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April 23, 2015

Fisher Associates
135 Calkins Road
Rochester, New York 14623

Attn: Daniel P. Yanosh Jr., P.E.

Re: Preliminary Geotechnical Evaluation
Existing NYSDOT Maintenance Facility
3rd Street
Ithaca, New York
Empire Geo Project No. BE-15-049

Dear Mr. Yanosh:

This report presents the results of a subsurface exploration program and preliminary geotechnical engineering evaluation completed by Empire Geo-Services, Inc. (Empire) for the planned commercial redevelopment of the existing NYSDOT maintenance facility site located on 3rd Street in the city of Ithaca, Tompkins County, New York. The approximate location of the project site is shown on Figure 1.

Fisher Associates retained Empire to complete this work, which was done in general accordance with our proposal number PBE-14-247, last revised February 27, 2015. SJB Services, Inc. (SJB), our affiliated drilling and materials testing company, completed the subsurface exploration program which included the advancement of conventional test borings at the project site.

On this basis, Empire prepared this report, which summarizes the subsurface conditions revealed by the test borings and presents general/preliminary geotechnical considerations and recommendations to assist in planning for design and construction of future foundations, floor slabs, pavements and associated earthwork at the site.

1.0 SITE AND PROJECT DESCRIPTION

The project site is approximately eight acres in size and is located on the Cayuga Inlet waterfront. The site is currently occupied with three principal structures: a main building with office and garage space, a utilitarian type outbuilding, and a salt storage dome. Adjoining properties include the Ithaca Farmers Market to the north and the Cornell University Rowing Center to the south. The main building is a single story structure built in 1958 which is reportedly supported on large (9' x 9') spread footings; no significant structural issues were reported in connection with the building and none were observed. The existing DOT facility is to be relocated to a site in the village of Dryden.

As we understand it, no specific redevelopment plan has yet been established, but it is envisioned the existing buildings/structures will be removed and that plans might ultimately include the construction of a new three to five-story wood-frame building somewhere on the site. The building would likely have CMU or cast-in-place foundation walls. It would also likely feature an elevator, and a basement may or may not be included. Proposed grades would likely be kept similar to existing grades so as to minimize earthwork, although this is uncertain at this time.

Topography in the site locale consists of lowlands at the south end of Cayuga Lake, and while it is relatively flat in the project area, prominent hillsides rise to the west and east (at distances of about 1,500 feet and 4,000 feet, respectively). USGS data indicates the water surface elevation in the Cayuga Inlet is typically in the range of 379 to 383 feet above NGVD 1929.

Representatives of the Ithaca Building Department indicate there has been a number of foundation related issues with buildings in the site locale with similar soil conditions. In the commercial corridor about a mile south of the site, the Cellular One building at 725 South Meadow Street, which was built in the late 1990s, exhibited chronic foundation problems and was razed within the last year or two. Additionally, the Bed Bath and Beyond store was closed temporarily to allow foundation repairs, and the Lowe's store parking lot has exhibited excessive settlement. A newer Panera Bread building is reportedly supported on a deep foundation system, as is the Lowe's building and some others. Timber piles, helical piles and pipe piles are reportedly among the deep foundation systems in use in the area, and pile supported structures are evidently performing satisfactorily. A newer building at the Cornell rowing center (immediately south of the subject site) was recently constructed on a mat foundation.

2.0 METHOD OF INVESTIGATION

Test Borings

Subsurface conditions at the site were investigated through the completion of three test borings (designated as B-1 through B-3) at the approximate locations depicted on the subsurface investigation plan (Figure 2). The target borehole locations were selected by Fisher Associates, and were staked/marked in the field using taped measurements from existing site features; the actual locations were established within the limitations of equipment access and underground/overhead utilities. The ground surface elevation at each borehole was determined using differential leveling and referenced to a temporary benchmark (floor of garage area, main building, with an elevation of 394.0 feet as indicated on a DOT record drawing provided for our use).

The test borings were completed between March 18 and 20, 2015 using a Central Mine Equipment (CME) model 75 truck-mounted drill rig equipped with hollow stem augers. As the augers were advanced, the soils were sampled in accordance with ASTM D1586 – Standard Method for Penetration Test and Split-Barrel Sampling of Soils. Split spoon samples and standard penetration tests (SPTs) were taken continuously from the ground surface to a nominal depth of 12 feet, and at standard five foot intervals thereafter to the borehole termination depths. The boreholes were thus advanced to total depths of 25.0 to 97.0 feet below existing grade.

Representative portions of the recovered soil samples were transported to Empire's office, whereupon a geotechnical engineer prepared individual test boring logs based on visual classification of the recovered soil samples and review of the driller's field notes. The soil samples were described based on a visual/manual estimation of grain size distribution, and characteristics such as color, texture, moisture content, relative density, consistency, etc. The subsurface logs are presented in Attachment A, along with general information and a key of terms and symbols used in their preparation.

<u>Observation Well</u>

A temporary groundwater observation well was installed in test boring B-2 upon its completion to allow periodic measurement of static water level at that location. The well was set at a depth of 23.0 feet, and consists of 2-inch diameter PVC with machine-slotted screen and riser pipe, along with a sand filter, bentonite seal and protective flush-mount cover. The well is identified as MW B-2, and a well completion detail sheet is included with the subsurface log for borehole B-2.

<u>Laboratory Testing</u>

Selected recovered samples from the test borings were tested in our soils laboratory as part of the subsurface investigation, to confirm the visual classifications and to provide index properties for our use in the geotechnical evaluation. This testing was performed in general accordance with the following standard methods:

- Moisture content by ASTM D2216 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- Grain size by ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- Particle size by ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils
- Organic content by ASTM D2974 – Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
- Atterberg limits by ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

Individual samples were tested as summarized in the following table. Laboratory test results are presented in Attachment B.

Table 1 - Summary of Laboratory Testing Performed							
Test Boring	Sample No.	Depth (ft)	Moisture Content	Sieve Analysis	Hydrometer	Organic Content	Atterberg Limits
B-1	S-5	8-10	x		x	x	x
B-1	S-8	20-22	x	x		x	
B-1	S-11	35-37	x		x		x
B-2	S-4	6-8	x		x		x
B-2	S-6	10-12	x		x	x	
B-3	S-7	15-17	x		x		x
B-3	S-8	20-22	x			x	
B-3	S-10	30-32	x		x	x	x
B-3	S-15	55-57	x		x		
B-3	S-19	75-77	x	x			
B-3	S-21	85-87	x	x			
B-3	S-23	95-97	x	x			

3.0 SUBSURFACE CONDITIONS

The test borings revealed several feet of essentially granular fill followed by deep, soft lacustrine deposits with organics. The individual subsurface logs should be referenced for the conditions at each test boring location. A summary of these conditions by stratum is provided below.

Surface and Fill Materials

Asphalt pavement approximately 0.5 feet thick was present at the ground surface at borehole B-2, and about 0.4 feet of crushed stone was present at B-3; no distinct surface material was noted at B-1. Directly beneath any surface material that was present, fill soils were disclosed to depths of about six to eight feet at the test boring locations. The fill was very loose to compact in relative density overall (typically loose) and generally comprised of silty sands and sandy silts with lesser amounts of gravel or clay. Relatively minor amounts of organics, peat and/or glass were also noted within the fill in places as indicated by the recovered samples.

Indigenous Soils

The native lacustrine deposits underlying the fill were generally comprised of silts with lesser amounts of clay, sand and/or organics, occasionally interlayered with peat (composed primarily of organic matter), and occasionally with sand as the prevalent grain size. These soils were typically very soft/loose in consistency and extended to depths of about 23 to 30 feet. Below this, the fine-grained deposits graded to clayey silt with trace to little amounts of embedded small shells and plant matter, exhibiting the characteristics of marl, again for the most part very soft in consistency. The marl deposit was present to depths of 45 to 50 feet or greater.

Underlying the marl were very loose sandy silts to a depth of about 75 feet, then interlayered silty sands, sandy silts and clayey silts to the extent of the depths explored at 97.0 feet below existing grade. Soils below 75 feet were typically loose to firm in relative density; little amounts of gravel were noted near the borehole termination depth at B-3.

The native soils encountered are classified among the ML, SM, MH and Pt group soils using the Unified Soil Classification System (USCS), and as previously indicated, are for the most part especially soft/loose in relative consistency/density.

The laboratory test data indicate the fine-grained deposits are low to marginally high plasticity silts and clays with organics. Measured liquid limits ranged from 29 to 53 percent, and corresponding plastic limits ranged from NP (not plastic) to 43 percent; plasticity indices ranged from NP to 10 percent. The natural moisture content of these soils was 30.1 to 93.2 percent, and was typically near or above the liquid limit. Organic content in the samples tested for that parameter was in the range of 1.9 to 21.4 percent. Consolidation testing performed on these lacustrine deposits for other projects in the area indicates a compression index (C_c) in the range of 0.18 to 0.48 for soils with organic content between 4.2 to 11.8 percent; the compression index of primarily organic soil layers is expected to be considerably greater.

Bedrock

Bedrock was not encountered within the depths explored for this study. For information purposes, the Geologic Map of New York, Finger Lakes Sheet (New York State Education Department, 1970) maps bedrock underlying the project area as shales, siltstones and limestones of the Genesee group.

Groundwater Conditions

Water level measurements were periodically made as the boreholes were advanced and/or upon the completion of sampling, and these measurements are noted on the subsurface logs. It should be understood that time sufficient for groundwater to enter the augers and achieve a static level likely did not elapse prior to these measurements being taken, given that permeability of the fine-grained soils is expected to be rather slow.

Based on the degree of wetness of the recovered soil samples and water level measurements in the boreholes and observation well, it appears that groundwater is present at a depth of about four to eight feet below existing grade, this being at or near the interface of the fill and native soils, and near to (or a few feet above) water levels in the Cayuga Inlet.

Water levels periodically measured at the MW B-2 observation well are tabulated below:

Table 2 - Observation Well Water Level Summary at MW B-2		
Date	Measured Water Level in Well	
	Depth Below Grade (ft.)	Elevation (ft.)
3/24/15	8.7	383.8
4/20/15	6.2	386.3
Approx. Ground Surface Elevation at Well (ft.)	392.5	

Water may also have a tendency to become trapped in the upper fill soils and/or perched upon the relatively impermeable native clayey soils below. It should be expected that groundwater levels, and the quantity/extent of any perched water, will vary with seasonal fluctuations in precipitation, runoff and water levels in the Cayuga Inlet.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Planning for design and construction of future structures will be impacted primarily by the presence of fill and especially soft/compressible native soils, along with relatively shallow groundwater. The fill varies in composition and is typically loose, while the native clayey deposits with organics under the fill are of low strength and are expected to be highly compressible.

Considering the poor subgrade conditions, Empire has evaluated three options for design of the new buildings including: a) pile foundation system, b) conventional spread foundations, and c) mat foundation system. Each of these alternatives is described in further detail subsequently.

Regardless of the foundation system chosen, it should be understood that any planned grade increases would be expected to induce some consolidation settlement in the soft native soils. Should any grade increases ultimately be planned, we recommend the fill/grading across the site be performed well in advance of building construction and allowed to sit, so as to permit the underlying soft/compressible soils to fully consolidate under the weight of the added fill and/or surcharge. Pre-loading and/or surcharging the building area may also be considered as a means of mitigating building settlement potential, depending on foundation type. Also depending on foundation type and other details of the proposed configuration, the use of transition slabs and/or flexible utility connections may be warranted to accommodate any chronic differential movement that may occur between the finished building and surrounding ground.

The required waiting period for a pre-loading program would depend on the consolidation rate of the soils, but may take upwards of several months; this should be understood and accommodated in developing the project schedule. Settlement plates should be installed as part of a settlement monitoring program so as to track the rate and total amount of settlement that occurs.

4.1 Building Foundations

The following building foundation options are presented in no particular order of preference, as each is viewed as potentially workable, depending on the specific type and configuration of the structure(s) ultimately built. It may be prudent to perform additional boreholes once a specific building location and configuration is settled on, so as to confirm the conditions at that location and allow a more refined geotechnical evaluation.

Pile Foundations

A driven displacement pile foundation system may be considered for support of the building. With this option, the existing fill may be left in place and the new building structure and floor slab supported on piles. In general, no suitable stratum was disclosed that would support end bearing piles, and in the absence of a suitable end bearing stratum, the piles must develop their capacity primarily through friction in the native soils. As the native soils were soft and/or loose, pile capacities will be limited.

For preliminary planning purposes, an allowable static capacity of 20 kips may be assumed for a single tapered timber pile (7-inch tip and 11-inch butt) driven to a nominal depth of 50 feet or greater. This pile embedment depth and estimated capacity was determined based on a theoretical static analysis and should be satisfactory for preliminary design purposes. The actual production pile lengths may vary and should be determined based on the results of a test pile program, as described in section 4.5. Other types of piles may offer a satisfactory alternative to timber piles, as material availability, cost, contractor preference or expertise with a given type of pile, or other factors which may render one type of pile more attractive than another; Empire would be pleased to consult further on this as necessary. A pile foundation system will provide the greatest level of assurance against excessive building settlement.

It is reiterated that if grade increases are planned, the site should be pre-loaded as necessary to take consolidation settlement of the soft/organic soils induced by new loads "out of the system". Fill which is placed on soils which are not sufficiently consolidated prior to construction may result in downdrag loads on piles in excess of their capacity, or relative settlement/movement of the ground outside the building which is otherwise stationary on piles.

Conventional Spread Foundation System

As large spread footings have apparently performed satisfactorily at the existing DOT building, it seems that consideration could be given to the use of conventional spread foundations for support of a proposed structure that is relatively light. A maximum net allowable soil bearing pressure of 1,000 pounds per square foot (psf) may be assumed for preliminary planning purposes. Foundation subgrades should be prepared as described below.

Continuous foundations should have a minimum width of two feet, and individual foundations should have a minimum width of three feet. All exterior foundations should be seated at least four feet below final adjacent grades for frost protection. Interior foundations (beneath heated spaces) should bear at a nominal depth of 2.5 feet or greater below finished floor to develop adequate bearing capacity.

It should be understood that the use of conventional spread foundations will require complete removal and replacement of existing fill beneath foundations, along with any organic soils or remnants of former structures that may be found. Furthermore, the undercut should be extended at least two feet below planned foundation bearing grades, even if this requires removal of native soils, to establish a uniform and stable base for construction and to reduce the potential for settlement. Over-excavation beneath the proposed foundations should extend horizontally beyond each side of the foundation a distance equal to at least one-half the depth of undercut below the final bearing grade elevation. The over-excavation should be backfilled with an imported structural fill which adheres to the material and placement recommendations outlined in Attachment C.

As subsurface conditions may vary from that found at the test boring locations, careful inspection of the subgrades is recommended as excavations are made to verify that foundations are constructed on the materials intended. Additionally, the undercutting work may be impacted by perched groundwater and/or soft subgrade conditions, this requiring special construction procedures to maintain the integrity of the subgrade soils and facilitate dewatering as described in section 4.5.

Any water which enters foundation excavations should be promptly removed together with any softened bearing grade materials. All final bearing grades should be firm, stable, and free of any loose soil, mud, water or frost. Foundations proportioned for modest pressures and constructed as described herein should experience settlement within limits that are generally considered to be typical and tolerable.

Mat Foundation

A rigid mat foundation system would provide an added measure of assurance against total and differential settlement as compared with conventional spread foundations. The use of a mat foundation system would also require removal and replacement of all existing fill and undercutting of native soils as required to provide a minimum two feet thick base of granular material beneath the mat, even if this requires removal of some native soils. This is intended to establish a uniform and stable base for construction and to reduce the potential for settlement. Assume an allowable contact pressure of 500 pounds per square foot (psf) for a mat foundation for preliminary planning purposes.

Again, the site should be pre-loaded as necessary to take primary and secondary consolidation of the soft/organic soils induced by any new loads "out of the system". The total amount of primary and secondary settlement expected in association with the new loads should be used as the target displacement for the pre-loading/settlement monitoring program. Soils which are not sufficiently consolidated prior to construction may result in excessive or uneven settlement, or excessive movement of the building relative to the surrounding ground.

Finally, the inclusion of a basement level along with a mat foundation would be of benefit in limiting settlement, as the weight of the building would be partially or fully compensated for by the excavated soils. However, considering the shallow groundwater and proximity to the Cayuga Inlet, construction dewatering, foundation drainage and waterproofing demands would of course be greater in this instance.

4.2 Floor Slabs

The recommended means of floor slab support will be a function of the foundation type selected. In the event that piles are used for foundation support, we recommend the use of a structural floor slab that is also pile supported. It is assumed that the floor slab would be integrated with a mat foundation system.

If floor slabs are not pile supported or part of a mat foundation system, then complete removal and replacement of existing fill from beneath the building floor slab is recommended to minimize the potential for excessive settlement. As noted previously, removal and replacement of the fill may be impacted by high groundwater levels and/or soft subgrade conditions. This should be coordinated with any site pre-loading as appropriate.

Alternatively, cognizant of the potential groundwater impacts on removal/replacement work, and in the interest of economic site development, consideration may be given to leaving the fill in place after its surface is proof-rolled to identify any soft areas, which should be locally undercut and stabilized as necessary (note that the DOT building floors appear to have performed satisfactorily). If this option is chosen, the owner must accept some risk of floor slab settlement should voids and/or prevalent organic matter, not identified through the subsurface investigation or through proof-rolling, be present in the fill materials left in place.

In any event, grade-supported interior floors should be constructed over a minimum six inch thick base course of subbase stone; material specification and placement guidelines for the subbase stone are provided in Attachment C (see structural fill). Required grade increases should be performed well in advance of building construction such that the soft soils at depth are allowed to fully consolidate under the weight of the added fill, as described previously, and floor slab subgrades should be prepared as outlined in section 4.5. Under these parameters, the floor slabs may be designed and constructed in accordance with procedures recommended by the Portland Cement Association or American Concrete Institute using 100 pounds per cubic inch as a modulus of subgrade reaction at the top of the base layer.

Basement Floors

In the event a basement is included, basement floor areas which extend below groundwater levels should be provided with a subslab drainage system consisting of a crushed stone drainage layer (along with a perimeter foundation drain). In this case, it is recommended that the planned subgrade elevation be undercut by at least twelve inches using a backhoe equipped with a steel plate welded across the bucket's teeth. A geotextile filter fabric (Mirafi 160N or equivalent) should be placed over the subgrade followed by a base of clean crushed stone, along with collection and discharge piping as appropriate (recommended spacing of collection laterals no greater than 15 feet). The stone may be an equal blend of No. 1 and No. 2 size aggregate as defined in Table 703-4 of the NYSDOT Standard Specifications for Construction and Materials. The stone should be placed as a single lift and chinked together by completing several passes with a dual drum walk-behind vibratory roller.

These recommendations assume that positive gravity drainage can be, and is provided to the system. While less desirable than gravity drainage, a redundant sump and pump system (with backup, in the event of a primary pump failure) may also be considered. If adequate drainage is not provided, the basement walls and floors must be designed to resist the hydrostatic pressures induced by high groundwater levels, and waterproofing should be provided as appropriate.

4.3 Seismic Design Considerations

Site Class

In our estimation, the site meets the criteria for seismic Site Class "E" (soft soil profile) as set forth in Table 1613.5.2 of the Building Code of New York State. Spectral response accelerations in the project area were obtained from the U.S. Seismic Design Maps web application available at the United States Geological Survey (USGS) web site (www.usgs.gov). The accelerations are based on 2008 USGS seismic hazard data as promulgated in the 2010 NYS Building Code.

Using geographic coordinates 42.4482°N, 76.5065°W for the project site, the indicated maximum spectral response accelerations normalized for reference Site Class B conditions are 0.125g for the short period response (0.2 second, S_s) and 0.048g for the 1 second period response (S_1). For design purposes, these spectral response accelerations must be modified for the soil profile determined at the project site, as follows:

Maximum spectral response accelerations, modified for Site Class E:

- Short Period Response (S_{MS}) - 0.311g
- 1 Second Period Response (S_{M1}) - 0.170g

Maximum five percent damped design spectral response accelerations:

- S_{DS} - 0.208g
- S_{D1} - 0.113g

Liquefaction Potential

Based on the subsurface conditions encountered, the potential for liquefaction to occur during a seismic event is considered low.

4.4 Pavement Design

Soils disclosed by the test borings are considered adequate for the support of asphalt pavement. However, any required grade increases should be performed well in advance of construction as described elsewhere herein, and pavement subgrades should be prepared as outlined in section 4.5.

Design recommendations are provided in the table below for commercial duty hot mix asphalt pavement, one section intended for truck use and areas subjected to frequent and/or heavier loads (heavy duty), and another intended for automobile parking and occasional light delivery truck traffic (standard duty). Pavement design is dependent on a number of service parameters for which limited information was available; in the absence of specific information, typical values were assumed.

Table 3 - Recommended Asphalt Pavement Sections

Pavement Course	Thickness (inches)	
	Heavy Duty Section	Standard Duty Section
Top	2.0	1.5
Binder	3.0	2.0
Subbase	12	8
Geotextile	✓	✓

It may be necessary to increase subbase stone thickness in some areas to improve subgrade conditions and to promote drainage. Pavement structure components should meet the following material specifications:

Table 4 - Asphalt Pavement Section Material Specifications

Asphalt Top Course	NYSDOT Type 7 Top Course - Hot Mix Asphalt
Asphalt Binder Course	NYSDOT Type 3 Binder Course - Hot Mix Asphalt
Stone Subbase Course	NYSDOT Type 2 Subbase - Crushed Aggregate
Geotextile	Woven polypropylene stabilization/separation geotextile (Mirafi 500X or equivalent)

Accumulation of water on pavement subgrades should be avoided by grading the subgrade to a slope of at least two percent, and/or by providing underdrains. Failure to provide adequate drainage will shorten pavement life.

4.5 Site Preparation and Construction

Construction Dewatering

Construction dewatering should be implemented as necessary along with excavation activities, such that work proceeds in the dry. Surface water should be diverted away from open excavations and prevented from accumulating on exposed subgrades. Any seepage of groundwater should be intercepted and maintained below the excavation bottom. Subgrades will be susceptible to strength degradation in the presence of excessive wetness.

The amount of groundwater encountered will depend on the excavation location, depth and groundwater conditions at the time of construction. We expect that for the most part, it will occur as relatively slow seepage which may be controlled through standard sump and pump methods of dewatering. More pervious sands, gravels and/or fill materials, if encountered, may yield more substantial quantities of groundwater. Groundwater associated impacts on construction may be lessened if site development is planned during seasonally dry periods.

Driven Pile Construction

Timber piles should be designed to develop their capacity primarily through friction in the native soils. For preliminary design purposes, cohesion of 650 psf may be assumed for the clayey silts, and an angle of internal friction of 26 degrees may be assumed for the sandy native soils. An effective (submerged) unit weight of 50 pounds per cubic foot may be assumed in each case.

As previously discussed in section 4.1, an allowable capacity of 20 kips has been estimated for a tapered timber pile (7-inch tip and 11-inch butt) driven to a nominal depth of 50 feet below existing grade. If a different pile length/size is selected, its static capacity may be estimated using the design parameters above. Per the Building Code of NYS, final timber pile design must be in accordance with the AFPA NDS.

The estimated pile capacity should be verified through wave equation analysis prior to installation of the piles, and dynamic pile driving analyzer (PDA) testing of at least one pile. The PDA testing should be performed as the pile is driven to its planned depth, and again on a restrike of the pile one or more days after the initial drive. This or whatever load test method is used should verify that the design pile capacity has been achieved with an adequate factor of safety (i.e., per the Building Code of NYS, allowable load not more than one-half the ultimate load capacity of pile as determined by load test).

The piles should be equipped with a driving shoe to limit potential damage at the toe when driving, and with banding at the butt end to prevent splintering from hammer impact. Plumbness of the piles should be maintained within one percent of the total length. Any misaligned or damaged piles should be replaced.

A qualified individual should observe all pile driving and prepare an individual pile driving report for each pile installed. The report should include pile number and location, hammer and cushion type, pile size and material, installed length, blows per foot, unusual conditions encountered during driving, top of pile elevation following driving, notes on any re-striking that may be necessary and other pertinent information as appropriate. Installed piles should be monitored for potential heaving during installation of adjacent piles. Any piles that heave should be re-driven and re-seated as appropriate.

Excavation for Foundation Construction

Excavation to the proposed subgrades for foundation construction should be performed using a method which limits disturbance to subgrades, such as a backhoe equipped with a smooth blade bucket. Where non-pile supported, all existing fill should be removed from beneath proposed foundation bearing grades, along with any disturbed soils, remains of former structures or otherwise unsuitable materials that may be found.

Subgrades should be carefully inspected during construction to verify that foundations are constructed on suitable materials. Subgrades should be observed and evaluated by the geotechnical engineer prior to foundation construction, or where over-excavation is required, before placement of structural fill. Placement and compaction of structural fill beneath foundations should be as outlined in Attachment C.

In places, exposed subgrades may soften and swell in the presence of excess wetness and foot traffic upon excavation. Should this occur, we recommend over-excavating the subgrade by one foot and placing a separation/drainage geotextile (e.g., Mirafi 140N) over the undercut subgrade, followed by 12 inches of drainage stone (equal blend of NYSDOT no.1 and no. 2 sized aggregate). The drainage stone should be consolidated with several passes of a vibratory plate tamper, and the geotextile should be wrapped completely around the drainage stone. Where subgrades are undercut to improve bearing capacity and limit settlement potential, a drainage stone layer may count toward the total required thickness of replacement structural fill.

All bearing grades for foundation construction should be protected from precipitation and surface water. Water should not be allowed to accumulate on the soil bearing grades and the bearing grades should not be allowed to freeze, either prior to or after construction of foundations. Any water which enters foundation excavations should be promptly removed together with any softened bearing grade materials. All final bearing grades should be firm, stable, and free of any loose soil, mud, water or frost.

Foundation excavations should be backfilled as soon as possible and prior to construction of the superstructure. We recommend that foundation backfill consist of structural fill or suitable granular fill.

Subgrade Preparation for Slab-on-Grade and Pavements

Beneath new building floor slabs and pavement areas, all existing pavements and topsoil should be removed, along with any remnants of former structures, stumps, roots, excessively coarse or other deleterious material which may be found; all existing fill should be removed from beneath building floor slabs for the greatest level of assurance against settlement.

Following removal of surface materials and excavation to proposed subgrades, the exposed subgrades should be proof-rolled to evaluate their condition. The proof-rolling should be performed prior to any required fill placement, using a smooth drum roller with a static weight of at least seven tons. The roller should be operated in the static (non-vibratory) mode and complete at least two passes over the exposed subgrades in opposite directions.

The subgrade proof-rolling should be observed by the geotechnical engineer. Any areas which appear wet, loose, soft, unstable or otherwise unsuitable should be undercut. Over-excavation, which may be required as a result of the evaluation, should be performed based on guidance provided the engineer. Where undercut to remove unsuitable soils and improve stability, subgrades should be backfilled with structural fill.

Suitable granular fill may be used for general grade increases and to raise site grades beneath the subbase course for slabs-on-grade and pavements; it is recommended that utility trenches located within slab-on-grade areas be backfilled with structural fill. Placement of material to raise site grades should be monitored by a representative of the engineer to ensure these recommendations are adhered to. Material and placement guidelines for imported granular fill materials are provided in Attachment C.

During construction, the contractor should take precautions to limit construction traffic over building slab and pavement subgrades. Any subgrades which become damaged, rutted, unstable or are otherwise degraded should be undercut and repaired as necessary prior to placement of the subbase course.

Excavation Safety

All excavations must be performed in accordance with federal Occupational Safety and Health Administration (OSHA) standards, along with state and local codes, as applicable. Site soils should be considered Type C pursuant to 29 CFR Part 1926 Subpart P. The contractor is solely responsible for all aspects of excavation safety.

5.0 CONCLUDING REMARKS

This report was prepared to assist in planning for the proposed redevelopment of the existing NYSDOT maintenance facility site on 3rd Street in Ithaca, New York. The report has been prepared for the exclusive use of Fisher Associates and affiliated parties for specific application to this site and project only. The recommendations were prepared based on Empire's understanding of the project, as described herein, and through the application of generally accepted soils and foundation engineering practices. No other warranties, expressed or implied, are made by the conclusions, opinions, recommendations or services provided.

Empire should be informed of any changes to the planned construction so that it may be determined whether the changes warrant modification to the recommendations contained herein. Empire should also be afforded the opportunity to review final plans and specifications to verify that the recommendations were properly interpreted and applied.

Important information which should be reviewed regarding the use and interpretation of this report is presented in Attachment D.

Respectfully Submitted,
EMPIRE GEO-SERVICES, INC.

Parviz Akbari
Geotechnical Engineer

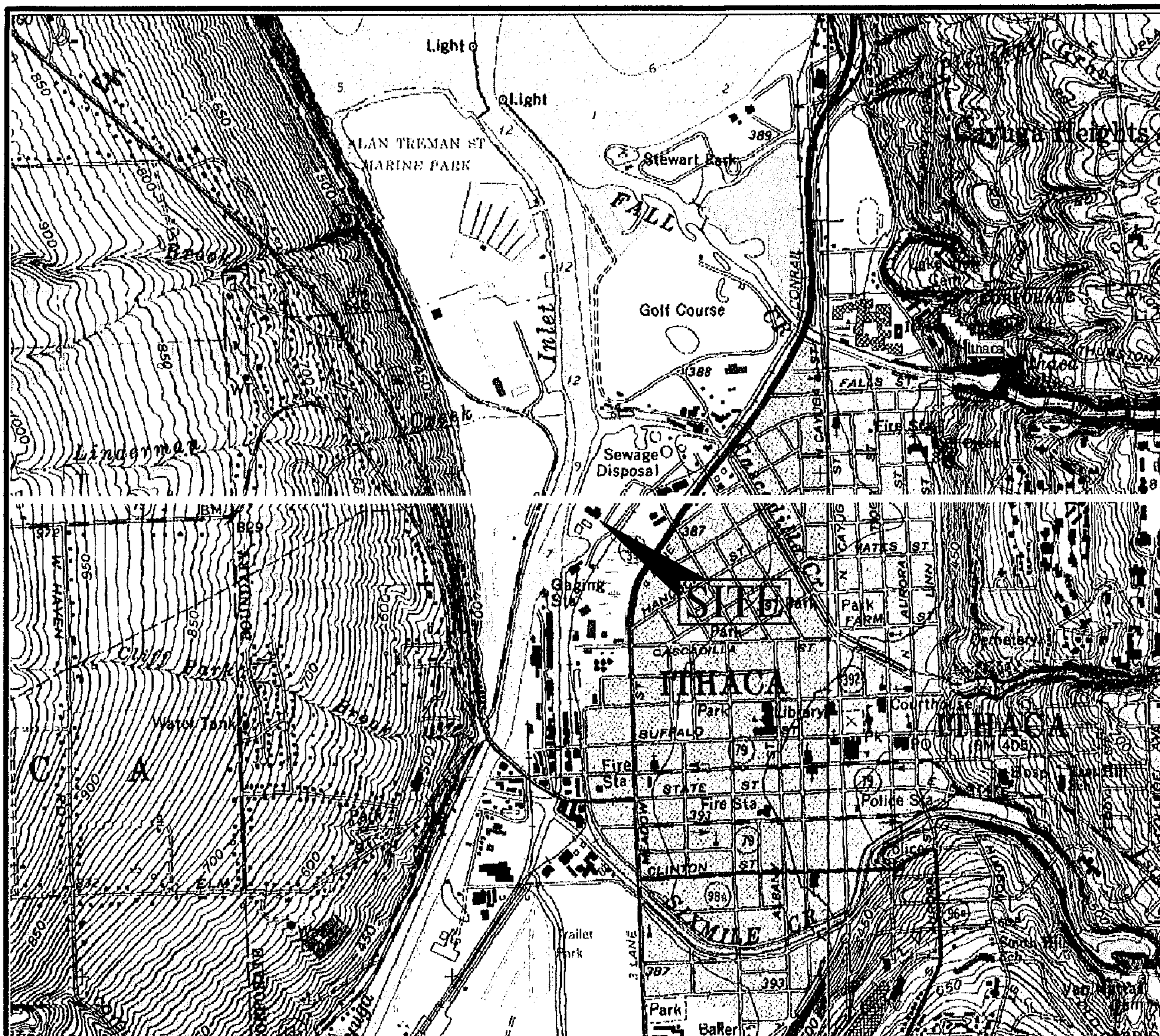
John S. Hutchison, P.E.
Geotechnical Engineer
and Project Reviewer

Enc.: Figures and Attachments A through D

STATE OF NEW YORK
JOHN S. HUTCHISON
085390
LICENSED PROFESSIONAL ENGINEER

Figures

Site Location Map
Subsurface Investigation Plan



SCALE 1:24,000

1 — 1/2 — 0 — 1 MILE

1000 — 0 — 1000 — 2000 — 3000 — 4000 — 5000 — 6000 — 7000 FEET

1 — .5 — 0 — 1 KILOMETER

CONTOUR INTERVAL 10 FEET

DATUM IS MEAN SEA LEVEL

SOURCE: ITHACA WEST, NY
USGS 7.5' QUADRANGLE (1990).

EMPIREGEO SERVICES INC
a subsidiary of SJB Services, Inc.

SITE LOCATION MAP

PRELIMINARY GEOTECHNICAL EVALUATION
EXISTING NYSDOT MAINTENANCE FACILITY
3rd STREET
ITHACA, NEW YORK

SCALE:	AS SHOWN
DATE:	4/15
DRAWN BY:	jsh
REV'D BY:	
DWG. FILE:	be15049
PROJ. No.:	BE-14-049
FIGURE No.:	1

BASE MAP: 2012 DIGITAL ORTHOIMAGERY – NYS INTERACTIVE MAPPING GATEWAY.

EMPIREGEO SERVICES INC
a subsidiary of SJB Services, Inc.

SUBSURFACE INVESTIGATION PLAN

PRELIMINARY GEOTECHNICAL EVALUATION
EXISTING NYSDOT MAINTENANCE FACILITY
3rd STREET
ITHACA, NEW YORK

SCALE:	±1" = 100'
DATE:	4/15
DRAWN BY:	jsh
REV'D BY:	
DWG. FILE:	be15049
PROJ. No.:	CE-15-049
FIGURE No.:	2

ATTACHMENT A

Subsurface Logs and Key

DATE: 4-1-2015
STARTED: 3/19/2015
FINISHED: 3/19/2015

SJB SERVICES, INC.

SUBSURFACE LOG

HOLE NO. B-1
SURF. ELEV. 391.9
G.W. DEPTH See Notes
SHEET 1 of 2

PROJECT: Relocation of NYSDOT Maintenance Facility
CLIENT: Fisher Associates
LOCATION: 3rd Street, Ithaca, Tompkins County, New York

DEPTH-FT.	SAMPLE NO.	BLOWS ON SAMPLER 0-6	6-12	12-18	18-24	N	Rec (ft)	SOIL OR ROCK CLASSIFICATION	NOTES
	S-1	32	29	20	16	49	1.8	Fill: Gray SAND, some f. Gravel, little Silt, SM (Moist, Compact)	
	S-2	6	5	3	4	8	1.6	Fill: Gray SILT, some f. Sand, little Clay, trace organics ML (Moist, Loose)	
5	S-3	1	1	3	2	4	1.3	Fill: Gray silty f.-m. SAND, some clayey Silt, trace organics, trace glass, SM (Wet, Loose)	
	S-4	1	2	1	2	3	2.0	(Very Loose)	
	S-5	WH	1	1	2	2	2.0	Brownish gray organic clayey SILT, little Peat, trace sand, MH (Moist, Soft)	WH: weight of hammer and drilling rods.
10	S-6	3	4	3	4	7	2.0	(Medium)	
15	S-7	1	1	1	2	2	2.0	Gray f. SAND, some Silt, trace peat, SM (Wet, Very Loose)	
20	S-8	WR	WH	1	2	1	2.0		WR: weight of drilling rods.
25	S-9	1	1	1	1	2	2.0		
30	S-10	WH	WH	1	1	1	2.0	Gray SILT, little Clay, trace shells, trace peat, ML (Wet, Very Soft)	S-10 to completion: Marl deposits.
35	S-11	WH	1	1	1	2	2.0		
40									

DRILLER: John Warner
DRILL RIG: CME-75
METHOD OF INVESTIGATION: 31/4" I.D. Hollow Stem Augers, 2" Split Spoon Sampler (ASTMD1586)
JOB NUMBER: BE-15-049
CLASSIFIED BY: Geotechnical Engineer

DATE: 4-1-2015
STARTED: 3/19/2015
FINISHED: 3/19/2015

SJB SERVICES, INC.

SUBSURFACE LOG

HOLE NO. B-1
SURF. ELEV. 391.9
G.W. DEPTH See Notes

PROJECT: Relocation of NYSDOT Maintenance Facility
CLIENT: Fisher Associates
LOCATION: 3rd Street
Ithaca, Tompkins County, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0-6	6-12	12-18	18-24	N	Rec (ft)	SOIL OR ROCK CLASSIFICATION	NOTES
	/	S-12	WH	WH	1	2	1	2.0	Similar	
45	/	S-13	WH	WH	1	1	1	2.0		
	/	S-14	WH	1	1	2	2	2.0		
50									Test boring complete at 50 feet.	Freestanding water was not encountered during drilling or after completion of sampling with augers at 48 feet. Borehole sidewalls caved-in at about 3.6 feet after augers were removed.
55										
60										
65										
70										
75										
80										

DRILLER: John Warner
DRILL RIG: CME-75
METHOD OF INVESTIGATION: 31/4" I.D. Hollow Stem Augers, 2" Split Spoon Sampler (ASTMD1586)
JOB NUMBER: BE-15-049
CLASSIFIED BY: Geotechnical Engineer

DATE: 4-1-2015
STARTED: 3/20/2015
FINISHED: 3/20/2015

SJB SERVICES, INC.

SUBSURFACE LOG

HOLE NO. B-2
SURF. ELEV. 392.5
G.W. DEPTH See Notes
SHEET 1 of 1

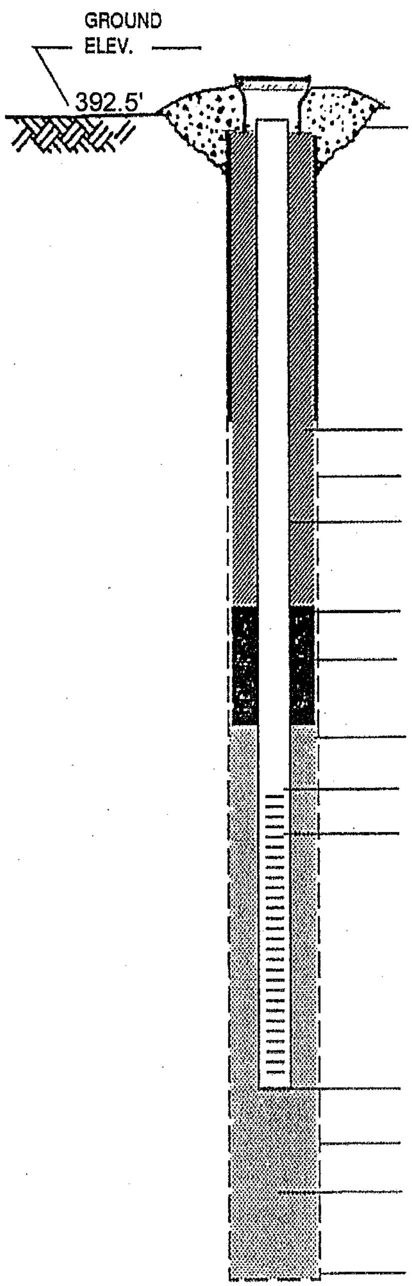
PROJECT: Relocation of NYSDOT Maintenance Facility
CLIENT: Fisher Associates
LOCATION: 3rd Street, Ithaca, Tompkins County, New York

DEPTH-FT.	SAMPLE NO.	BLOWS ON SAMPLER 0-6	6-12	12-18	18-24	N	Rec (ft)	SOIL OR ROCK CLASSIFICATION	NOTES
	S-1	-	7	4	6	10	1.5	Fill: Brown f.-m. SAND, little Silt, SM (Moist, Firm)	Driller noted approximately 0.5 feet of asphalt at the ground surface.
	S-2	7	5	6	6	11	1.6	"and" SILT	
5	S-3	3	2	1	1	3	0.0	No recovery (Very Loose)	
	S-4	1	1	1	WH	2	2.0	Gray SILT, some Clay, trace sand, trace peat, ML (Very Moist, Very Soft)	
	S-5	1	1	WH	1	1	2.0	Gray SILT, trace clay, trace to little Peat, ML (Wet, Very Soft)	WH: weight of hammer and drilling rods.
10	S-6	1	2	2	2	4	2.0		
15	S-7	WH	WH	WH	WH	-	2.0	Gray SILT, some f. Sand, little Peat, ML (Wet, Very Loose)	
20	S-8	WH	WH	2	3	2	2.0	Gray f.-m. SAND, little Silt, trace peat (Wet, Very Loose)	
	S-9	WH	WH	WH	1	-	2.0	Brownish gray SILT, little to some Clay, little Shells, ML (Very Moist, Soft)	S-9: Marl deposit.
25								Test boring complete at 25 feet.	Freestanding water was not encountered during drilling. After completion of sampling, water level was at 22.2 ft with augers at 23 ft.
30									
35									
40									

DRILLER: John Warner
DRILL RIG: CME-75
METHOD OF INVESTIGATION: 31/4" I.D. Hollow Stem Augers, 2" Split Spoon Sampler (ASTMD1586)
JOB NUMBER: BE-15-049
CLASSIFIED BY: Geotechnical Engineer

MONITORING WELL COMPLETION RECORD

PROJECT: Relocation of NYSDOT Maintenance Facility	
PROJECT NUMBER: BE-15-049	**DRILLING METHOD: ASTM D-1586**
WELL NUMBER: MW B-2	**GEOLOGIST: N/A**
DRILLER: J. Warner	**INSTALLATION DATE(S): 3/20/2015**



TYPE OF SURFACE SEAL: Flush Mount & Concrete Seal

ELEV./ TOP OF RISER PIPE: 3.6" below Ground Surface
Elevation=392.2 feet

TYPE OF BACKFILL: Cuttings

BOREHOLE DIAMETER: 6-Inches

I.D. OF RISER PIPE: 2-Inches

TYPE OF RISER PIPE: PVC

DEPTH OF SEAL: 10 feet

TYPE OF SEAL: Bentonite Chips

DEPTH OF SAND PACK: 12 feet

DEPTH OF TOP OF SCREEN: 13 feet

TYPE OF SCREEN: Slotted

SLOT SIZE X LENGTH: 0.010 X 10 feet

I.D. OF SCREEN: 2-Inches

TYPE OF SAND PACK: #0 Morie

DEPTH BOTTOM OF SCREEN: 23 feet

DEPTH BOTTOM OF SAND PACK: 25 feet

TYPE OF BACKFILL BELOW OBSERVATION WELL:
Sand

ELEVATION/ DEPTH OF HOLE: 25 feet

DATE: 4-1-2015
STARTED: 3/18/2015
FINISHED: 3/18/2015

SJB SERVICES, INC.

SUBSURFACE LOG

HOLE NO. B-3
SURF. ELEV. 393.6
G.W. DEPTH See Notes
SHEET 1 of 3

PROJECT: Relocation of NYSDOT Maintenance Facility
CLIENT: Fisher Associates
LOCATION: 3rd Street, Ithaca, Tompkins County, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0-6	6-12	12-18	18-24	N	Rec (ft)	SOIL OR ROCK CLASSIFICATION	NOTES
	/	S-1	10	6	7	10	13	1.6	Fill: Brown f.-m. SAND, some Silt (Wet, Firm)	Driller noted approximately 0.4 feet of crushed stone at ground surface.
	/	S-2	5	4	3	4	7	1.4	Becomes gray (Loose)	
5	/	S-3	5	3	2	2	5	1.6	Fill: Gray SILT, some f. Sand, trace peat (Moist, Loose)	WH: weight of hammer and drilling rods.
	/	S-4	4	3	3	2	6	1.8	Contains "and" f.-m. SAND (Wet)	
	/	S-5	1	4	2	2	6	0.6	Gray f.-m. Silty SAND and black organic clayey SILT, trace peat, (Moist, Loose)	S-5, S-6: seams.
10	/	S-6	3	2	2	2	4	1.5		
15	/	S-7	WH	WH	WH	WH	-	2.0	Gray SILT, little Clay, trace f. sand, trace peat, ML (Moist, Very Soft)	
20	/	S-8	WH	WH	2	4	4	2.0	Brown-dark brown PEAT, little gray silt, Pt (Moist, Soft)	
25	/	S-9	1	2	2	2	4	2.0	Gray SILT, trace clay, trace shells, trace peat, ML (Very Moist to Wet, Soft)	S-9 thru S-12: Marl deposits.
30	/	S-10	WH	WH	WH	WH	-	2.0	(Very Soft)	
35	/	S-11	WH	WH	WH	WH	-	2.0		
40										WR: weight of drilling rods.

DRILLER: John Warner
DRILL RIG: CME-75
METHOD OF INVESTIGATION: 31/4" I.D. Hollow Stem Augers, 2" Split Spoon Sampler (ASTMD1586)
JOB NUMBER: BE-15-049
CLASSIFIED BY: Geotechnical Engineer

DATE: 4-1-2015
STARTED: 3/18/2015
FINISHED: 3/18/2015

SJB SERVICES, INC.

SUBSURFACE LOG

HOLE NO. B-3
SURF. ELEV. 393.6
G.W. DEPTH See Notes
SHEET 2 of 3

PROJECT: Relocation of NYSDOT Maintenance Facility
CLIENT: Fisher Associates
LOCATION: 3rd Street, Ithaca, Tompkins County, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0-6	6-12	12-18	18-24	N	Rec (ft)	SOIL OR ROCK CLASSIFICATION	NOTES
	/	S-12	WH	WH	WH	2	-	2.0	Similar	WH: weight of hammer and drilling rods. WR: weight of drilling rods.
45	/	S-13	WH	WH	WH	WH	-	2.0	Grayish brown SILT, little f. Sand, ML (Wet to Saturated, Very Loose)	
50	/	S-14	WH	WH	WH	3	-	2.0	Grades to "trace to little" Clay, "trace" f. sand	
55	/	S-15	WR	WR	WH	3	-	2.0		
60	/	S-16	WR	WH	WH	6	-	2.0		
65	/	S-17	WR	WH	3	3	3	2.0		
70	/	S-18	WH	WH	1	3	1	2.0		
75	/	S-19	2	6	8	11	14	2.0	Grayish brown f.-m. SAND, some Silt, SM (Wet to Saturated, Firm)	
80										

DRILLER: John Warner
DRILL RIG: CME-75
METHOD OF INVESTIGATION: 31/4" I.D. Hollow Stem Augers, 2" Split Spoon Sampler (ASTMD1586)
JOB NUMBER: BE-15-049
CLASSIFIED BY: Geotechnical Engineer

DATE: 4-1-2015
STARTED: 3/18/2015
FINISHED: 3/18/2015

SJB SERVICES, INC.

SUBSURFACE LOG

HOLE NO. B-3
SURF. ELEV. 393.6
G.W. DEPTH See Notes
SHEET 3 of 3

PROJECT: Relocation of NYSDOT Maintenance Facility
CLIENT: Fisher Associates
LOCATION: 3rd Street, Ithaca, Tompkins County, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0-6	6-12	12-18	18-24	N	Rec (ft)	SOIL OR ROCK CLASSIFICATION	NOTES
	/	S-20	WR	2	2	3	4	2.0	Grayish brown varved/partings Clayey SILT and f. Sandy SILT, ML (Wet, Loose)	WR: weight of drilling rods.
85	/	S-21	1	2	6	8	8	2.0		WH: weight of hammer and drilling rods.
90	/	S-22	1	8	3	7	11	1.6	(Firm)	Driller noted sand and gravel starting at about 93 feet.
95	/	S-23	21	17	10	19	27	1.3	Gray SAND, little Silt, little Gravel, SM (Wet, Firm)	
									Test boring complete at 97 feet.	Freestanding water was not encountered during drilling or after completion of drilling. Borehole sidewalls caved-in at about 22.4 feet after augers were removed.
100										
105										
110										
115										
120										

DRILLER: John Warner
DRILL RIG: CME-75
METHOD OF INVESTIGATION: 31/4" I.D. Hollow Stem Augers, 2" Split Spoon Sampler (ASTMD1586)
JOB NUMBER: BE-15-049
CLASSIFIED BY: Geotechnical Engineer

GENERAL INFORMATION & KEY TO SUBSURFACE LOGS

The Subsurface Logs attached to this report present the observations and mechanical data collected by the driller at the site, supplemented by classification of the material removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a fraction of the total volume of the deposits at the site and may not necessarily be representative of the subsurface conditions between adjacent borings or between the sampled intervals. The data presented on the Subsurface Logs together with the recovered samples provide a basis for evaluating the character of the subsurface conditions relative to the project. The evaluation must consider all the recorded details and their significance relative to each other. Often analyses of standard boring data indicate the need for additional testing or sampling procedures to more accurately evaluate the subsurface conditions. Any evaluation of the contents of this report and recovered samples must be performed by qualified professionals. The following information defines some of the procedures and terms used on the Subsurface Logs to describe the conditions encountered, consistent with the numbered identifiers shown on the Key opposite this page.

1. The figures in the Depth column define the scale of the Subsurface Log.

2. The Samples column shows, graphically, the depth range from which a sample was recovered. See Table I for descriptions of the symbols used to represent the various types of samples.

3. The Sample No. is used for identification on sample containers and/or Laboratory Test Reports.

4. Blows on Sampler - shows the results of the "Penetration Test", recording the number of blows required to drive a split spoon sampler into the soil. The number of blows required for each six inches is recorded. The first 6 inches of penetration is considered a seating drive. The number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N. The outside diameter of the sampler, hammer weight and length of drop are noted at the bottom of the Subsurface Log.

5. Blows on Casing - Shows the number of blows required to advance the casing a distance of 12 inches. The casing size, hammer weight, and length of drop are noted at the bottom of the Subsurface Log. If the casing is advanced by means other than driving, the method of advancement will be indicated in the Notes column or under the Method of Investigation at the bottom of the Subsurface Log. Alternatively, sample recovery may be shown in this column, or other data consistent with the column heading.

6. All recovered soil samples are reviewed in the laboratory by an engineering technician, geologist or geotechnical engineer, unless noted otherwise. Visual descriptions are made on the basis of a combination of the driller's field descriptions and noted observations together with the sample as received in the laboratory. The method of visual classification is based primarily on the Unified Soil Classification System (ASTM D 2487) with regard to the particle size and plasticity (See Table No. II), and the Unified Soil Classification System group symbols for the soil types are sometimes included with the soil classification. Additionally, the relative portion, by weight, of two or more soil types is described for granular soils in accordance with "Suggested Methods of Test for Identification of Soils" by D.M. Burmister, ASTM Special Technical Publication 479, June 1970. (See Table No. III). Description of the relative soil density or consistency is based upon the penetration records as defined in Table No. IV. The description of the soil moisture is based upon the relative wetness of the soil as recovered and is described as dry, moist, wet and saturated. Water introduced into the boring either naturally or during drilling may have affected the moisture condition of the recovered sample. Special terms are used as required to describe soil deposition in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two inch diameter split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the casing and sampler blows or through the "action" of the drill rig as reported by the driller.

7. Rock description is based on review of the recovered rock core and the driller's notes. Frequently used rock classification terms are included in Table VI.

8. The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Solid stratification lines delineate apparent changes in soil type, based upon review of recovered soil samples and the driller's notes. Dashed lines convey a lesser degree of certainty with respect to either a change in soil type or where such change may occur.

9. Miscellaneous observations and procedures noted by the driller are shown in this column, including water level observations. It is important to realize the reliability of the water level observations depends upon the soil type (water does not readily stabilize in a hole through fine grained soils), and that any drill water used to advance the boring may have influenced the observations. The ground water level will fluctuate seasonally, typically. One or more perched or trapped water levels may exist in the ground seasonally. All the available readings should be evaluated. If definite conclusions cannot be made, it is often prudent to examine the conditions more thoroughly through test pit excavations or groundwater observation wells.

10. The length of core run is defined as the length of penetration of the core barrel. Core recovery is the length of core recovered divided by the core run. The RQD (Rock Quality Designation) is the total length of pieces of NX core exceeding 4 inches divided by the core run. The size core barrel used is also noted in the Method of Investigation at the bottom of the Subsurface Log.

ATTACHMENT B

Laboratory Test Results

SJB SERVICES, INC.

Contract Drilling
and Testing

60 Miller Street, Cortland, NY 13045

PROJECT: Relocation of NYSDOT Maintenance Facility
Project Location: Ithaca, New York
EGS Project No.: BE-15-049
CLIENT: Fisher Associates

Moisture Content						
HOLE NUMBER	B-1	B-1	B-1	B-2	B-2	B-3
SAMPLE NUMBER	S-5	S-8	S-11	S-4	S-6	S-7
DEPTH bgs (feet)	8'-10'	20'-22'	35'-37'	6'-8'	10'-12'	15'-17'
W_t+TARE	323.9	389.4	369.6	369.9	308.6	404.2
W_s+TARE	247.6	316.5	285.5	285.6	223.0	335.9
W_w	76.3	72.9	84.1	84.3	85.6	68.3
TARE	97.6	108.5	107.4	98.4	111.3	108.9
W_s	150.0	208.0	178.1	187.2	111.7	227.0
w	50.9%	35.0%	47.2%	45.0%	76.6%	30.1%

Moisture Content						
HOLE NUMBER	B-3	B-3	B-3	B-3	B-3	B-3
SAMPLE NUMBER	S-8	S-10	S-15	S-19	S-21	S-23
DEPTH bgs (feet)	20'-22'	30'-32'	55'-57'	75'-77'	85'-87'	95'-97'
W_t+TARE	316.4	388.6	400.5	384.3	314.3	407.6
W_s+TARE	216.0	301.6	334.7	330.4	275.6	377.0
W_w	100.4	87.0	65.8	53.9	38.7	30.6
TARE	108.3	113.4	97.2	112.7	111.8	112.1
W_s	107.7	188.2	237.5	217.7	163.8	264.9
w	93.2%	46.2%	27.7%	24.8%	23.6%	11.6%

Technician: CH

Date: 4/1/2015

SJB SERVICES, INC.

Contract Drilling and Testing

60 Miller Street, Cortland, NY 13045

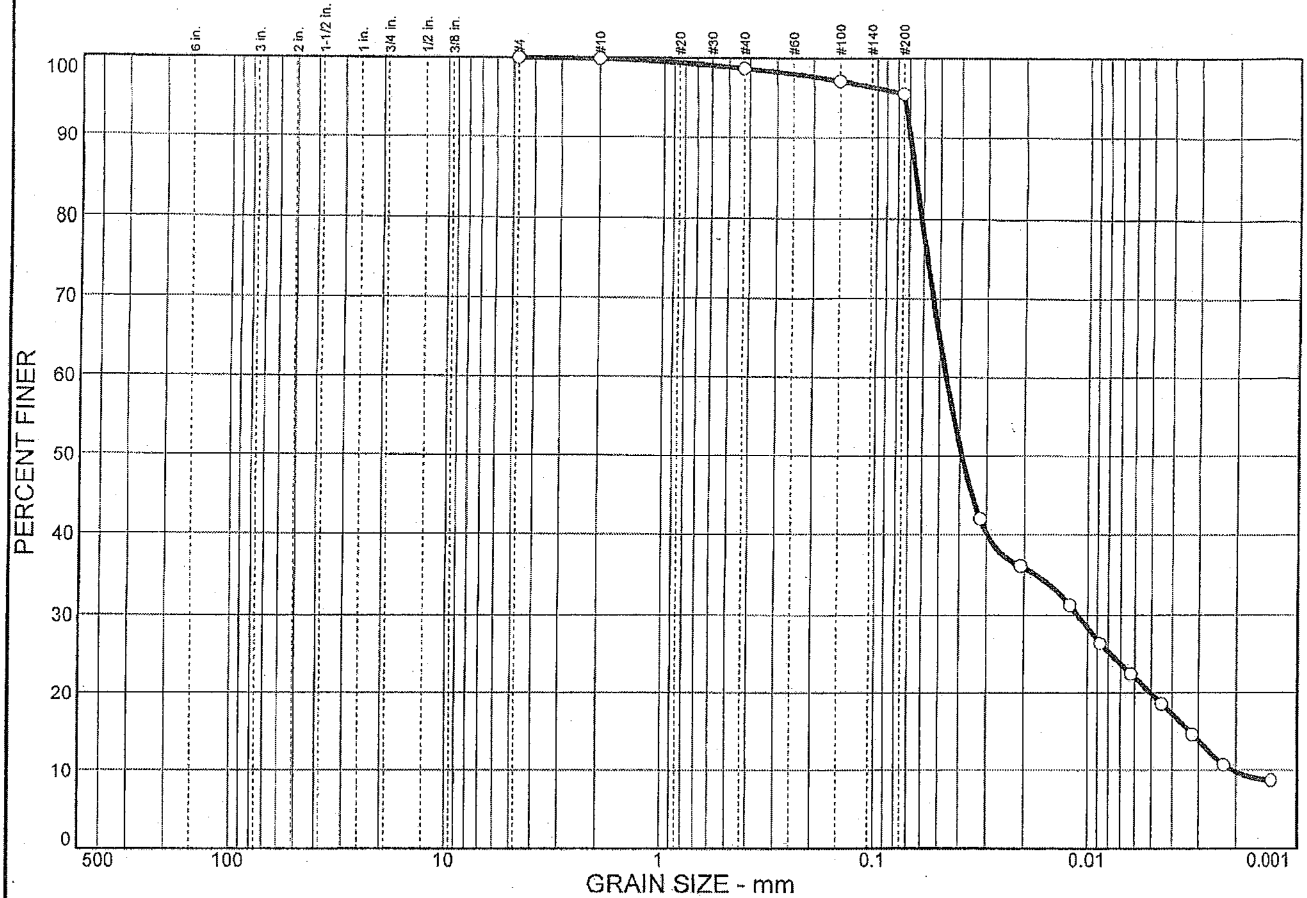
PROJECT: Relocation of NYSDOT Maintenance Facility
Project Location: Ithaca, New York
EGS Project No.: BE-15-049
CLIENT: Fisher Associates

Organic Content					
HOLE NUMBER	B-1	B-1	B-2	B-3	B-3
SAMPLE NUMBER	S-5	S-8	S-6	S-8	S-10
DEPTH bgs (feet)	8'-10'	20'-22'	10'-12'	20'-22'	30'-32'
W_t+TARE	48.3	59.8	51.0	51.9	51.7
W_s+TARE	47.3	59.3	48.5	48.3	51.1
W_w	1.0	0.5	2.5	3.6	0.6
TARE	31.5	33.0	33.0	31.5	31.5
W_s	15.8	26.3	15.5	16.8	19.6
Organic Content	6.3%	1.9%	16.1%	21.4%	3.1%

Technician: CH

Date: 4/6/2015

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	4.5	75.7	19.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#40	98.7		
#100	97.1		
#200	95.5		

* (no specification provided)

Soil Description

Elastic silt

Atterberg Limits

PL= 43 LL= 53 PI= 10

Coefficients

D_{85}= 0.0657 D_{60}= 0.0465 D_{50}= 0.0391
D_{30}= 0.0112 D_{15}= 0.0033 D_{10}= 0.0021
C_u= 22.28 C_c= 1.28

Classification

USCS= MH AASHTO=

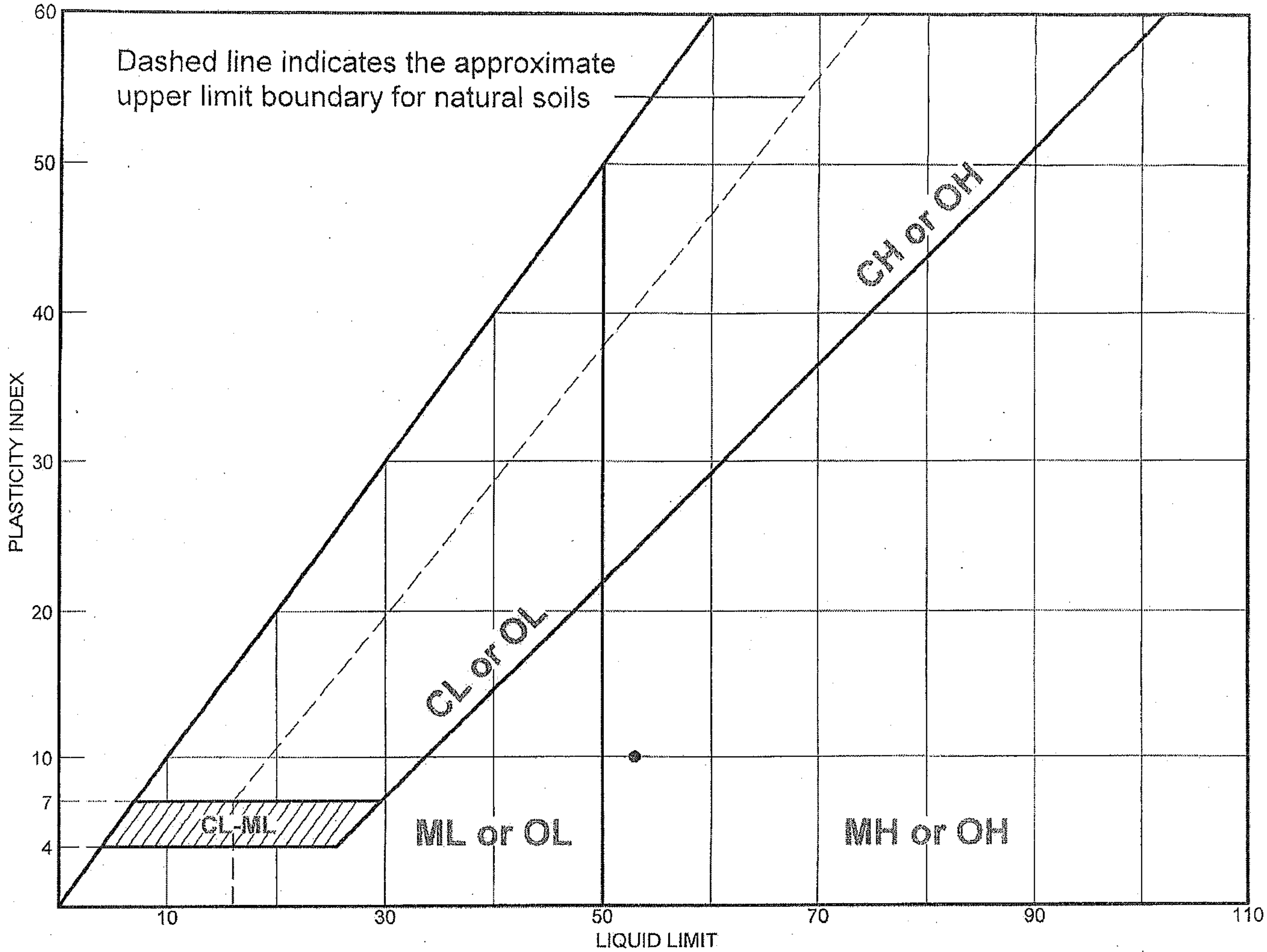
Remarks

Sample No.: 238 **Source of Sample:** **Date:** 4-10-15
Location: B-1,S-5 **Elev./Depth:** 8'-10'

SJB SERVICES, INC.

Client: Fisher Associates
Project: Relocation of NYSDOT Maintenance Facility
Project No: BE-15-049 **Plate** 238

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Elastic silt	53	43	10	98.7	95.5	MH

Project No. BE-15-049 **Client:** Fisher Associates

Project: Relocation of NYSDOT Maintenance Facility

● **Location:** B-1,S-5

Remarks:

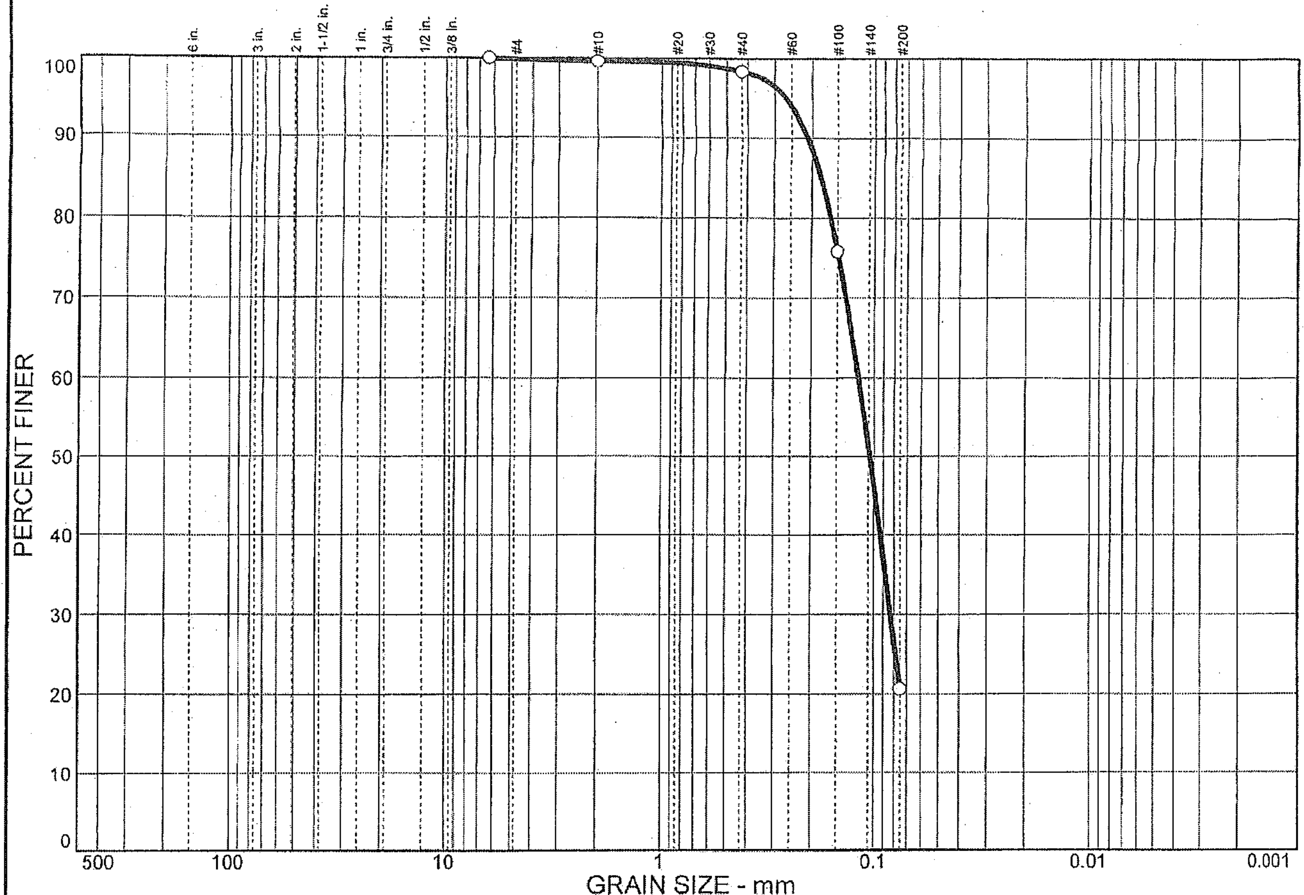
● Date Tested:4-10-15

LIQUID AND PLASTIC LIMITS TEST REPORT

SJB SERVICES, INC.

Plate 238

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.1	79.3	20.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.25 in.	100.0		
#10	99.6		
#40	98.3		
#100	75.9		
#200	20.6		

* (no specification provided)

Soil Description

Silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.181 D_{60}= 0.118 D_{50}= 0.104
D_{30}= 0.0832 D_{15}= D_{10}=
C_u= C_c=

Classification

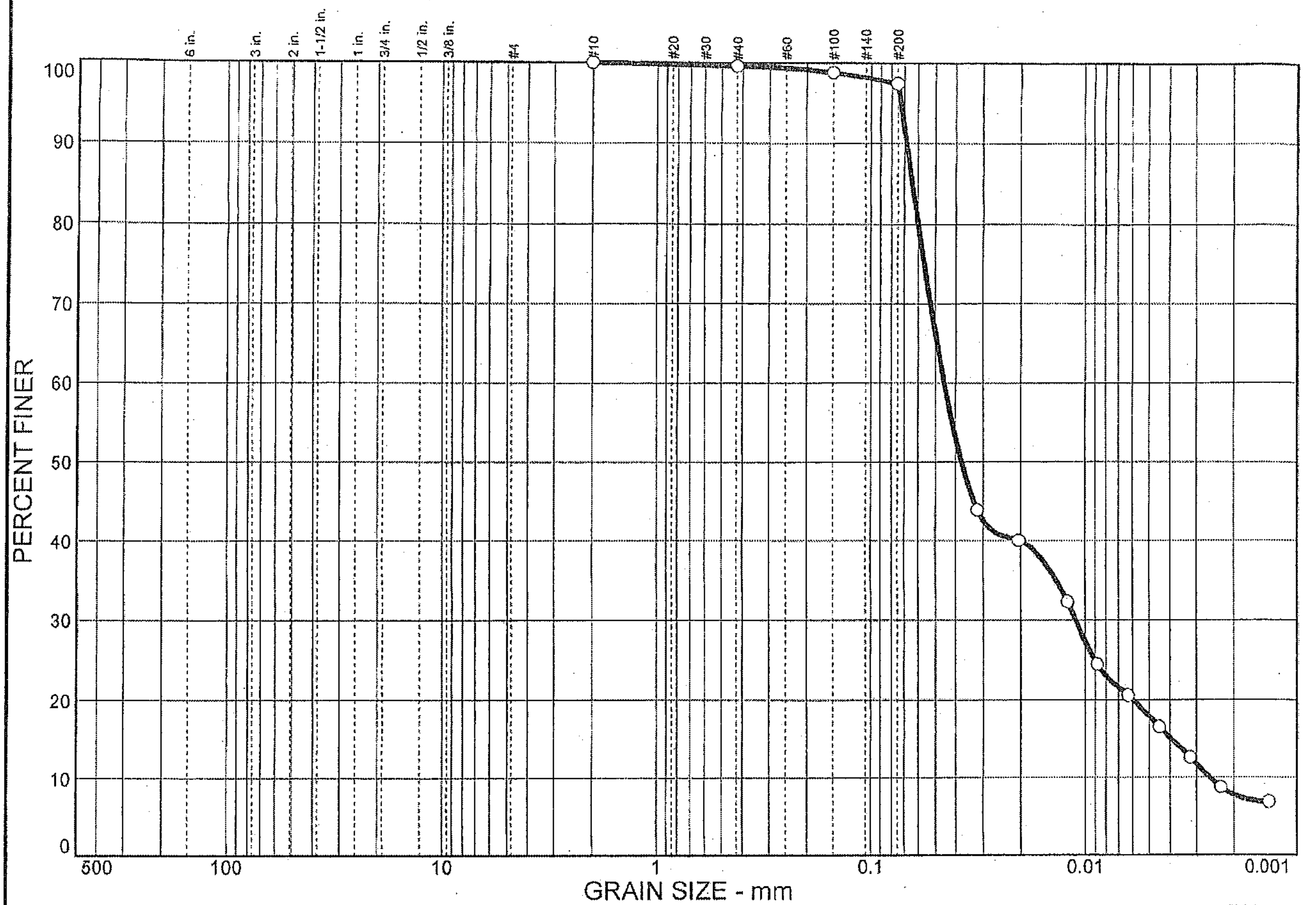
USCS= SM AASHTO=

Remarks

Sample No.: 239 Source of Sample: Date: 4-6-15
Location: B-1,S-8 Elev./Depth: 20'-22'

SJB SERVICES, INC.	Client: Project: Project No: Plate 239

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	2.6	79.6	17.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.6		
#100	98.8		
#200	97.4		

* (no specification provided)

Soil Description

Silt

Atterberg Limits

PL= LL= 39 PI= NP

Coefficients

D_{85}= 0.0643 D_{60}= 0.0454 D_{50}= 0.0378
D_{30}= 0.0111 D_{15}= 0.0040 D_{10}= 0.0026
C_u= 17.42 C_c= 1.04

Classification

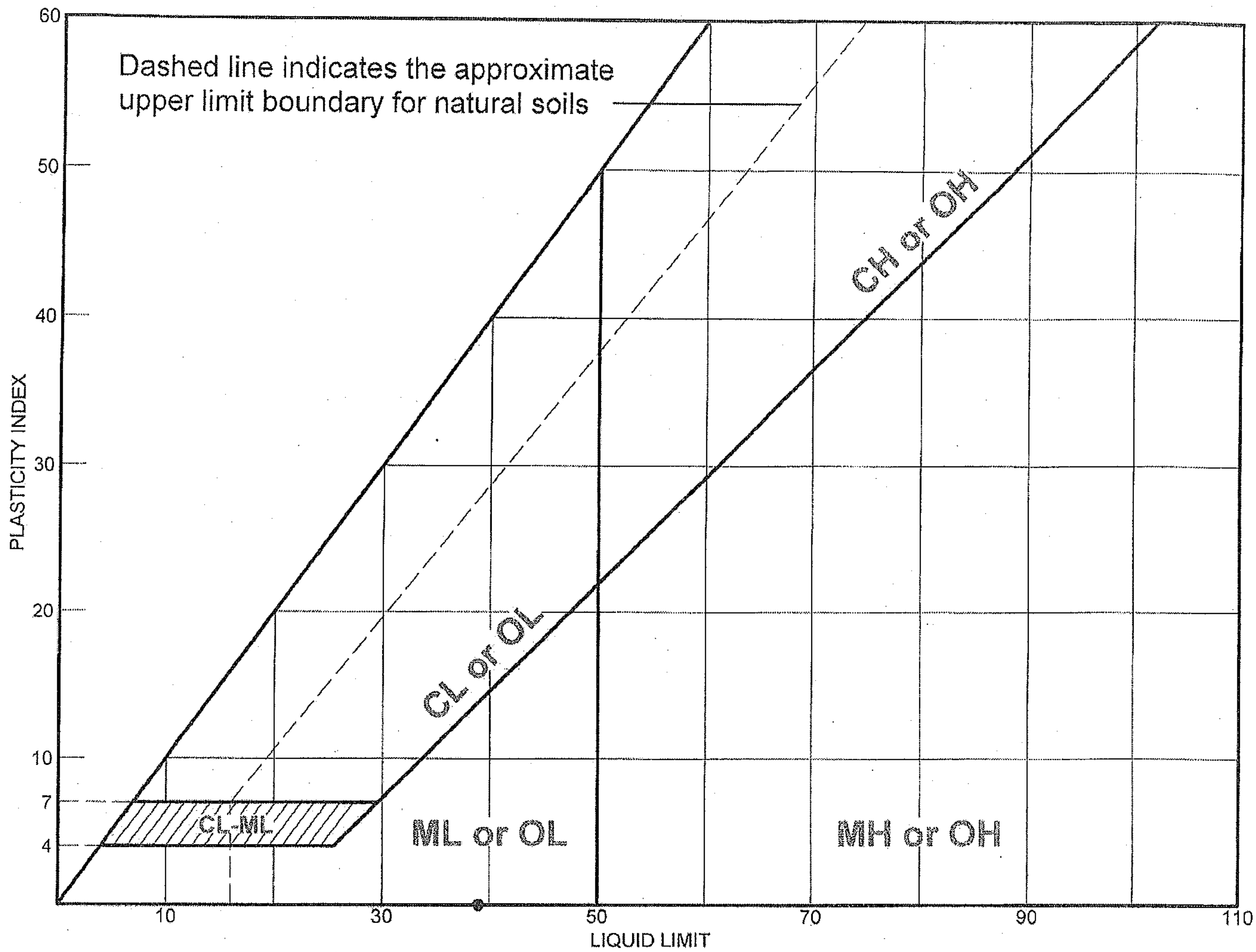
USCS= ML AASHTO=

Remarks

Sample No.: 240 **Source of Sample:** **Date:** 4-10-15
Location: B-1,S-11 **Elev./Depth:** 35'-37'

SJB SERVICES, INC.	**Client:** **Project:** **Project No:** **Plate** 240

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silt	39		NP	99.6	97.4	ML

Project No. **Client:**

Project:

● **Location:** B-1,S-11

Remarks:

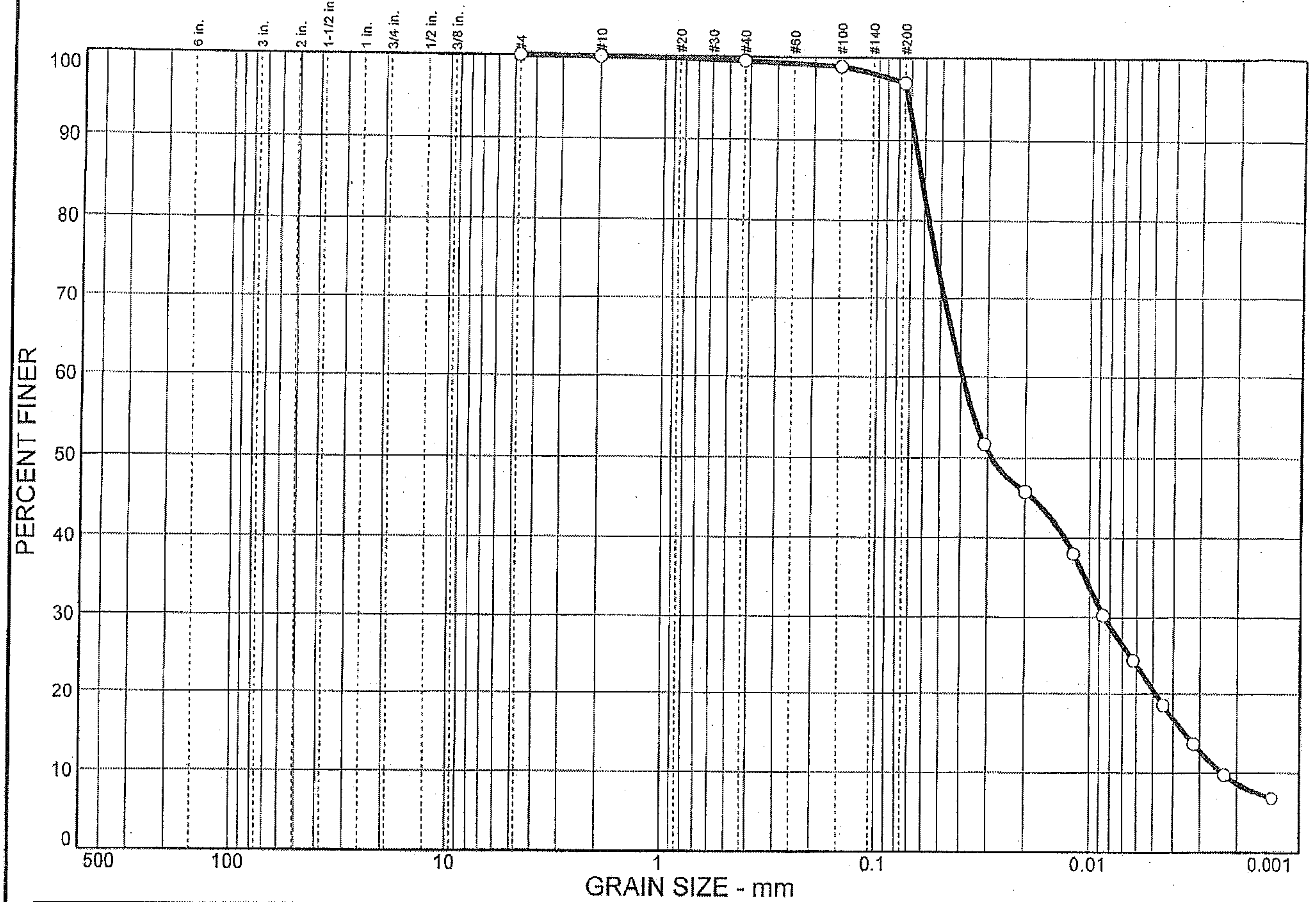
● Date Tested:4-10-15

LIQUID AND PLASTIC LIMITS TEST REPORT

SJB SERVICES, INC.

Plate 240

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	3.1	76.5	20.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#40	99.5		
#100	98.9		
#200	96.9		

* (no specification provided)

Soil Description

Silt

Atterberg Limits

PL= 32 LL= 36 PI= 4

Coefficients

D_{85}= 0.0621 D_{60}= 0.0392 D_{50}= 0.0286
D_{30}= 0.0085 D_{15}= 0.0036 D_{10}= 0.0024
C_u= 16.55 C_c= 0.78

Classification

USCS= ML AASHTO=

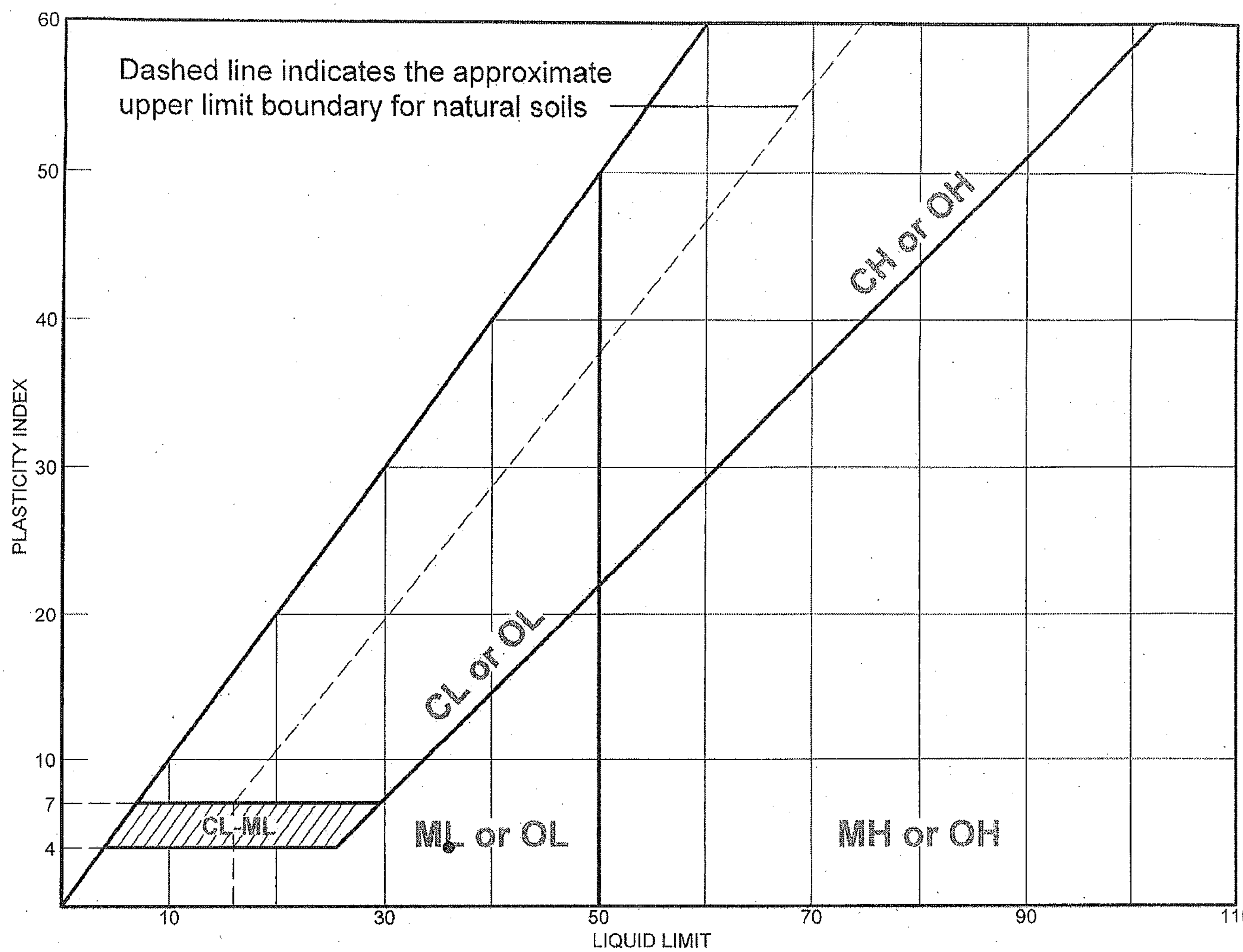
Remarks

Sample No.: 241 **Source of Sample:** **Date:** 4-10-15
Location: B-2,S-4 **Elev./Depth:** 6'-8'

SJB SERVICES, INC.

Client:
Project:
Project No: **Plate** 241

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silt	36	32	4	99.5	96.9	ML

Project No. **Client:**

Project:

● **Location:** B-2,S-4

Remarks:

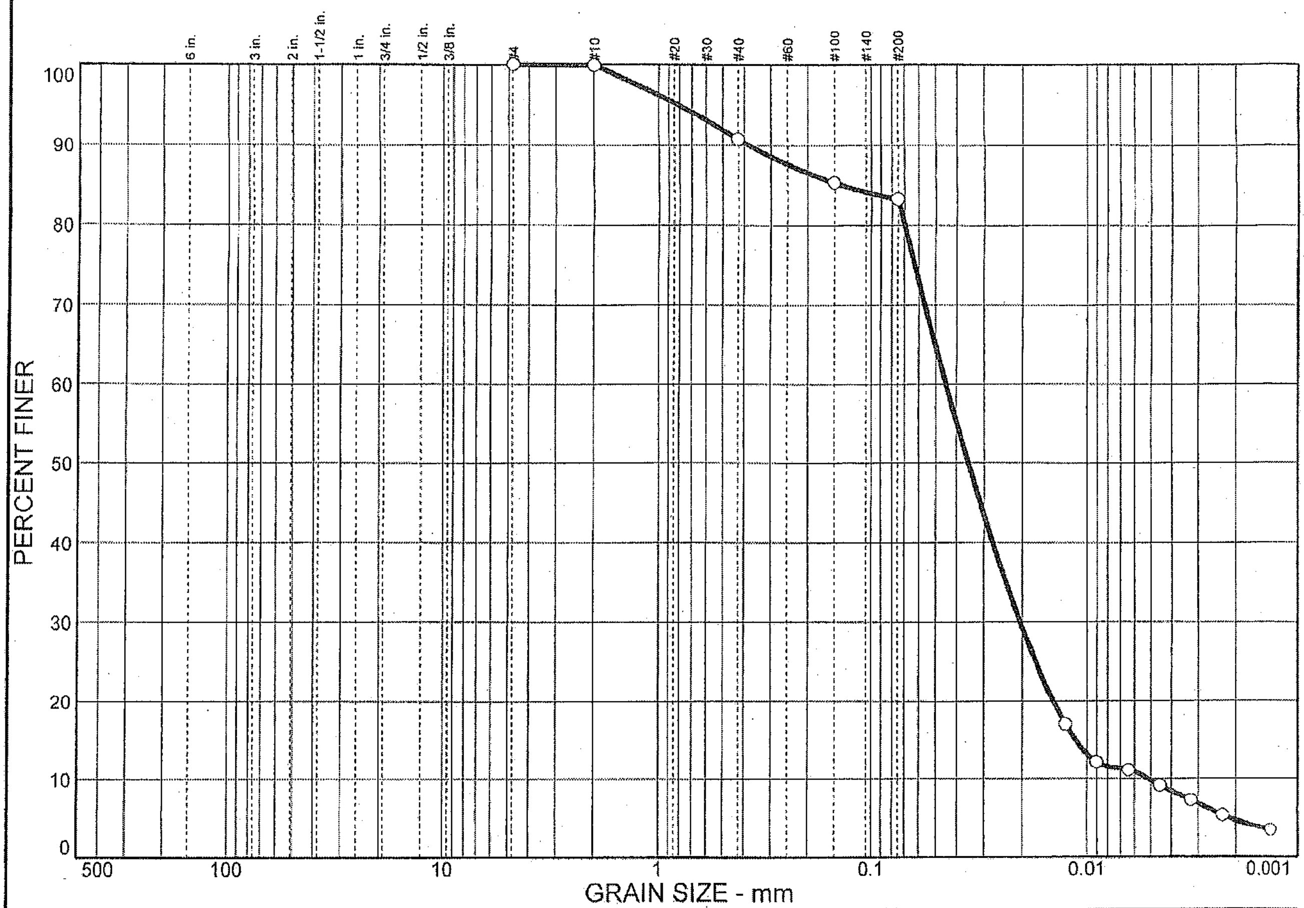
● Date Tested:4-10-15

LIQUID AND PLASTIC LIMITS TEST REPORT

SJB SERVICES, INC.

Plate 241

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	16.7	73.6	9.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#40	90.7		
#100	85.3		
#200	83.3		

* (no specification provided)

Soil Description

Silt with sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.138 D_{60}= 0.0448 D_{50}= 0.0354
D_{30}= 0.0205 D_{15}= 0.0113 D_{10}= 0.0052
C_u= 8.62 C_c= 1.80

Classification

USCS= ML AASHTO=

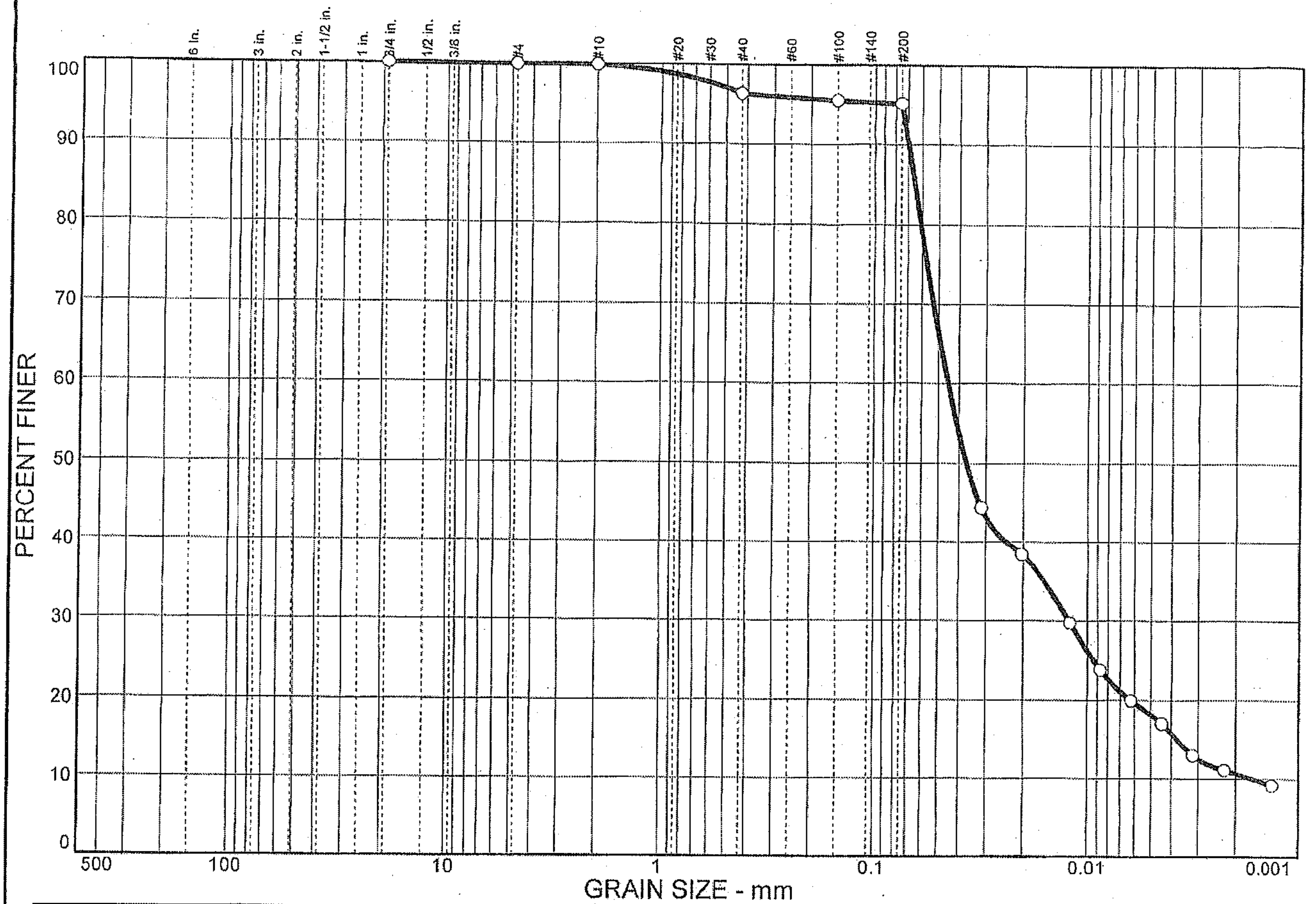
Remarks

Sample No.: 242 **Source of Sample:** **Date:** 4-10-15
Location: B-2,S-6 **Elev./Depth:** 10'-12'

SJB SERVICES, INC.

Client:
Project:
Project No: **Plate** 242

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.1	4.8	77.0	18.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75 in.	100.0		
#4	99.9		
#10	99.9		
#40	96.3		
#100	95.5		
#200	95.1		

* (no specification provided)

Soil Description

Silt

Atterberg Limits

PL= 26 LL= 29 PI= 3

Coefficients

D_{85}= 0.0654 D_{60}= 0.0450 D_{50}= 0.0370
D_{30}= 0.0123 D_{15}= 0.0038 D_{10}= 0.0017
C_u= 26.90 C_c= 1.99

Classification

USCS= ML AASHTO=

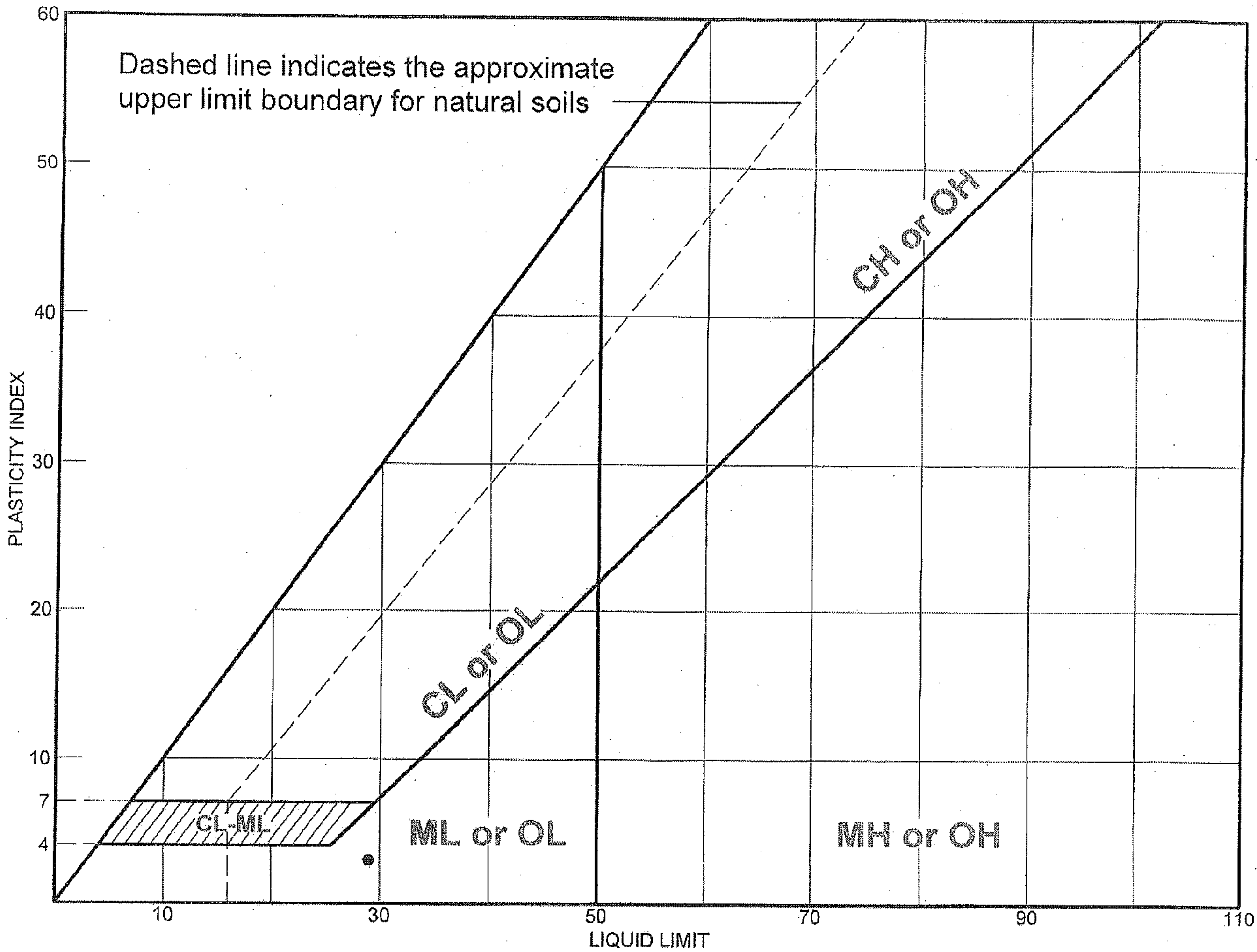
Remarks

Sample No.: 243 **Source of Sample:** **Date:** 4-14-15
Location: B-3,S-7 **Elev./Depth:** 15'-17'

SJB SERVICES, INC.

Client:
Project:
Project No: **Plate** 243

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silt	29	26	3	96.3	95.1	ML

Project No. **Client:**

Project:

● **Location:** B-3,S-7

Remarks:

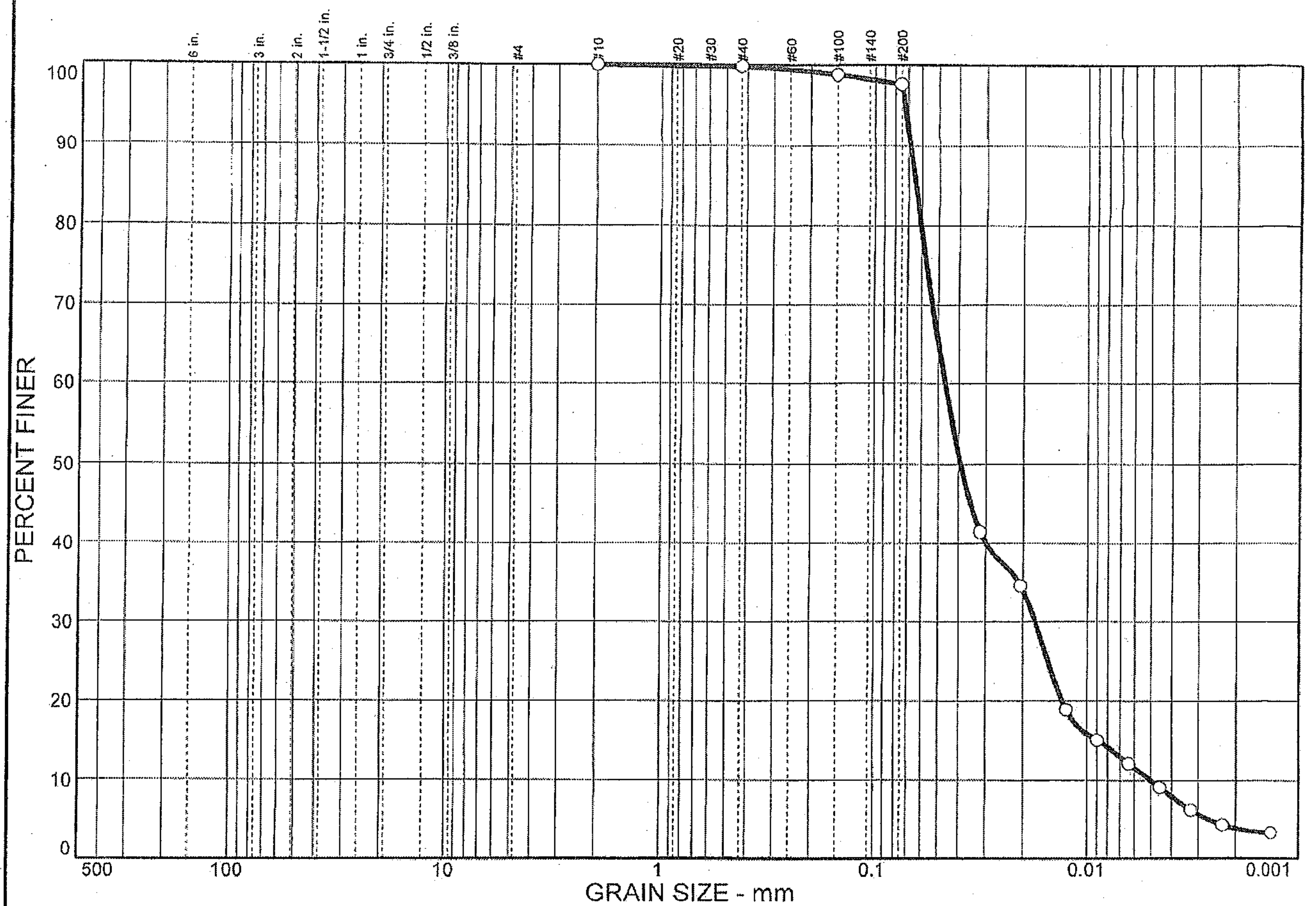
● Date Tested:4-15-15

LIQUID AND PLASTIC LIMITS TEST REPORT

SJB SERVICES, INC.

Plate 243

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	2.4	87.7	9.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.8		
#100	98.8		
#200	97.6		

* (no specification provided)

Soil Description

Silt

Atterberg Limits

PL= LL= 32 PI= NP

Coefficients

D_{85}= 0.0645 D_{60}= 0.0465 D_{50}= 0.0393
D_{30}= 0.0176 D_{15}= 0.0089 D_{10}= 0.0050
C_u= 9.24 C_c= 1.32

Classification

USCS= ML AASHTO=

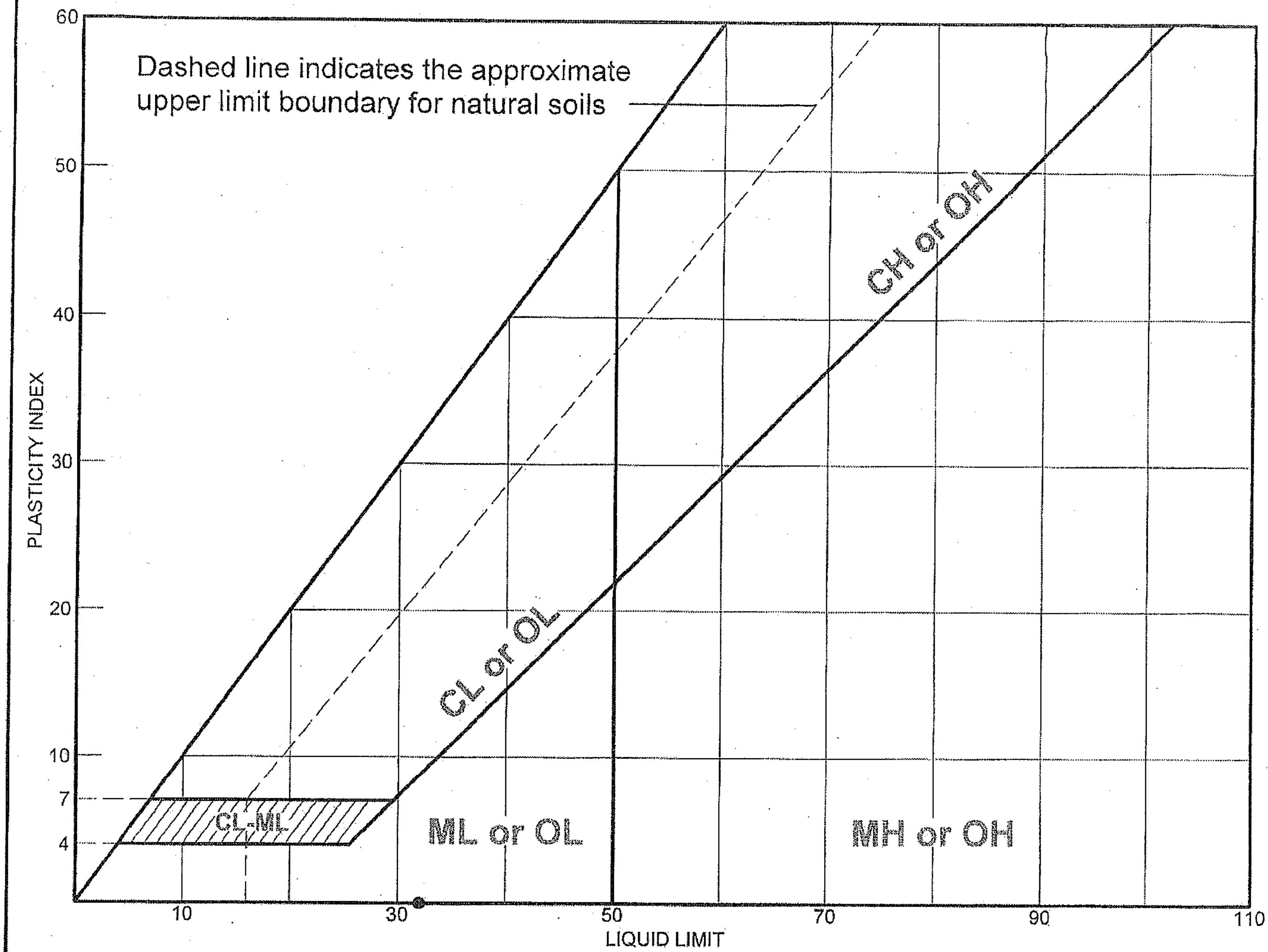
Remarks

Sample No.: 245 **Source of Sample:** **Date:** 4-15-15
Location: B-3,S-10 **Elev./Depth:** 30'-32'

SJB SERVICES, INC.

Client:
Project:
Project No: **Plate** 245

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silt	32		NP	99.8	97.6	ML

Project No. **Client:**

Project:

● **Location:** B-3,S-10

Remarks:

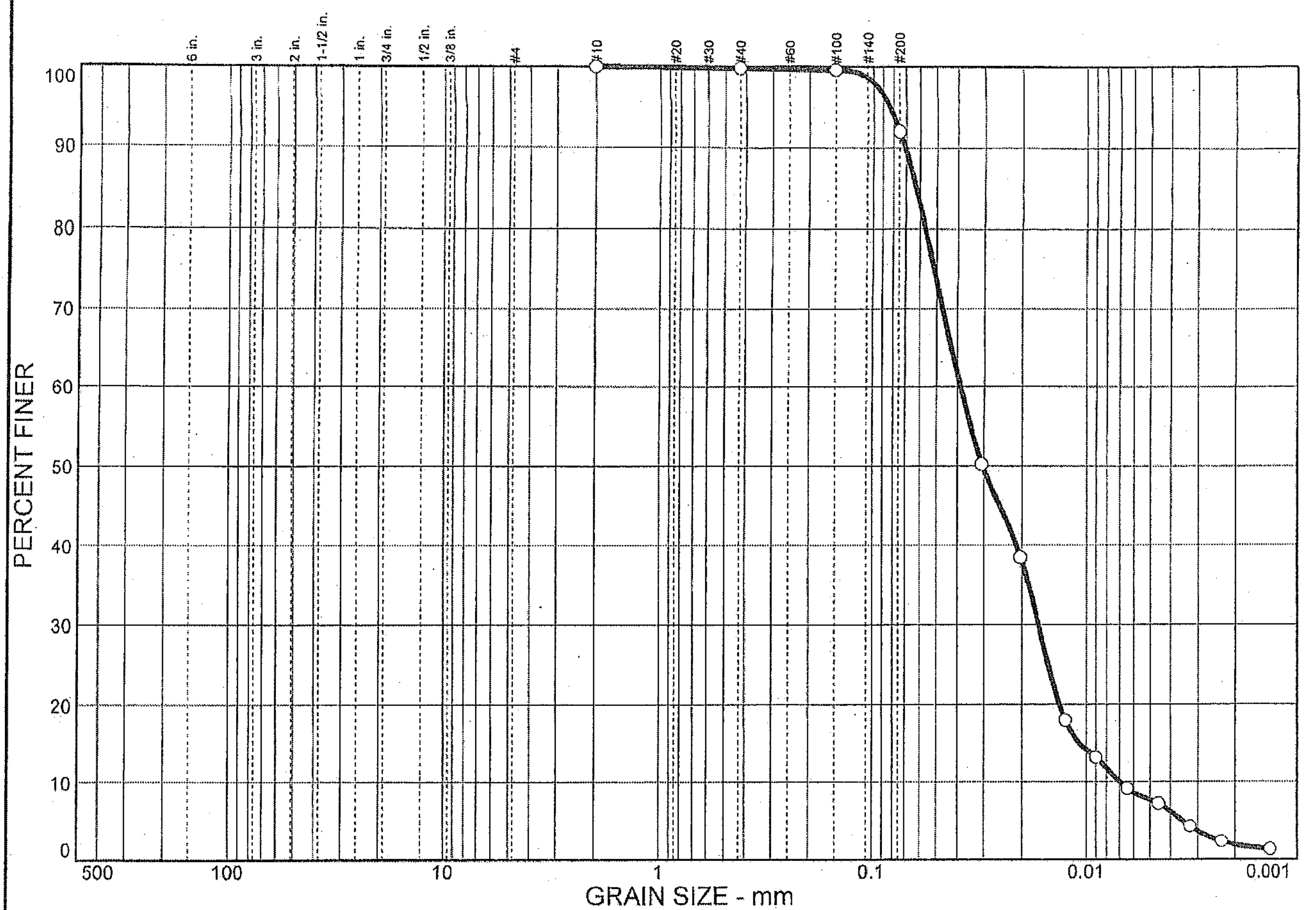
● Date Tested:4-15-15

LIQUID AND PLASTIC LIMITS TEST REPORT

SJB SERVICES, INC.

Plate 245

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	8.0	84.3	7.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.8		
#100	99.6		
#200	92.0		

* (no specification provided)

Soil Description

Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0629 D_{60}= 0.0388 D_{50}= 0.0306
D_{30}= 0.0167 D_{15}= 0.0108 D_{10}= 0.0070
C_u= 5.54 C_c= 1.03

Classification

USCS= ML AASHTO=

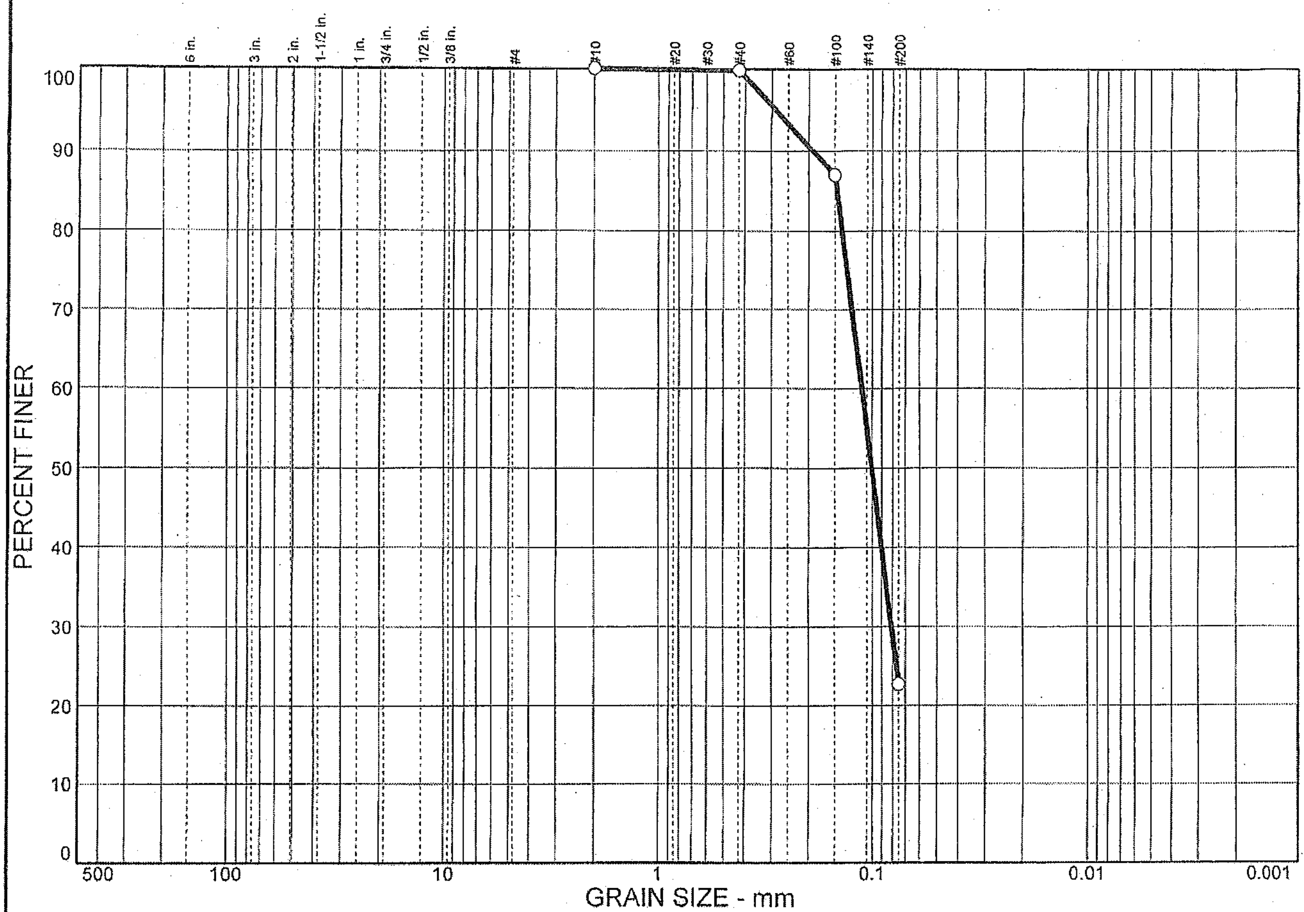
Remarks

Sample No.: 246 **Source of Sample:** **Date:** 4-15-15
Location: B-3,S-15 **Elev./Depth:** 55'-57'

SJB SERVICES, INC.

Client:
Project:
Project No: **Plate** 246

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	77.3	22.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.8		
#100	87.0		
#200	22.7		

* (no specification provided)

Soil Description

Silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.147 D_{60}= 0.112 D_{50}= 0.101
D_{30}= 0.0811 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

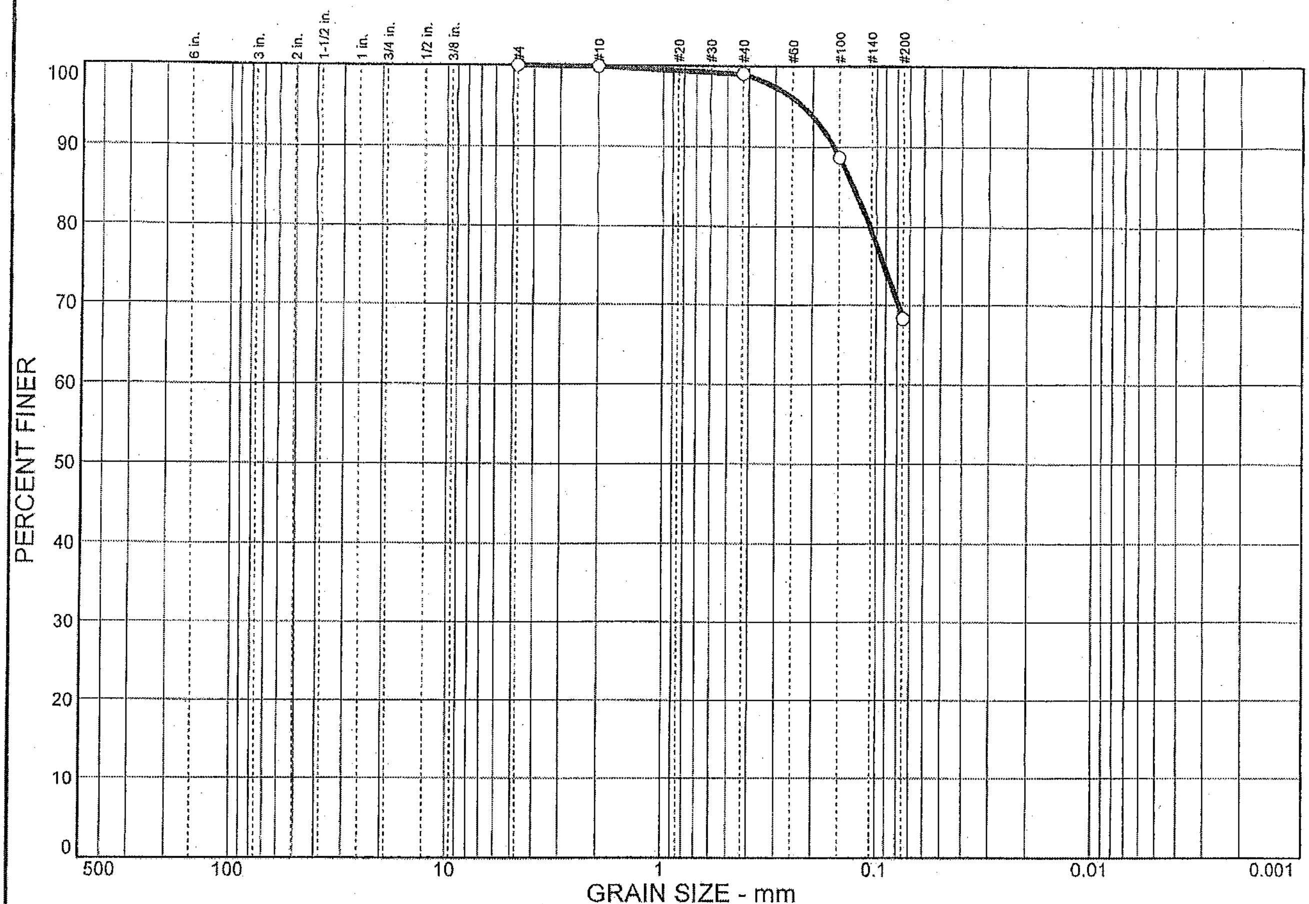
Remarks

Sample No.: 247 **Source of Sample:** **Date:** 4-6-15
Location: B-3,S-19 **Elev./Depth:** 75'-77'

SJB SERVICES, INC.

Client:
Project:
Project No: **Plate** 247

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	31.7	68.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#40	99.0		
#100	88.7		
#200	68.3		

* (no specification provided)

Soil Description

Sandy silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.129 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

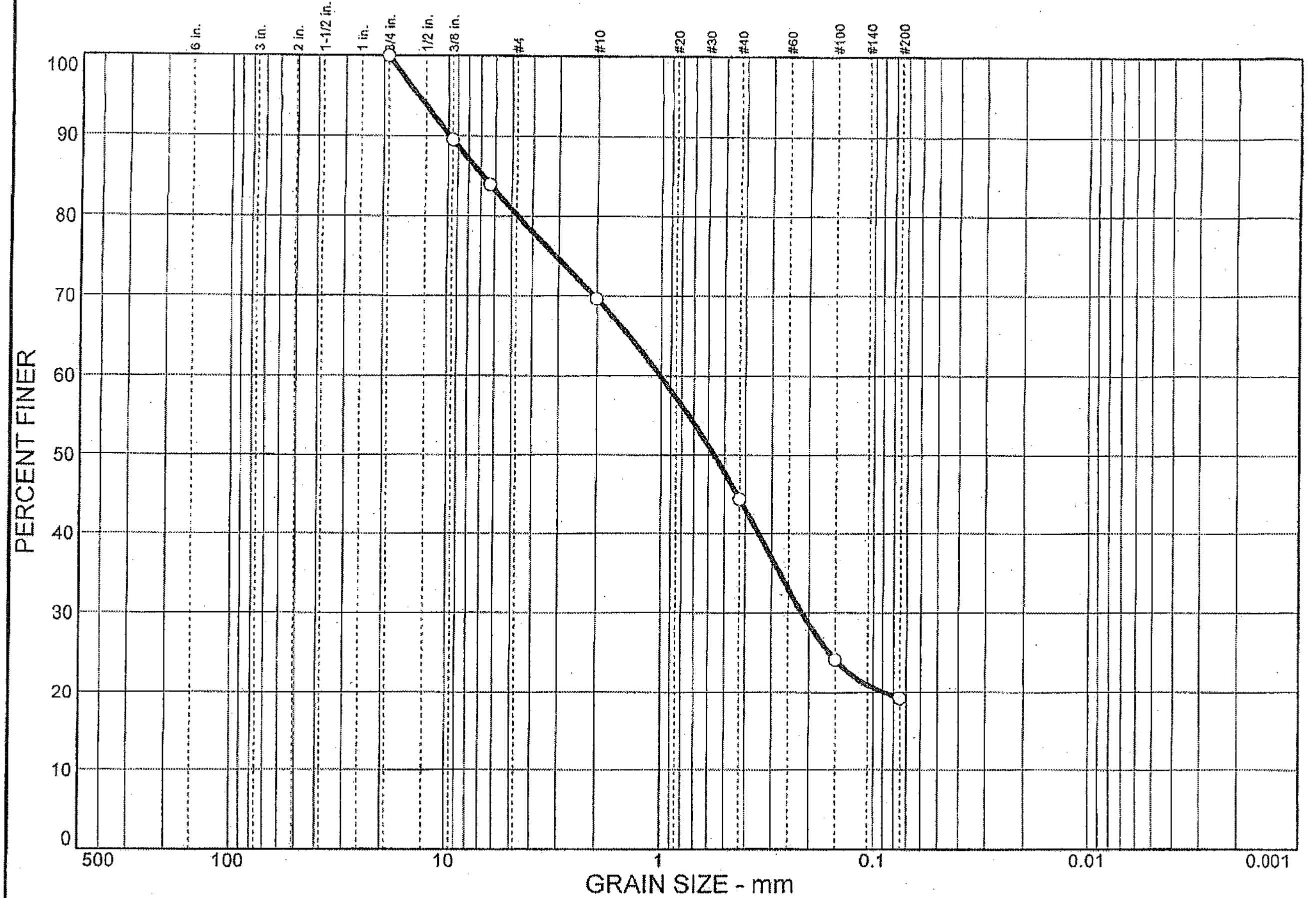
Remarks

Sample No.: 248 **Source of Sample:** **Date:** 4-6-15
Location: B-3,S-21 **Elev./Depth:** 85'-87'

SJB SERVICES, INC.

Client:
Project:
Project No: **Plate** 248

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	19.8	61.0	19.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75 in.	100.0		
0.375 in.	89.5		
0.25 in.	83.9		
#10	69.6		
#40	44.4		
#100	24.1		
#200	19.2		

* (no specification provided)

Soil Description

Silty sand with gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 6.90 D_{60}= 1.01 D_{50}= 0.563
D_{30}= 0.216 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample No.: 249 **Source of Sample:** **Date:** 4-6-15
Location: B-3,S-23 **Elev./Depth:** 95'-97'

SJB SERVICES, INC.	**Client:** **Project:** **Project No:** **Plate** 249

ATTACHMENT C

General Fill Material and Earthwork Recommendations

ATTACHMENT C

GENERAL FILL MATERIAL AND EARTHWORK RECOMMENDATIONS

I. Material Recommendations

A. Structural Fill

Structural Fill should consist of a crusher run stone, free of clay, organics and friable or deleterious particles. As a minimum, the crusher stone should meet the requirements of New York State Department of Transportation, Standard Specifications, Item 304.12 M – Type 2 Subbase, with the following gradation requirements.

Sieve Size Distribution	Percent Finer by Weight
2 inch	100
¼ inch	25-60
No. 40	5-40
No. 200	0-10

B. Suitable Granular Fill

Suitable soil material, classified as GW, GP, GM, SW, SP and SM soils using the Unified Soil Classification System (ASTM D-2487) and having no more than 85- percent material by weight passing the No. 40 sieve, no more than 20- percent material by weight passing the No. 200 sieve and which is generally free of particles greater than 6 inches, will be acceptable as Suitable Granular Fill. It should also be free of topsoil, asphalt, concrete rubble, wood, debris, clay and other deleterious materials. Suitable Granular Fill should be used as foundation backfill.

II. Placement and Compaction Requirements

All controlled fill placed beneath foundations, and as foundation backfill should be compacted to a minimum of 95 percent of the maximum dry density as measured by the modified Proctor test (ASTM D1557). Placement of fill should not exceed a maximum loose lift thickness of 6 to 9 inches and should be reduced in conjunction with the compaction equipment used so that the required density is attained.

Fill should have a moisture content within two percent of the optimum moisture content prior to compaction. Subgrades should be properly drained and protected from moisture and frost. Placement of fill on frozen subgrades is not acceptable. It is recommended that all fill placement and compaction be monitored and tested by a representative of Empire Geo-Services, Inc.

III. Quality Assurance Testing

The following minimum laboratory and field quality assurance testing frequencies are recommended to confirm fill material quality and post placement and compaction conditions. These minimum frequencies are based on generally uniform material properties and placement conditions. Should material properties vary or conditions at the time of placement vary (i.e. moisture content, placement and compaction, procedures or equipment, etc.) Then additional testing is recommended. Additional testing, which may be necessary, should be determined by qualified geotechnical personnel, based on evaluation of the actual fill material and construction conditions.

A. Laboratory Testing of Material Properties

- Moisture content (ASTM D-2216) - 1 test per 4000 cubic yards or no less than 2 tests per each material type.
- Grain Size Analysis (ASTM D-422) - 1 test per 4000 cubic yards or no less than 2 tests per each material type.
- Liquid and Plastic Limits (ASTM D-4318) 1 test per 4000 cubic yards or no less than 2 tests per each material type. Liquid and Plastic Limit testing is necessary only if appropriate, based on material composition (i.e. clayey or silty soils).
- Modified Proctor Moisture Density Relationship (ASTM D-1557) 1 test per 4000 cubic yards or no less than 1 test per each material type. A maximum/minimum density relationship (ASTM D-4253 and ASTM D-4254) may be an appropriate substitute for ASTM D-1557 depending on material gradation.

B. Field In-Place Moisture/Density Testing (ASTM D-3017 and ASTM D-2922)

- Backfilling along trenches and foundation walls - 1 test per 50 lineal feet per lift.
- Backfilling Isolated Excavations (i.e. column foundations, manholes, etc.) - 1 test per lift.

ATTACHMENT D

Information Regarding Geotechnical Report

GEOTECHNICAL REPORT LIMITATIONS

Empire Geo-Services, Inc. (Empire) has endeavored to meet the generally accepted standard of care for the services completed, and in doing so is obliged to advise the geotechnical report user of our report limitations. Empire believes that providing information about the report preparation and limitations is essential to help the user reduce geotechnical-related delays, cost over-runs, and other problems that can develop during the design and construction process. Empire would be pleased to answer any questions regarding the following limitations and use of our report to assist the user in assessing risks and planning for site development and construction.

PROJECT SPECIFIC FACTORS: The conclusions and recommendations provided in our geotechnical report were prepared based on available project specific factors described in the report, such as size, loading, and intended use of structures; general configuration of structures, roadways, and parking lots; existing and proposed site grading; or any other pertinent project information. Changes to the project details may alter the factors considered in development of the report conclusions and recommendations. *Accordingly, Empire cannot accept responsibility for problems which may develop if we are not consulted regarding any changes to the project specific factors that were assumed during the report preparation.*

SUBSURFACE CONDITIONS: The site exploration investigated subsurface conditions only at discrete test locations. Empire has used judgment to infer subsurface conditions between the discrete test locations, and on this basis the conclusions and recommendations in our geotechnical report were developed. It should be understood that the overall subsurface conditions inferred by Empire may vary from those revealed during construction, and these variations may impact on the assumptions made in developing the report conclusions and recommendations. *For this reason, Empire should be retained during construction to confirm that conditions are as expected, and to refine our conclusions and recommendations in the event that conditions are encountered that were not disclosed during the site exploration program.*

USE OF GEOTECHNICAL REPORT: Unless indicated otherwise, our geotechnical report has been prepared for the use of our client for specific application to the site and project conditions described in the report. *Without consulting with Empire, our geotechnical report should not be applied by any party to other sites or for any uses other than those originally intended.*

CHANGES IN SITE CONDITIONS: Surface and subsurface conditions are subject to change at a project site subsequent to preparation of the geotechnical report. Changes may include, but are not limited to, floods, earthquakes, groundwater fluctuations, and construction activities at the site and/or adjoining properties. *Empire should be informed of any such changes to determine if additional investigative and/or evaluation work is warranted.*

MISINTERPRETATION OF REPORT: The conclusions and recommendations contained in our geotechnical report are subject to misinterpretation. *To limit this possibility, Empire should review project plans and specifications relative to geotechnical issues to confirm that the recommendations contained in our report have been properly interpreted and applied.*

Subsurface exploration logs and other report data are also subject to misinterpretation by others if they are separated from the geotechnical report. This often occurs when copies of logs are given to contractors during the bid preparation process. *To minimize the potential for misinterpretation, the subsurface logs should not be separated from our geotechnical report and the use of excerpted or incomplete portions of the report should be avoided.*

OTHER LIMITATIONS: Geotechnical engineering is less exact than other design disciplines, as it is based partly on judgment and opinion. For this reason, our geotechnical report may include clauses that identify the limits of Empire's responsibility, or that may describe other limitations specific to a project. These clauses are intended to help all parties recognize their responsibilities and to assist them in assessing risks and decision making. Empire would be pleased to discuss these clauses and to answer any questions that may arise.