2-4, Lab No. 6367SL	1.5			15.4			
SS-2	X	100	3-4-4			**SILTY CLAY LOAM**, soft, moist, brown and gray, A-7-6, Lab No. 6373SL	1.25			11.6			
						LOAM, medium stiff, moist, brown, with occasional sandy loam seams, A-4, Lab No. 6374SL							
						End of Boring at 4 ft							
						Shelby tube sample obtained from 1½ to 3½ ft in offset boring. Recovery = 54%							

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	After Drilling
To Water	3	NW	BF
To Cave-in		1	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/22/04 End 9/22/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION, Inc.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-6
Elevation 810
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny 80° F	Driller	A.C.
Des. No.	0200821	Station	86+96	Offset	5' Lt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (9 in.)							
SS-1	X	100	10-8-5			**SANDY LOAM with Some Gravel**, medium dense, moist, brown, (fill), A-2-4, Lab No. 6367SL							
SS-2	X	100	3-4-5	5	805	**CLAY LOAM**, medium stiff, moist, brown to dark gray below 6½', with trace organic matter near 6½', A-6, Lab No. 6372SL	2.5			16.0			
SS-3	X	90	4-4-3				0.5			21.6			
SS-4	X	100	4-4-6			**SANDY LOAM**, loose, moist, brown, A-4, Lab No. 6369SL	2.75			11.6			
				10	800	**LOAM**, medium stiff, moist, brown, A-4, Lab No. 6374SL							
						End of Boring at 10 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	NW	NW	BF
To Cave-in		6	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/22/04 End 9/22/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION, INC.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-7
Elevation 820
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny 80° F	Driller	A.C.
Des. No.	0200821	Station	92+30	Offset	5' Rt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (9 in.)							
SS-1	X	90	11-4-3			**SANDY LOAM with Some Gravel**, medium dense, moist, brown, (fill), A-2-4, Lab No. 6367SL	2.5			16.2			
SS-2	X	100	5-6-6			**CLAY LOAM**, medium stiff, moist, brown and gray, A-6, Lab No. 6372SL	1.5			11.8			
						LOAM, stiff, moist, brown, A-4, Lab No. 6374SL							
						End of Boring at 4 ft							
						Shelby tube sample obtained from 1½ to 3½ ft in offset boring. Recovery = 50%							

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	After Drilling
To Water	NW	NW	BF
To Cave-in		1½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/22/04 End 9/22/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION, Inc.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-8
Elevation 816
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny 80° F	Driller	A.C.
Des. No.	0200821	Station	94+72	Offset	5' Rt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (9 in.)							
					815	**CINDERS**, loose, moist, black, (fill; visual)							
SS-1	X	100	6-21-25			**SANDY LOAM with Some Gravel**, dense, moist, brown, (fill), A-2-4, Lab No. 6367SL							
SS-2	X	90	10-9-10	5		**CINDERS**, medium dense, moist, black, (fill; visual)							
					810	**SANDY LOAM with Some Gravel**, medium dense, moist, brown, (fill), A-2-4, Lab No. 6367SL							
SS-3	X	100	2-2-2			**SILTY CLAY LOAM**, moist, brown and gray, A-7-6, Lab No. 6373SL	1.75			26.4			
SS-4	X	80	1-1-1	10		**CLAY LOAM**, soft to very soft, moist to very moist, brown and gray, A-6, Lab No. 6372SL	0.75			16.4			
					805								
SS-5	X	100	2-2-5				<0.25			15.0			
						LOAM, medium stiff, moist, brown and gray, A-4, lab No. 6374SL							
						End of Boring at 13 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	8½	NW	BF
To Cave-in		3	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/22/04 End 9/22/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION, Inc.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-9
Elevation 824
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny 80° F	Driller	A.C.
Des. No.	0200821	Station	100+00	Offset	5' Lt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (8 in.)							
SS-1	X	100	3-4-6			**SANDY LOAM with Some Gravel**, loose, moist, brown and black, (fill), A-2-4, Lab No. 6367SL	2.0 1.5			25.9 20.3			
SS-2	X	100	4-4-5		820	**SILTY CLAY LOAM**, moist, brown and gray, A-7-6, Lab No. 6373SL							
				5		**CLAY LOAM**, stiff to medium stiff, moist, brown, A-6, Lab No. 6372SL	0.25 2.5			20.6 11.5			
SS-3	X	95	4-4-4			**LOAM**, medium stiff, moist, brown, A-4, Lab No. 6374SL							
						SILTY LOAM, medium stiff, moist, brown and gray, A-6(12), Lab No. 6370SL	1.75			28.0	33	21	12
SS-4	X	100	3-5-11		815	**SILTY LOAM**, medium dense, moist, brown and gray, A-4(0), Lab No. 6371SL				12.8	NP	NP	NP
				10		End of Boring at 10 ft							

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	After Drilling
To Water	NW	NW	BF
To Cave-in		4½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/22/04 End 9/22/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION, Inc.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-10
Elevation 832
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny ° F	Driller	A.C.
Des. No.	0200821	Station	105+35	Offset	5' Rt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (9 in.)							
SS-1	X	45	9-4-2		830	**SANDY LOAM with Some Gravel**, loose, moist, brown and black, (fill), A-2-4, Lab No. 6367SL							
						SILTY CLAY LOAM, soft to medium stiff, moist, brown and gray, A-7-6, Lab No. 6373SL							
SS-2	X	100	4-5-5	5			1.75			24.4			
						CLAY LOAM, medium stiff, moist, brown, A-6, Lab No. 6372SL							
SS-3	X	90	5-3-3		825		1.0			14.7			
						SILTY LOAM, medium stiff, moist, brown and gray, A-4, Lab No. 6371SL							
SS-4	X	100	3-5-10	10		**LOAM**, stiff, moist, brown, A-4, Lab No. 6374SL	1.25			11.5			
						End of Boring at 10 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	NW	NW	BF
To Cave-in		2½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/23/04 End 9/23/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

LOG OF TEST BORING

EARTH EXPLORATION Inc

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects

Boring No. RB-11
Elevation 832
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny ° F	Driller	A.C.
Des. No.	0200821	Station	110+100	Offset	5' Rt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (9 in.)							
SS-1		65	3-2-1		830	**SANDY LOAM with Some Gravel**, very loose, moist, brown and black, A-2-4, Lab No. 6367SL	1.75			18.8	33	14	19
SS-2		100	4-5-7			**CLAY LOAM**, very soft, moist, brown, A-6(9), Lab No. 6372SL	2.0			20.2			
						LOAM, stiff, moist, brown, A-4, Lab No. 6374SL				11.7			

End of Boring at 4 ft

Shelby tube sample obtained from 1½ to 3½ ft in offset boring. Recovery = 50%

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	⊻ After Drilling
To Water	NW	NW	BF
To Cave-in		6	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/23/04 End 9/23/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-12
Elevation 829
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny ° F	Driller	A.C.
Des. No.	0200821	Station	115+16	Offset	5' Lt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (8 in.)							
SS-1	X	95	4-4-4			**SANDY LOAM with Some Gravel**, loose, moist, brown and black, (fill), A-2-4, Lab No. 6367SL	2.0			19.9	42	18	24
SS-2	X	100	3-4-5		825	**SILTY CLAY LOAM**, medium stiff, moist, brown and gray, A-7-6(21), Lab No. 6373SL	1.75			19.5			
				5									
SS-3	X	80	2-3-3			**CLAY LOAM**, medium stiff, moist, brown, A-6, Lab No. 6372SL	1.5			17.5			
SS-4	X	100	3-3-3		820	**LOAM**, medium stiff, moist, brown, A-4, Lab No. 6374SL	0.5			12.3			
				10		End of Boring at 10 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	NW	NW	BF
To Cave-in		3	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/23/04 End 9/23/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-13
Elevation 828
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny ° F	Driller	A.C.
Des. No.	0200821	Station	119+89	Offset	5' Rt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (8 in.)							
SS-1	X	90	5-4-4			**SANDY LOAM with Some Gravel**, loose, moist, brown and black, (fill), A-2-4, Lab No. 6367SL	0.75			21.3			
					825	**SILTY LOAM**, medium stiff, moist, brown, (possible fill), A-6, Lab No. 6368SL							
SS-2	X	100	3-3-4	5		**CLAY LOAM**, medium stiff, moist, dark gray, with trace organic matter,A-6, Lab No. 6372SL, LOI = 4.2%	1.75			17.6 20.6			
SS-3	X	100	3-5-5			**SILTY CLAY LOAM**, medium stiff, moist, brown and gray, A-7-6, Lab No. 6373SL	1.5			27.0 18.6			
					820	**CLAY LOAM**, medium stiff to soft, moist, brown, A-6, Lab No. 6372SL							
SS-4	X	100	2-2-2	10			1.0			15.4			
						End of Boring at 10 ft							

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	After Drilling
To Water	NW	NW	BF
To Cave-in		2	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/23/04 End 9/23/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-14
Elevation 837
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny ° F	Driller	A.C.
Des. No.	0200821	Station	125+00	Offset	5' Lt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (8 in.)							
SS-1	X	100	3-4-6		835	**SANDY LOAM with Some Gravel**, very loose, moist, brown and black, (fill), A-2-4, Lab No. 6367SL	2.75			22.6			
						SILTY CLAY LOAM, medium stiff, moist, brown, A-7-6, Lab No. 6373SL							
SS-2	X	100	3-5-9	5		**CLAY LOAM**, medium stiff, moist, brown, A-6, Lab No. 6372SL	1.5 3.0			13.5			
SS-3	X	100	6-10-12		830	**LOAM**, very stiff to medium stiff, moist, brown to brown and gray, with occasional sand seam below 8½', A-4(0), Lab No. 6374SL	>4.5			12.6	18	13	5
SS-4	X	100	4-4-5	10			2.0			12.7			
						End of Boring at 10 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	NW	NW	BF
To Cave-in		3	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/23/04 End 9/23/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

LOG OF TEST BORING

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-15
Elevation 837
Datum USC & GS
EEI Proj. No. 1-04-308
Sheet 1 of 1

Proj. No.	STP-9954 ( )	Struct. No.	---	Weather	Sunny ° F	Driller	A.C.
Des. No.	0200821	Station	135+00	Offset	5' Rt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
				0		**ASPHALTIC CONCRETE**, (6 in.)							
						GRANULAR SUBBASE, (6 in.)							
SS-1		90	3-2-2		835	**SILTY CLAY LOAM**, soft, moist, brown, A-7-6, Lab No. 6373SL	2.0			26.8			
SS-2		100	3-3-3			**LOAM**, medium stiff, moist, brown, A-4, Lab No. 6374SL	1.75			12.1			
						End of Boring at 4 ft							
						Shelby tube sample obtained from 1½ to 3½ ft in offset boring. Recovery = 100%							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	NW	NW	BF
To Cave-in		1	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 9/23/04 End 9/23/04 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

SUMMARY OF SOUNDINGS

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Project No.: STP 9954 ( )
Client: United Consulting Engineers & Architects
EEI Project No.: 1-04-308
Date: September 23, 2004
Method: Probe Rod

Sounding No.	Station	Offset Line "A"	Approx. Ground Surface Elevation	Depth Interval (in.)	Description – Based on Rod Penetration Resistance
S-1	53+40	30 ft Rt.	790	0-9 9	Loose Granular-type Soil Stiff Cohesive-type Soil
S-2	56+46	30 ft Lt.	794	Nominal	Loose Granular-type Soil
S-3	60+00	15 ft Lt.	801	0-37 37	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-4	70+00	11 ft Rt.	811	0-42 42	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-5	80+00	13 ft Lt.	815	0-28 28	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-6	86+96	16 ft Rt.	804	0-13 13	Water (Existing Pond) Stone (Could not penetrate with rod)
S-7	92+30	17 ft Rt.	818	0-13 13	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-8	94+72	15 ft Rt.	814	0-18 18	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-9	100+00	16 ft Lt.	813	0-15 15	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-10	105+35	14 ft Rt.	831	0-19 19	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-11	110+00	13 ft Rt.	830	0-21 21	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil

SUMMARY OF SOUNDINGS

Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Project No.: STP 9954 ( )
Client: United Consulting Engineers & Architects
EEI Project No.: 1-04-308
Date: September 23, 2004
Method: Probe Rod

Sounding No.	Station	Offset Line "A"	Approx. Ground Surface Elevation	Depth Interval (in.)	Description – Based on Rod Penetration Resistance
S-12	115+16	11 ft Lt.	827	0-18 18	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-13	119+89	17 ft Rt.	826	0-20 20	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-14	125+00	13 ft Lt.	836	0-28 28	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil
S-15	135+00	15 ft Rt.	836	0-6 6	Topsoil and Soft Cohesive-type Soil Stiff Cohesive-type Soil

APPENDIX D

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

SUMMARY OF SOIL SUBGRADE TEST RESULTS

SUMMARY OF CLASSIFICATION TEST RESULTS

GRAIN SIZE DISTRIBUTION CURVE (8)

MOISTURE-DENSITY RELATIONS (4)

SUMMARY OF CBR TEST RESULTS

CALIFORNIA BEARING RATIO

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project No.: STP-9954( )
Des. No.: 0200821
Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
EEI Project No.: 1-04-308

Laboratory Number	Test Boring No.	Sample Number	Sample Depth Interval, ft	Moisture Content, %	pH	LOI
6367SL	RB-1	SS-1	1-2.5		6.9	
6368SL		SS-3	6-7.5	24.6	7.2	
6378SL		SS-4T	8.5-10	23.5		
6378SL		SS-4B	8.5-10	11.9		
6378SL		SS-5	11-12.5	7.7		
6378SL		SS-6	13.5-15	9.4		
6369SL	RB-2	SS-2	3.5-5	12.7	7.1	
6378SL		SS-4	8.5-10	10.2		
6378SL	RB-3	SS-1	1-2.5	23.0		
6378SL	RB-4	SS-1T	1-2.5	16.1		
6378SL		SS-1B	1-2.5	20.1		
6378SL		SS-2	2.5-4	13.5		
6378SL	RB-5	SS-1	1-2.5	15.4		
6378SL		SS-2	2.5-4	11.6		
6378SL	RB-6	SS-2	3.5-5	16.0		
6378SL		SS-3	6-7.5	21.6		
6378SL		SS-4	8.5-10	11.6		
6378SL	RB-7	SS-1	1-2.5	16.2		
6378SL		SS-2	2.5-4	11.8		
6378SL	RB-8	SS-3	6-7.5	26.4		
6378SL		SS-4	8.5-10	16.4		
6378SL		SS-5	11.5-13	15.0		
6378SL	RB-9	SS-1T	1-2.5	25.9		
6378SL		SS-1B	1-2.5	20.3		
6378SL		SS-2T	3.5-5	20.6		
6378SL		SS-2B	3.5-5	11.5		
6370SL		SS-3	6-7.5	28.0	7.2	
6371SL		SS-4	8.5-10	12.8	7.3	
6378SL	RB-10	SS-2	3.5-5	24.4		
6378SL		SS-3	6-7.5	14.7		
6378SL		SS-4	8.5-10	11.5		
6372SL	RB-11	SS-1	1-2.5	18.8	7.1	
6378SL		SS-2T	2.5-4	20.2		
6378SL		SS-2B	2.5-4	11.7		
6378SL	RB-12	SS-1	1-2.5	19.9		
6378SL		SS-2	3.5-5	19.5		
6378SL		SS-3	6-7.5	17.5		
6378SL		SS-4	8.5-10	12.3		

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project No.: STP-9954( )
Des. No.: 0200821
Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
EEI Project No.: 1-04-308

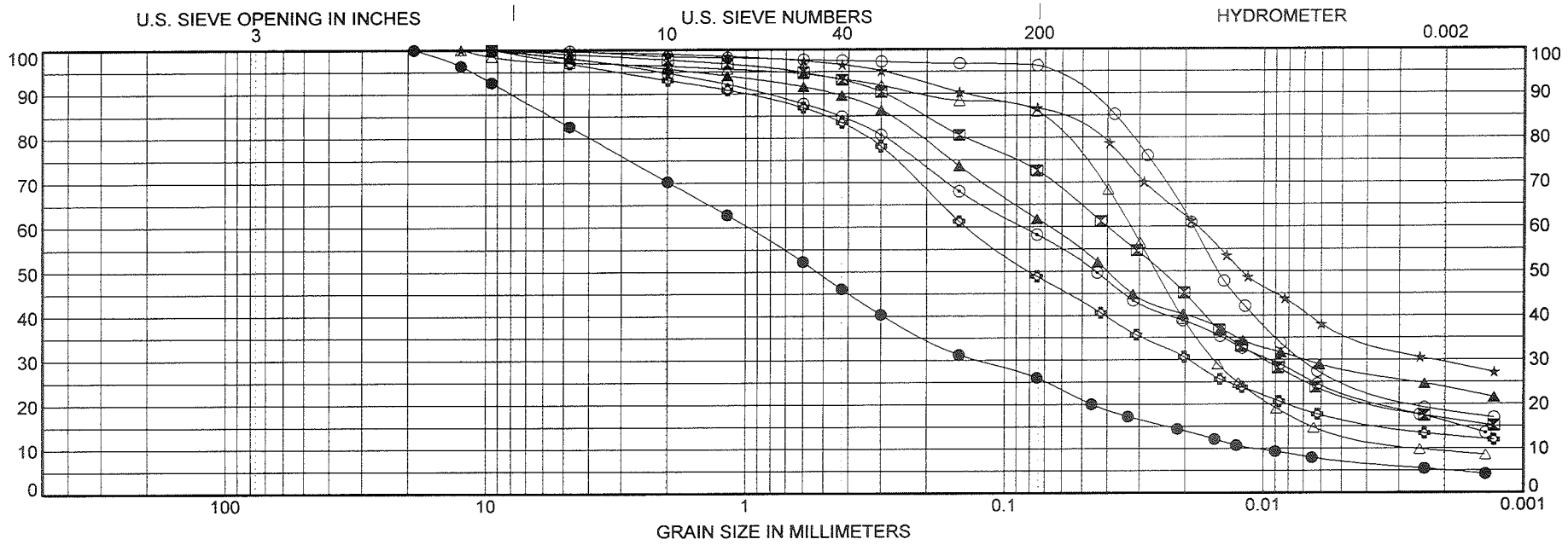
Laboratory Number	Test Boring No.	Sample Number	Sample Depth Interval, ft	Moisture Content, %	pH	LOI
6373SL	RB-12A	BS-1	1.5-3.5		6.9	
6378SL	RB-13	SS-1	1-2.5	21.3		
6378SL		SS-2T	3.5-5	17.6		
6379SL		SS-2B	3.5-5	20.6		4.2
6378SL		SS-3T	6-7.5	27.0		
6378SL		SS-3B	6-7.5	18.6		
6378SL		SS-4	8.5-10	15.4		
6378SL	RB-14	SS-1	1-2.5	22.6		
6378SL		SS-2	3.5-5	13.5		
6374SL		SS-3	6-7.5	12.6	7.3	
6378SL		SS-4	8.5-10	12.7		
6378SL	RB-15	SS-1	1-2.5	26.8		
6378SL		SS-2	2.5-4	12.1		

SUMMARY OF SOIL SUBGRADE TEST RESULTS

EARTH EXPLORATION, INC.

Project No.: STP-9954 ( )
Project: CR 300S from US 231 to Ladoga Road
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
EEI Project No.: 1-04-308

Boring and Sample I.D.	Sample Depth Interval, ft	Soil Type	Dry Density, lbs/cu. ft	Maximum Dry Density, lbs/cu. ft	% Max. Dry Density	Natural Moisture Content	Optimum Moisture Content	Diff. Between M.C. and Opt. M.C.
RB-3, ST-1	1.5 – 2.0	Silty Loam	110.1	111.4	98.8	19.0	15.2	+3.8
RB-4, ST-1	1.5 – 2.0	Clay Loam	101.3	112.5	90.0	22.2	15.3	+6.9
RB-4, ST-1	2.75 – 3.25	Clay Loam	102.8	112.5	91.4	20.8	15.3	+5.5
RB-5, ST-1	1.5 – 2.0	Silty Clay Loam	97.2	105.4	92.2	24.7	17.8	+6.9
RB-7, ST-1	2.0 – 2.5	Loam	126.6	130.2	97.2	11.0	9.2	+1.8
RB-11, ST-1	1.5 – 2.0	Clay Loam	110.7	112.5	98.4	16.8	15.3	+1.5
RB-11, ST-1	2.0 – 2.5	Clay Loam	109.6	112.5	97.4	17.9	15.3	+2.6
RB-15, ST-1	1.5 – 2.0	Silty Clay Loam	98.3	105.4	93.3	24.6	17.8	+6.8
RB-15, ST-1	2.0 – 2.5	Loam	123.2	130.2	94.6	13.1	9.2	+3.9



BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Lab No.	Boring	Station/Offset/Line	Sample No.	Depth ft	Classification	% Passing			% Gravel	% Sand	% Silt	% Clay	% Coll.	LL	PL	PI	Opt. Moist.	♂max pcf	* CBR at	
							No.10	No.40	No.200											93%	97%
●	6367SL	RB-1	52+73 5' Rt. "A"	SS-1	1.0 - 2.5	SANDY LOAM with some gravel A-2-4 (0)	70.2	46.1	26.0	29.8	44.2	21.0	5.0	2.8	NP	NP	NP				
⊠	6368SL	RB-1	52+73 5' Rt. "A"	SS-3	6.0 - 7.5	SILTY LOAM A-6 (9)	97.7	93.1	72.6	2.3	25.1	55.9	16.7	14.4	33	19	14				
▲	6372SL	RB-11	110+100 5' Rt. "A"	SS-1	1.0 - 2.5	CLAY LOAM A-6 (9)	95.6	89.6	61.7	4.4	33.9	38.1	23.7	20.0	33	14	19				
★	6373SL	RB-12A	115+18 5' Lt. "A"	BS-1	1.5 - 3.5	SILTY CLAY LOAM A-7-6 (21)	99.1	96.5	86.6	0.9	12.4	57.3	29.3	26.0	42	18	24	17.8	105.4	2.1	4.0
⊙	6374SL	RB-14	125+00 5' Lt. "A"	SS-3	6.0 - 7.5	LOAM A-4 (0)	94.7	84.8	58.2	5.3	36.5	42.2	16.0	10.9	18	13	5				
✿	6369SL	RB-2	56+46 8' Lt. "A"	SS-2	3.5 - 5.0	SANDY LOAM A-4 (0)	93.0	83.5	48.9	7.0	44.2	35.9	13.0	11.2	20	15	5				
○	6370SL	RB-9	100+00 5' Lt. "A"	SS-3	6.0 - 7.5	SILTY LOAM A-6 (12)	98.5	97.5	96.3	1.5	2.3	77.8	18.5	16.1	33	21	12				
△	6371SL	RB-9	100+00 5' Lt. "A"	SS-4	8.5 - 10.0	SILTY LOAM A-4 (0)	96.3	93.3	85.8	3.7	10.4	76.5	9.3	7.5	NP	NP	NP				

EARTH EXPLORATION, Inc.

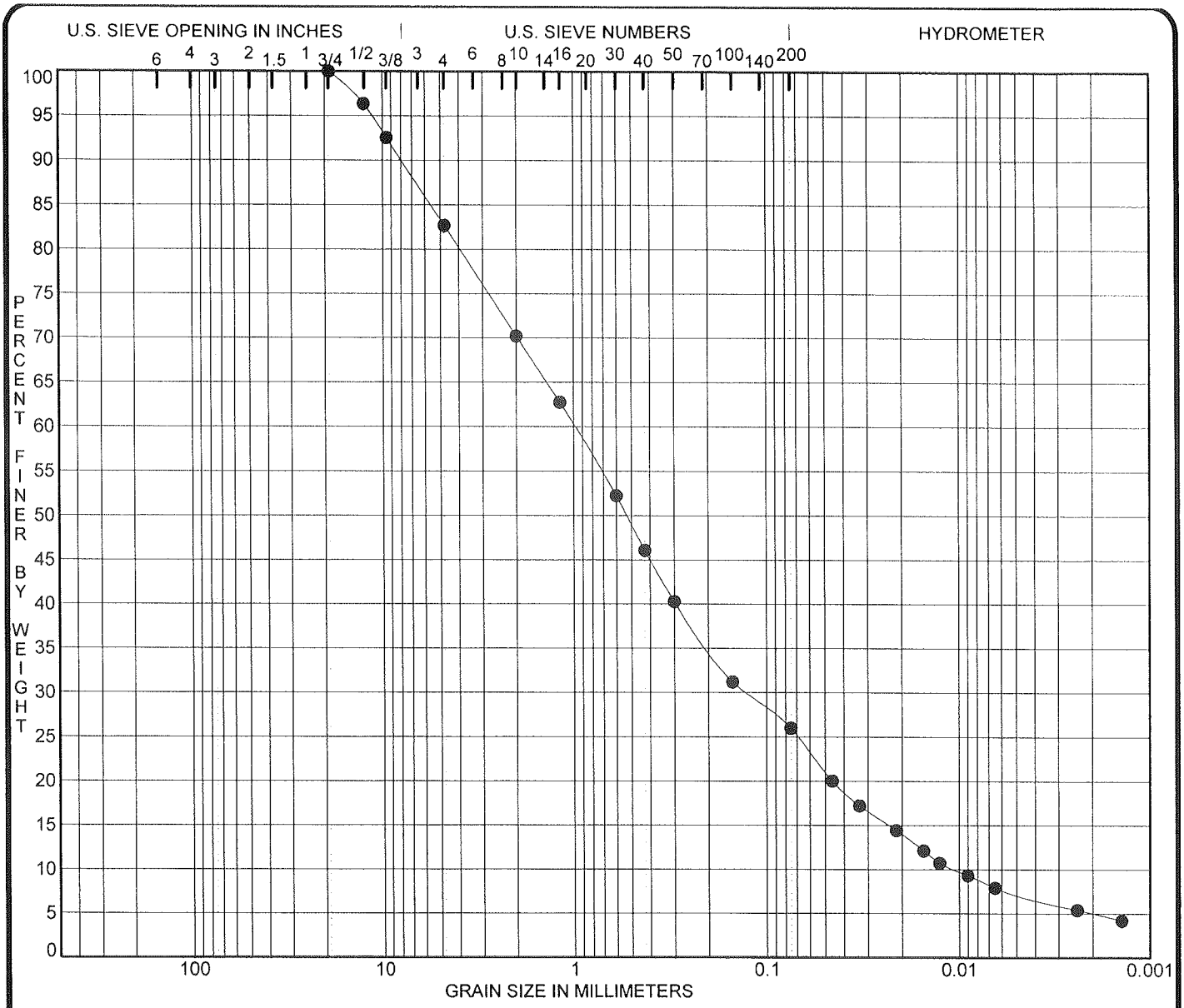
Project No. STP-9954 ( )
Structure No. ---
EEI Project No. 1-04-308

Project Location CR 300S from US 231 to Ladoga Road
Montgomery County, Indiana
Client United Consulting Engineers & Architects

SUMMARY OF CLASSIFICATION TEST RESULTS

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

* See text for recommended values.



BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
RB-1	SS-1	52+73 5' Rt. "A"	1.0 - 2.5 ft.	796.0 - 794.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6367SL	SANDY LOAM with some gravel A-2-4 (0)	6.9	29.8	44.2	21.0	5.0	---	NP	NP	NP

Remarks:

EARTH EXPLORATION Inc

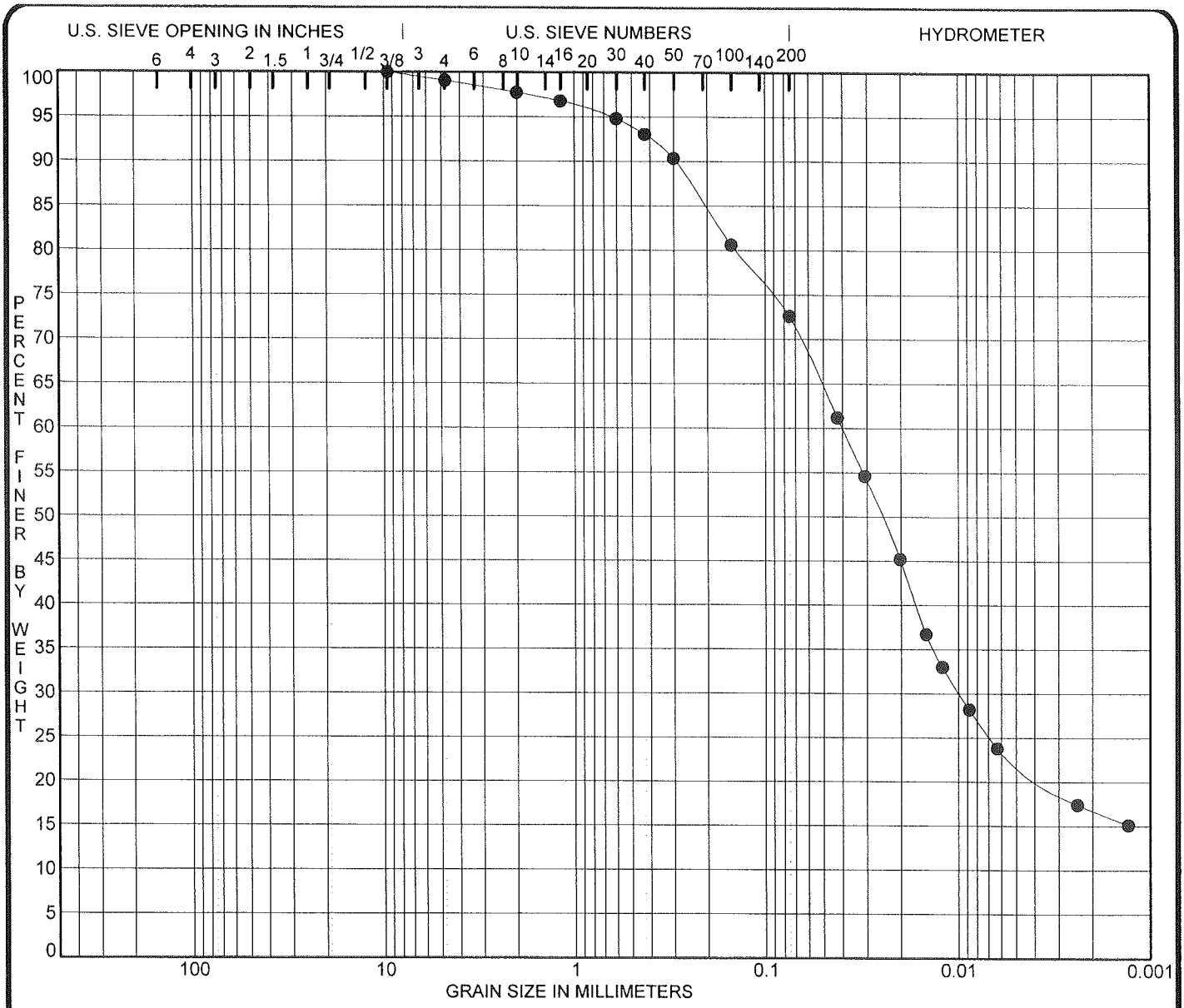
Project No. STP-9954 ( ) **Project** CR 300S from US 231 to Ladoga Road

Structure No. --- **Location** Montgomery County, Indiana

EEI Proj. No. 1-04-308 **Client** United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)



Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
● RB-1	SS-3	52+73 5' Rt. "A"	6.0 - 7.5 ft.	791.0 - 789.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6368SL	SILTY LOAM A-6 (9)	7.2	2.3	25.1	55.9	16.7	24.6	33	19	14

Remarks:

EARTH EXPLORATION Inc

Project No. STP-9954 ( ) **Project** CR 300S from US 231 to Ladoga Road

Structure No. --- **Location** Montgomery County, Indiana

EEI Proj. No. 1-04-308 **Client** United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

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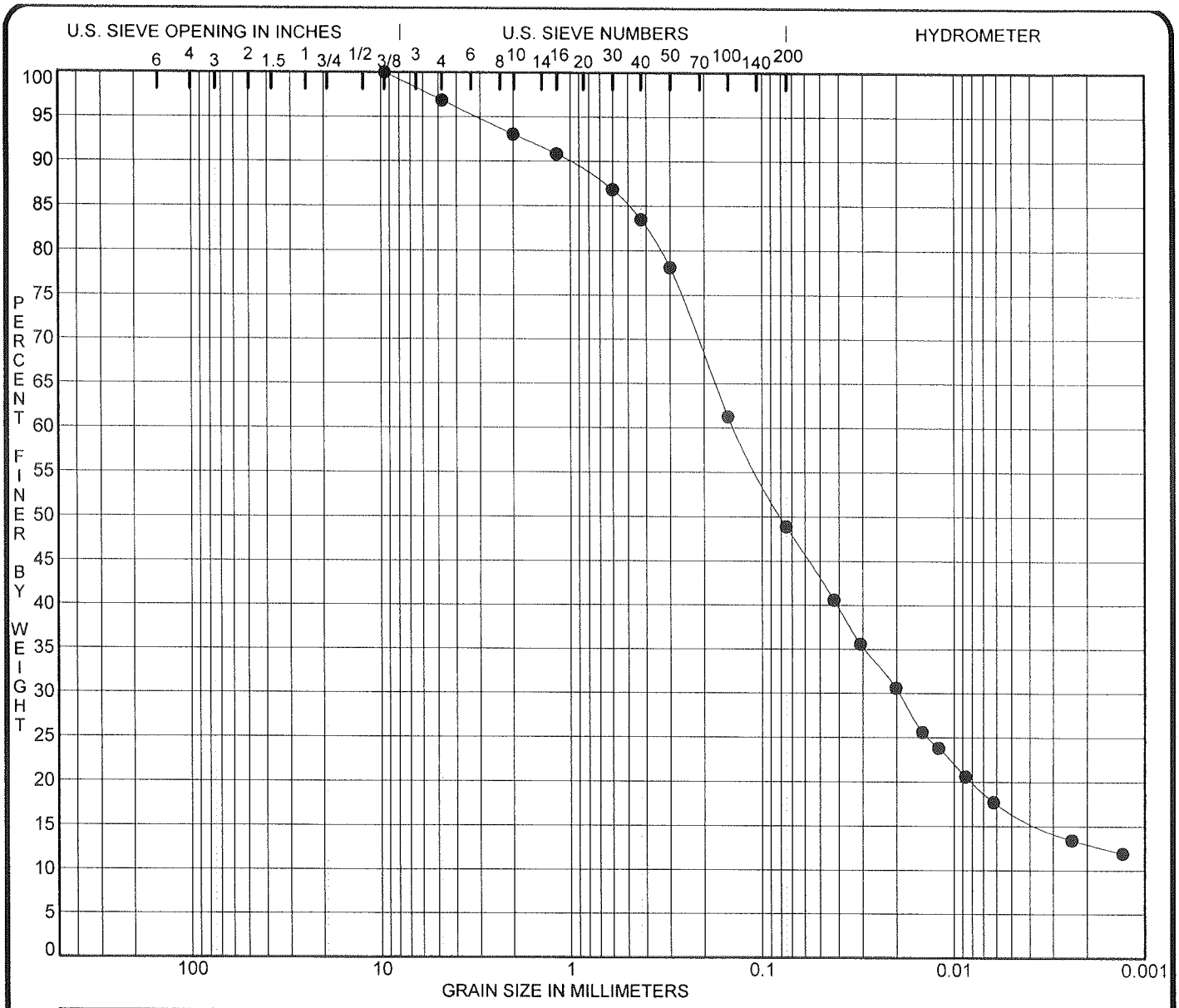

BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
●	RB-2	SS-2	56+46 8' Lt. "A"	3.5 - 5.0 ft.	796.5 - 795.0

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6369SL	SANDY LOAM A-4 (0)	7.1	7.0	44.2	35.9	13.0	12.7	20	15	5

Remarks:

EARTH EXPLORATION Inc

Project No. STP-9954 ( ) **Project** CR 300S from US 231 to Ladoga Road

Structure No. --- **Location** Montgomery County, Indiana

EEI Proj. No. 1-04-308 **Client** United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

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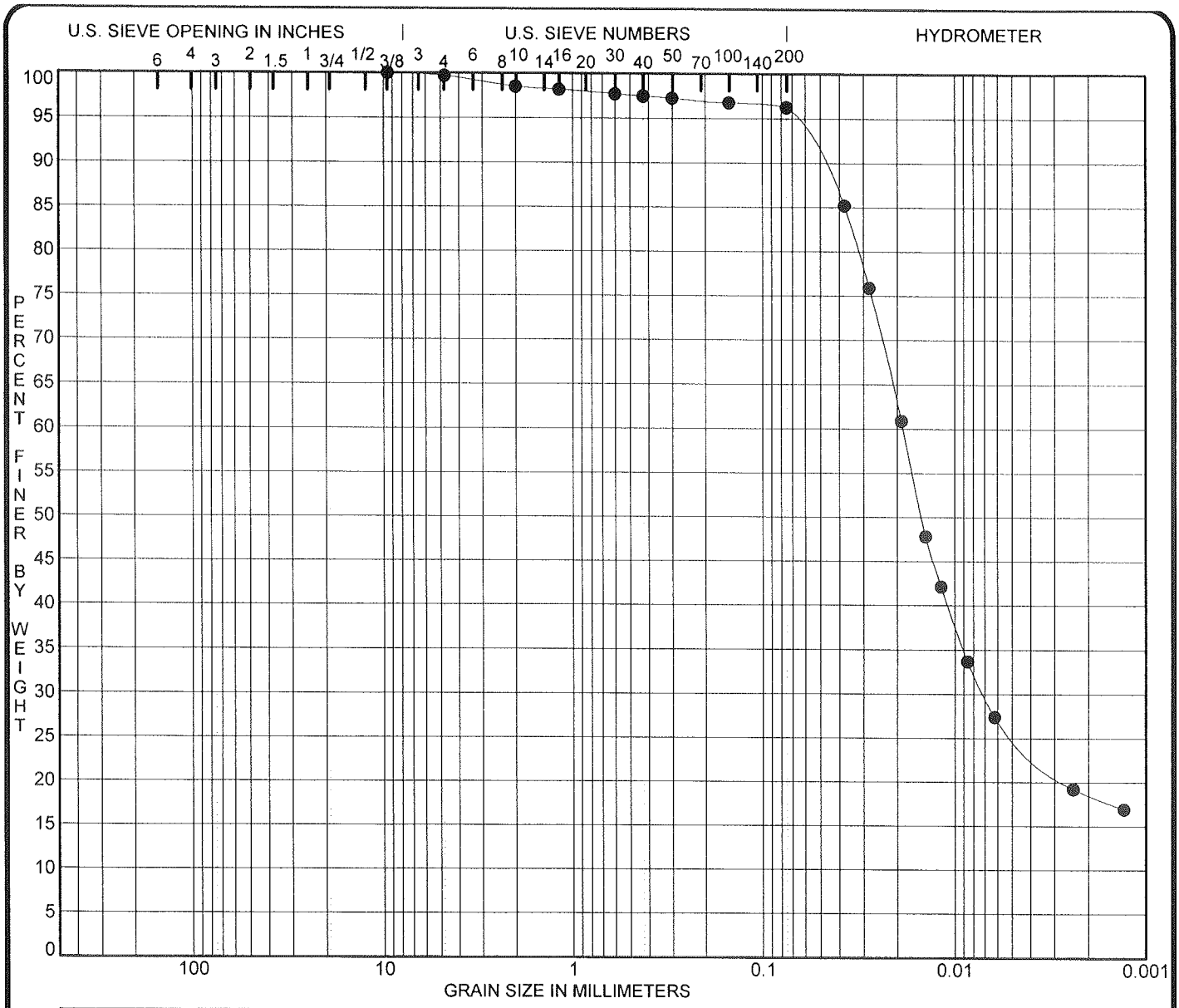

Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
● RB-9	SS-3	100+00 5' Lt. "A"	6.0 - 7.5 ft.	818.0 - 816.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6370SL	SILTY LOAM A-6 (12)	7.2	1.5	2.3	77.8	18.5	28.0	33	21	12

Remarks:

EARTH EXPLORATION, Inc.

Project No. STP-9954 ( )
Structure No. ---
EEI Proj. No. 1-04-308

Project CR 300S from US 231 to Ladoga Road
Location Montgomery County, Indiana
Client United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

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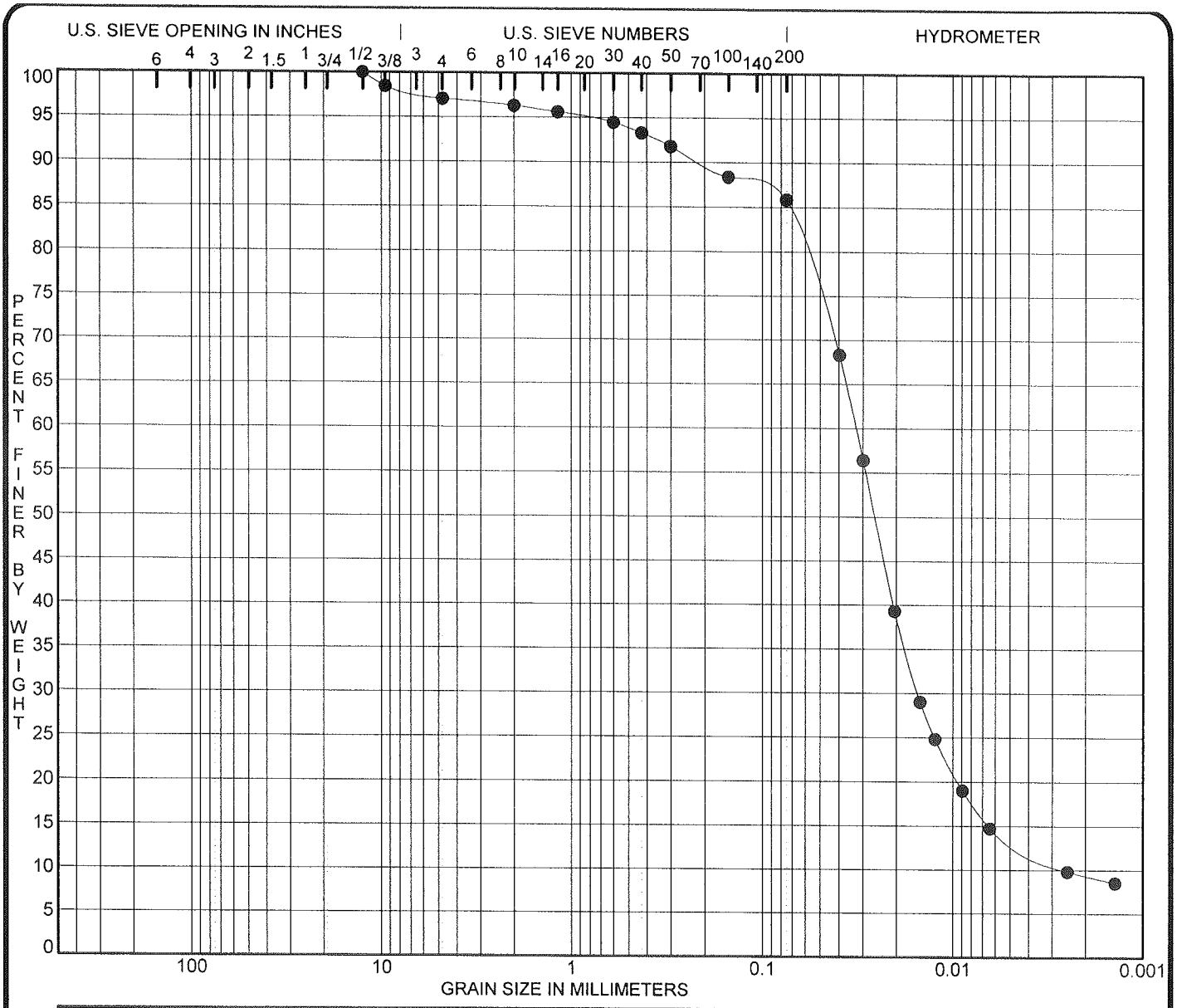

Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
● RB-9	SS-4	100+00 5' Lt. "A"	8.5 - 10.0 ft.	815.5 - 814.0

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6371SL	SILTY LOAM A-4 (0)	7.3	3.7	10.4	76.5	9.3	---	NP	NP	NP

Remarks:

EARTH EXPLORATION Inc

Project No. STP-9954 ( )
Structure No. ---
EEI Proj. No. 1-04-308

Project CR 300S from US 231 to Ladoga Road
Location Montgomery County, Indiana
Client United Consulting Engineers & Architects

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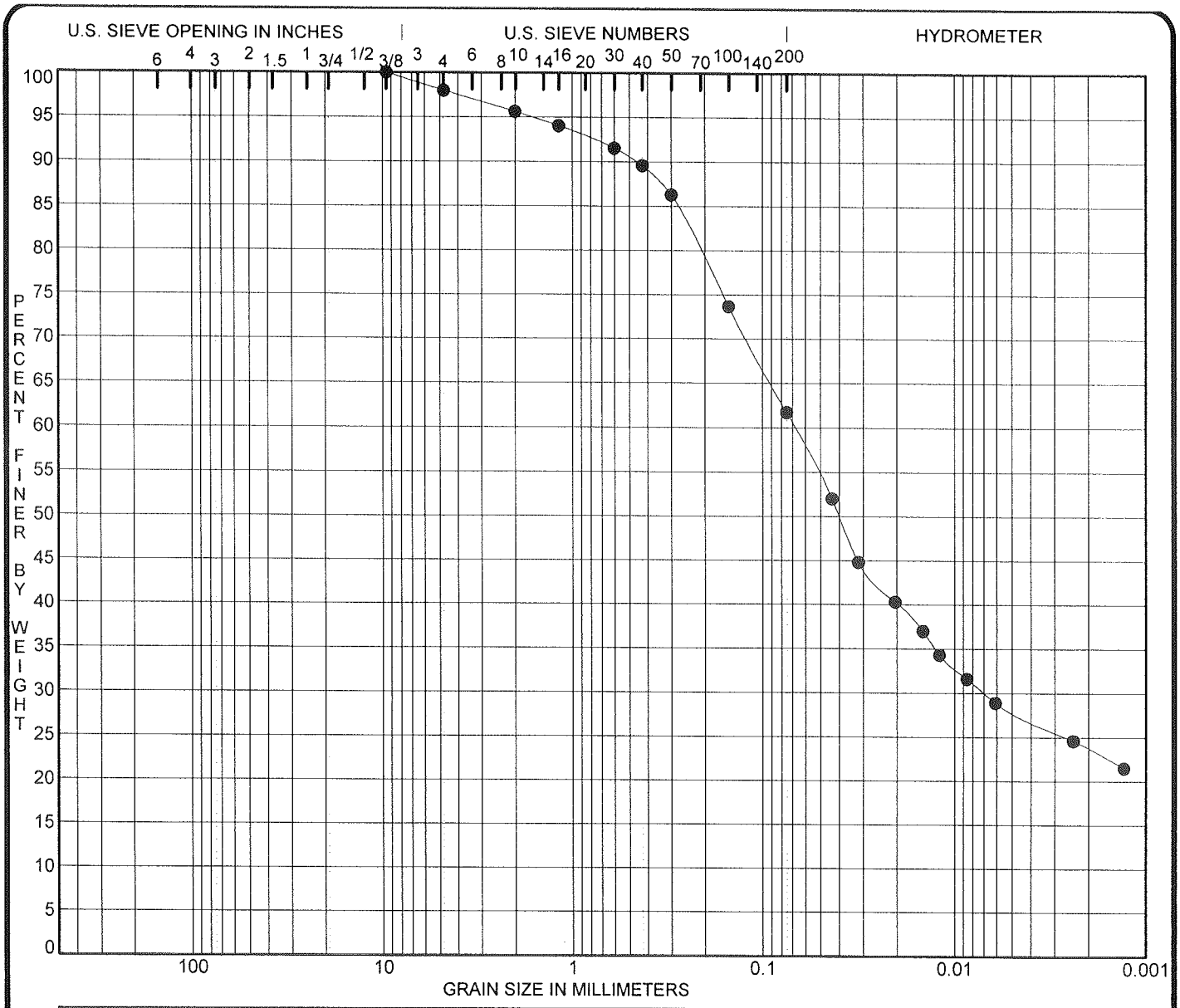

BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Sample Identification	Station / Offset / Line	Depth, ft.	Elevation, USCGS
● RB-11 SS-1	110+100 5' Rt. "A"	1.0 - 2.5 ft.	831.0 - 829.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6372SL	CLAY LOAM A-6 (9)	7.1	4.4	33.9	38.1	23.7	18.8	33	14	19

Remarks:

EARTH EXPLORATION, Inc.

Project No. STP-9954 ( )
Structure No. ---
EEI Proj. No. 1-04-308

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Location Montgomery County, Indiana
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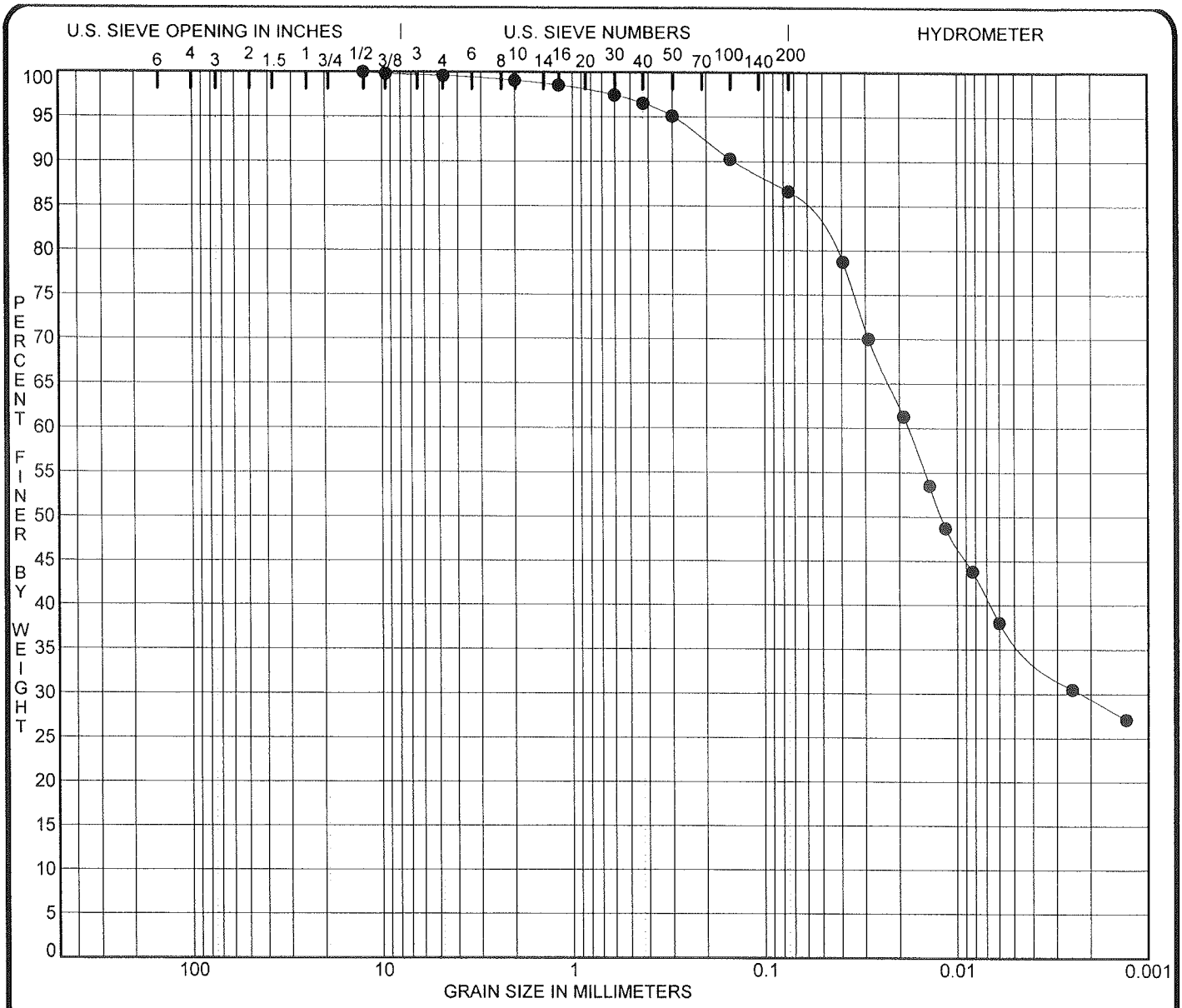

BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
●	RB-12A	BS-1	115+18 5' Lt. "A"	1.5 - 3.5 ft.	827.5 - 825.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6373SL	SILTY CLAY LOAM A-7-6 (21)	6.9	0.9	12.4	57.3	29.3	---	42	18	24

Remarks:

EARTH EXPLORATION Inc

Project No. STP-9954 ( )
Structure No. ---
EEI Proj. No. 1-04-308

Project CR 300S from US 231 to Ladoga Road
Location Montgomery County, Indiana
Client United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

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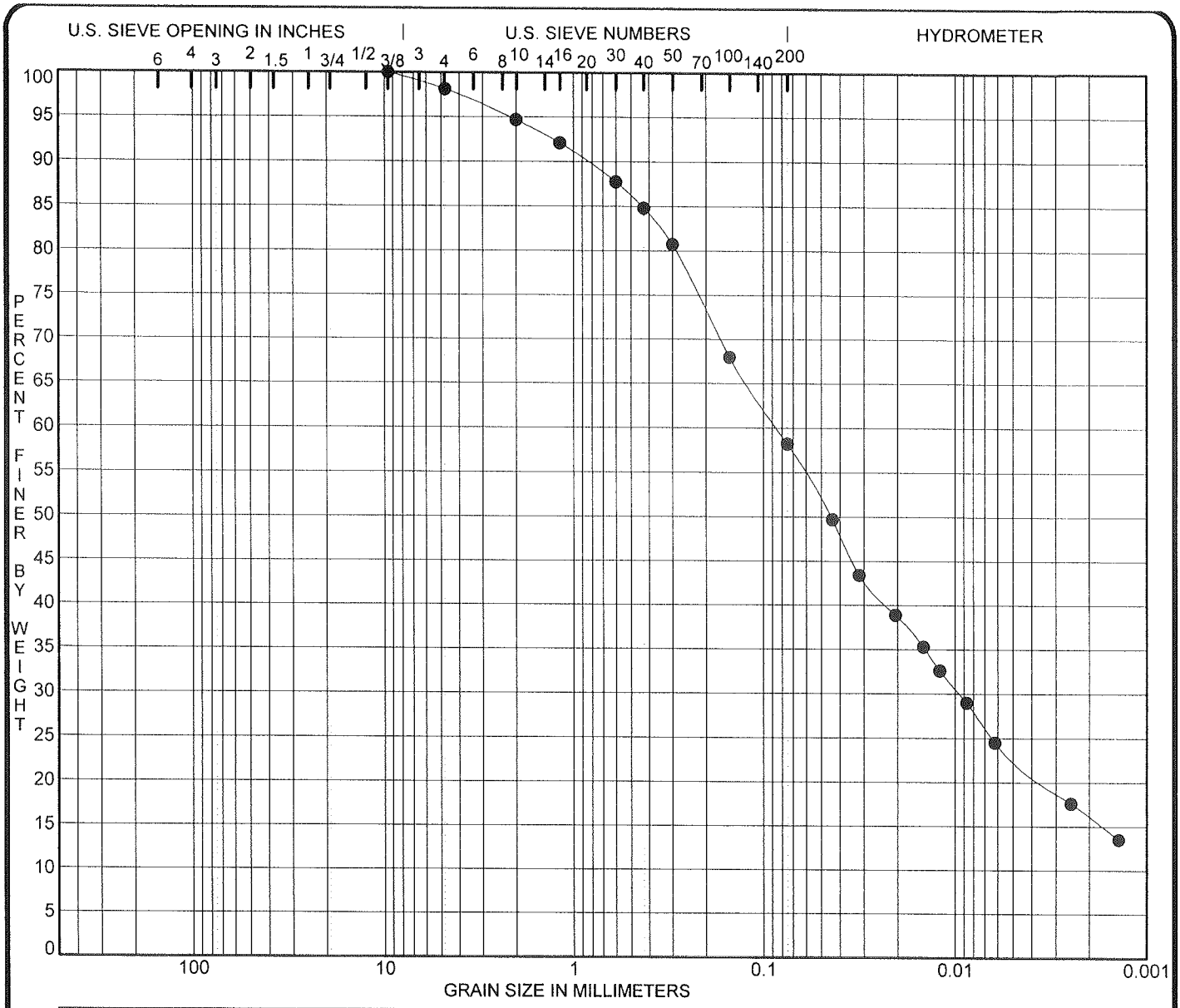

BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
●	RB-14	SS-3	125+00 5' Lt. "A"	6.0 - 7.5 ft.	831.0 - 829.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6374SL	LOAM A-4 (0)	7.3	5.3	36.5	42.2	16.0	12.6	18	13	5

Remarks:

EARTH EXPLORATION, Inc.

Project No. STP-9954 ( )
Structure No. ---
EEI Proj. No. 1-04-308

Project CR 300S from US 231 to Ladoga Road
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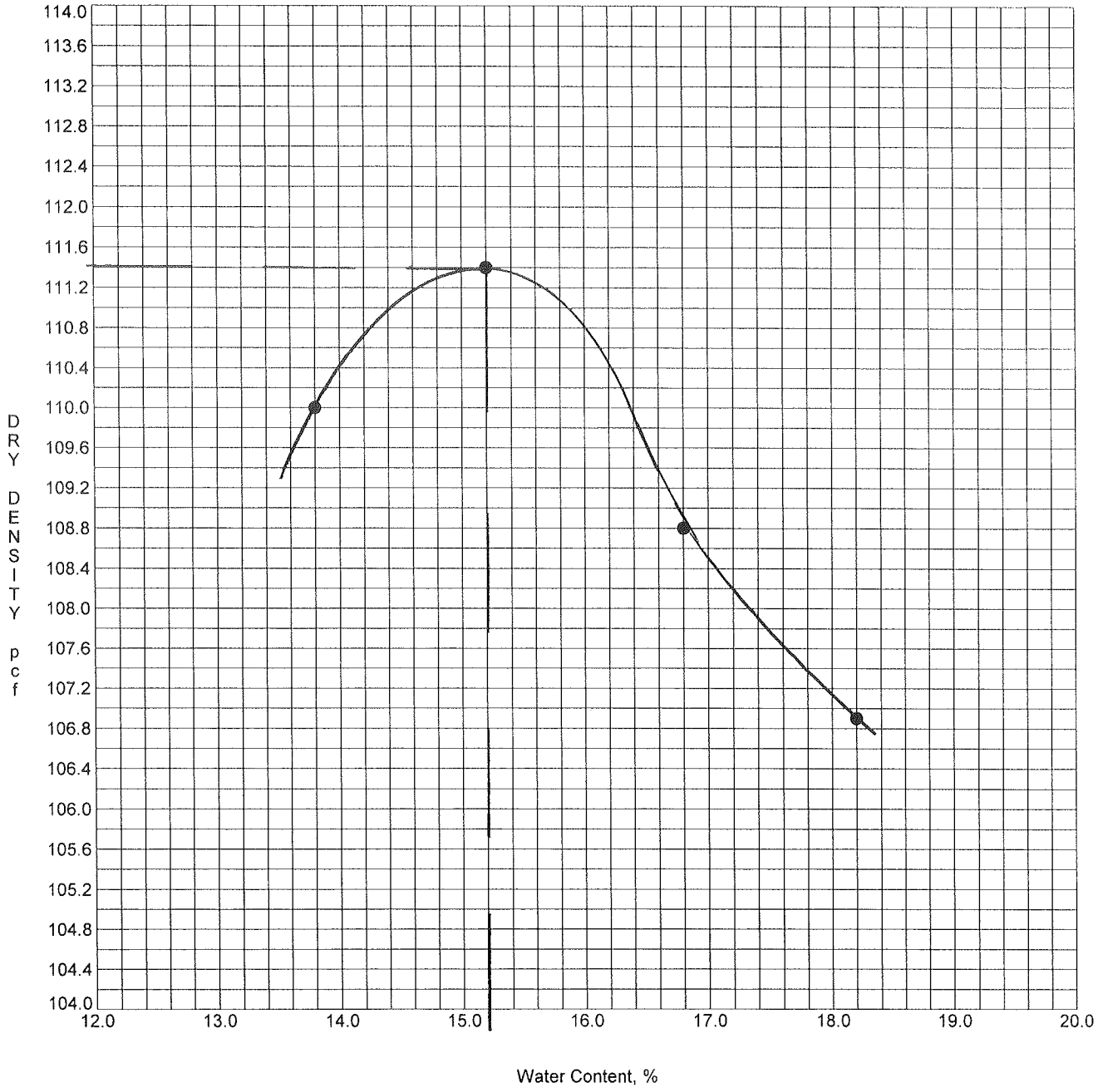


Sample Identification	Station / Offset / Line	Depth, ft.	Elevation, USC+GS
● RB-3A BS-1	60+00 30' Rt. "A"	1.5 - 2.5	799.5 - 799.5

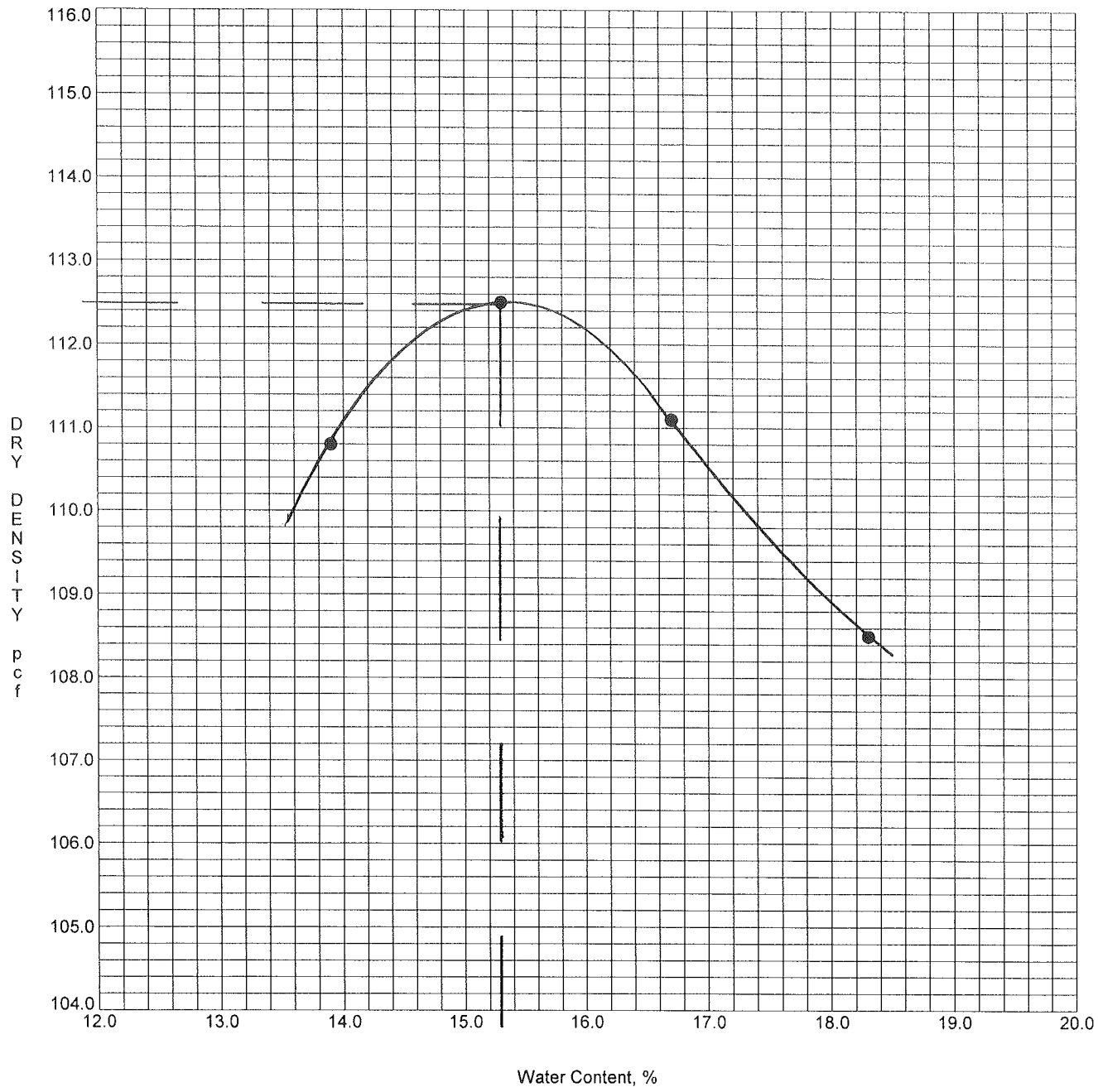
Lab No.	Classification	As Received M.C., %	Optimum M.C., %	Maximum Dry Den., pcf	Test Method
6375SL	SILTY LOAM	---	15.2	111.4	AASHTO T 99

EARTH EXPLORATION Inc

Project No. STP-9954 ( ) **Project** CR 300S from US 231 to Ladoga Road
Structure No. --- **Location** Montgomery County, Indiana
EEI Proj. No. 1-04-308 **Client** United Consulting Engineers & Architects

MOISTURE - DENSITY RELATIONS

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)



Sample Identification	Station / Offset / Line	Depth, ft.	Elevation, USC+GS
● RB-4A BS-1	70+00 30' Rt. "A"	1.5 - 2.5	808.5 - 808.5

Lab No.	Classification	As Received M.C., %	Optimum M.C., %	Maximum Dry Den., pcf	Test Method
6376SL	CLAY LOAM	---	15.3	112.5	AASHTO T 99

EARTH EXPLORATION Inc

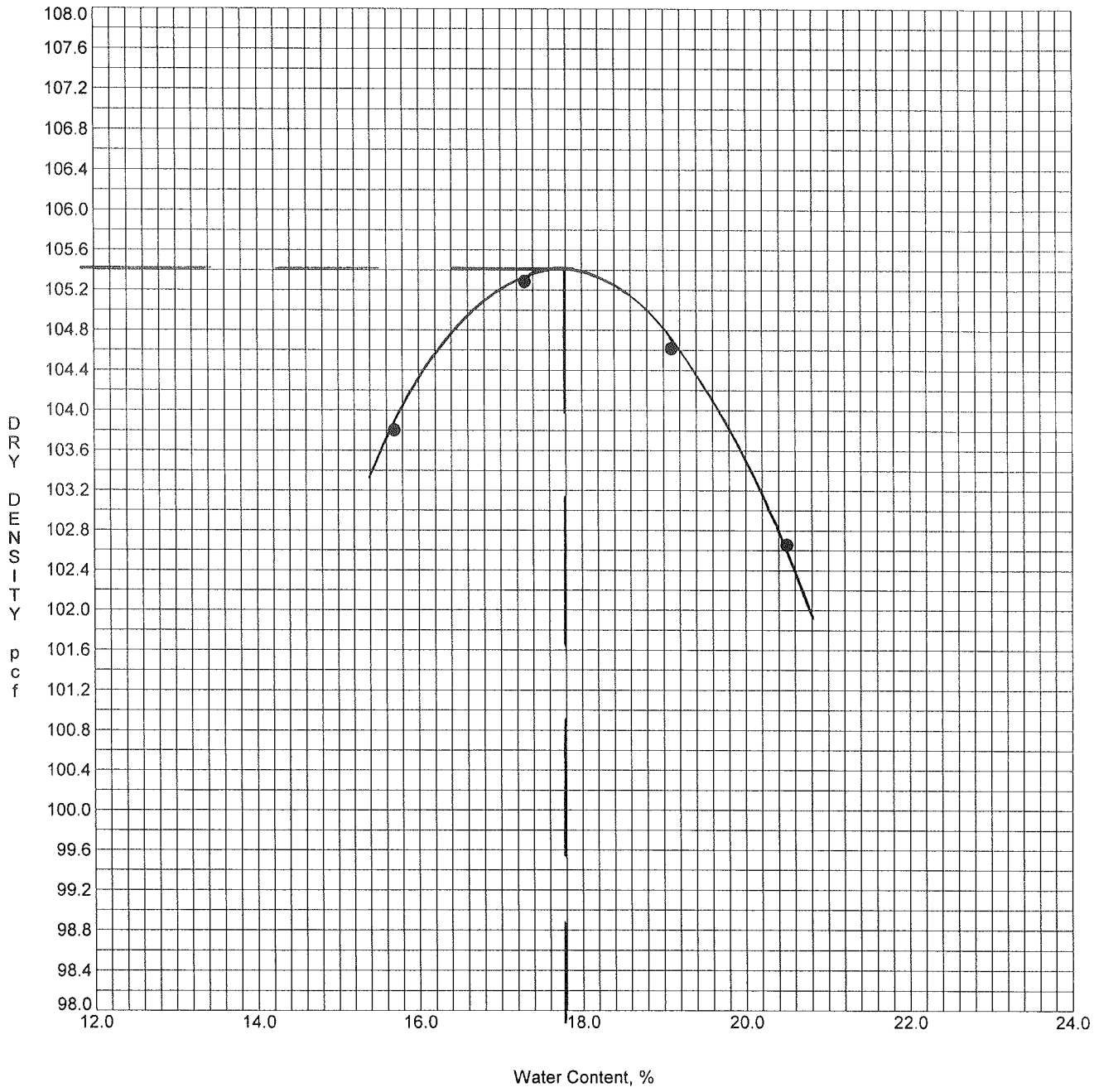
Project No. STP-9954 ( ) **Project** CR 300S from US 231 to Ladoga Road

Structure No. --- **Location** Montgomery County, Indiana

EEI Proj. No. 1-04-308 **Client** United Consulting Engineers & Architects

MOISTURE - DENSITY RELATIONS

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)



Sample Identification	Station / Offset / Line	Depth, ft.	Elevation, USC+GS
● RB-12A BS-1	115+18 5' Lt. "A"	1.5 - 3.5	827.5 - 825.5

Lab No.	Classification	As Received M.C., %	Optimum M.C., %	Maximum Dry Den., pcf	Test Method
6373SL	SILTY CLAY LOAM A-7-6 (21)	---	17.8	105.4	AASHTO T 99

EARTH EXPLORATION Inc

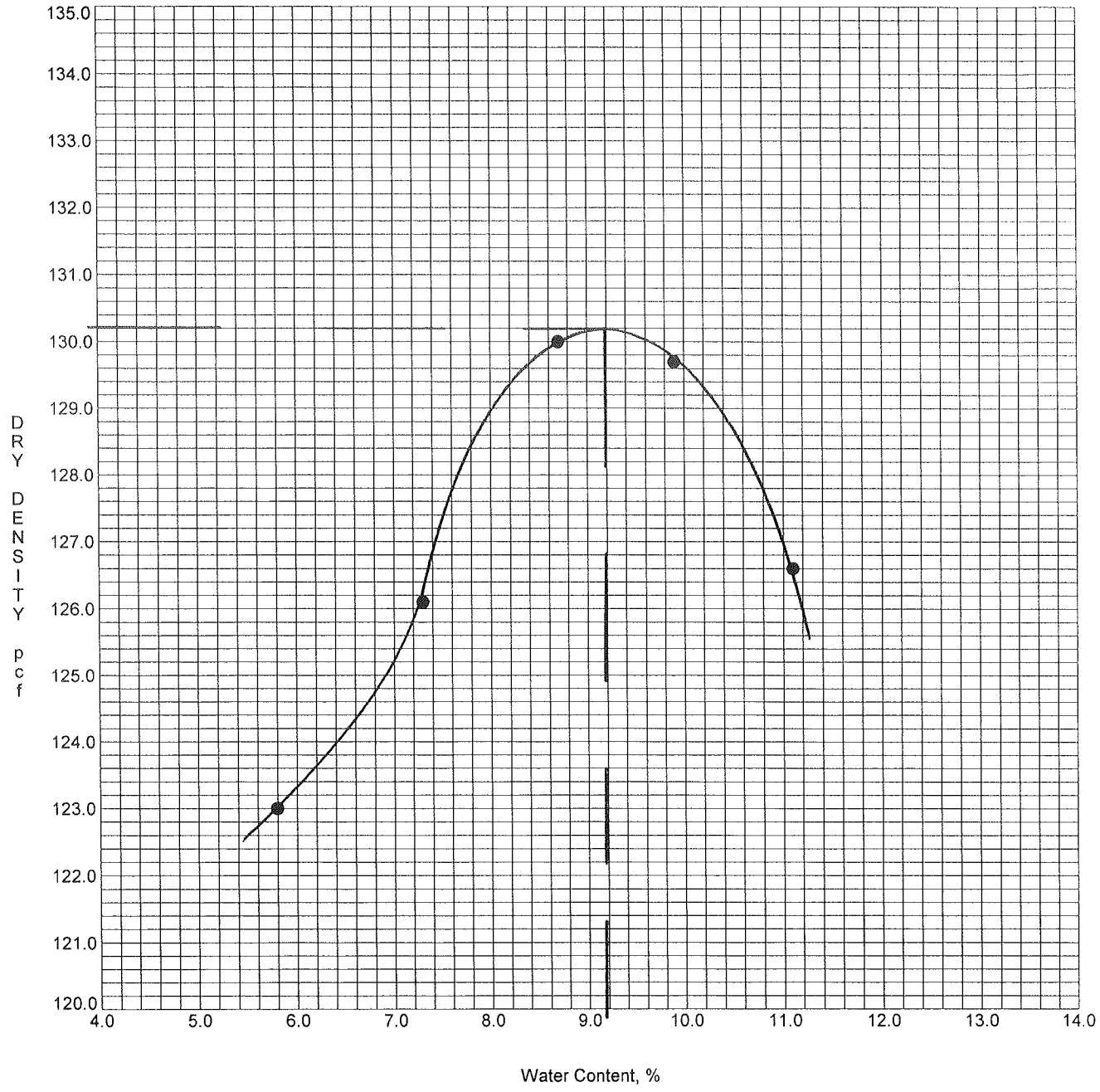
Project No. STP-9954 ( ) **Project** CR 300S from US 231 to Ladoga Road

Structure No. --- **Location** Montgomery County, Indiana

EEI Proj. No. 1-04-308 **Client** United Consulting Engineers & Architects

MOISTURE - DENSITY RELATIONS

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)



Sample Identification	Station / Offset / Line	Depth, ft.	Elevation, USC+GS
● RB-15A BS-1	135+00 30' Rt. "A"	2.0 - 3.5	835.0 - 835.0

Lab No.	Classification	As Received M.C., %	Optimum M.C., %	Maximum Dry Den., pcf	Test Method
6377SL	LOAM	---	9.2	130.2	AASHTO T 99

EARTH EXPLORATION Inc

Project No. STP-9954 ( ) **Project** CR 300S from US 231 to Ladoga Road

Structure No. --- **Location** Montgomery County, Indiana

EEI Proj. No. 1-04-308 **Client** United Consulting Engineers & Architects

MOISTURE - DENSITY RELATIONS

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

SUMMARY OF CBR TEST RESULTS

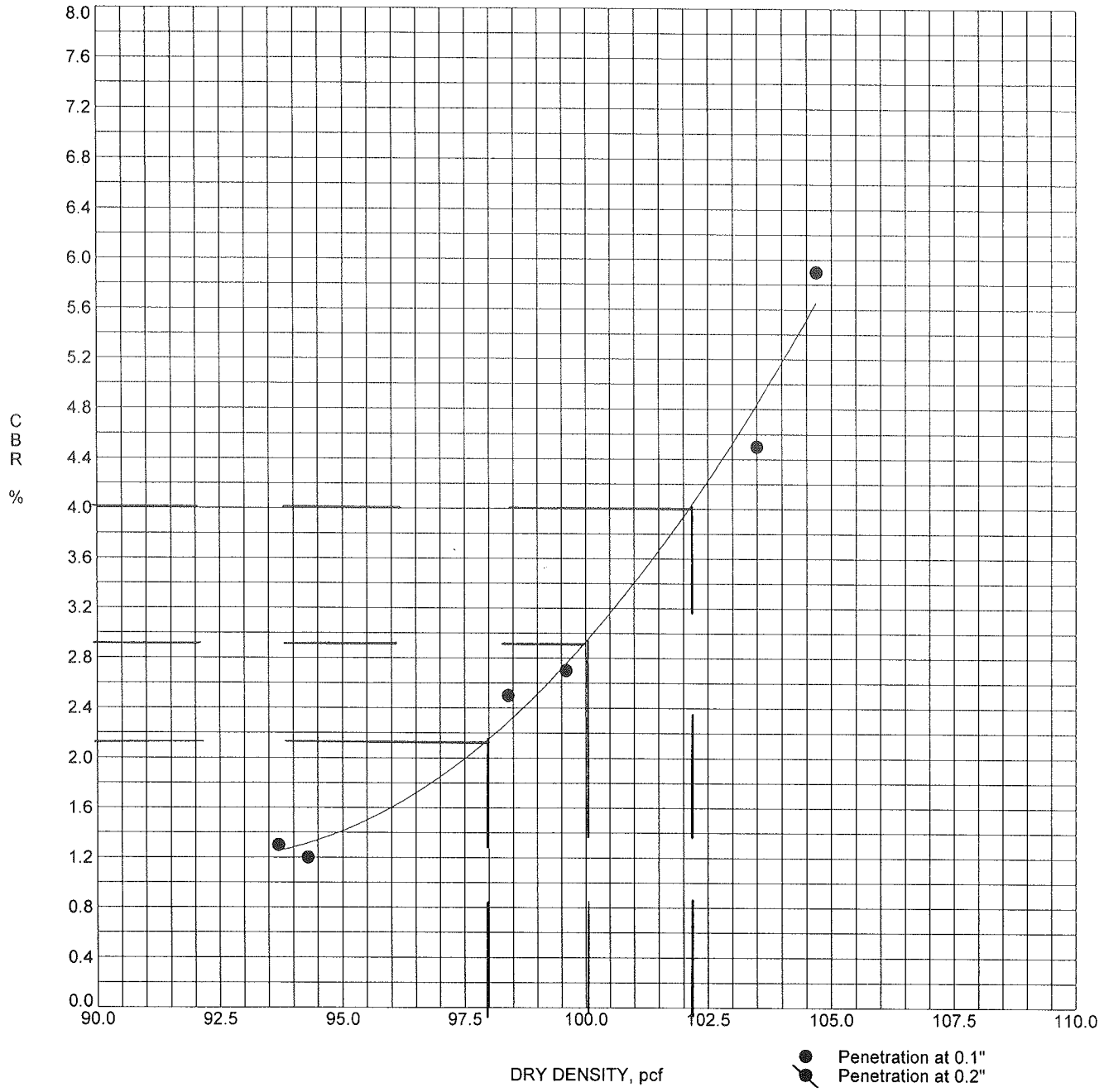
PROJECT:	CR 300S from US 231 to Ladoga Road
LOCATION:	Montgomery County, Indiana
CLIENT:	United Consulting Engineers & Architects
EEI PROJECT NO.:	1-04-308
BORING NO.:	RB-12A
LOCATION:	115+18, 5' Lt. "A"
SAMPLE DEPTH, ft:	1.5 - 3.5
SOIL DESCRIPTION:	Silty Clay Loam, A-7-6(21)
MAXIMUM DRY DENSITY, pcf:	105.4
OPT. MOISTURE CONTENT, %:	17.8
SURCHARGE WEIGHT, lbs:	25.0

TEST DATA

Specimen No.	Blows/ Layer	Initial Dry Density, pcf	% Max. Dry Density	Avg. Water Content, %		Swell, %	CBR, % @ 0.1" Pen.	CBR, % @ 0.2" Pen.
				As Molded	After Soaking			
1	56	104.7	99.3	17.9	20.8	0.83	5.9	5.5
2	56	103.5	98.2	18.1	21.3	1.00	4.5	4.4
3	32	99.6	94.5	18.1	23.5	1.42	2.7	2.7
4	30	98.4	93.4	18.0	23.2	1.44	2.5	2.5
5	20	94.3	89.5	18.2	26.0	1.75	1.2	1.2
6	20	93.7	88.9	18.1	25.4	1.68	1.3	1.3

TEST RESULTS

Dry Density, pcf	Percent Maximum Dry Density	CBR, %
98.0	93.0	2.1
100.1	95.0	2.9
102.2	97.0	4.0



Sample Identification		Station / Offset / Line	Depth, ft.	Classification
RB-12A	BS-1	115+18 5' Lt. "A"	1.5 - 3.5	SILTY CLAY LOAM A-7-6 (21)

Lab No.	Maximum Wet Den, pcf	Maximum Dry Den, pcf	Optimum M.C., %	LL	PL	PI	CBR at 93%	CBR at 95%	CBR at 97%
6373SL	124.2	105.4	17.8	42	18	24	2.1	2.9	4.0

% Passing No. 10	% Passing No. 40	% Passing No. 200	%Gravel	%Sand	%Silt	%Clay
99.1	96.5	86.6	0.9	12.4	57.3	29.3

EARTH EXPLORATION, Inc.

Project No. STP-9954 ( )
Structure No. ---
EEI Proj. No. 1-04-308

Project CR 300S from US 231 to Ladoga Road
Location Montgomery County, Indiana
Client United Consulting Engineers & Architects

CALIFORNIA BEARING RATIO

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

GEOTECHNICAL EVALUATION

PROJECT NO. NHS-081-5(014)
DES. NO. 0201249
US 231 and CR 300S INTERSECTION IMPROVEMENTS
MONTGOMERTY COUNTY, INDIANA

Prepared for

UNITED CONSULTING ENGINEERS & ARCHITECTS
1625 NORTH POST ROAD
INDIANAPOLIS, INDIANA 46219

By

EARTH EXPLORATION, INC.
7770 WEST NEW YORK STREET
INDIANAPOLIS, INDIANA 46214-2988

July 15, 2005

EARTH EXPLORATION INC.

Indiana Department of Transportation

Materials and Tests Division

120 South Shortridge Road P. O. Box 19389
Indianapolis, Indiana 46219-0389
Phone: (317) 610-7251 Fax: (317) 356-9351

July 18, 2005

Mr. Bruno Canzian
Local Transportation Manager
Intermodal Transportation Division
Room N601 - IGCN

Subject: Des No: 0201249
Project No: NHS-081-5 (014)
Intersection Improvement US 231 and CR 300S
County: Montgomery
District: Crawfordsville

Gentlemen:

The Geotechnical Investigation for the subject project has been completed and copies of the Geotechnical Report are being forwarded to those listed below.

If you have any questions concerning this matter, please call us.

Very truly yours,

Athar A. Khan.
Chief Geotechnical Engineer

Somanath S. Hiremath
Geotechnical Engineering Group Leader

SSH/SS
cc: Montgomery County Board of Commissioners - Attachment
✓ United Consulting Engineers, Inc. - Attn: Mr. C. L. Hammond – Attachment
Mr. J. Wright - Attachment
Mr. G. Alan Plunkett – Attn: Mr. B. Conrad – Attachment (2)
Mr. D. Cohen – Attachment
Ms. J. Somers – Attachment
File
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SUMMARY OF RECOMMENDATIONS[1]
GEOTECHNICAL EVALUATION
PROJECT NO. NHS-081-5(014, DES NO. 0201249
US 231 and CR 300S INTERSECTION IMPROVEMENTS
MONTGOMERY COUNTY, INDIANA

Earthwork and Engineered Fill Placement and Compaction

We recommend in areas to receive pavement components or engineered fill that topsoil, wet or soft/loose near-surface soils, and existing pavement components be removed from within the construction limits. In addition, we recommend that existing underground utilities be appropriately relocated. Where utilities are relocated, we recommend that the resulting excavations be backfilled with "B" borrow in accordance with Section 203.09 of the ISS. After removal and where feasible, we recommend that exposed soils in pavement areas and areas to receive fill be proof-rolled in accordance with the ISS, Section 203.26. Based on the test boring information and laboratory testing, widespread soft/loose conditions are not anticipated beneath the existing roadway. However, plans indicate that the embankment over Structure No. Montgomery 107 will be widened to accommodate the widened roadway section. Two to 3 ft of soft/loose conditions should be anticipated in and/or near the creek bed. Where these conditions are encountered during construction or if the field activities occur during poor weather conditions, subgrade stabilization will be required. Furthermore, where soil with organic matter is encountered, if any, it should be removed to a depth of at least 2 ft beneath the pavement section. Suggested stabilization techniques are provided in the body of the report.

We recommend that engineered fill, used to raise grades (if necessary) or backfill of undercut areas, be placed in loose lift thicknesses not exceeding 8 in. and be compacted to 95 percent of the maximum density obtained in accordance with AASHTO T 99 as specified in the ISS. In our opinion, the soils as observed at the test boring locations are suitable for reuse as engineered fill. However, the natural moisture content of the shallow cohesive soils (i.e., upper 6 ft) typically exceeds the optimum. Therefore, it is likely that some drying (by aeration or chemical treatment) of the fill will be required before placement in order to satisfy the ISS if these soils are utilized. Drying of the soils will also be required where encountered within the range of subgrade treatment. Under some climatic conditions, such as cold or rainy weather, or in confined areas, adequate moisture conditioning may be difficult to achieve, and in this case, granular fill could be required to expedite construction activities.

Pavement Design Considerations

Based upon the test results and the projected traffic volume (9,980 VPD), we recommend using a Type IA subgrade treatment (per ISS 207.04) with a resilient modulus of 5,250 lbs/cu. in. In addition, we recommend that consideration be given to the use of subsurface pavement drains with screened outlets in the design of the pavement system. In our opinion, the drains should be surrounded by a permeable drainage medium consisting of a uniformly-graded aggregate. In addition, due to the presence of an appreciable amount of silt at some locations, permeable geotextile filter fabric should be used in conjunction with the underdrains to prevent the contamination of the permeable backfill around the drains.

Culvert Considerations

It is important to have proper support to prevent the pipe from becoming overstressed in bending or compression. In general, the conditions encountered at the proposed culvert elevation should be adequate for support with some undercutting likely to remove the soft/loose conditions observed at the soundings S-1 and S-2. Where soft or loose soils are encountered, it is our opinion they should be removed and replaced with compacted granular structural fill material to achieve a stable base. If this is not feasible due to the depth of the unstable materials, the use of geogrid and/or compacted crushed aggregate may be required to stabilize the trench. In this case, a minimum of 24-in. of the soft soils should be removed prior to stabilization. Since the culvert excavations will be primarily located beneath the proposed roadway and roadway embankment and for ease of fill placement and compaction, the area immediately adjacent to the culvert should be backfilled with granular structural backfill. In our opinion, the granular structural backfill should be compacted to 100 percent of maximum dry density obtained in accordance with AASHTO T 99 and INDOT Specifications.

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[1] **The purpose of this summary is to provide an abbreviated discussion of our recommendations contained in the attached evaluation. In our opinion, the recommendations in this summary are the "most significant" geotechnical issues affecting the proposed construction. For additional discussion and recommendations, our geotechnical report should be consulted and/or Earth Exploration, Inc. should be contacted.**

EARTH EXPLORATION, INC.
7770 West New York Street
Indianapolis, IN 46214-2988
317-273-1690 (FAX) 317-273-2250

July 15, 2005

Mr. Christopher L. Hammond, P.E.
United Consulting Engineers & Architects
1625 North Post Road
Indianapolis, IN 46219

Re: Geotechnical Evaluation
Project No. NHS-081-5(014)
Des. No. 0201249
US 231 and CR 300S Intersection Improvements
Montgomery County, Indiana
EEI Project No. 1-05-104

Dear Mr. Hammond:

We are pleased to submit our geotechnical evaluation for the above-referenced project. This report presents the results of our subsurface exploratory program and provides geotechnical recommendations for the proposed intersection improvements. The work for this project was authorized by your firm via a subconsultant agreement, and has been performed in accordance with Earth Exploration, Inc. (EEI) Proposal No. P1-05-148.

The opinions and recommendations submitted in this report are based, in part, on our interpretation of the subsurface information revealed by the test borings and soundings indicated on an attached plan. Understandably, this report does not reflect variations in subsurface conditions between or beyond these locations. Therefore, variations in these conditions can be expected, and fluctuation of the groundwater levels may occur with time. Other important limitations of this report are discussed in Appendix A.

PROJECT DESCRIPTION

We understand that INDOT and the commissioners of Montgomery County, in assistance with federal funds, are planning to make improvements to the intersection of US 231 and CR 300S. Refer to the Drawing No. 1-05-104.A1 in Appendix C for the general location of the project. From our understanding, construction is generally planned to include replacement of the existing pavement with a new widened asphaltic concrete section with turn lanes. The limits of the project extend about 450 ft to the west of the intersection and about 1,700 ft to the north and south of the intersection. It is our understanding that improvements to the east leg of the intersection will be performed during the reconstruction of CR 300S (EEI Project No. 1-04-308). In addition, plans indicate that both ends of an existing 5 ft by 4 ft box culvert (Structure No. 107) will be extended to accommodate the wider section. Earth fill is not anticipated to exceed 12 ft at the location

of the culvert, and earth cut is not anticipated to exceed 12 ft at offset locations. The new roadway is anticipated to consist of bituminous paving materials. Furthermore, from information provided on the plans, the projected (i.e., year 2026) annual average daily traffic (AADT) is estimated to be 9,980 vehicles per day (VPD) for US 231 and 1,060 VPD for CR 300S. The roadside ditches are generally planned to include a 4-ft wide bottom with 3H:1V sideslopes. The roadside ditches are anticipated to transport runoff to nearby ditches and creeks.

At this time, it is anticipated that construction will begin in 2006. In the event that the nature, design or location of the proposed construction changes, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the conclusions are modified or confirmed in writing.

FIELD EXPLORATION AND LABORATORY TESTING

Subsurface conditions for the improvements were explored by performing five road borings (designated RB-1 through RB-5) and two hand soundings (designated S-1 and S-2). The number and location of the borings were selected by Earth Exploration, Inc. (EEI), in conjunction with INDOT, Division of Materials and Test, Geotechnical Section. Additionally, the borings were located in the field by EEI personnel referencing identifiable features shown on the previously mentioned plans. Ground surface elevations at the boring locations were interpolated to the nearest 1 ft based on topographic information provided on the plans. The boring locations and elevations should be considered accurate only to the degree implied by the methods used.

Exploratory field activities were performed by EEI on May 4, 2005. In general, these activities were performed using hollow stem augers to advance the boreholes. Representative samples of the soil conditions using Standard Penetration Test (SPT) procedures (AASHTO T 206) were obtained at predetermined intervals. After obtaining final groundwater observations, each borehole was backfilled with auger cuttings, and a concrete patch was placed at the surface (i.e., in accordance with the "Aquifer Protection Guidelines" [revised October 30, 1996] developed by INDOT). Additional details of the drilling and sampling procedures are provided in Appendix B.

Following the exploratory activities, the soil samples were visually classified by an EEI engineering technician and later reviewed by an EEI geotechnical engineer. After visually classifying the soils, representative samples were selected and submitted for laboratory testing. These tests included: natural moisture content (AASHTO T 265); grain size analysis (AASHTO T 88); Atterberg limits (AASHTO T 89 and T 90); soil pH and hand penetrometer readings. The results of the tests are provided on the boring logs in Appendix C and/or respective summary sheets in Appendix D. For your information, soil

descriptions on the boring logs are in general accordance with the AASHTO system [AASHTO designation, e.g., A-7-6(20)] and the INDOT Standard Specifications (ISS[1]) (textural classification, e.g., silty clay loam). The final boring logs represent our interpretation of the individual samples and field logs, and results of the laboratory tests. The stratification lines on the boring logs represent the approximate boundary between soil types; although, the transitions may actually be gradual.

SITE CONDITIONS

Surface Conditions

Based on our observations and the previously mentioned topographic information, the ground surface along the project alignment is relatively flat to the north and west and gently to moderately sloping to the south and east. The lowest elevation of the existing ground surface is near Elevation 780 at the beginning of Line "B," i.e., the southern limit of the project, and the highest is Elevation 817 near Station 1335+00, Line "B," i.e., in the northern portion of the project. The surface of the existing roadways consists of asphaltic concrete with little to no shoulders and shallow roadside ditches in most locations. Residential structures were noted along both US 231 and CR 300S. The surface conditions along US 231 (Line "B", Borings RB-1 through RB-4) consisted of about 6 to 17 in. of asphaltic concrete. At Borings, RB-1 and RB-2, 3 to 5 in. of granular subbase (i.e., crushed stone) was observed beneath the asphaltic concrete. In addition, at Borings RB-1 and RB-4, 6 to 9 in. of Portland cement concrete was noted beneath the aforementioned conditions. The surface conditions along CR 300S (Line "A", Boring RB-5) consisted of 5 in. of asphaltic concrete, and no granular subbase was observed.

Soil Conditions

The subsurface profile was generally consistent at the test boring locations, and the conditions were similar to those observed during the geotechnical evaluation of CR 300S east of US 231 (EEI Project No. 1-04-308). The subsurface conditions generally consisted of clay loam, silty clay loam, silty loam (cohesive-type) and sandy loam (cohesive-type) overlying loam at depths of 3 to 6 ft beneath the naturally-occurring ground surface. However, at Boring RB-4, loam was observed immediately beneath the pavement conditions, and at Borings RB-3 and RB-5, 1½- to 3½-ft thick layers of silty loam (granular-type) and gravelly sand were observed within the cohesive strata. It should also be noted that these conditions were described as fill to a depth of about 11 ft at Boring RB-2. The soil fill at this location is present due to the existing embankment over an existing structure (Montgomery 107). Two hand soundings were also performed

[1]References the Indiana Department of Transportation (INDOT) Standard Specifications, 1999 Edition.

in the existing creek bed for the structure, and the results indicate that about 2 to 3 ft of soft/loose conditions are present.

The consistency of the cohesive soils both naturally-occurring and fill was generally soft to stiff based on N-value criteria established by INDOT. Moisture contents were in the range of 7 to 30 percent, and hand penetrometer readings generally ranged from ¼ to 2½ tons/sq. ft (tsf). However, the loam at Boring RB-1 and the sandy loam at Boring RB-3 were observed to be very stiff to hard based on the aforementioned N-value criteria, and the hand penetrometer readings were on the order of 4 to over 4½ tsf. The relative density of the granular soil layers was medium dense with SPT N-values in the range of 12 to 25 blows/ft.

Based on a comparison of the moisture contents and Atterberg limits, the cohesive soils beneath the surficial conditions were of low to moderate plasticity with plasticity indices in the range of 3 to 26. In general, the higher plasticity soils were observed at a shallower depth. The lower plasticity and over-consolidated soils were observed with depth (i.e., loam). Furthermore, several samples were also tested for pH level, and these results indicated that the pH levels ranged from 7.2 to 7.7. All of the test results are provided in Appendix C on the logs or on the grain size distribution curves in Appendix D.

Groundwater Conditions

Groundwater level observations made during, upon completion, and up to 3 hrs after completion of the exploratory activities are shown at the bottom of the logs. Groundwater was observed at most boring locations at depths ranging from 5 to 14 ft beneath the surface. In our opinion, these elevations likely represent a condition where water is perched above the underlying loam stratum, and the actual "piezometric" groundwater level is deeper than the maximum depth explored, as suggested by the Soil Survey of Montgomery County. It should be recognized that groundwater levels either static or perched can fluctuate due to changes in precipitation, infiltration, surface run-off, and other hydrogeological factors.

DISCUSSION AND RECOMMENDATIONS

General

Based upon our understanding of the improvements and information obtained from the test boring locations, it is our opinion that the subsurface conditions are generally conducive for the support of the pavement and box culvert structure. However, given the type of subgrade soils (i.e., moisture-sensitive), improvement techniques of the pavement subgrade will likely be required depending on the season/climate conditions at the time of

construction. Also, as mentioned previously, 2 to 3 ft of soft/loose soil conditions should be anticipated in the creek bed at Structure No. Montgomery 107. Additional discussion and recommendations regarding these issues are provided in the following paragraphs.

Earthwork

Site Preparation

We recommend in areas to receive pavement components or engineered fill that topsoil, wet or soft/loose near-surface soils, and existing pavement components be removed from within the construction limits. In addition, we recommend that existing underground utilities be appropriately relocated. Where utilities are relocated, we recommend that the resulting excavations be backfilled with "B" borrow in accordance with Section 203.09 of the ISS.

After removal and where feasible, we recommend that exposed soils in pavement areas and areas to receive fill be proof-rolled in accordance with the ISS, Section 203.26. Based on the test boring information and laboratory testing, widespread soft/loose conditions are not anticipated beneath the existing roadway. However, plans indicate that the embankment over Structure No. Montgomery 107 will be widened to accommodate the widened roadway section. As mentioned previously, 2 to 3 ft of soft/loose conditions should be anticipated in and/or near the creek bed. Where these conditions are encountered during construction or if the field activities occur during poor weather conditions, subgrade stabilization will be required. Furthermore, where soil with organic matter is encountered, if any, it should be removed to a depth of at least 2 ft beneath the pavement section. We recommend that soft or otherwise unstable soils (as previously described) encountered during the proof-rolling operations which will not readily compact, be aerated (if feasible) to reduce the moisture content and be recompacted. If construction takes place during late fall, winter or early spring, reducing the moisture content may be difficult if not impossible, to achieve. If adverse weather conditions exist or if the underlying subgrade begins to "pump," other means of stabilization such as undercutting and replacement with granular fill (e.g., "B" Borrow), possibly in conjunction with Type I geogrid, or chemical modification may be required. However, if chemical modification is used, we recommend that slurry be considered to prevent the dust from spreading to adjacent residential properties. For smaller areas, stabilization can likely be achieved by removal and replacement of the existing soils. In general, it is feasible to treat isolated areas with the use of INDOT No. 53 Stone or the use of Type I geogrid and "B" Borrow backfill. For larger areas, chemical modification is typically more conducive. The final decision regarding stabilization should be made at the time of construction, based on the observed actual conditions. Additionally, it is recommended that a line item for unspecified quantity be included in the plans and specifications.

Engineered Fill Placement and Compaction

We recommend that engineered fill, used to raise grades (if necessary) or backfill of undercut areas, be placed in loose lift thicknesses not exceeding 8 in. and be compacted to 95 percent of the maximum density obtained in accordance with AASHTO T 99 as specified in the ISS. In our opinion, the soils as observed at the test boring locations are suitable for reuse as engineered fill. However, the natural moisture content of the shallow cohesive soils (i.e., upper 6 ft) typically exceeds the optimum. Therefore, it is likely that some drying (by aeration or chemical treatment) of the fill will be required before placement in order to satisfy the ISS if these soils are utilized. Drying of the soils will also be required where encountered within the range of subgrade treatment. Under some climatic conditions, such as cold or rainy weather, or in confined areas, adequate moisture conditioning may be difficult to achieve, and in this case, granular fill could be required to expedite construction activities. In our opinion, given the proposed embankments constructed with 3H:1V sideslopes and the foundation conditions, slope instability is not of concern.

Pavement Design Considerations

The pavement subgrades are anticipated to consist of naturally-occurring cohesive soils or engineered fill used to raise the grade. The results of a California Bearing Ratio (CBR) test performed on a sample of critical fine-grained soil (i.e., silty clay loam) obtained from Boring RB-12A of EEI Project No. 1-04-308, indicated CBR values of 4.0 at 97 percent, 2.9 at 95 percent and 2.1 at 93 percent of the maximum dry density (Standard Proctor, AASHTO T 99). Based upon the test results and the projected traffic volume (9,980 VPD), we recommend using a Type IA subgrade treatment (per ISS 207.04) with a resilient modulus of 5,250 lbs/cu. in (CBR = 3.5).

Water infiltration into cohesive subgrade soils can reduce the life of a pavement section. Since these soils have a low permeability, we would anticipate that any water which may infiltrate the subgrade would affect the long term performance of the pavement. Under these conditions, we recommend that consideration be given to the use of subsurface pavement drains with screened outlets in the design of the pavement system. In our opinion, the drains should be surrounded by a permeable drainage medium consisting of a uniformly-graded aggregate. In addition, due to the presence of an appreciable amount of silt at many locations, permeable geotextile filter fabric should be used in conjunction with the underdrains to prevent the contamination of the permeable backfill around the drains.

Box Culvert Considerations

As mentioned earlier, the existing 5 ft by 4 ft box culvert (Structure No. Montgomery 107) will be extended to accommodate the widened embankment. In general, the placement of the proposed culvert within the soil profile will not increase the load on the underlying soil above that anticipated from the embankment. However, it is important to have proper support to prevent the culvert from becoming overstressed in bending or compression. In general, the conditions encountered at the proposed culvert elevation should be adequate for support with some undercutting likely to remove the soft/loose conditions observed at the soundings S-1 and S-2. Where soft or loose soils are encountered at the base of the culverts, it is our opinion they should be removed and replaced with compacted granular structural fill material to achieve a stable base. If this is not feasible due to the depth of the unstable materials, the use of geogrid and/or compacted crushed aggregate may be required to stabilize the excavation. In this case, a minimum of 24-in. of the soft soils should be removed prior to stabilization.

Since the culvert excavations will be primarily located beneath the proposed roadway and roadway embankment and for ease of fill placement and compaction, the area immediately adjacent to the culvert should be backfilled with granular structural backfill. In our opinion, the granular structural backfill should be compacted to 100 percent of maximum dry density obtained in accordance with AASHTO T 99 and INDOT Specifications. Hand- or remote-guided vibratory compactors are recommended for compacting the bedding material, if necessary, and material on either side of the pipe. The first several lifts of backfill over the culvert should also be compacted with small vibratory compactors to assure proper compaction is achieved and to prevent damage to the pipe from heavier, high-energy compactors.

In our opinion, the outer 10 ft of the "B" Borrow backfill, under the ends of the drainage structure, should be enveloped at the top, bottom, and outside ends, with a continuous length of permeable filter fabric. The purpose of the filter fabric is to act as a separator and reduce the likelihood of erosion from beneath the structure. This filter fabric should also extend the full width of the excavation. In addition, riprap and a permeable filter fabric should be used at the ends of the structure to protect the exposed "B" Borrow backfill. A cut-off wall should also be considered at both ends of the structures to prevent undermining.

In addition, dewatering of the soil is anticipated, and based on the soil types, it is our opinion that dewatering can likely be accomplished by installing slotted casing into a pit excavated 2 to 3 ft outside of the culvert excavation. It will also be necessary to redirect the ditch to prevent the surface flow from entering the excavation.

CONCLUDING REMARKS

In closing, we recommend that EEI be provided the opportunity to review the final design and project specifications to confirm that earthwork and foundation requirements have been properly interpreted and implemented in the design and specifications. We also recommend that EEI be retained to provide construction observation services during the earthwork and foundation construction phases of the project. This will allow us to verify that the construction proceeds in compliance with the design concepts, specifications and recommendations. It will also allow design changes to be made in the event that subsurface conditions differ from those anticipated.

We appreciate the opportunity to provide our services to you on this project. Please contact our office if you have any questions or need further assistance with the project.

Sincerely,
EARTH EXPLORATION, INC.

Michael S. Wigger, P.E.
Geotechnical Engineer

Scott J. Ludlow, Ph.D., P.E.
Principal Engineer

Appendices

APPENDIX A	-	Important Information about Your Geotechnical Report
APPENDIX B	-	Field Methods for Exploring and Sampling Soils and Rock
APPENDIX C	-	Exploratory Location Plan (Drawing No. 105-104.A1)
		Log of Test Boring - General Notes
		Log of Test Boring (5)
		Summary of Soundings
APPENDIX D	-	Summary of Special Laboratory Test Results
		Summary of Classification Test Results
		Grain Size Distribution Curve (4)

APPENDIX A

IMPORTANT INFORMATION ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you*—should apply the report for any purpose or project except the one originally contemplated.

Read the full report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions *only* at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an *opinion* about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject To Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of these provisions indicate where geotechnical engineers responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE

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UGER1000.10M

APPENDIX B

FIELD METHODS FOR EXPLORING AND SAMPLING SOILS AND ROCK

FIELD METHODS FOR EXPLORING AND SAMPLING SOILS AND ROCK

A. Boring Procedures Between Samples

The boring is extended downward, between samples, by a hollow stem auger (AASHTO* Designation T251-77), a continuous flight auger, driven and washed-out casing, or rotary boring with drilling mud or water.

B. Penetration Test and Split-Barrel Sampling of Soils

(AASHTO* Designation: T206-87)

This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140 pound weight falling freely through a distance of 30 inches. The sampler is first seated 6-inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance or N-Value. The blow counts are reported on the Test Boring Records per 6 inch increment. Recovered samples are first classified as to texture by the driller. Later, in the laboratory the driller's classification is reviewed by a soils engineer who examines each sample.

C. Thin-walled Tube Sampling of Soils

(AASHTO* Designation: T207-87)

This method consists of pushing a 2-inch or 3-inch outside diameter thin wall tube by hydraulic or other means into soils, usually cohesive types. Relatively undisturbed samples are recovered.

D. Soil Investigation and Sampling by Auger Borings

(AASHTO* Designation: T203-82)

This method consists of augering a hole and removing representative soil samples from the auger flight or bucket at 5-foot intervals or with each change in the substrata. Relatively disturbed samples are obtained and its use is therefore limited to situations where it is satisfactory to determine approximate subsurface profile.

E. Diamond Core Drilling for Site Investigation

(AASHTO* Designation: T225-83)

This method consists of advancing a hole in bedrock or other hard strata by rotating downward a single tube or double tube core barrel equipped with a cutting bit. Diamond, tungsten carbide, or other cutting agents may be used for the bit. Wash water is used to remove the cuttings. Normally, a 3-inch outside diameter by 2-inch inside diameter coring bit is used unless otherwise noted. The rock or hard material recovered within the core barrel is examined in the field and laboratory. Cores are stored in partitioned boxes and the length of recovered material is expressed as a percentage of the actual distance penetrated.

* American Association of State Highway and Transportation Officials, Washington D.C.

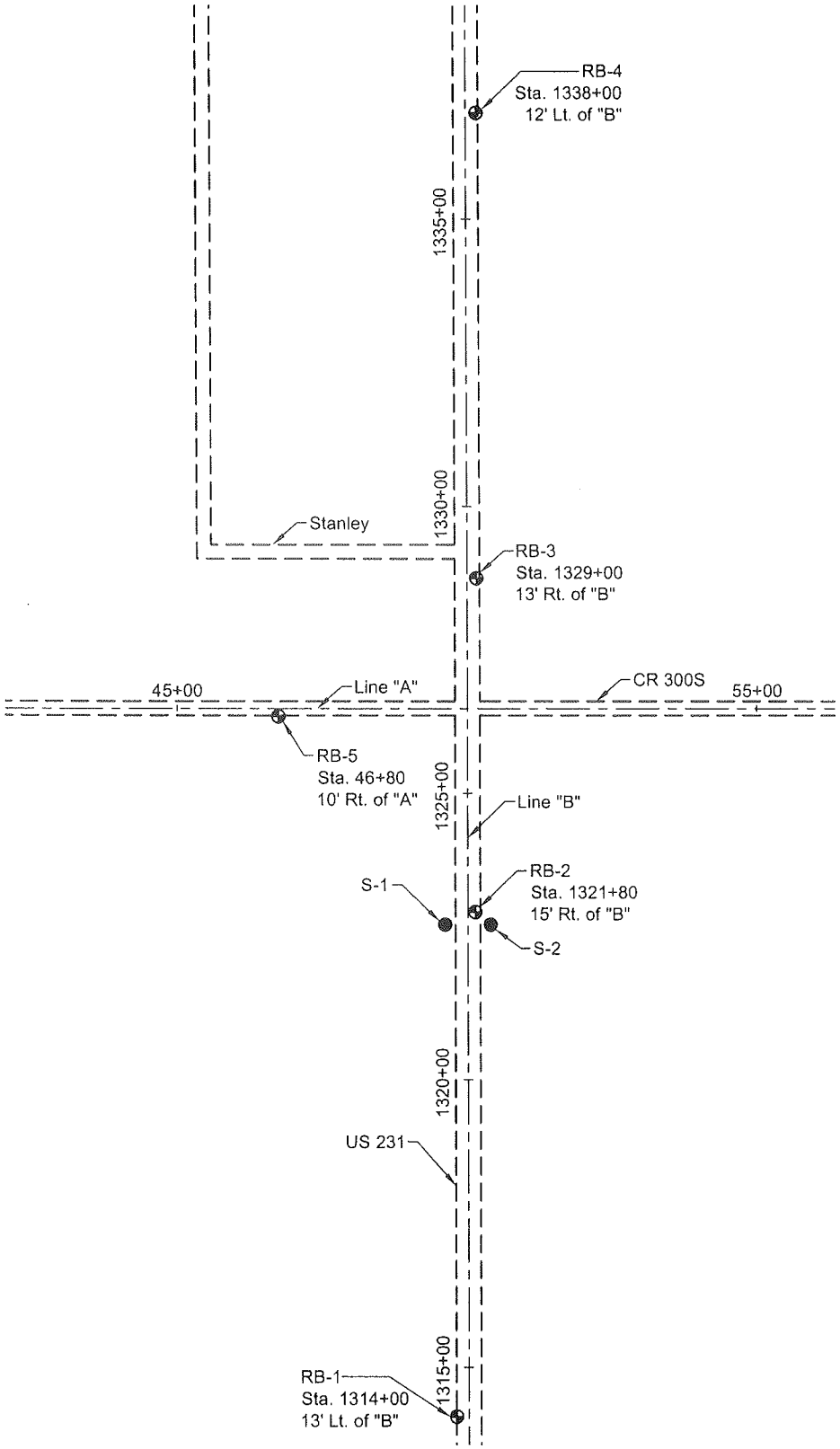
APPENDIX C

EXPLORATORY LOCATION PLAN
(Drawing No. 1-05-104.A1)

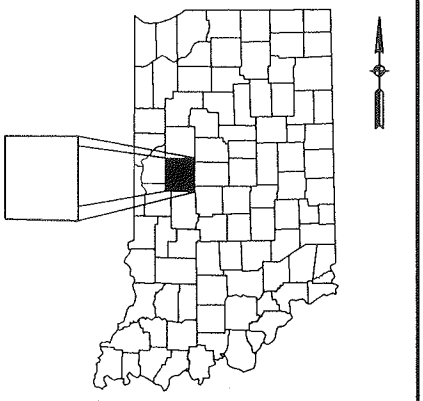
LOG OF TEST BORING - GENERAL NOTES

LOG OF TEST BORING (5)

SUMMARY OF SOUNDINGS



VICINITY MAP
N.T.S.



Montgomery County, Indiana

LEGEND

RB-1 Sta. 1314+00 22' Lt. of "B"	⊕	Test Boring Location, Designation, Station and Offset
S-1	●	Sounding Location and Designation

NOTES

1. Base map generated using commercially-available software by DeLorme (Street Atlas USA ver. 7.0).
2. Borings were located in the field by Earth Exploration, Inc.
3. Ground surface elevation at the test boring locations were interpolated to the nearest 1-ft based on topographic information provided on plans dated April 25, 2005.
4. Boring locations are approximate.
5. Soundings performed by hand in existing creek bed.

EXPLORATORY LOCATION PLAN

PROJECT:	US 231 and CR 300S Intersection Improvements
LOCATION:	Montgomery County, Indiana
CLIENT:	United Consulting Engineers & Architects
EEI PROJECT NO.:	1-05-104
APPROXIMATE SCALE:	1" = 300'

PROJECT ENG: MSW	
APPROVED BY: SJL	
DRAWN BY: JDR	
DATE AND TIME: 6-7-05 12:48:05	

EARTH EXPLORATION
7770 West New York Street
Indianapolis, IN 46214-2988
317-273-1690
(FAX) 317-273-2250

DRAWING NO.:

1-05-104.A1

LOG OF TEST BORING - GENERAL NOTES

DESCRIPTIVE SOIL CLASSIFICATION

GRAIN SIZE TERMINOLOGY

Soil Fraction		Particle Size	US Standard Sieve Size
Boulders		Larger than 75 mm	Larger than 3"
Gravel		2.00 to 75 mm	#10 to 75 mm
Sand:	Coarse	0.425 to 2.00 mm	#40 to #10
	Fine	0.075 to 0.425 mm	#200 to #40
Silt		0.002 to 0.075 mm	Smaller than #200
Clay		Smaller than 0.002 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

GENERAL TERMINOLOGY

Physical Characteristics
- Color, moisture, grain shape, fineness, etc.

Major Constituents
- Clay, silt, sand, gravel

Structure
- Laminated, varved, fibrous, stratified, cemented, fissured, etc.

Geologic Origin
- Glacial, alluvial, eolian, residual, etc.

RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Term	Defining Range by % of Weight
Trace	1 - 10%
Little	11 - 20%
Some	21 - 35%
And	36 - 50%

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	LOI
w/ trace organic matter	1 - 6%
w/ little organic matter	7 - 12%
w/ some organic matter	13 - 18%
Organic Soil (A-8)	19 - 30%
Peat (A-8)	More than 30%

RELATIVE DENSITY

Term	"N" Value
Very loose	0 - 5
Loose	6 - 10
Medium dense	11 - 30
Dense	31 - 50
Very Dense	51+

CONSISTENCY

Term	"N" Value
Very soft	0 - 3
Soft	4 - 5
Med stiff	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	31+

PLASTICITY

Term	Plastic Index
None to slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High/Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6-in. penetrations of the 2-in. split-barrel sampler. The sampler is driven with a 140-lb weight falling 30 in. and is seated to a depth of 6 in. before commencing the standard penetration test.

SYMBOLS

DRILLING AND SAMPLING

- AS - Auger Sample
- BS - Bag Sample
- C - Casing: Size 2½", NW; 4", HW
- COA - Clean-Out Auger
- CS - Continuous Sampling
- CW - Clear Water
- DC - Driven Casing
- DM - Drilling Mud
- FA - Flight Auger
- FT - Fish Tail
- HA - Hand Auger
- HSA - Hollow Stem Auger
- NR - No Recovery
- PMT - Borehole Pressuremeter Test
- PT - 3" O.D. Piston Tube Sample
- PTS - Peat Sample
- RB - Rock Bit
- RC - Rock Coring
- REC - Recovery
- RQD - Rock Quality Designation
- RS - Rock Sounding
- S - Soil Sounding
- SS - 2" O.D. Split-Barrel Sample
- 2ST - 2" O.D. Thin-Walled Tube Sample
- 3ST - 3" O.D. Thin-Walled Tube Sample
- VS - Vane Shear Test
- WPT - Water Pressure Test

LABORATORY TESTS

- qp - Penetrometer Reading, tsf
- qu - Unconfined Strength, tsf
- W - Moisture Content, %
- LL - Liquid Limit, %
- PL - Plastic Limit, %
- PI - Plasticity Index
- SL - Shrinkage Limit, %
- LOI - Loss on Ignition, %
- γ - Dry Unit Weight, pcf
- pH - Measure of Soil Alkalinity/Acidity

WATER LEVEL MEASUREMENT

- BF - Backfilled upon Completion
- NW - No Water Encountered

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

EARTH EXPLORATION, Inc.

LOG OF TEST BORING

Project **US 231 & CR 300S Intersection Improvements**
Location **Montgomery County, Indiana**
Client **United Consulting Engineers & Architects**

EARTH EXPLORATION Inc
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. **RB-1**
Elevation **796**
Datum **USC & GS**
EEI Proj. No. **1-05-104**
Sheet **1** of **1**

Proj. No.	NHS-081-5(014)	Struct. No.	---	Weather	Sunny 60° F	Driller	B.J.
Des. No.	0201249	Station	1314+00	Offset	13 ft Lt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (6 in.)							
					795	**GRANULAR SUBBASE**, (3 in.)							
SS-1	X	90	4-4-4			**PORTLAND CEMENT CONCRETE**, (6 in.)	2.5			17.9			
						CLAY LOAM, medium stiff, moist, brown, A-6, Lab No. 6814SL	0.5			---			
SS-2	X	100	4-5-6			**SANDY LOAM**, medium stiff to stiff, moist, brown, (visual)	2.0			---			
				5									
					790								
SS-3	X	100	4-4-5			**LOAM**, medium stiff to very stiff, moist, brown, with silty loam seam near 9' to 9½', A-4, Lab No. 6816SL	1.25			12.6			
SS-4	X	100	5-8-8	▽			3.25			15.3			
				10									
						End of Boring at 10 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	9½	NW	BF
To Cave-in		7½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start **5/4/05** End **5/4/05** Rig **CME 75**
Drilling Method **3¼" I.D. HSA** **Truck**
Remarks **Backfilled with auger cuttings, bentonite chips and concrete patch at surface.**

LOG OF TEST BORING

Project: US 231 & CR 300S Intersection Improvements
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-2
Elevation 796
Datum USC & GS
EEI Proj. No. 1-05-104
Sheet 1 of 1

Proj. No.	NHS-081-5(014)	Struct. No.	---	Weather	Sunny 50° F	Driller	B.J.
Des. No.	0201249	Station	1321+80	Offset	15 ft Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
					795	**ASPHALTIC CONCRETE**, (17 in.)							
SS-1	X	45	42-12-7			**GRANULAR SUBBASE**, (crushed stone; 5 in.)	0.75			21.1	35	14	21
SS-2	X	90	2-2-3	5		**CLAY LOAM**, stiff to very soft, moist to very moist, brown, (fill), A-6(11), Lab No. 6814SL	0.5			17.2			
SS-3	X	100	1-1-2		790		0.25			23.5			
SS-4	X	100	2-2-3	10		**SILTY LOAM**, soft, moist, brown to gray below 9½', (fil), A-4, Lab No. 6815SL	0.25			29.4			
SS-5	X	100	1-2-3		785		0.5			13.5			
SS-6	X	100	3-3-4	15		**CLAY LOAM**, soft to medium stiff, moist, brown to gray below 16', A-6, Lab No. 6814SL	0.75			11.5			
SS-7	X	100	4-4-8		780		2.5			11.1			
SS-8	X	100	5-6-8	20		**LOAM**, stiff, moist, gray, A-4, Lab No. 6816SL	4.0			10.7			
						End of Boring at 20 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	14	NW	BF
To Cave-in		17	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 5/4/05 End 5/4/05 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION, Inc.

LOG OF TEST BORING

Project: US 231 & CR 300S Intersection Improvements
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects
7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-3
Elevation 814
Datum USC & GS
EEI Proj. No. 1-05-104
Sheet 1 of 1

Proj. No.	NHS-081-5(014)	Struct. No.	---	Weather	Sunny 45° F	Driller	B.J.
Des. No.	0201249	Station	1329+00	Offset	13 ft Rt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (7 in.)							
SS-1		100	0-2-4			**SILTY LOAM**, very soft, very moist, brown, A-4(6), Lab No. 6815SL	0.75			26.1	29	21	8
						SILTY CLAY LOAM, medium stiff, moist, brown, A-7-6 Lab No. 6817SL	1.0			23.1			
SS-2		100	3-4-5		810		2.0			12.8			
				5									
SS-3		100	3-4-6			**LOAM**, medium stiff, moist, brown and gray, A-4, Lab No. 6816SL	1.0			12.4			
SS-4		100	3-4-6		805		1.25			11.8			
				10		**SILTY LOAM**, medium dense, moist, gray, (visual)							
SS-5		100	11-14-22			**SANDY LOAM**, hard, moist, brown to gray below 12', (visual)	>4.5			7.6			
						End of Boring at 12.5 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ 3 hrs After Drilling
To Water	12	8½	5
To Cave-in		9	8½

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 5/4/05 End 5/4/05 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION Inc

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

LOG OF TEST BORING

Project: US 231 & CR 300S Intersection Improvements
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects

Boring No.: RB-4
Elevation: 816
Datum: USC & GS
EEI Proj. No.: 1-05-104
Sheet: 1 of 1

Proj. No.	NHS-081-5(014)	Struct. No.	---	Weather	Sunny 40° F	Driller	B.J.
Des. No.	0201249	Station	1338+00	Offset	12 ft Lt. "B"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
					815	**ASPHALTIC CONCRETE**, (8 in.)							
						PORTLAND CEMENT CONCRETE, (9 in.)							
SS-1	X	100	3-3-4				0.75			12.6	17	14	3
SS-2	X	100	3-3-5	5			1.5			12.0			
SS-3	X	100	3-4-4		810	**LOAM**, medium stiff, moist, brown and gray to gray below 11', A-4(0), Lab No. 6816SL	1.25			12.7			
SS-4	X	100	3-3-5	10			1.75			12.6			
SS-5	X	100	2-3-4		805		1.0			---			
						End of Boring at 12.5 ft							

WATER LEVEL OBSERVATIONS

Depth ft	While Drilling	Upon Completion	After Drilling
To Water	NW	NW	BF
To Cave-in		9	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 5/4/05 End 5/4/05 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

EARTH EXPLORATION, Inc.

LOG OF TEST BORING

Project: US 231 & CR 300S Intersection Improvements
Location: Montgomery County, Indiana
Client: United Consulting Engineers & Architects

7770 West New York Street - Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

Boring No. RB-5
Elevation 807
Datum USC & GS
EEI Proj. No. 1-05-104
Sheet 1 of 1

Proj. No.	NHS-081-5(014)	Struct. No.	---	Weather	Sunny 65° F	Driller	B.J.
Des. No.	0201249	Station	46+80	Offset	10 ft Rt. "A"	Inspector	---

SAMPLE No.	Type	Rec %	Blow Counts	Depth ft	Elev	DESCRIPTION/CLASSIFICATION and REMARKS	q_p tsf	q_u tsf	γ_d pcf	W %	LL %	PL %	PI %
						ASPHALTIC CONCRETE, (5 in.)							
SS-1		90	3-3-3		805	**SILTY LOAM**, medium stiff, moist, dark brown, A-4, Lab No. 6815SL	1.75			21.8			
						SILTY CLAY LOAM, medium stiff, moist, brown, A-7-6(20), Lab No. 6817SL	1.25			24.2	41	15	26
SS-2		90	2-1-2	5		**LOAM**, very soft, very moist, brown, with occasional sandy loam seams, A-4, Lab No. 6816SL	0.5			14.2			
SS-3		90	8-13-12		800	**GRAVELLY SAND**, medium dense, wet, brown, (visual)							
SS-4		90	3-5-8	10		**LOAM**, stiff, moist, brown, A-4, Lab No. 6816SL	1.25			10.1			
						End of Boring at 10 ft							

WATER LEVEL OBSERVATIONS

Depth ft	▽ While Drilling	▼ Upon Completion	▽ After Drilling
To Water	6	6	BF
To Cave-in		6½	

The stratification lines represent the approximate boundary between soil/rock types and the transition may be gradual.

GENERAL NOTES

Start 5/4/05 End 5/4/05 Rig CME 75
Drilling Method 3¼" I.D. HSA Truck
Remarks: Backfilled with auger cuttings, bentonite chips and concrete patch at surface.

SUMMARY OF SOUNDINGS

Project: US 231 and CR 300S Intersection Improvements
Location: Montgomery County, Indiana
Project No.: NHS-081-5(014)
Client: United Consulting Engineers & Architects
EEI Project No.: 1-05-104
Date: June 7, 2005
Method: Probe Rod

Sounding No.	Station	Offset Line "A"	Approx. Ground Surface Elevation	Depth Interval (ft)	Description – Based on Rod Penetration Resistance
S-1	1321+66	60 ft Lt.	783	0-2 2	Loose/Soft Conditions Medium Stiff to Stiff Cohesive-type Soil
S-2	1321+66	60 ft Rt.	783	0-3 3	Loose/Soft Conditions Medium Stiff to Stiff Cohesive-type Soil

APPENDIX D

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

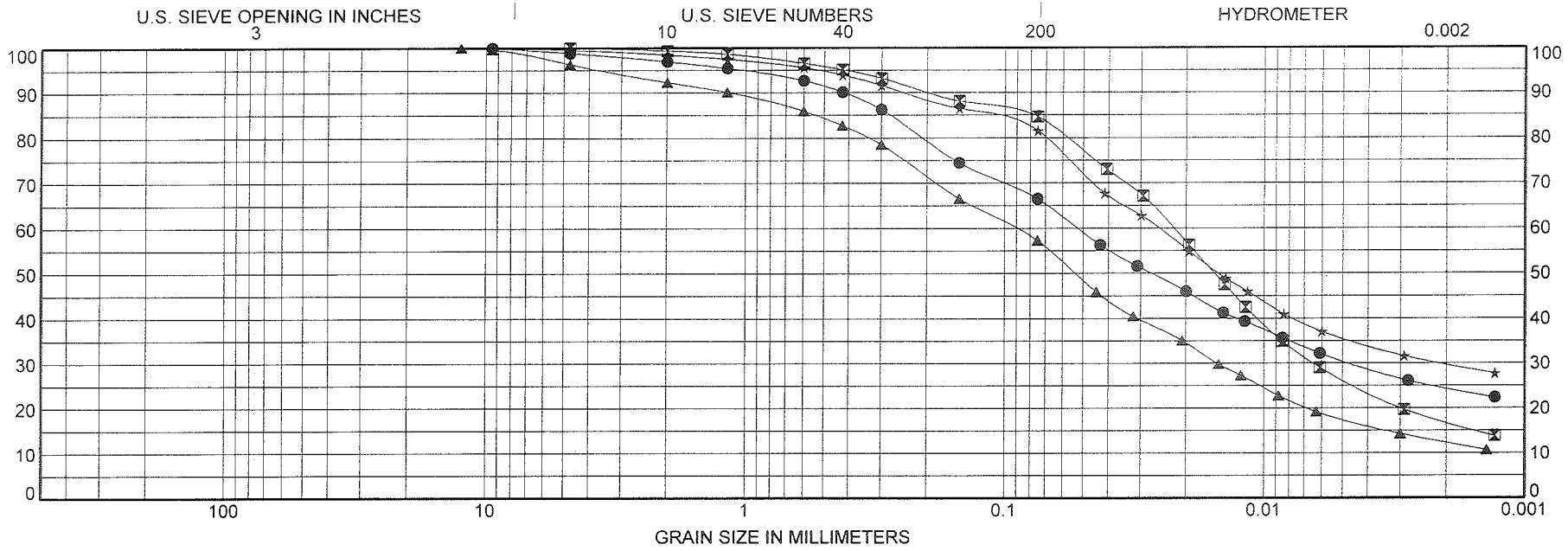
SUMMARY OF CLASSIFICATION TEST RESULTS

GRAIN SIZE DISTRIBUTION CURVE (4)

SUMMARY OF SPECIAL LABORATORY TEST RESULTS

Project: US 231 & CR 300S Intersection Improvements
Location: Montgomery County, Indiana
Project No.: STP-9954( )
DES No.: 0201249
Client: United Consulting Engineers & Architects
EEI Project No.: 1-05-104

Laboratory Number	Test Boring No.	Sample Number	Sample Depth Interval, ft	Moisture Content, %	pH
6818SL	RB-1	SS-1	1-2.5	17.9	
6818SL		SS-3	6-7.5	12.6	
6818SL		SS-4	8.5-10	15.3	
6814SL	RB-2	SS-1	1-2.5	21.1	7.7
6818SL		SS-2	3.5-5	17.2	
6818SL		SS-3	6-7.5	23.5	
6818SL		SS-4	8.5-10	29.4	
6818SL		SS-5	11-12.5	13.5	
6818SL		SS-6	13.5-15	11.5	
6818SL		SS-7	16-17.5	11.1	
6818SL		SS-8	18.5-20	10.7	
6815SL	RB-3	SS-1T	1-2.5	26.1	7.2
6818SL		SS-1B	1-2.5	23.1	
6818SL		SS-2	3.5-5	12.8	
6818SL		SS-3	6-7.5	12.4	
6818SL		SS-4	8.5-10	11.8	
6818SL		SS-5	11-12.5	7.6	
6816SL	RB-4	SS-1	1-2.5	12.6	7.4
6818SL		SS-2	3.5-5	12.0	
6818SL		SS-3	6-7.5	12.7	
6818SL		SS-4	8.5-10	12.6	
6818SL	RB-5	SS-1T	1-2.5	21.8	
6817SL		SS-1B	1-2.5	24.2	7.3
6818SL		SS-2	3.5-5	14.2	
6818SL		SS-4	8.5-10	10.1	



BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Lab No.	Boring	Station/Offset/Line	Sample No.	Depth ft	Classification	% Passing			% Gravel	% Sand	% Silt	% Clay	% Coll.	LL	PL	PI	Opt. Moist.	γmax pcf	* CBR at	
							No.10	No.40	No.200											93%	97%
●	6814SL	RB-2	1321+80 15 ft Rt. "B"	SS-1	1.0 - 2.5	CLAY LOAM A-6 (11)	97.0	90.1	66.5	3.0	30.5	42.0	24.5	21.4	35	14	21				
⊠	6815SL	RB-3	1329+00 13 ft Rt. "B"	SS-1	1.0 - 2.5	SILTY LOAM A-4 (6)	99.3	95.2	84.6	0.7	14.7	67.7	17.0	12.3	29	21	8				
▲	6816SL	RB-4	1338+00 12 ft Lt. "B"	SS-1	1.0 - 2.5	LOAM A-4 (0)	92.3	82.8	57.3	7.7	35.0	44.9	12.4	9.0	17	14	3				
★	6817SL	RB-5	46+80 10 ft Rt. "A"	SS-1	1.0 - 2.5	SILTY CLAY LOAM A-7-6 (20)	98.4	94.0	81.6	1.6	16.8	51.8	29.8	26.4	41	15	26				

EARTH EXPLORATION

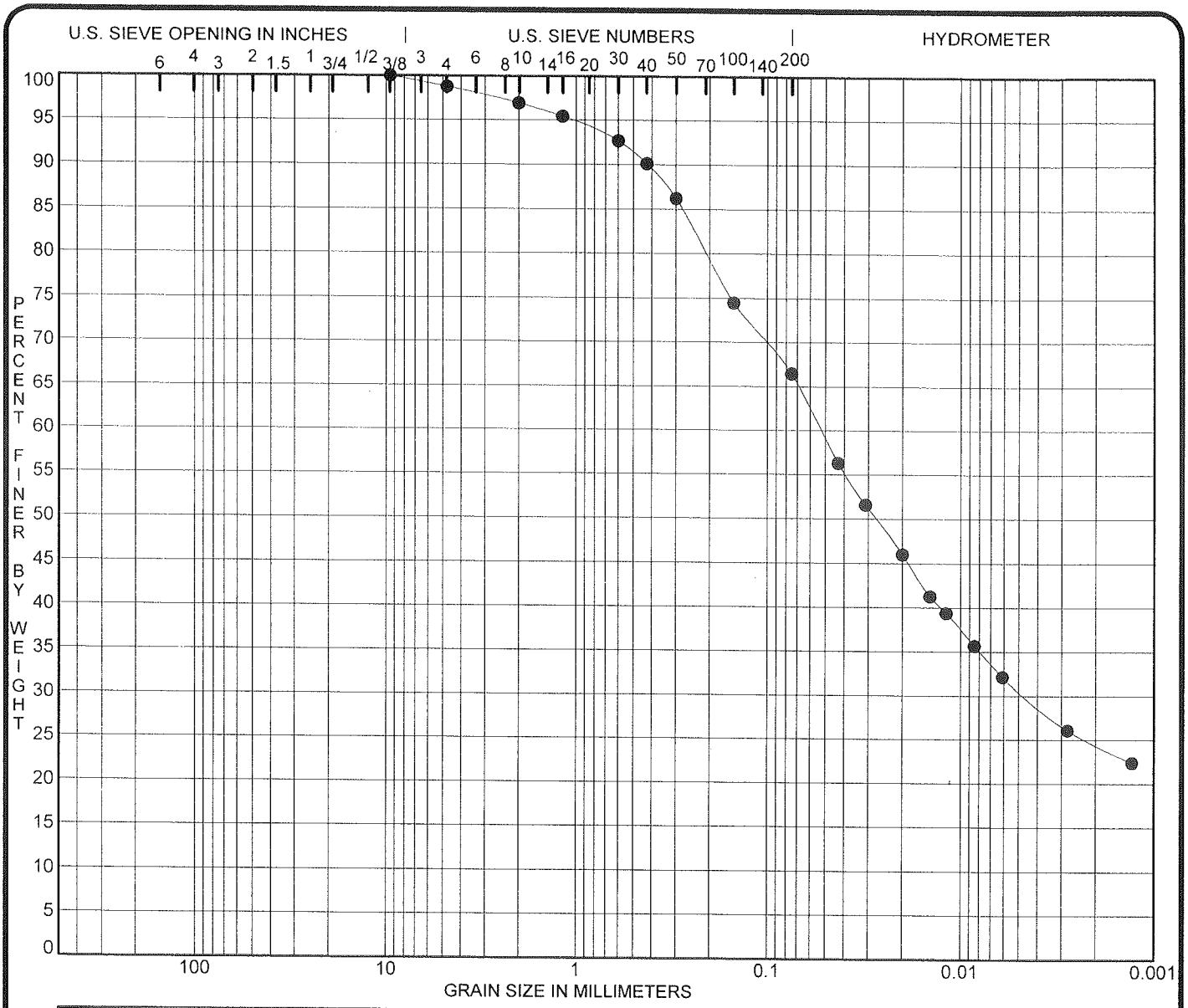
Project No. NHS-081-5(014)
Structure No. ---
EEI Project No. 1-05-104

Project Location US 231 & CR 300S Intersection Improvements
Montgomery County, Indiana
Client United Consulting Engineers & Architects

SUMMARY OF CLASSIFICATION TEST RESULTS

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)

* See text for recommended values.



BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
RB-2	SS-1	1321+80 15 ft Rt. "B"	1.0 - 2.5 ft.	795.0 - 793.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6814SL	CLAY LOAM A-6 (11)	7.7	3.0	30.5	42.0	24.5	20.1	35	14	21

Remarks:

EARTH EXPLORATION Inc

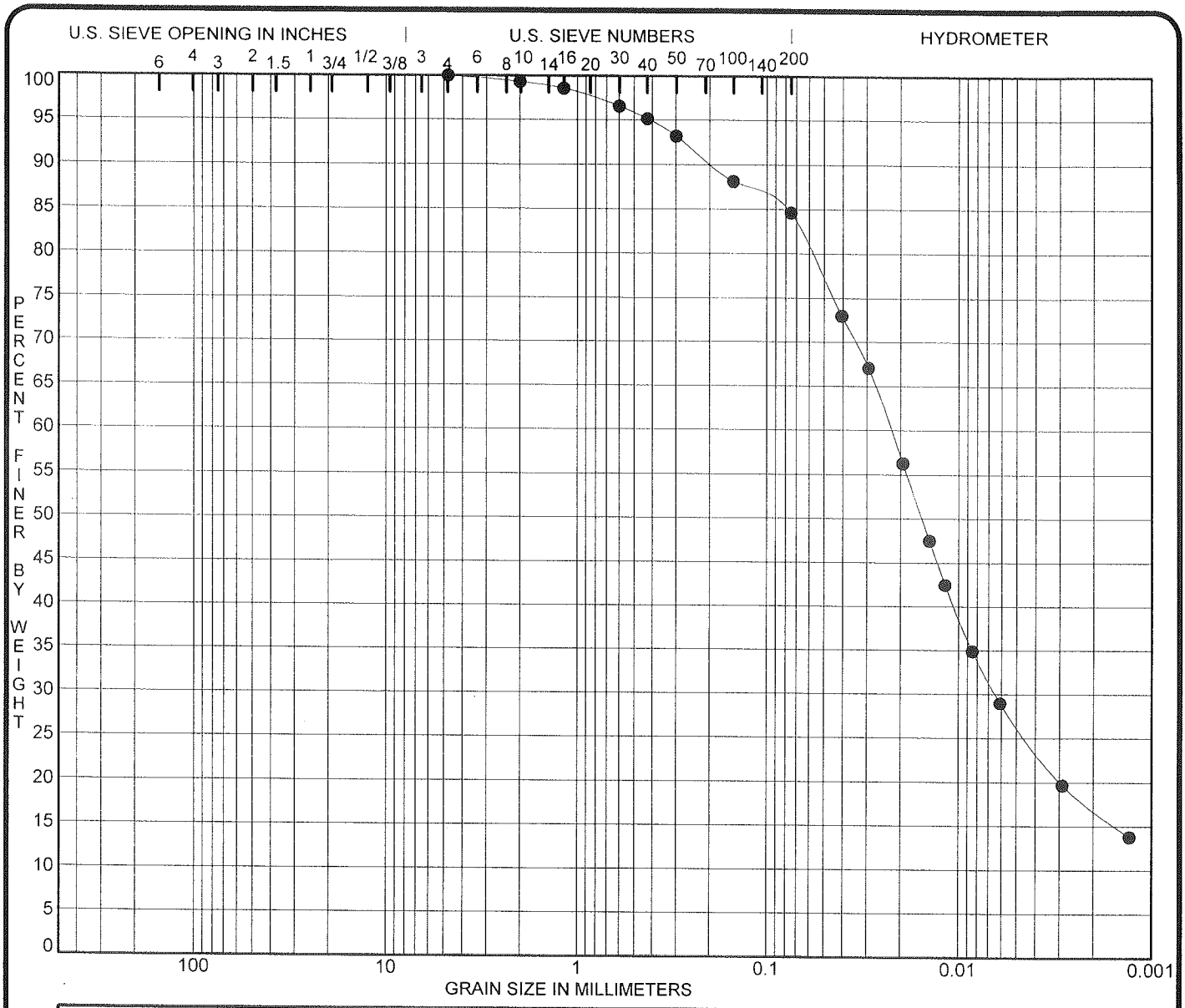
Project No. NHS-081-5(014) **Project** US 231 & CR 300S Intersection Improvements

Structure No. --- **Location** Montgomery County, Indiana

EEI Proj. No. 1-05-104 **Client** United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
317-273-1690 / 317-273-2250 (Fax)



BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
●	RB-3	SS-1	1329+00 13 ft Rt. "B"	1.0 - 2.5 ft.	813.0 - 811.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6815SL	SILTY LOAM A-4 (6)	7.2	0.7	14.7	67.7	17.0	26.1	29	21	8

Remarks:

EARTH EXPLORATION Inc

Project No. NHS-081-5(014)
Structure No. ---
EEI Proj. No. 1-05-104

Project US 231 & CR 300S Intersection Improvements
Location Montgomery County, Indiana
Client United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

Earth Exploration, Inc.
7770 West New York Street Indianapolis, Indiana 46214
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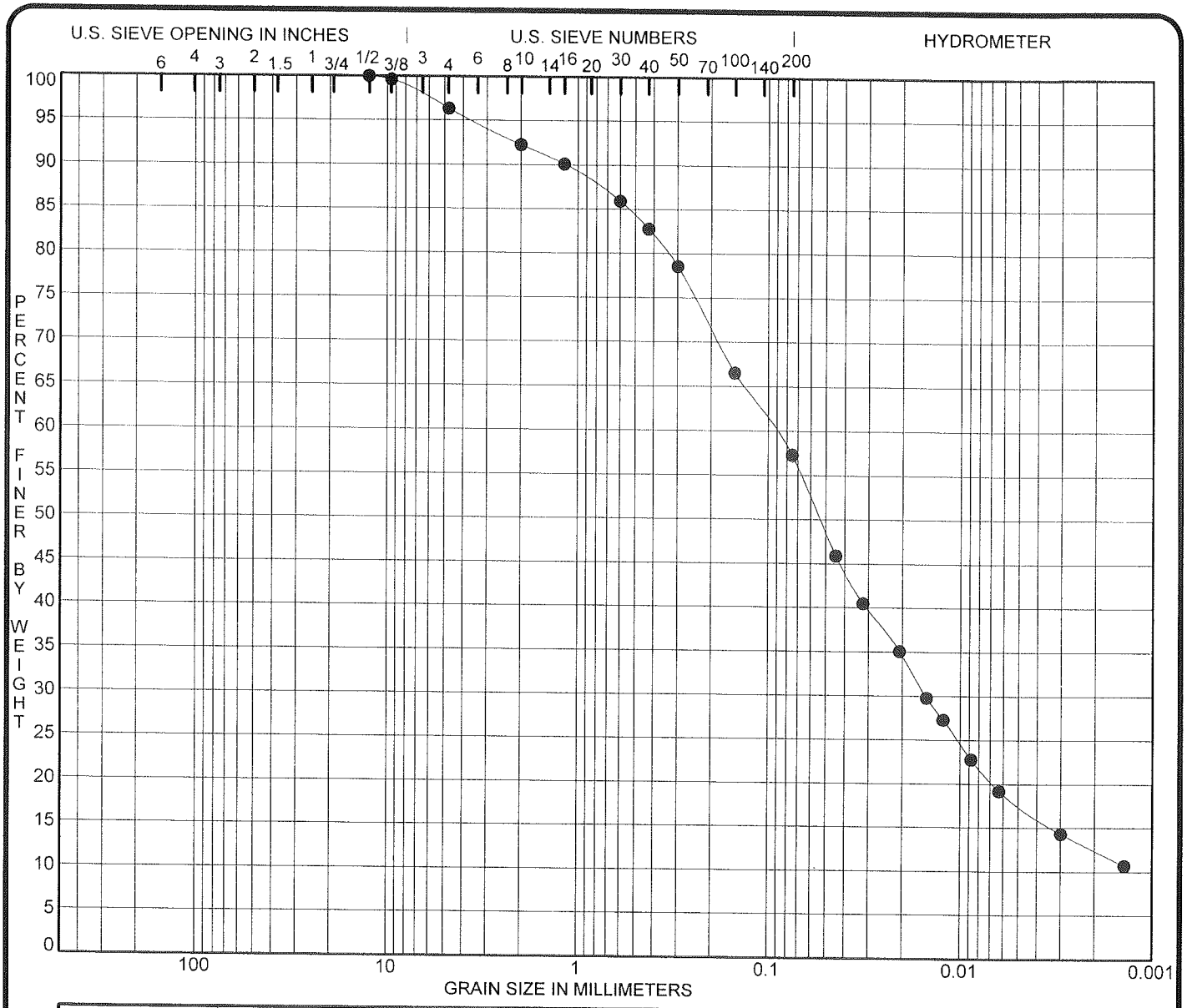

BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
● RB-4	SS-1	1338+00 12 ft Lt. "B"	1.0 - 2.5 ft.	815.0 - 813.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6816SL	LOAM A-4 (0)	7.4	7.7	35.0	44.9	12.4	12.6	17	14	3

Remarks:

EARTH EXPLORATION Inc

Project No. NHS-081-5(014) **Project** US 231 & CR 300S Intersection Improvements

Structure No. --- **Location** Montgomery County, Indiana

EEI Proj. No. 1-05-104 **Client** United Consulting Engineers & Architects

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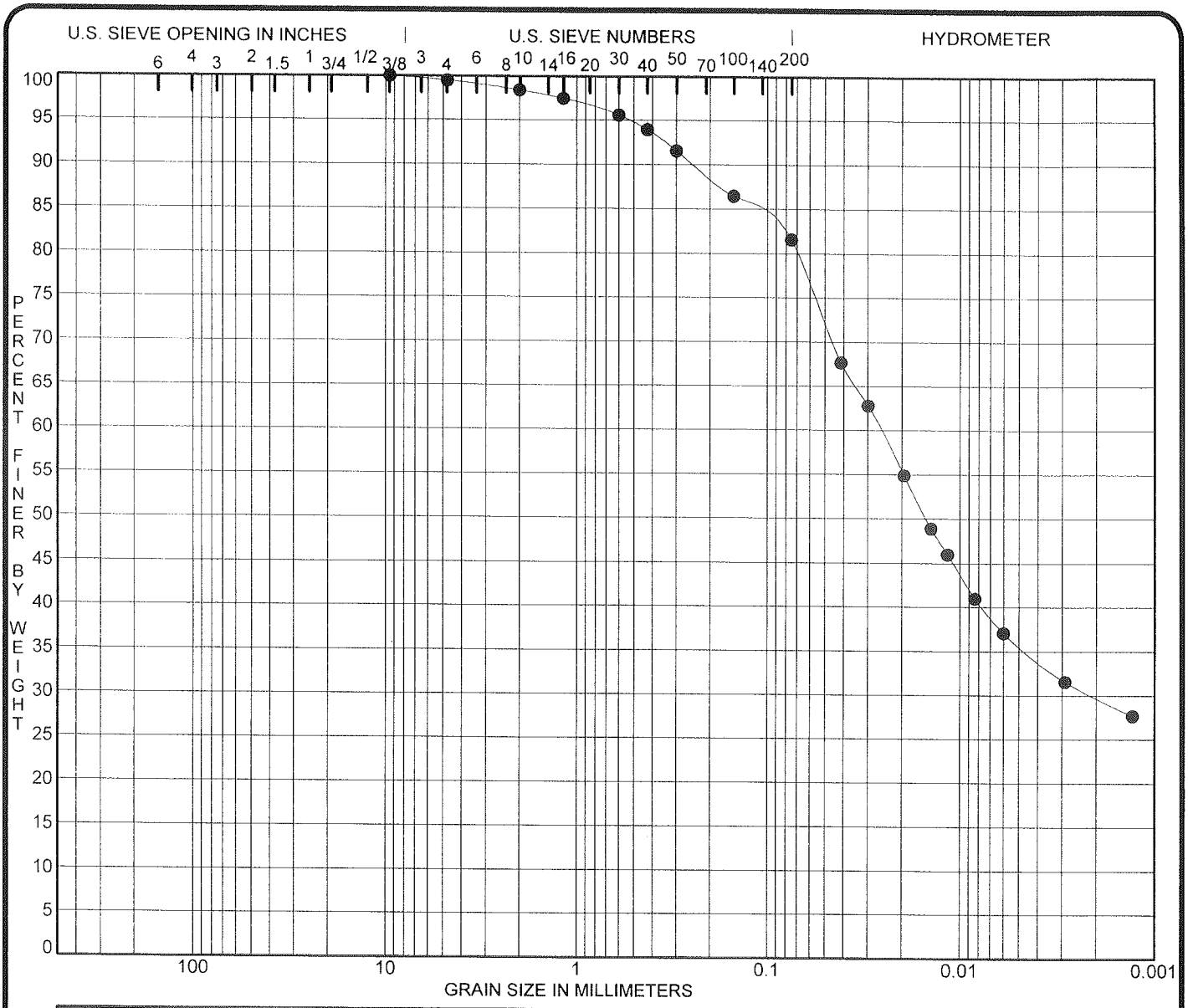

BOULDERS	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Sample Identification		Station / Offset / Line	Depth, ft.	Elevation, USCGS
●	RB-5	SS-1	46+80 10 ft Rt. "A"	1.0 - 2.5 ft.	806.0 - 804.5

Lab No.	Classification	pH	%Gravel	%Sand	%Silt	%Clay	MC%	LL	PL	PI
6817SL	SILTY CLAY LOAM A-7-6 (20)	7.3	1.6	16.8	51.8	29.8	24.2	41	15	26

Remarks:

EARTH EXPLORATION INC

Project No. NHS-081-5(014) **Project** US 231 & CR 300S Intersection Improvements

Structure No. --- **Location** Montgomery County, Indiana

EEI Proj. No. 1-05-104 **Client** United Consulting Engineers & Architects

GRAIN SIZE DISTRIBUTION CURVE

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