

**FINAL GEOTECHNICAL EVALUATION
MIRADOR LAS CASAS APARTMENTS IMPROVEMENTS
EDUARDO CONDE STREET
SANTURCE, SAN JUAN, PUERTO RICO
(JOB NO.: 20-4656)**



VICTOR E. RIVERA ASSOCIATES LLC
GEOTECHNICAL ENGINEERS
& CONCRETE TESTING LABORATORIES



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Submitted To:
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EXHIBIT B	"Routine Field and Laboratory Testing Procedures"

1. INTRODUCTION

This report presents the results of the **final** subsoil exploration and geotechnical engineering evaluation performed along the proposed improvements to **Mirador Las Casas Apartments** in turn located at Eduardo Conde Street, Santurce, San Juan, Puerto Rico.

This evaluation was performed as requested by Fernando L. Sumaza & Co., Inc., developers, and as per our approved proposal dated July 30, 2020 dully authorized as per your PO number 20-09-15 dated July 30, 2020.

2. SCOPE AND FIELD WORK

The evaluation was conducted with the aim of deciphering the engineering and geologic characteristics of the subsoil underlain the site, and use the data thus gathered in formulating **final** geotechnical recommendations for the proposed improvements. These geotechnical recommendations include:

- Site development;
- Foundation design parameters for the existing structures improvements, and new structures; and
- Anticipate any construction related problem and suggest the most feasible way to deal with it.

To comply with the before discussed scope, seventeen (17) test borings were drilled at the approximate locations shown on the enclosed plan as per exhibit A, **"Site Location Map; Site and Borings Location Plan; and Logs"**. Borings are identified as no. B-101 thru B-117. Boring B-110 was not performed due to the inaccessibility of the area for the drill rig. The depth of the borings vary from 20.5ft to 41ft for a total aggregate footage of 498.0 lineal feet of boring been drilled at the subject site. Borings were staked-out in the field using approximate tape measurements from existing reference points. No drilling fluid was used. Borings were drilled using either a trailer or truck mounted CME-55 drill rig or advanced by means of a motorized cathead tripod mounted equipment. Besides, a previous geotechnical evaluation performed by our office along the subject site was incorporated in our analysis.

All soil sampling was achieved by means of the universally adopted standard penetration test (SPT). All samples secured were visual-manually described and examined for the detection of any weak and/or secondary plane, or foreign/organic matter contain that could undermine its shearing strength, thus its load carrying capacity and compressibility as well. Routine laboratory tests as moisture content (w_n) and unconfined compressive strength (Q_u) tests were ran whenever possible.

Please, find on attached exhibit B, “**Routine Field and Laboratory Testing Procedures**”, a full description of the methods followed in the routine testing program.

All depths mentioned on this report are referred to the existing ground surface at the time our field exploration was conducted (October 22 thru 28, 2020). No elevations are given.

3. PROJECT GENERAL INFORMATION

3.1 Site Description

Mirador Las Casas Apartments location is shown on attached exhibit A. It is located south of Eduardo Conde Street, Santurce, San Juan, Puerto Rico. The residential complex consists in a cluster of 21 buildings 3-story in height (identified as no. 1 thru no. 21), a community center (building no. 22), an open basketball/volleyball court, parking facilities, and a local street. Please, see attached site plan as per exhibit A for more details.

The site where the residential complex is seated was raised up by filling to actual ground surface elevations over 40 years ago. It is understood that all buildings are supported over piles.

3.2 Project Description

The proposed improvements consist in the addition of laundry rooms at all building’s rear facades. This addition corresponds to a cast in-place concrete structure of approximately 6 ft wide by 24ft long extending up all three levels.

A new 3,500 square feet (sq.ft.) one-1 level multipurpose gym (cast in-place concrete structure) is to be constructed between buildings no. 8, 9, and 10. Additionally, a new 1,500 sq.ft. one-1 level

administration bldg. of the cast in-place concrete type is to be constructed between buildings no. 11 and 12. The improvements also contemplate the reconstruction of the existing open basketball/volleyball court. The area where the court is located is about 4ft lower in elevation than the buildings at north (No. 10) and east (No. 15). The project contemplates the demolition of the structure, raising the actual ground levels to match the ones of the residential complex, and the reconstruction of the court. A new steel framed structure and metal roof panels are to be provided. Finally, an underground cistern is also contemplated. Preliminary dimensions are 14ft. in width by 40ft in length and 8ft in depth.

Preliminary structural details call for the construction of the proposed additions and new construction over mat foundations, and over isolated footings for the basketball court roofing.

No grading plan is available as per today, however, based on the prevailing lot topography we assume that a shallow fill deposit, not exceeding 1.5ft in thickness, could be required to reach final grades along the proposed buildings no. 10, 15, and 16 additions, and the new gym and administration buildings location. Along the new basketball/volleyball roofed structure, fill could reach 4ft. in thickness. At all other construction areas, we understood that the site is to remain as "it is".

Please, bear in mind the before given general description is aimed as an assistance for a better understanding of the project and of this report content by the user. In no case, it constitutes a precise and complete description of the project, but most of it highlights as forehanded by the designing office. Complete information pertaining earthwork and all other project details for quantification and cost estimates should be obtained on corresponding construction final drawings once they become available.

4. GEOLOGIC SETTING

According to the US Geological Survey Map I-1010 "Geologic Map of the San Juan Quadrangle, Puerto Rico", prepared by Maurice H. Pease, Jr. and W.H. Monroe (1977), three (3) main geologic units superficially prevail at the project site and vicinity. Description given are as follow:

- Af =** *Artificial Fill (Holocene) – sand, limestone, and volcanic rocks as fill in valleys, swamps, and locally, a part of Bahía de San Juan....*
- Qs =** *Swamp deposits (Holocene) – sandy muck and clayey sand; generally underlain by*

peat formed in mangrove swamps....
Qss = Silica Sand (Holocene) – quartz sand, very pure, derived from by ferruginous and leaching...

A portion of the geologic map of the San Juan Quadrangle with the site depicted on it is shown on figure 1 below.

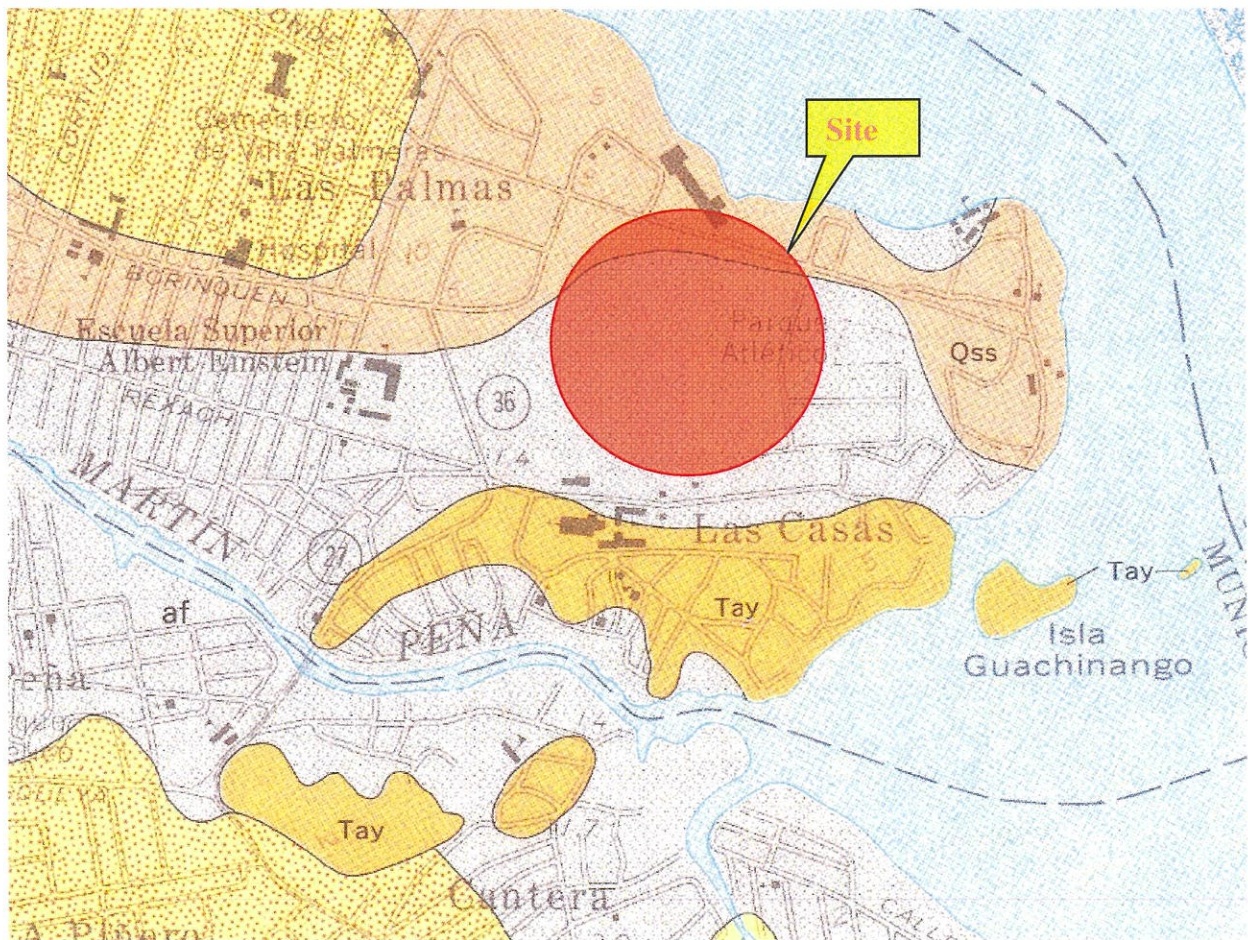


Figure no. 1. Portion of the Geologic Map of the San Juan Quadrangle. Project Site is Shown Encircled.

The exploratory test boring did confirm the presence of the above described units and are consistent with the results of the previous borings.

5. GENERALIZED SUBSOIL CONDITIONS

5.1 Generalized Subsoil Profile

The generalized subsoil conditions as uncovered by the test-boring very well match descriptions given on preceding item, i.e., can be divided in three main horizons: man-made fill (artificial fill), swamp deposits, and silica sand deposit. Each unit is briefly described below:

The **man-made fill** was found at the listed location as per table I below. It corresponds mostly to a mixture of gravel and sand mixed in variable proportions and containing different amounts of silt and clay. At some locations it consist of silt with variable amounts of sand and clay. When the fine and cohesive portions prevails (clay/silt), it shows medium soft to very stiff consistency. When the granular portion prevails, it shows very loose to medium relative densities, though medium prevails. Predominant colors are brown, yellow, red, and gray in various shades and tones.

Table I: Man-made Fill (Artificial Fill) Location and Thickness

Boring No.	Thickness (ft.)	Boring No.	Thickness (ft.)
B-101	2	B-109	12
B-102	2	B-111	3
B-103	6	B-112	4
B-104	3	B-113	4
B-105	4	B-114	6
B-106	4	B-115	4
B-107	4	B-116	11
B-108	3	B-117	8

The **swamp deposit** was found at the locations listed on table II below. It corresponds to fine sand with variable proportions of silt and peat intrusions, sandy silt, clay with variable proportions of sand, or as peat. When sandier it shows very loose to medium relative density, though very loose to loose prevails and it is predominantly gray to dark greenish gray in color. When fine and cohesive (clay or silt) it shows very soft to stiff consistencies. When peat is encountered, it correspond to a black and fibrous one in a slightly -consolidated state showing soft consistencies.

Table II: Swamp Deposit Location, Depth Range and Thickness

Boring No.	Depth Range (ft)	Thickness (ft)
B-103	6 to 19	13
B-104	3 to 5.5	2.5
B-109	12 to 18	4
B-111	3 to 15	12
B-113	4 to 9	5
B-114	6 to 19.5	13.5
B-115	4 to 13	9

The **silica sand deposit** was found at all boring locations underlying either the fill or the swamp deposit, and at all locations, it extends to the drilled depths. It consist mostly of fine grained sand with variable proportions of silt and clay, except at some locations where it consist of clay with variable proportions of sand and silt. When sandier, it shows very loose to very dense relative densities, though loose to medium prevails. When fine and cohesive it shows soft to hard consistencies. Prevailing colors are gray, yellow, and brown in various shades and tones.

5.2 Ground Water Level

The site ground water table was found at the below listed depths:

Table III: Ground Water Location, Depth and Elevation

Boring No.	Depth (ft.)		Boring No.	Depth (ft.)	
	During Drilling Operations	Upon Completion of Drilling Operations		During Drilling Operations	Upon Completion of Drilling Operations
B-101	9	9	B-109	8	8
B-102	8	5	B-111	8	4
B-103	8	8	B-112	10	4
B-104	8	5	B-113	10	4
B-105	8	3	B-114	9	7
B-106	8	4	B-115	9	9
B-107	8	4	B-116	7	7
B-108	15	4	B-117	8	8

The period the listed levels were monitored is recognized as being too short and that variations in any observed ground water level could arise according, among other factors, to the local dry and wet seasonal changes, and the closeness of the site to the sea shore. An accurate monitoring program calls for the installation of monitoring wells and prolonged observation periods, which in turn are out of our scope of work. Therefore, we suggest adopting the given level (during drilling operations) as **temporary** for this report purposes, and that variations can be found by the time constructions begins.

Please, see enclosed boring logs as per exhibit **A** for a more detailed description of all soil stratigraphic units encountered, field and laboratory results. These logs represent our best interpretation of the subsurface conditions based on the field data, and the visual-manual examination of the grabbed samples. The stratification lines and depth designations represent approximate boundaries between the subsurface strata. Actual transitions between strata may be gradual, and subsurface conditions between each boring location may vary

6. CONCLUSIONS AND DISCUSSION

The result of our investigation shows that the proposed structures can be constructed along the subject site according to our conclusions and recommendations discussed on forthcoming items.

However, the presence of the peat layer of the swamp deposit, and the saturated very loose to medium loose sand layers of the silica sand deposit; and the presence of the ground water at shallow depths prompts one main concern: settlements associated to primary/secondary consolidation of the peat layers, and due to liquefaction of the and layers under the event of a strong. To asset the consolidation and liquefaction potential, a settlement analysis was conducted.

6.1 Consolidation Settlement Assessment

Primary consolidation settlement develops as the result of a volume change in saturated cohesive soils because of water expulsion that occupies void spaces. Secondary consolidation settlement develops in saturated cohesive soils and organic matter as the result of the plastic deformation of soil fabrics at the end of primary consolidation when subjected to a constant effective stress. Settlements caused by secondary consolidation in peat shall be very significant.

The settlement evaluation for the existing buildings addition and the proposed one-1 level new buildings was conducted assuming they are to be erected over mat foundations , a permanent fill layer of 1.5ft. (where it applies), and soil consolidation parameters (for normally loaded soils) obtained by means of correlations among actual moisture content, void ratio and Atterberg limits. The following correlations were used:

$$Cc = 0.009 (LL-10) \text{ (Terzaghi and Peck, 1967)}$$

$$Cc = .0115w_n \text{ (organic soils)}$$

$$e_o = w_n G_s$$

Where: e_o = initial void ratio
LL = liquid limit (%)
 w_n = in-situ moisture content
 G_s = specific gravity

The results of the analysis conducted indicate that primary consolidation settlements in the order of 2.5 to 3.5 inches could take place within the construction areas at the vicinity of borings B-103, B-107, B-109, and B-113 through B-115. Secondary consolidation settlement could add up to 4 inches in a span of 10 years after completion of primary consolidation at the location of boring B-109. Needless to say, such magnitude of settlement will provoke damages to the proposed structures, substructures, and underground utilities around the new buildings. Keep in mind that at the location of the older borings, both primary and secondary settlements were estimated to range between 2.5 to 8 inches, and up to 4 inches, respectively.

6.2 Liquefaction Potential Assessment

Liquefaction is defined as the liquid state behavior a sand deposit reaches when the internal pore water pressure equals the overburden pressure. This phenomenon takes place when a loose saturated sand deposit is subjected to vibrations. If drainage is unable to occur, the pore water pressure increases and if it is allowed to built-up, then it could equal the overburden pressure, therefore, the soils “boils”. Afterwards, the sand deposit tends to compact and decrease in volume.

A computer program called LiquefyPro “A Computer Program for Liquefaction and Settlement Analysis” developed by a private company named Civiltech Corporation at Washington, USA was used in our

evaluation. To evaluate the liquefaction potential of the sand bar, the program evaluates the liquefaction potential and calculates settlement of soils deposits due to seismic loads. The software compute the liquefaction potential of level ground soils deposits by a procedure divided into four steps: 1) calculation of cyclic stress ratio (CSR, earthquake “loads”) induced in the soil by an earthquake; 2) calculation of cyclic resistance ratio (CRR, soil “strength”) based on in-situ test data from standard penetration test (SPT) or cone penetration test (CPT) tests; 3) by calculating a factor of safety against liquefaction (FS) by dividing CRR / CSR; and 4) estimation of liquefaction induced settlement. A safety factor of 1.0 or less means soils has liquefaction potential under seismic loading.

Incorporated on the analysis were the actual properties of different soil strata, i.e., thickness, SPT “N” values recorded, soil unit weight, percent of soil material passing the no. 200 (0.75µm) sieve, the ground water level depth, and the ground acceleration.

In order to properly assign a ground acceleration attenuation for our liquefaction evaluation, we referred to a paper published by Carlos E. Rodriguez Perez, PhD, and Jose L. Capacete, MS in 1988 (Revista Dimension, Año 2, Vol.8, Enero-Febrero-Marzo, 1988) which was based on empirical data gathered from studies conducted from Housner (1973), De Kiureghian and Ang (1975) and others. According to this publication, the seismic activity of Puerto Rico is mainly associated with three major tectonic features: the Puerto Rico Trench at north, the Mona Passage at west, and the Anegada Trough at east of the Island. One of the most important earthquakes was registered in 1867 and occurred along the Anegada Trough at east. Accordingly, the event was assigned with a magnitude 7.5 based on tectonics considerations and historical damages.

Based on said earthquake and the one registered in 1918 in the Mona Passage, they recommend a design earthquake event of 7.7 magnitude and ground accelerations of about 0.11g for areas located at the north coast to 0.18g for those areas on the west coast.

Nevertheless, the actual seismic events (January 2020) associated to the Montalva Fault located along the southwest coast of the Island, reached magnitudes of 6.0 and 6.4. Preliminary information indicates peak ground accelerations of about 0.40g at those Municipalities close to the epicenter (Yauco, Guanica,

and Guayanilla), and 0.2 at el Tuque sector in Ponce (our office location).

Therefore, a seismic evaluation using the preliminary values recorded from the recent seismic events, 0.40g was performed. An earthquake magnitude of 7.7 was adopted. Table IV below shows the revised results of the theoretical settlements obtained using the mentioned approach for the previous borings and new borings.

Table IV: Liquefaction-Induced Settlement Results

Boring No.	Settlement in Inches	Boring No.	Settlement in Inches	Boring No.	Settlement in Inches	Boring No.	Settlement in Inches	Boring No.	Settlement in Inches
B-2	1.13	B-9	0.56	B-101	11.33	B-108	3.65	B-116	None
B-3	6.00	B-10	8.86	B-102	0.96	B-109	None	---	---
B-4	7.23	B-11	5.30	B-103	4.22	B-111	4.05	---	---
B-5	4.97	B-12	8.64	B-104	None	B-112	2.27	---	---
B-6	1.92	B-13	4.70	B-105	None	B-113	4.65	---	---
B-7	9.15	B-14	0.23	B-106	None	B-114	6.06	---	---
B-8	0.67	B-15	1.39	B-107	None	B-115	2.80	---	---

The results of the analysis indicate that settlements due to liquefaction are likely to occur along the site where the residential complex is located. At those areas where the estimated theoretical settlements are less than 2 inches, it is our professional judgment that it can be tolerated by a mat foundation without impairing the structural integrity of the structure. However, if located over the peat layers, settlement due to consolidation will govern.

The results of the assessment indicates that both, consolidation and liquefaction settlements, are likely to occur under the proposed improvements either because of the structures load (static loads) or due to an earthquake event (dynamic loads). Such total and differential settlements could not be effectively handled by the mat foundations; therefore, a ground improvement technique must be implemented below the structures footprint in order to minimize the potential settlements. After evaluating the different soil improvement techniques available, we understood that the most cost effective solution for the project is reinforcing the soil by means rammed aggregate piers (RAP'S) or vibro stone columns (VSC's) thus allowing the construction of the structures over mat foundation. The use of a deep foundation system as auger cast in-place piles (ACIP piles) can be also considered for the structure

construction.

7. RECOMMENDATIONS

The following guidelines must be implemented below any structure where fill is to be required to reach final grades.

7.1 Site Development

1. Remove any topsoil supporting any existing vegetation, and/or any foreign matter, and/or any construction debris, all throughout the construction area. Excavation depth could vary crosswise and final depths shall be established as fieldwork progresses. All the material so excavated must be disposed off in an orderly manner or used in finishing purposes along the green areas. The existing fill can remain as "it is".
2. Any existing underground utility to be abandoned must be removed and the excavations backfilled following an engineered control procedure as detailed below, always under the permanent supervision of the project geotechnical engineer field representative. Alternatively, they can be abandoned in-place whenever filled with a lean concrete mix (500psi minimum compressive strength resistance).
3. Before any placement of fill/backfill is made, the exposed area shall be proof rolled. If any weak or soft spot is uncovered, it shall be fully excavated.
4. The proof rolling operations must be at all instances supervised by the project geotechnical engineer field representative.
5. All soil-aggregate mixture for fill/backfill purposes shall meet an A-2-6 or better classification as per AASHTO M145 standard. A deviation from the before fill/backfill material(s) classification can be allowed but always directed by the geotechnical engineer and/or his/her representatives. In same fashion the maximum size of the fill aggregate shall not exceed 4 inches to achieve the recommended compaction criterion to be detailed ahead.
6. Place the new fill/backfill deposit in layers not exceeding 8 inches, loose measured, and each layer shall be imparted with a minimum percent of compaction of 95% of the new fill material maximum dry density (MDD) as obtained from laboratory compaction curves conducted according to ASTM standard D1557, Modified Proctor Test. Whenever the minimum percent of

compaction is not attained, additional rolling shall be performed to obtain said density, or otherwise the contractor must obtain the appropriate equipment and/or adopt any other sound practice to comply with the compaction criteria.

7. Because of the close proximity of existing residential structures, compaction operations shall be monitored at the very beginning of the compaction operation. If wave's velocities that might pose a risk to any close by structure and/or substructure are so monitored, the geotechnical engineer must evaluate the situation and issue the pertinent preventive recommendations allowing the project to continue ahead overcoming any risk for the said structures and/or substructures.
8. The backfill/fill material shall exhibit a moisture content ranging from 2 to 4% above the corresponding optimum moisture content (OMC) prior to impart any compaction effort.
9. This backfill/fill procedure must be conducted until final grades are reached.
10. No fill/backfill material shall be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rains, fill/backfill operations shall not be resumed until the field tests made by the geotechnical engineer or his/her representative indicates that the moisture content and density of the fill are as previously specified.
11. Any resulting fill slope shall be made 2:1 (horizontal to vertical) regardless of its height and shall be superficially stabilized by chain rolling but to such a density that vegetation growing is allowed. It also shall be protected against gully and sheet erosion by providing proper drainage facilities and sodding. Avoid any surface drainage down the slopes.
12. All fill/backfill operations shall be supervised by a geotechnical engineer or his representative who is to certify the quality degree achieved.

7.2. Foundation Design Parameters

7.2.1 Existing Buildings Additions, Administration Bldg., Gym Bldg., and Basketball/Volleyball Court Bldg.

7.2.1.1 Soil Reinforcement Alternative - Installation of Aggregate Piers

It is our best engineering judgment that the most feasible and economical solution is reinforcing the underlying soils below the new structure footprints by means of aggregate piers or vibro stone columns thus allowing the construction of the structure over either isolated footings or a mat foundation. The advantage of this solution is that construction might proceed faster.

This type of ground improvement would consist of compacting columns of well-graded crushed rock to increase the bearing capacity of the loose, potentially liquefiable soils and reduce the potential for settlement. After the aggregate piers are installed, the new foundations can be supported directly on the improved ground. The method of installation shall consider the potential cave in of the sand deposit.

The use of these systems will result in a settlements reduction within the structure and in an increased soil allowable bearing pressure allowing the construction of the structure over the contemplated mat foundations (bldgs. additions) or isolated foundations (gym bldg., administration bldg., and basketball/volleyball court structure). Typical values of allowable soil bearing pressure increases reaching anywhere from 3.5 to 4.5 kips per sq. ft. (KSF), depending on loads and actual soil conditions. The above recommended reinforcement soil techniques are a specialized matter that must be designed by the pier or columns suppliers which shall determine the piers/columns spacing and lengths to be constructed below the building additions and new structures based on the structural loads and foundation plans, and structure settlement tolerance. All drawings and specifications produced by these suppliers shall be signed by a P.R. licensed professional engineer authorized to render this kind of specialty.

Based on the findings of the test borings we might anticipated that the depth of either the aggregate piers or vibro stone columns could vary between 15 to 40ft. Table V below details the minimum pier lengths to be installed at each structure as per our best judgment. Once again, the final depth must be established by the pier designers.

Table V: Aggregates Pier Length Schedule

Bldg. ID ^(a)	Aggregate Pier Length (ft.) ^(b)
No.5, No.10, No.17	15
No.6, No.8, No.13, No.19, No.21	20
No.2, No.4, No.7, No.11, No.16, Gym and Basket/Volleyball Bldg.	25
No.1, No.18, No.20, New Adm. Bldg.	30
No.3, No.15	35
No.12, New Underground Cistern	40 ^(c)

Note: (a) It is our best engineering judgment that buildings no. 9 and 14 additions can be supported over a rigid mat foundation resting over the foundation soils, that is, no aggregates piers are deemed required. If a mat foundation is selected, it can be proportioned for an allowable soil contact pressure not exceeding 2,000 psf at a minimum foundation depth (Df) equal to 1ft below actual grades.

(b) Below actual ground surface.

(c) Effective length of 32ft as referred to the bottom of excavation which has been established at 8ft. below actual ground surface.

It is understood that the existing buildings are constructed over a piling system of unknown details. The new additions are recommended in a different foundation system; therefore, construction joints must be incorporated between the existing and new additions in order to manage the different response of the structure to the foundation systems. Otherwise, all additions must be structurally anchored to the existing buildings.

It is highly suggested to carefully visually inspect any surrounding structures including taking photos and/or videos recording, of the conditions of said structures before any aggregate pier operation is attempted. By doing so, frivolous damage claims against all concerned parties could be avoided in the future, and if not avoided, the proper documentation of said photos and/or videos should serve in proving against any such claim.

Monitoring of the vibrations to be induced by the aggregate pier installation equipment shall be continuously executed because of the closeness of various existing structures. If excess wave velocities

are recorded, the project geotechnical engineer shall formulate the recommendations to mitigate the risk any excess vibration could pose to the surrounding structures.

7.2.1.2 Deep Foundation System – 12 or 14 Inches Continuous Flight Augured (CFA) Piles

The soil reinforcement by means of aggregates piers could prove to be the most economical solution for the construction of the existing building additions and new construction. Nevertheless, the use of a deep foundation system instead of the aggregated piers can be also considered as a foundation alternate solution. Detailed recommendations for the piling solution could be submitted upon request.

7.2.2 Underground Cistern

The underground cistern must be also supported over the recommended aggregates piers/vibro stone columns. According to the theoretical approach conducted, we have estimated as much as 11 inches of liquefaction induced settlements could take place around the proposed structure location and vicinity. Therefore, all connections must be designed to absorb much of the expected settlements, flexible connections. The following guidelines must be followed for the construction of the cistern.

7.2.2.1 Excavation Classification, Dewatering and Temporary Excavation Walls Geometry

The excavation to reach the cistern slab bottom elevation can be easily accomplished by conventional earth excavating equipment as a backhoe, i.e., a hydraulic excavator commonly known as backhoe. Our best estimation is that a backhoe with a flywheel power of 157 HP (Caterpillar 229D or similar) could be satisfactorily used for this purpose. However, the potential contractor must carefully examine the attached boring log and construction site, and then reach their own conclusions.

Since no groundwater table was hit within the new proposed excavation depth (8ft), no dewatering is anticipated. Based on our experience with similar soil conditions, all the temporary excavation walls shall be trimmed to conform a geometry 1:1 (horizontal to vertical). **Nevertheless, all excavation deeper than 4ft. should be performed in accordance with Occupational Safety and Health Administration (OSHA) excavation standard, 29 CFR Part 1926 subpart P, published by the U.S. Department of Labor, and/or any other applicable local standard.**

In no case the excavated materials are to be temporarily or permanently stockpiled at a distance less than one (1) times the excavation depth as referred to the upper edge of the excavation.

7.2.2.2 Structure Foundation Design Parameters

The cistern bottom slab shall be designed as a rigid mat foundation proportioned for an allowable soil contact pressure (q_a) not exceeding 4,000 pounds per square ft (psf) at the planned foundation depth of 8ft. below existing ground surface supported over the aggregate piers or vibro stone columns. Even though no ground water was found within the contemplated excavation depth, we highly suggest to provide both the bottom slab and walls to resist an unbalance head of water of not less than 4.0 ft. due any accumulation of water on the excavation after the cistern has been put in-place.

Additionally, the following soil parameters shall be assumed for the backfill to be placed behind and confined by the cistern walls:

	Borrow Fill (A-2-6 or better)	In-situ Soils
Moist unit weight -pcf (γ):	130	115
Internal friction angle (ϕ):	34	25
Cohesion (psf):	neglect	2,000
Active earth pressure coefficient (K_a) =	0.28	0.40
At rest earth pressure coefficient (K_o) =	0.44	0.58

In the event the top slab of is not poured until after the backfill has been placed, the active earth pressure condition should be used. However, if the slab is poured ahead of the backfilling placing and compaction, the slab will restrain deflection of the walls due to the backfill, and therefore, the at rest condition (K_o) shall be used.

The backfill shall be conducted under an engineered quality control. Notice that the compaction equipment here should be a small roll or damper, thus the backfill lift thickness is not to exceed 4 inches. Each lift shall be compacted to not less than 95% of the backfill maximum dry density (MDD) as obtained by means of laboratory compaction curves tests conducted as per ASTM D1557 standard (modified proctor). The backfill material must meet an A-2-6 or better classification as per AASHTO

M145. The material to result from the tank excavation can be used for backfilling purposes whenever tested and approved by the project geotechnical engineer.

7.3 Temporary Loads and Seismic Design Parameters

The allowable bearing pressure can be increased 33% of the given value to deal with short term loading conditions due to earthquake and/or winds.

According to the International Building Code (2018) and down to the limited depth drilled, the designer should consider a soil profile type D (stiff soil profile) in designing the structure for seismic considerations. The later considers that the compressible soils are reinforced by the recommended rigid elements.

7.4 Excavations

All excavations can be performed by means of a medium size backhoe down to the anticipated foundation depths.

All excavation shall be performed in accordance with Occupational Safety and Health Administration (OSHA) excavation standard, 29 CFR Part 1926 subpart P, published by the U.S. Department of Labor, and/or any other applicable local standard.

7.5 Dewatering of Excavations

No dewatering of excavations is anticipated is maximum depth reached not exceeding 4ft., except that from run-off and rain. Otherwise dewatering must be achieved. Any such kind of water entering the excavations can be pumped- out directly and the dampened soil be removed from the excavation before any concrete pour is made.

8. ADDITIONAL COMMENTS

In the preceding discussions we have presented our preliminary conclusions and recommendations based upon results attained from our field exploration made by means of test borings, visual inspection

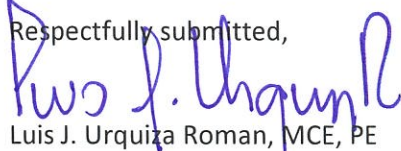
of the site area, soil parameter assumptions, and other pertinent information advanced to this office. It is our understanding best geotechnical engineering practices were adopted in achieving said goals.

Differing conditions could arise beyond the boring location as the field work progresses. If any such differing conditions arise, the geotechnical engineer in charge must carry out the pertinent evaluation and produce, at his own risk, the recommendations to deal with such event. All recommendations herein submitted shall apply only for the project and site conditions herein detailed. In no case these shall be applicable for other structures or areas out of scope of this work.

It must be pointed out that only a limited numbers of borings were drilled at the site in order to uncover the soil type and strength properties, and to submit preliminary design recommendation for the structure foundations. A complementary geotechnical exploration must be conducted aimed to better define such soil properties keeping in mind the variations between the drilled borings, and for submitting recommendations for a piling solution.

Finally, all fill/backfill operations shall be conducted under the permanent supervision of this geotechnical engineering office that is to also certify the degree of quality excellence achieved in the construction of the fill deposit as well as to judge the fill deposit as a structural load carrying element. The non-compliance with these supervision requirements means that this office shall not be held responsible for any or all the recommendations given on this report.

Respectfully submitted,


Luis J. Urquiza Roman, MCE, PE
Staff Geotechnical Engineer

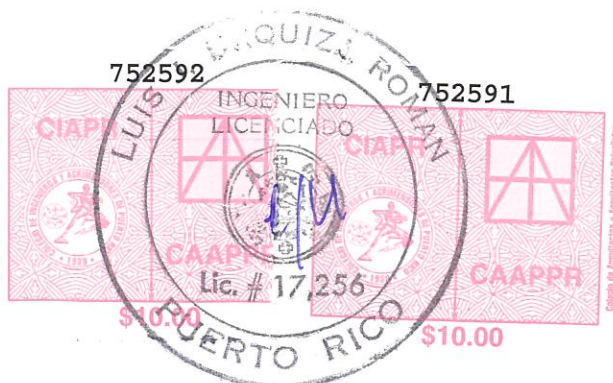


EXHIBIT "A"
SITE LOCATION MAP; SITE AND BORINGS
LOCATION PLAN; AND LOGS
MIRADOR LAS CASAS APARTMENTS IMPROVEMENTS
EDUARDO CONDE STREET
SANTURCE, SAN JUAN, PUERTO RICO
(JOB NO.: 20-4656)

By:

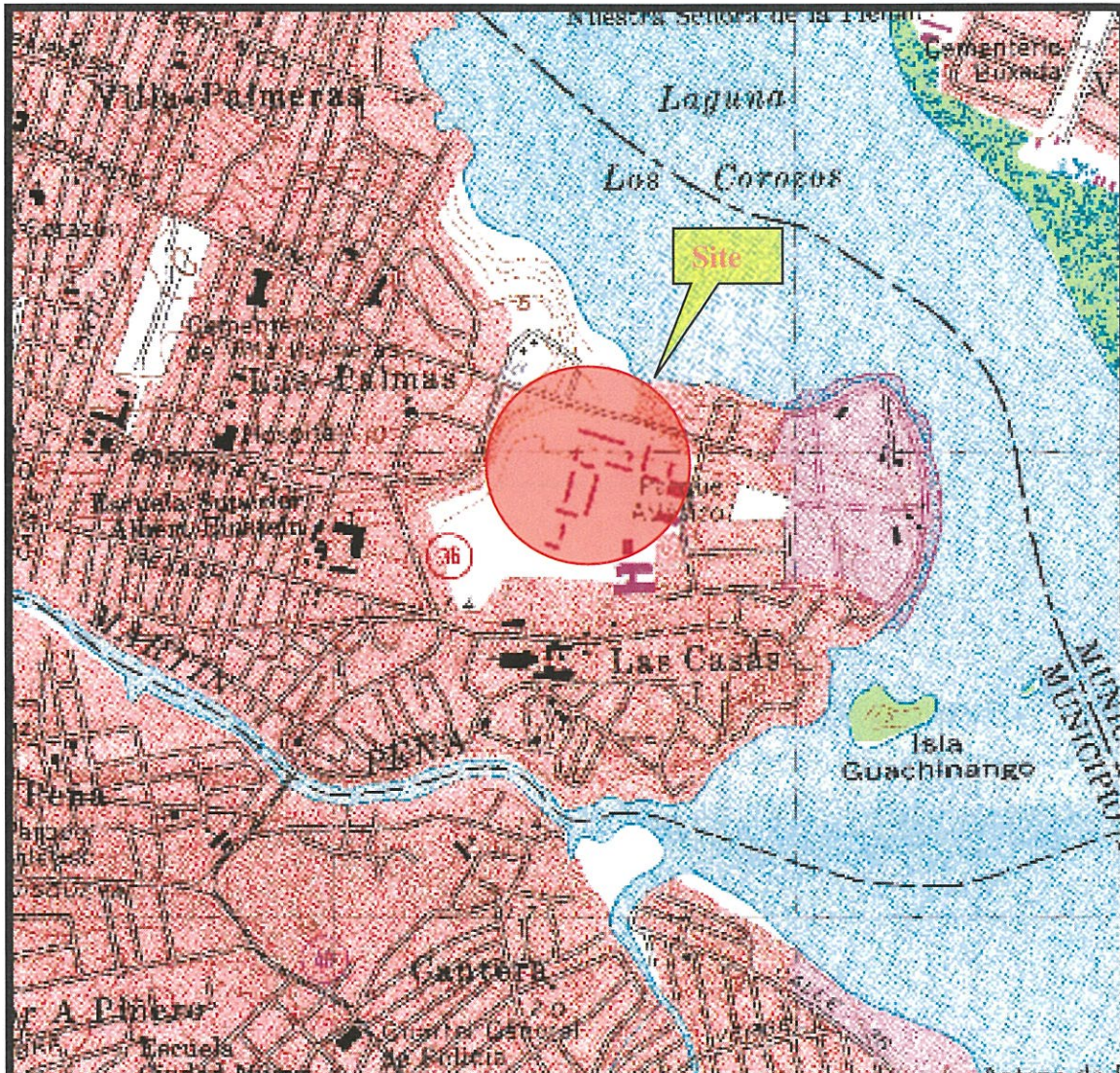
LUIS J. URQUIZA ROMAN, M.C.E. P.E.
VICTOR E. RIVERA ROLDAN, M.B.A., P.E.
VICTOR E. RIVERA ASSOCIATES
GEOTECHNICAL ENGINEERS



October 29, 2020

SITE LOCATION MAP

After US Geological Survey



Final Geotechnical Evaluation
Mirador Las Casas Apartments Improvements
Eduardo Conde Street, Santurce
San Juan, Puerto Rico
Fernando L. Sumaza & Co., Inc. - Sponsor

DATE: 10/29/2020

JOB NO.: 20-4656

SCALE: Not to scale



VICTOR E. RIVERA ASSOCIATES LLC
GEOTECHNICAL ENGINEERS
& CONCRETE TESTING LABORATORIES



AASHTO R18®
Accredited Laboratory



US Army Corps
of Engineers®
Validated Laboratory

SITE AND BORINGS LOCATION PLAN



Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-101 SHEET NO.: 1/2

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Maldonado WORK STARTED: 10-23-2020 WORK FINISHED: 10-23-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-23-2020: -9ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		1 - 4	Sand, some silt, trace gravel, medium - light reddish brown (a)	9	13.5	---				
2		5 - 5								
3		4 - 7	Sandy clay, stiff to very stiff - yellowish brown / brownish yellow / red / white (c)	14	19.1	3.52				
4		7 - 7								
5		1 - 2		6	24.1	2.86				
6		4 - 5								
7		7		12	18.2	1.50				
8										
9										
10		2 - 4		8	19.6	2.86				
11		4 - 6								
12										
13			Fine sand, trace to some silt, loose to medium loose - red / light yellowish red / brownish yellow (c)							
14										
15		2 - 3		7	18.0	---				
16		4 - 6								
17										
18										
19										
20		1/12"		5	16.1	---				
21		4 - 6								
22										
23										
24										
25		4 - 5		10	17.8	---				
26		5 - 6								
27										
28										
29										
30		1 - 3		7	19.2	---				
31		4 - 4								
32										
33										
34										
35		2 - 6 - 6 - 9		12	22.0	---				

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

PO Box 32198
Ponce, PR 00732-2198

VICTOR E. RIVERA & ASSOCIATES
Geotechnical Engineers

Tels.: (787) 259-1410
Fax: (787) 259-1604

Final Geotechnica Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-101 SHEET NO.: 2/2

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-23-2020 WORK FINISHED: 10-23-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-23-2020: -9ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
36			Fine sand, trace to some silt, loose to medium loose – red / light yellowish red / brownish yellow (c) -37'							
37										
38			Fine sand, trace silt, medium – brownish yellow (c)							
39										
40		5 – 9 – 11	-40.5'	20	18.7	---				A
41			END OF BORING							
42										
43										
44			(a) Man-made fill							
45			(b) Swamp Deposit							
46			(c) Silica Sand							
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
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61										
62										
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66										
67										
68										
69										
70										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-102 SHEET NO.: 1/2

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-28-2020 WORK FINISHED: 10-28-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-28-2020: -5ft.
10-28-2020: -8ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		1 - 3	Clayey gravel with sand, medium loose - yellowish red (a)	10	13.8	---				
2		7 - 12								
3		6 - 7	Fine sand, trace silt, loose to dense = gray / brown / light gray (c)	21	12.7	---				
4		14 - 14								
5	▼	8 - 8		16	24.5	---				
6		8 - 10								
7		4 - 4		8	24.9	---				
8	▼	4 - 3	Fine sand, trace silt, medium to very dense - gray / brown (c)							
9		7 - 14		33	21.8	---				
10		19 - 20								
11										
12										
13			Fine sand, trace silt, medium to very dense - gray / brown (c)							
14										
15		19 - 25		52	20.4	---				
16		27								
17										
18			Fine sand, trace silt, medium to very dense - gray / brown (c)							
19										
20		13 - 18		38	23.1	---				
21		20								
22										
23			END OF BORING							
24										
25		20 - 24 - 28		52	14.7	---				
26										
27										
28			(a) Man-made fill deposit							
29			(b) Swamp deposit							
30			(c) Silica sand							
31										
32										
33										
34										
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-103 SHEET NO.: 1/2

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-28-2020 WORK FINISHED: 10-28-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-28-2020: -8ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		33 - 15	Clayey gravel with sand, medium to dense - red / gray / brownish yellow (a)	31	25.1	---				
2		16 - 14								
3		8 - 11		21	23.7	---				
4		10 - 13								
5		16 - 17	Sand and clay, trace gravel, medium dense - brown (a)	36	15.5	---				
6		19 - 22								
7		5 - 5	Fine sand, trace silt, medium loose - gray (b)	12	27.3	---				
8	▼	7 - 4								
9			Peat and sand, soft - black (b)							
10										
11		2 - 5		12	94.1	---				
12		7 - 9								
13			Clayey fine sand, few peat intrusions, very loose -gray (b)							
14										
15		4 - 1		4	20.4	---				
16		3 - 3								
17										
18										
19										
20		20 - 50/4"		50/4"	17.2	---				
21										
22										
23										
24										
25		5 - 7	Clayey sand, medium to very dense - olive brown (c)	18	17.6	---				
26		11								
27										
28										
29										
30		15 - 24 - 29								
31				53	17.9	---				
32										
33										
34										
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-104 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-27-2020 WORK FINISHED: 10-27-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-27-2020: -5ft.
10-27-2020: -8ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		1 - 5	Sandy silt with gravel, medium - brownish yellow / yellowish red (a)	12	19.0	---				
2		7 - 8								
3		7 - 5		12	28.4	---				
4		7 - 8	Sandy silt with organic matter, stiff - black / gray (b)							
5	▼	4 - 5		11	34.4	---				
6		6 - 15								
7		8 - 10	Fine sand, trace silt, medium - light gray / olive brown (c)	16	25.4	---				
8	▼	6 - 8								
9										
10		10 - 11		25	18.6	---				
11		14 - 14								
12										
13			Clay and sand. Medium soft - gray / brown (c)							
14										
15		4 - 5		13	18.5	0.50				A
16		9								
17										
18										
19			Clay, some sand, stiff - reddish brown (c)							
20		5 - 5		15	27.3	1.50				
21		10								
22										
23										
24										
25		5 - 6	Clay and sand, medium - red (c)	16	19.8	0.75				
26		10								
27										
28			Sand and clay, dense - red (c)							
29										
30		9 - 15 - 18		33	27.4	27.4				
31			END OF BORING							
32			(a) Man-made fill							
33			(b) Swamp Deposit							
34			(c) Silica Sand							
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

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N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-105 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-23-2020 WORK FINISHED: 10-23-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-23-2020: -4ft.
10-23-2020: -8ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		10 - 8	Fine sand, trace silt, many roots, medium loose - brown (a)	12	13.4	---				
2		4 - 4								
3		6 - 6		11	12.7	---				
4	▼	5 - 4								
5		10 - 11	Fine sand, trace silt, medium to very dense - gray - brown (c)	20	25.0	---				
6		9 - 9								
7		7 - 8		20	20.0	---				
8	▼	12 - 14								
9		10 - 14		29	20.3	---				
10		15 - 18								
11										
12										
13										
14										
15		12 - 20	END OF BORING	54	21.7	---				
16		34								
17										
18										
19										
20		10 - 16		44	23.5	---				
21		28								
22										
23										
24										
25		10 - 15 - 35		50	21.8	---				
26			(a) Man-made fill (b) Swamp Deposit (c) Silica Sand							
27										
28										
29										
30										
31										
32										
33										
34										
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

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N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

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% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-106 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-23-2020 WORK FINISHED: 10-23-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-23-2020: -4ft.
10-23-2020: -8ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		3 - 6	Clay and sand. Some gravel, medium stiff to stiff - brown (a)	10	18.9	---				
2		4 - 5								
3		7 - 9		18	23.0	---				
4	▼	9 - 11		-4'						
5		6 - 9	Fine sand, trace silt, medium - light gray / brownish (c)	21	21.1	---				A
6		12 - 15								
7		10 - 9		20	19.6	---				
8	▼	11 - 11								
9		9 - 11		27	20.7	---				
10		16 - 21								
11										
12										
13										
14										
15		30 - 27	Sandy clay, stiff - light yellowish brown / gray (c)	79	19.1	1.50				B
16		52		-16'						
17										
18			Fine sand, trace silt, very dense - brownish gray (c)							
19										
20		14 - 28 - 30		-20.5'	58	17.4	---			
21			END OF BORING							
22			(a) Man-made fill							
23			(b) Swamp Deposit							
24			(c) Silica Sand							
25										
26										
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28										
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32										
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34										
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

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(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

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PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-107 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-22-2020 WORK FINISHED: 10-22-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-22-2020: -4ft.
10-22-2020: -8ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		3 - 3	Sandy clay with gravel, very stiff - yellowish brown / olive brown (a)	8	16.0	---				
2		5 - 6								
3		7 - 14		26	15.8	---				
4	▼	12 - 11		-4'						
5		8 - 7	Fine sand, trace silt, loose - light yellowish brown / olive brown (c)	10	18.5	---				
6		3 - 3		-6'						
7		8 - 9	Clay and sand, soft to medium - yellowish brown / grayish (c)	17	24.6	0.60				
8	▼	8 - 9								
9		4 - 5		11	16.7	---				
10		6 - 6								
11										
12										
13				13'						
14										
15		3 - 10	Fine sand, trace silt, medium to very dense - light yellowish brown / grayish (c)	17	18.5	---				
16		7								
17										
18										
19										
20		24 - 34		74	18.2	---				
21		40								
22										
23										
24										
25		20 - 29 - 41		-25.5'	70	13.8	---			
26										
27			END OF BORING							
28										
29										
30										
31										
32			(a) Man-made fill							
33			(b) Swamp Deposit							
34			(c) Silica Sand							
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-108 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-27-2020 WORK FINISHED: 10-27-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-27-2020: -4ft.
10-27-2020: -15ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		2 - 3	Sandy clay, trace gravel, very stiff - grayish brown / red (a)	9	22.4	3.25				
2		6 - 6								
3		5 - 8		-3'	18	17.6	---			
4		10 - 10	Sand, trace silt, medium loose to medium - gray (c)							
5	▼	4 - 5		11	19.9	---				
6		6 - 5								
7		6 - 13	Clay and sand, stiff - gray / olive brown (c)	27	19.9	---				
8		14 - 15		-8'						
9		6 - 5		10	19.9	---				
10		5 - 6								
11				-11'						
12										
13			Clayey sand, medium loose to medium - olive gray / olive brown / light gray / yellowish brown (c)							
14										
15	▼	5 - 7		16	17.0	1.50				A
16		9								
17										
18										
19										
20		6 - 5		10	16.9	---				
21		5								
22										
23				-23'						
24										
25		5 - 10	Sand, some silt, dense to very dense - yellowish brown / olive brown (c)	25	15.6	---				
26		15								
27										
28										
29										
30		17 - 19 - 22		-30.5'	41	15.9	---			
31			END OF BORING							
32			(a) Man-made fill							
33			(b) Swamp Deposit							
34			(c) Silica Sand							
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-109 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-27-2020 WORK FINISHED: 10-27-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-27-2020: -8ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		2 - 8	Clayey silty gravel with sand, medium loose to medium - brownish yellow (a)	16	18.2	---				
2		8 - 8								
3		4 - 7		13	28.0	---				
4		6 - 7	Sandy clay, some gravel, medium - yellowish red / gray (a)							
5		1 - 4		8	22.5	---				
6		4 - 7	Sand, some silt, dense - dark greenish gray (a)							
7		9 - 13		27	15.5	---				
8	▼	14								
9			Gravelly clay with sand, medium soft - light gray / brownish yellow (a)							
10		3 - 3		7	29.0	0.50				
11		4 - 6								
12			Fibrous peat, very stiff - black (b)							
13										
14										
15		Push/24"		WH	418.7	---				
16			Fine sand, trace silt, medium to dense - light gray (c)							
17										
18										
19		8 - 14		31	27.2	---				
20		17								
21										
22										
23										
24										
25		9 - 13 - 14		27	22.1	---				
26			END OF BORING							
27										
28										
29										
30										
31										
32			(a) Man-made fill							
33			(b) Swamp Deposit							
34			(c) Silica Sand							
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-111 SHEET NO.: 1/2

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-28-2020 WORK FINISHED: 10-28-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-28-2020: -4ft.
10-28-2020: -8ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		7 - 8	Sandy gravel with clay, medium loose to medium - yellowish red / gray (a)	20	16.0	---				
2		12 - 15								
3		10 - 7		-3'	12	23.1	---			
4	▼	5 - 4	Clayey sand, loose - gray (b)							
5		1 - 4		6	18.3	---				
6		2 - 2								
7		2 - 4	Fine sand, trace silt, medium loose - light gray (b)	6	22.5	---				
8	▼	2 - 2		-8'						
9										
10		1 - 3	Peat with sand, very soft - black (b)	12	26.6	---				
11		9 - 12		-13'						
12										
13			Fine sand, trace silt, medium - olive brown (c)							
14				-15'						
15		5 - 8		18	187.6	---				
16		10	Clay and sand, very stiff - light gray (c)		22.3	---				
17				-19'						
18										
19		3 - 4	Clayey sand, medium - light gray (c)	9	15.0	3.25				
20		5 - 9		-23						
21										
22			Clay, some sand, very stiff - brownish yellow (c)							
23				-25'						
24		8 - 11		27	13.8	---				
25		16	END OF BORING							
26										
27										
28			(a) Man-made fill deposit (b) Swamp deposit (c) Silica sand							
29										
30		10 - 16 - 19		-30.5'	35	22.7	3.25			
31										
32										
33										
34										
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

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Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-112 SHEET NO.: 1/2

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-23-2020 WORK FINISHED: 10-23-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-23-2020: -4ft.
10-23-2020: -10ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		3 - 4	Sand, some clay, loose - reddish brown (a)	10	9.5	---				
2		6 - 6								
3		15 - 17	Gravelly sandy clay, very stiff - red / brownish (a)	35	24.3	2.60				
4	▼	18 - 20								
5		10 - 10	Fine sand, trace silt, medium loose to medium - light gray / olive brown (c)	20	24.5	---				
6		10 - 11								
7		10 - 9		21	21.4	---				
8		8 - 8								
9		6 - 6		14	23.1	---				
10	▼	5 - 4								
11			Sandy clay, stiff to very stiff - red / yellowish red (c)							
12										
13										
14										
15		8 - 12		28	20.2	3.25				
16		16								
17			Sandy clay, medium to stiff - red / yellowish red (c)							
18										
19										
20		10 - 12		26	20.8	1.98				
21		14								
22										
23			Sandy clay, medium to stiff - red / yellowish red (c)							
24										
25		8 - 10		22	21.0	2.38				
26		12								
27										
28										
29			Sandy clay, medium to stiff - red / yellowish red (c)							
30		5 - 5		11	22.1	0.60				
31		6								
32										
33										
34										
35		6 - 11 - 12		23	20.9	1.25				

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

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Final Geotechnica Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-112 SHEET NO.: 2/2

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-23-2020 WORK FINISHED: 10-23-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-23-2020: -4ft.
10-23-2020: -10ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
36										
37										
38										
39										
40		8 - 12 - 13	Fine sand, trace silt, medium - yellowish red (c) -40.5'	25	19.6	---				A
41			END OF BORING							
42										
43										
44			(a) Man-made fill							
45			(b) Swamp Deposit							
46			(c) Silica Sand							
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
60										
61										
62										
63										
64										
65										
66										
67										
68										
69										
70										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-113 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-22-2020 WORK FINISHED: 10-22-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-22-2020: -4ft.
10-22-2020: -10ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		1 - 2	Sandy clay, some gravel, many roots, stiff - red / yellowish brown / gray (a)	5	22.3	1.45				
2		3 - 5								
3		5 - 9		21	23.9	1.50				
4	▼	12 - 12								
5		9 - 12	Clay, some sand, few peat intrusions (@9ft), medium soft to stiff - yellowish brown / red / gray (b)	25	45.9	0.60				
6		13 - 8								
7		7 - 7		14	33.3	2.02				
8		7 - 7								
9		8 - 6	Fine sand, trace silt, loose to medium loose - gray / olive brown (c)	13	40.6	0.50				
10	▼	7 - 7								A
11										
12										
13			Fine sand, trace silt, loose to medium loose - gray / olive brown (c)							
14										
15		3 - 4		8	25.9	---				
16		4								
17			Fine sand, trace silt, very dense - gray / olive brown (c)							
18										
19										
20		5 - 6		15	22.9	---				
21		9	Fine sand, trace silt, very dense - gray / olive brown (c)							
22										
23										
24										
25		22 - 22	Fine sand, trace silt, very dense - gray / olive brown (c)	62	18.6	---				
26		40								
27										
28										
29			Fine sand, trace silt, very dense - gray / olive brown (c)							
30		22 - 50/6"		506"	20.6	---				B
31										
32										
33			End of Boring @35.5ft.							
34										
35		50/5"		50/5"	22.2	---				

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-114 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Maldonado WORK STARTED: 10-26-2020 WORK FINISHED: 10-26-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-26-2020: -7ft.
10-26-2020: -9ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		2 - 4	Silty sand, some gravel, medium loose - brown / brownish yellow (a)	11	15.5	---				
2		7 - 7								
3		2 - 6	Sandy clay with gravel, medium soft - brownish yellow / reddish (a)	12	21.1	---				
4		6 - 6								
5		2 - 5		11	27.8	---				
6		6 - 10								
7	▼	4 - 5	Sand, trace to some silt, very loose to medium - dark greenish gray (b)	11	22.3	---				
8		6								
9	▼									
10		1 - 1		3	24.7	---				
11		2 - 3								
12										
13										
14										
15		1 - 2	Silty sand, very loose to loose - dark greenish gray (b)	3	21.0	---				
16		1 - 1								
17										
18										
19										
20		2 - 6		17	24.6	---				
21		11 - 13	Fine sand, trace silt, medium to dense - light gray / pale brown / brown (c)							
22										
23										
24										
25		6 - 10		23	20.1	---				
26		13								
27										
28										
29										
30		4 - 9		23	22.6	--				
31		14 - 18								
32										
33										
34										
35		12 - 21 - 28	End of Boing @ -35.ft.	49	23.3	----				

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

(A) = STANDARD BORING IN SOILS SHOWING "N" VALUES BELOW 50

(B) = ROTARY DRILLING USING ALLOY DRAG BIT AND/OR IN SOILS SHOWING "N" VALUES ABOVE 50

N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-115 SHEET NO.: 1/2

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Maldonado WORK STARTED: 10-22-2020 WORK FINISHED: 10-22-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-22-2020: -9ft, DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		2 - 3	Sandy clay with gravel, very stiff - reddish yellow (a)	11	22.0	---				
2		8 - 7								
3		3 - 9		20	14.0	---				
4		11 - 8	Clay and sand, trace gravel, very stiff - dark gray(a) -7'			2.25				
5		1 - 1	Clay and sand, very soft - gray (b)	2	23.1	---				
6		1 - 1								
7		1/12"		1/12"	22.0	---				
8		1 - 1								
9										
10		WH/24"		WH	27.0	---				
11										
12										
13										
14										
15		1 - 4	Fine sand, trace silt, loose to medium loose - light gray (c)	11	24.5	---				
16		7 - 8								
17										
18										
19										
20		1 - 3		6	15.8	---				
21		3 - 4	Clay and sand, medium - gray (c)							
22										
23										
24										
25		1 - 3	Clay, some sand, medium soft - yellowish brown / olive brown (c)	5	25.0	0.50				
26		2 - 4								
27										
28										
29										
30		3 - 3	Sandy clay, soft to medium - olive brown (c)	7	20.5	0.25				
31		4 - 4								
32										
33										
34										
35		3 - 3 - 7		10	20.9	0.60				

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

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W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

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PO Box 32198
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VICTOR E. RIVERA & ASSOCIATES
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Fax: (787) 259-1604

Final Geotechnica Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-115 SHEET NO.: 2/2

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Maldonado WORK STARTED: 10-22-2020 WORK FINISHED: 10-22-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-22-2020: -9ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
36			Sandy clay, soft to medium – olive brown (c)							
37										
38										A
39			Clay and sand, medium soft – olive brown (c)							
40		4 – 3 – 4 - 6		7	20.6	0.50				
41			END OF BORING							
42										
43										
44			(a) Man-made fill							
45			(b) Swamp Deposit							
46			(c) Silica Sand							
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
60										
61										
62										
63										
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65										
66										
67										
68										
69										
70										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

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N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

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PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-116 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Ferrer WORK STARTED: 10-27-2020 WORK FINISHED: 10-27-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-27-2020: -7ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		1 - 1	Sand, some clay pockets, trace gravel, very loose - brown / brownish yellow (a)	2	10.3	---				
2		1 - 2								
3		5 - 4		5	23.3	---				
4		1 - 2								
5		3 - 6	Clayey gravel with sand, loose to medium - light yellowish red / gray (a)	12	17.9	---				
6		6 - 5								
7		3 - 6		18	30.9	---				
8		12								
9										
10		5 - 4	Fine sand, trace silt, medium - light gray (c)	7	33.5	---				
11		3 - 2								
12										
13										
14										
15		6 - 14	Clayey sand, medium - white light gray (c)	28	22.7	---				
16		14								
17										
18										
19		8 - 14	Clay and sand, stiff - white / light gray (c)	33	14.5	---				
20		19								
21										
22										
23										
24										
25		7 - 11 - 12		33	14.8	1.50				
26			END OF BORING							
27										
28										
29										
30										
31										
32			(a) Man-made fill							
33			(b) Swamp Deposit							
34			(c) Silica Sand							
35										

* = INDICATED AS NEEDED

(1) NO. OF BLOWS REQUIRED TO DRIVE SAMPLER 0"-6", 6"-12", 12"-18", 18"-24"

(2) FORCE TO CAUSE THIN WALLED SAMPLER TO PENETRATE AT RATE 1/2 FT/SEC.

W_N = NATURAL MOISTURE CONTENT IN % OF DRY WEIGHT

Q_u = UNCONFINED COMPRESSIVE STRENGTH IN TONS PER SQ. FT.

Td = TYPE OF DRILLING

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N = SUM OF SAMPLER PENETRATION FROM 6" TO 18"

LL = LIQUID LIMIT

PI = PLASTICITY INDEX

% = PERCENT FINER THAN NO. 200 SIEVE

Final Geotechnical Evaluation

PROJECT: Mirador Las Casas Apartments Improvements BORING NO.: B-117 SHEET NO.: 1/1

LOCATION: Eduardo Conde Street, Santurce, San Juan, PR CLIENT: Fernando L. Sumaza & Co., Inc.

INSPECTOR: L. Urquiza DRILLER: A. Maldonado WORK STARTED: 10-23-2020 WORK FINISHED: 10-23-2020

POWER DRIVEN HOLLOW STEM AUGER; SAMPLE-TYPES & SIZES 1 3/8" I.D. SPLIT SPOON HAMMER WGT: 140 POUNDS

HAMMER DROP: 30" DRILLING FLUID: NONE CORE DATA-TYPE BARREL: ----- TYPE & SIZE BIT: -----

GROUND WATER: DATE AND DEPTH: 10-23-2020: -8ft. DRILL MANUFACTURER TYPE & NO. CME-55

"X" COORDINATE: ----- "Y" COORDINATE: ----- ELEVATION: --- JOB NO.: 20-4656

DEPTH (FT.)	ELEV. (M)	S.P.T. "N" VALUES (1)	DESCRIPTION OF MATERIALS	N	W _N	Q _u	LL	PI	%	Td
1		4 - 5	Clayey silt, some sand, trace gravel, very stiff to hard - yellowish red (a)	11	25.8	---				
2		6 - 8								
3		9 - 9		21	27.3	---				
4		12 - 19								
5		6 - 12	Clayey sand, trace gravel, medium - gray (a)	26	14.0	---				
6		14 - 16	Sandy clay, some gravel, medium - olive brown (a)							
7		10 - 7		14	18.5	0.75				
8		7								
9			Fine sand, trace silt, very loose - gray / brown (c)							
10		1 - 1		3	22.1	---				
11		2 - 2								
12										
13			Find sand, trace silt, medium - gray (c)							
14										
15		8 - 12		26	30.4	---				
16		14	Clay and sand, very stiff - light gray (c)							
17										
18										
19										
20		6 - 5	Clay and sand, very stiff - light gray (c)	18	14.6	3.25				
21		13								
22										
23										
24			Fine sand, trace silt, medium loose - light gray (c)							
25		11 - 6		12	15.8	3.00				
26		6 - 10								
27										
28			Clay, trace sand, hard - yellowish brown (c)							
29										
30		6 - 13		30	14.9	---				
31		17	Clay, trace sand, hard - yellowish brown (c)		28.6	10.00				
32										
33										
34										
35		9 - 15 - 17	End of Boring @ -35.5ft.	32	27.2	6.00				

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EXHIBIT "B"
ROUTINE FIELD AND LABORATORY TESTING PROCEDURES
MIRADOR LAS CASAS APARTMENTS IMPROVEMENTS
EDUARDO CONDE STREET
SANTURCE, SAN JUAN, PUERTO RICO
(JOB NO.: 20-4656)

By:
LUIS J. URQUIZA ROMAN, M.C.E. P.E.
VICTOR E. RIVERA ROLDAN, M.B.A., P.E.
VICTOR E. RIVERA ASSOCIATES
GEOTECHNICAL ENGINEERS



October 29, 2020



VICTOR E. RIVERA ASSOCIATES LLC
GEOTECHNICAL ENGINEERS
& CONCRETE TESTING LABORATORIES



AASHTO R18®
Accredited Laboratory



**US Army Corps
of Engineers®**
Validated Laboratory

EXHIBIT "B"

ROUTINE FIELD AND LABORATORY TESTING PROCEDURES

The borings were made by the Auger Drilling Method or Process. The Auger Drilling Method consist of powered turning a continuous flight hollow stem auger 6" O.D. and 2 ½" I.D. into the soil to the desired depth or level. The auger is used to advance and case the test hole simultaneously. It is used with a center rod and plug assembly at it lower end. The plug assembly is held in-place by the cap inside drill rod and is coupled to the auger and its assembly to the rotating spindle on the drill rig, thus preventing dirt from entering the mouth of the auger.

Once the desire depth of level for sampling is reached, the plug is retracted by withdrawing the center rod to permit lowering of the sampler or core barrel, as the case may be, through the auger. After the sampler is retracted, the plug is reinserted and held in-place by the center rod, another auger section is connected to the first, together with one additional center rod to secure the plug to the cap, and the hole is advanced.

This procedure is repeated until the desire hole depth is reached. The auger can always be stopped at any depth level to allow normal sampling practice.

Soil samples are secured from the bottom of the hole by means of a 1 3/8" I.D. Split Spoon Sampler. While securing the soil samples, the standard penetration test is performed and the "N" values obtained. This is the number of blows required to drive the sampling spoon at a distance of 1 foot into the ground with 140 pounds hammer falling 30 inches. The "N" values give an indication of the consistency of cohesive soils and the state of packing of granular soils as follows:

COHESIVE SOILS

"N" Value (Blow/Ft.)	Consistency	Unconfined Compressive Strength (TSF)
Less than 2	Very Soft	0.25
2-4	Soft	0.25 - 0.50
4-8	Medium	0.50 - 1.00
8-15	Stiff	1.00 - 2.00
15-30	Very Stiff	2.00 - 4.00
More than 30	Hard	4.00

GRANULAR SOILS

"N" Values (Blows/Ft.)	Relative Density
0-5	Very Loose
5-10	Loose
10-30	Medium
30-50	Dense
Over 50	Very Dense

LABORATORY WORK

IDENTIFICATION OF SOILS

Soil samples are classified according to their constituents, and the following terminology is used to denote the percentage by weight of each component:

Description Term	Range of Proportion (%)
Trace	1-10
Some	10-20
Adjective (sandy, silty, clayey)	20-35
And	35-50

Granular soils are non-cohesive soils consisting of boulders, gravel, sand, silt, either separately or in combination, that is, soil showing no-plasticity. Boulders are the constituents with an average diameter larger than 3-inches. Gravel ranges from fine (No. 10 Sieve) to coarse (3 inches sieve). Sand particles are those passing No. 10 Sieve and retained on No. 200 mesh. The silt particle ranges from 0.66 to 0.002 mm.

Cohesive soils are those which possess characteristics of cohesiveness and plasticity. They may be granular soils as described above with the addition of clay or organic silt which causes cohesion and plasticity, or may be clay or organic silt with no coarse components. The clay fraction is composed of clay minerals and in general has an average particle diameter of less than 0.002 mm.

The organic fraction is that portion with average particle diameter less than 0.06 mm. The clay and organic silt may occur separately or in conjunction.

Both materials will exhibit plastic qualities within a certain range of water content, but the range will be greater in the case of clay. The organic silt has a more granular appearance than the clay.

Besides the constituents and colors, each sample is carefully examined for stratifications, presence of secondary structures, shells, fibrous or disseminated peat, plasticity, or any foreign matter that might undermine its shearing resistance, that is, its load carrying capacity.

NATURAL MOISTURE CONTENT

The natural moisture content is determined by finding the quality of water present in the voids of the soil specimen in the natural condition and dividing it by the dry weight of the sample. The result thus attained is expressed as a percentage (dry weight basis).

The weight of the water is determined by subtracting the weight of a soil specimen in its natural condition from the weight of the specimen after been dried in an oven at 110 C twenty-four (24) hours.

UNCONFINED COMPRESSION TESTS

The cohesive soil specimens obtained from split spoon samples, cannot be considered as undisturbed samples, nevertheless, their unconfined compressive strength can be easily determined to obtain some information as to the shearing strength. Unconfined compressive strength tests were performed by subjecting cylinders of soil some 2.75" high by 1.375" in diameter to axial deflection at a constant load and measuring the resisting stress developed in the soil. The load applied on the samples is measured by a scale and the deflection recorded on a strain dial calibrated in thousands of an inch.

OTHER DRILLING METHOD

- A. Semi-Consolidated or Gravel Materials
(B-Type of Drilling) Where Applicable:

Advancement of the hole into semi-consolidated or gravelly deposit generally showing "N" values below 100 by means of the conventional method previously described results on a very

low and costly operation, thus, requiring a different system for deepening the hole. On this case, a combined drilling and sampling method is used.

Sampling is made on the standard way already discussed, however, advancement of the hole is achieved by means of rotary drilling using alloy drag bit placed at the lower end of the powered turning rod. This method also combines from the standard wash boring the jet of water to clean-out the soil debris produced by the drilling action.

B. Rock Coring (C-Type of Drilling) Where Applicable:

This method is applied for drilling into hard or consolidated rock and some coarse gravel and boulder deposits, and basically consists of drilling with diamond bits secured to the lower end of a rock sampler (core barrel). This barrel is double tube to insure a high percentage of core recovery for most adequate evaluation of the rock sample.

Respectfully Submitted,

VICTOR E. RIVERA ASSOCIATES, LLC
GEOTECHNICAL ENGINEERS

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