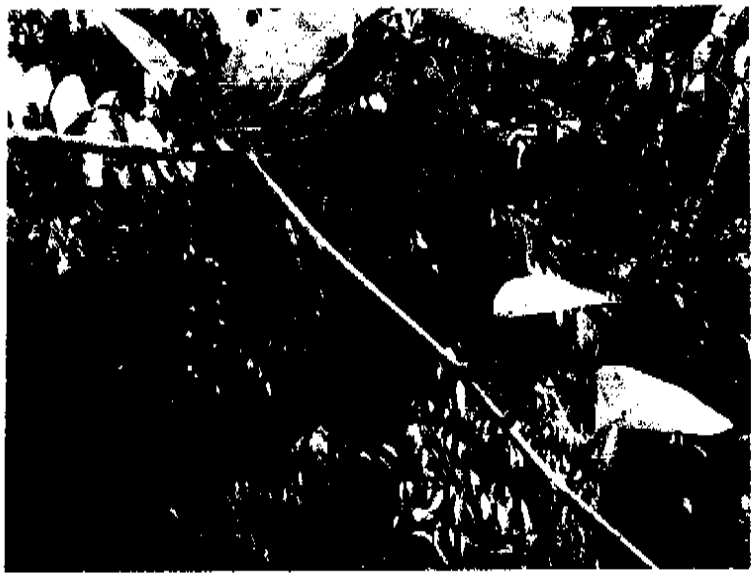

Figura 5. Frutos de Péndula (*Citharexylum fruticosum*)

Figura 6. Frutos de Palma Real (*Roystonea borinquena*)
(La foto no es del lugar de estudio)

Apéndice 9:

Investigación Geológica -Geotécnica

GeoCim LUIS O. GARCIA & ASSOCIATES
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February 14, 2006

Mr. Mark González, P.E.
Caram Construction Corp.
PO Box 8140
Fernández Juncos Station
San Juan, P.R. 00901

Fax: 787 722-8907

RE: Monte Arenas Residential
Development Project,
Bo. Quebrada Arenas, Vega Baja, PR.

Dear Mr. González:

In a February 2, 2005 letter to Mrs. Carmen Torres of the Junta de Planificación (JP), Ms. Gina M. Carrillo of the Permits, Endorsements, and Special Services office of the Puerto Rico Department of Natural and Environmental Resources (DNER) outlined some of the topics that should be discussed by the environmental document for the project of reference, which is located within the Northern Puerto Rico Karst Physiographic Province. The last item listed comprises a joint geotechnical-geophysical study. In recent years, the DNER has been requesting geophysical studies for projects in karst areas because several geophysical techniques have shown some degree of success in detecting subsurface cavities produced by limestone dissolution[1]. Although not stated explicitly, we suspect this was the intent of Ms. Carrillo's when she requested the geophysical study as she expresses concern about the possible presence of solution features and their potential impact on the structural integrity of the proposed structures and the safety of future Monte Arenas residents.

You provided us with a copy of the DNER letter in October 2005 as we were beginning the geotechnical investigation. We made a brief tour of the site and looked at the topographic and geologic quadrangle maps and aerial photographs of the general site

[1] These include electrical resistivity and ground penetrating radar, among others.

area and could not identify any of the typical karst features within the property, so we informed you that we did not consider the geophysical assessment to be necessary. That conclusion was validated during the geotechnical evaluation (described in our report dated February 13, 2006) which found no significant solution feature within the property. The site is located within the outcrop belt of the Cibao Formation which contains abundant terrigenous clay, silt, and sand occurring in distinct beds or strata or mixed with calcareous material in "dirty" limestones. These non-soluble materials inhibit the development of typical karst features such as caves, sinkholes, and subterranean drainage, none of which were observed within the site. The site earth materials contain abundant terrigenous sediment and the property has a well integrated surface drainage network of intermittent and perennial streams. Some streams drain into sinkholes but these are located well beyond the property limits. There are no sinkholes within the project area, and we did not see any feature that would suggest there may be large underground solution openings within the property.

In conclusion, we do not believe a geophysical survey of the site is necessary. Please contact us if you should have any questions concerning the above.

Respectfully Submitted,
GEO CIM – LUIS O. GARCIA & ASSOCIATES

Alejandro E. Soto, P.G.
Associate

James Baigés, P.E.
Principal

Geo Cim Job No. 3245-05
February 14, 2006

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GEOLOGIC-GEOTECHNICAL INVESTIGATION
OF THE
PROPOSED MONTE ARENAS DEVELOPMENT SITE
VEGA BAJA, PUERTO RICO

February 13, 2006

Geo Cim Inc. Job No. 3245-05

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GEOLOGIC-GEOTECHNICAL INVESTIGATION OF THE PROPOSED MONTE ARENAS DEVELOPMENT SITE VEGA BAJA, PUERTO RICO

February 13, 2006
Geo Cim Inc. Job No. 3245-05

I - INTRODUCTION

This report presents the results of a geologic-geotechnical assessment of a roughly 120 "cuerda" farm located in Quebrada Arenas Ward of the Municipality of Vega Baja. The purpose of this assessment was to compile information on the general character and distribution of the site earth materials and provide general geotechnical recommendations for use in project design. The work was performed in conformance with our proposal dated November 2, 2005 requested by Engr. Mark González, PE of Caram Construction Corporation, the Project Developer. Engr. Luis F. Franqui, PE, the Project Designer provided preliminary site layout plans in the early stages of the investigation that were used to lay out the subsurface exploration program, and subsequently provided a preliminary site grading plan that was used in preparing this report.

The project site straddles Route PR-645, which splits the property in two unequal halves crossing from north to south (Figure 1). Access to the property is via Route PR-155 which intersects PR-645 just north of the site. The proposed development contemplates the design and construction of approximately 800 individual residential units to be spread out throughout the site with the supporting infrastructure. The latter includes an electrical substation, a water tank, and three bridge crossings over existing drainages[1]. Additionally, there are plans to build a small

[1] The original project concept envisioned box culverts at these locations.

shopping center in the northwest portion of the property to serve the new development and existing nearby communities.

II - PROJECT SETTING

The proposed Monte Arenas Development will occupy an irregular-shaped parcel located amidst several low hills and ridges characterized by gentle to moderate slopes with gently rolling intervening lowlands (Figure 2). This topography differs markedly from the rugged karst terrain that rises to the north and east, several kilometers farther south, and, to a lesser degree, west of the site (Figure 1). Another notable difference from the karst areas is that the latter generally lack streams; drainage occurs underground via sinkholes that funnel runoff to the subsurface. In contrast, the Monte Arenas farm has a well integrated surface drainage system with one perennial stream, Quebrada Hicatea, and a number of 1st and 2nd order intermittent streams that collect runoff for the entire property. Quebrada Hicatea receives runoff from the land west of PR-645 and part of the northeast portion of the property. The southeast portion of the site drains toward Quebrada El Toro, a tributary to Río Indio located roughly 1.5 kilometers to the east. The east-central portion of the property has several intermittent streams that drain into sinkholes located in karstic terrain outside the property boundaries. This is also the case with Quebrada Hicatea, which flows into a large sinkhole approximately 1.8 kilometers north of the site.

Ground elevations within the property generally decrease toward the north but the lowest part of the farm at elevation near 120 meters is located along the creek tributary to Quebrada El Toro near the southeast corner of the site (Figure 2). This area also contains the greatest relief

(with elevation rising to about 180 meters near Boring B-22 northwest of the low point) and the steepest overall slopes in the property, with inclinations in the range from 20° to 35° in the lower parts of the hillsides. Excluding a rugged limestone hill that rises beyond the northeast property corner, the northeast part of the farm has the lowest relief (about 30 meters) and is characterized by gently-inclined surfaces. The most prominent topographic feature west of PR-675 is Quebrada Hicatea and its tributary valleys, which are bordered by gently inclined slopes that rise gradually with gentle to moderate slopes to the rounded crests of several hills and ridges. Maximum relief in this area is on the order of 30 to 40 meters, with maximum slopes of less than 30°.

According to the U.S. Geological Survey (USGS)[2], the site is underlain by gently-inclined (northward), calcareous and terrigenous strata of the Cibao Formation of Oligocene to Miocene age with small outcroppings of the younger Aguada Limestone forming the crest of two of the hills. Figure 3 presents the portion of the USGS map that includes the Monte Arenas farm. In it, the Cibao strata at the project site are grouped into 3 stratigraphic units or members; from oldest to youngest these are: the Quebrada Arenas Limestone Member (identified by the symbol *Tcq* on Figure 3), the Miranda Sand Member (*Tcn*), and the "upper member" (*Tcu*). The USGS did not recognize any geologic faults in the vicinity of the site.

The Quebrada Arenas Limestone Member is described as consisting of "... very finely crystalline to dense .... limestone that locally contains scattered grains of quartz sand ...". The lowermost unit, it outcrops in the lower slopes along all the main stream valleys, generally below

[2] Monroe, W.H., 1971; *Geologic Map of the Manatí Quadrangle, Puerto Rico*; USGS Misc. Geol. Investigation Map I-671; 1:20,000.

an elevation of 140 to 150 meters (note that the elevation of the surfaces of all of the map units will decrease northward because of the roughly 5° northerly dip of the strata). The Miranda Sand Member (*Tcn*) is said to consist of "angular to subangular coarse quartz sand in a noncalcareous silty clay matrix". It presumably accumulated in channels that formed when the Quebrada Arenas Limestone was eroded after it was uplifted above an ancient sea level. Its outcrop is restricted to the west slope of the ridge below Borings B-12 and B-14 in the southwest part of the property. The "upper member" (*Tcu*) is the most extensive unit within the property, underlying most of the north and eastern parts of the site. It reportedly consists of "soft chalky limestone and clayey chalk". The Aguada Formation (*Ta*), which makes up the hill at the northeast property corner and forms a cap in the hill behind the Boring B-22 location, consists of "thick layers of hard calcarenite alternating with chalky and rubbly limestone".

The site was recently used as a dairy farm. A 1964 aerial photograph that we reviewed (see next section) shows the dairy farm structures so that this use began during the early 60s or before that. At least three ponds were constructed for the dairy operation, including the existing oxygenation pond located east of the dairy buildings. The other two were located in the vicinity of Borings B-3 and BC-7.

III - SCOPE OF WORK

The scope of work for this project included the following activities:

1. Photointerpretation using aerial photographs of the general site area taken in 1937, 1964, 1978, and 1995 to assess surface processes that may be active in the general site area.
2. Site reconnaissance to observe the composition, distribution, and structure of the earth materials that underlie the site and any other pertinent geologic features that may influence the proposed activity.
3. Drilling 42 exploratory borings to obtain information about the composition, distribution, and gross geotechnical characteristics of the subsurface materials present within the site. The borings were drilled to depths of 10 to 35 feet for a total drilling footage of 919 feet using the "Hollow Stem Auger-Dry Sample" method of drilling. Table 1 provides general information about the borings, including coordinates, depth, and the planned grading at the boring location as per the preliminary grading plan. Soil samples were collected at 2.5-foot depth intervals from the ground surface to a depth of 10 feet and at 5-foot depth intervals thereafter to the bottom of each boring with a standard 1.5-foot long split-spoon sampler during the performance of the Standard Penetration Test (SPT; ASTM D-1586). The number of blows required to drive the split-spoon sampler into the soil was recorded in the field. The number of blows required to drive the last 12 inches of the sampler, termed the N-value, is an empirical measure of soil density and consistency. The boring locations are shown on

Figure 2. These were surveyed by Surveyor Pedro Lajara, who was retained by the Project Developer for this purpose.

4. The collected soil samples were placed in tightly closed plastic bottles and transported to the Geo Cim. Inc. laboratory in Guaynabo for routine laboratory tests including unconfined compression (determined using a spring tester and/or a pocket penetrometer) and natural moisture content determination, and for visual/manual soil description following standard laboratory procedures. Additionally, 21 representative samples were selected for classification testing to confirm the field classifications and further characterize the engineering properties of the soils encountered. The classification tests included grain size distribution analysis (ASTM D-1140) and determination of plasticity characteristics in accordance with the Atterberg Limits testing procedure (ASTM D-4318; 3-Point Method). The test results were used to classify the soils in accordance with the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO). Table 2 summarizes the classification test results. Detailed descriptions of the soils encountered at each boring are contained in the boring logs provided in Appendix A. Appendix C contains detailed results of the Classification Tests.
5. Data analysis and preparation of this report.

IV - DISCUSSION OF SITE CONDITIONS

The general geology of the site as mapped by the USGS was described above (Section II: Project Setting). In brief, most of the Monte Arenas farm is underlain by predominantly calcareous strata of the Cibao Formation that are inclined gently northward. The strata are grouped into 3 members: the Quebrada Arenas Limestone Member (identified by the symbol *Tcq* on Figure 3), the Miranda Sand Member (*Tcn*), and the "upper member" (*Tcu*). The "upper member" has the greatest surface exposure outcropping throughout much of the northern and eastern parts of the site and the highland in the southwest quadrant. The Quebrada Arenas underlies much of the west-central to southwestern lowlands, as well as those in the southeast part of the property, and the Miranda Sand Member occupies a small area between the other two members in the southwest part of the site.

The subsurface conditions we observed in the field and the exploratory borings generally conform to those described by the USGS. Limestone was encountered throughout the site. It occurs at or near the ground surface in the upper reaches of the hills and ridges along the west, south and south-central parts of the property. In the lower slopes it is typically covered by terrigenous soil of residual, colluvial, and/or alluvial origin. The exploratory borings also penetrated, and in scattered outcrops we observed exposures of terrigenous soil and weak rock interbedded with the limestone. These are dominated by silt and clay and excepting the Miranda Sand Member, they are not described in the USGS characterization of the other two Cibao Formation members. It could be that the Miranda Sand Member is more extensive than mapped, or more likely that the USGS map highlights the dominant materials in the units.

From a geotechnical standpoint, the subsurface characteristics in different areas present different conditions for the proposed development. These will be discussed in what follows:

The northeast part of the site where borings B-1 to B-4 and B-7 were drilled is characterized by a surface cover of high plasticity clayey soils (see Table 2) over the limestone. The clayey soils, which are up to 15 or more feet deep (B-3), typically exhibit a med-stiff to stiff consistency but undergo significant strength loss when disturbed and are prone to instability. We observed a moderate-sized earth flow on a slope north of the dairy facilities that has an inclination of only about 5° (Figure 2), which attests to the low strength of these soils. The soils are also likely to exhibit a high potential for expansion with increasing water content, and shrinkage upon drying[3]. The underlying limestone is separated from the clayey soils by a transition zone where the surface clays mix with the limestone as the latter is dissolved by percolating groundwater. This zone extends to depths of at least more than 25 feet (B-3) before merging with weathered limestone. The consistency of this material varies from soft to hard. Firm limestone was not encountered until the borings penetrated to depths of 20 feet, and could be as deep as 30 feet or more (B-3). The preliminary site plan that was provided to us as this report was being prepared shows most of the area will be filled up to a maximum depth of about 7.5 meters (25 feet) in the vicinity of Boring B-1 (Table 1). Unless disturbed, the clayey soil and transition zone material will generally provide adequate bearing support for the proposed fill which will in turn isolate the expansive materials from frequent significant moisture content changes thereby protecting against expansive behavior. Caution will be required to minimize

[3] Soil expansion potential arises from the same physical-chemical phenomena that produce soil plasticity. High plasticity soils typically experience large volume changes in response to moisture content variations.

disturbance of the surface clay soils during site preparation prior to grading to avoid creating muddy, difficult working conditions.

Limestone occurs at or near the surface throughout the hills along the west portion of the property (see Borings B-9, B-10, B-12 to B-14, the SC-# series, and SS-2 in Appendix A), where the preliminary grading plan shows crest elevations will be lowered by as much as 20.6 meters (68 feet). The thick transition and highly weathered limestone zone observed in the northeast is absent and relatively competent limestone was generally found at depths of 15 feet or less. Unfortunately the deepest exploratory borings in this area penetrated only 25 feet deep so it is possible that some clay-rich strata could be exposed. The only significant permanent cuts to be constructed for site grading occur along the west margin of the property. The preliminary design slopes are inclined at about 45°, i.e., 1.0(Horizontal):1.0(Vertical), which should be adequate for overall stability if relatively competent limestone is encountered in the excavation. If, however, weak limestone or clayey pockets are uncovered, a lower slope inclination would be required for stability. The presence of clayey soils on the excavation floor is also likely to impact foundation stability. This will be the case at the proposed shopping center location, where Borings SC-1, SC-2, and SS-3 encountered zones of soft to medium stiff, very high plasticity (Plasticity Index of 102% in a sample from SC-1) clay at the final grade elevations. Measures to minimize the potential foundation problems associated with these soils (bearing capacity, shrink-swell behavior) will be required to complete the project. Recommendations for this purpose are provided in the Conclusions and Recommendations section of this report.

Preliminary grade changes in the lowland valleys associated to Quebrada Ilicatea range from zero (portions of the streams will be altered as little as possible) to about 11.5 meters (38 feet) of fill at the Boring B-18 location in the upper reaches of one of the tributary valleys. The subsurface conditions in this portion of the site are the most diverse seen at the property. Competent limestone occurs at depths of near zero (close to the ground surface as at Borings BC-4 and BC-5) to more than 25 feet (Boring B-18). The intervening soils are an amalgamation of residual, colluvial, and alluvial materials (see corresponding boring logs in Appendix A) that includes soft (N-values of 4 blows per foot of sampler penetration or less) and high plasticity clays (see Table 2). The main geotechnical concern in this area will be foundation stability, for which recommendations are provided in the following section.

The hills in the east-central and southeast section of the property consist mostly of competent limestone with occasional layers or lenses of terrigenous stiff to hard clay, silt, sand (quartz), and/or gravel (see Borings B-8, B-15, B-16, and B-19 to B-29 logs in Appendix A). The preliminary grading contemplates excavating much of the area to depths of up to about 16 meters (53 feet) at the Boring B-8 site and some fills up to 13.6 meters (45 feet) thick (B-24 location). There's a good chance that the limestone and terrigenous strata that will be exposed throughout much of the excavation areas will be similar to what we have already observed and will therefore present adequate bearing properties for the type of single-family residential structures planned for the project. Much of the clay we have seen is highly plastic, expansive, and exhibits disturbance-sensitive strength behavior, and there is no reason to expect that deeper clays will be different. No permanent cuts will be constructed in this area so that cut slope stability is not a

concern. Places where the clayey soils are exposed, however, will probably confront foundation construction limitations. Recommendations to minimize these impacts are provided below.

Surface irregularities in the middle slopes south and west of the ridges at the B-22 and B-16 locations, respectively, suggest a history of periodic slope instability. They formed before the 1937 photos were taken but the slopes appear to have been relatively stable since then. We suspect the old failures are related to the outcropping of clay-rich strata such as the 12+ feet thick plastic clay observed in Boring B-24, located in the middle slope south of the B-22 ridge. If we project this layer on a 5° northerly dip it would outcrop in the lower part of the west-facing slope below the B-16 ridge, the other area that appears to have experienced instability in the not too distant past. The thick fills that will be constructed along the base of these slopes will act as buttresses over any unstable soil outcrops and if constructed as engineered fills with adequate drainage (see next section), should improve overall slope stability in the area. Additionally, the planned lowering of hill and ridge crests will reduce the stresses acting on the slope contributing to improved stability lower down the slope.

The only place where groundwater was observed was in the borings drilled along the Quebrada Ilicatea drainage creeks. No groundwater was observed in the slope borings, nor were any springs observed during the field reconnaissance.

V- CONCLUSIONS AND RECOMMENDATIONS

Our site investigation did not find any significant geotechnical-geological limitation to the proposed project. The site is located within the Northern Puerto Rico Karst Province but the site subsurface materials contain relatively high amounts of terrigenous sediment, both mixed with calcareous sediment and in carbonate-free strata, so the typical problems associated with purer limestone sequences are not present within the property. There are no sinkholes within the site, nor did we see any evidence of the existence of significant underground solution openings. The terrigenous sediment includes plastic, sensitive clay soil occurring as distinct strata or mixed with other earth materials, including weathered limestone. These clayey soils are susceptible to landsliding. We observed one shallow earthflow that occurred on a 5° slope and there is evidence of previous slope instability on several steeper slopes (see previous section) that is probably related to the presence of clayey soil. The proposed site grading, however, will minimize the potential for slope failures by the construction of large embankments along the lower slopes that will act as buttresses and by reducing stresses within the slopes by lowering the crest elevations. The only significant permanent cuts will be located along the west property boundary where the subsurface materials appear to be dominated by competent limestone.

The most significant limitation to site development is the likelihood of exposing plastic clay at final grade elevations in some of the cut areas. Specific recommendations to minimize the impact of these soils on building foundations are provided below. A second limitation is the presence of relatively weak soils along the Quebrada Hicatea drainage. The site grading plan

shows that the three bridges that are planned on these creeks are located at places that will receive between 6 and 7 meters (20 to 26 feet) of fill.

The following geotechnical and foundation recommendations are provided:

1. **General Site Excavation:** Significant earthwork is planned for site grading. Most of the property will be either filled or cut to attain project grades with maximum cut depth and fill thickness on the order of 20 meters (66 feet). The two deepest borings attained depths of only 35 feet and most of the borings did not penetrate below 25 feet. The materials encountered to those depths can generally be excavated with conventional excavation equipment including heavy-duty bulldozers and excavators. However, below the depths of there borings there could be layers of hard, indurated limestone that will require the use of rock excavation techniques to remove, including the use of explosives or heavy-duty impact breakers. Deepening some of the borings will improve our knowledge about the presence of difficult to excavate limestone.
2. **Expansive Soil:** As noted above, it is likely that plastic clay soils will be exposed at final project grades in different parts of the site. These soils are likely to experience large volume changes in response to moisture content variations, expanding (swelling) with moisture intake and shrinking as they dry up. Buildings whose foundations undergo large differential shrink-swell motion can experience severe cracking. Deepening some of the borings will provide additional information about areas where clay soils could be exposed during site grading.

A common approach to reduce the effects of shrink-swell activity is to bury the expansive soil under 3 or more feet of non-expansive fill material. Significant moisture variations due to weather conditions will generally occur within the fill cover whereas soil moisture in the expansive soil will stay relatively constant. At the same time, the weight of the fill resists the expansion pressures associated with swelling. We recommend the removal of any expansive clay soil encountered from below the residential structure footprints to a depth of 3 feet below final grade and its replacement with non-expansive, compacted fill material (constructed in accordance with the specifications provided below). This recommended excavation shall extend laterally a minimum of 1-meter beyond the perimeter of the proposed structures. This select fill pad will not be required in fill areas where 3 or more feet of non-expansive fill material is used to attain final grades. In addition, rain water from the roof of the structures should be collected and disposed of through the project's storm water system to prevent ground saturation near the proposed structures, and a steeper grading sloping away from the structures should be provided within a distance of about 2 meters from the structure so that rainfall will drain quickly away from the foundation.

3. **Suitability as Fill Material:** Limestone and non plastic soils excavated from cut areas will generally be suitable for use as compacted fill in fill areas. The clayey soils that occur in some areas, however, will generally not be suitable for use in engineered fills. Low plasticity clays or horizons with low clay content could be used but may require frequent reworking of the soil in the field in order to attain the optimum moisture

contents needed to achieve the compaction levels specified below. Sheeps-foot type rollers are generally more effective for compacting clayey soils.

4. **General Recommendations for Earthfill Construction**:

   a. Construction areas shall be cleared and grubbed of vegetation cover and topsoil as well as any structural debris, existing non-engineered fill, and garbage that may exist at the ground surface (topsoil may be stockpiled for later use during site landscaping). The latter includes sludge and soft sediment in the existing oxygenation pond and two currently non-existent ponds located in the vicinity of Borings B-3 and BC-7. The exposed surfaces shall then be proof-rolled with several passes of a heavy vibratory roller to detect any soft soil spot that may have to be removed and to densify any surface soil that may have been disturbed during the clearing and grubbing and/or cut operations.

   b. All fills will be constructed using soil material that classifies as non-expansive, A-2-6 soil or better in accordance with the AASHTO soil classification system.

   c. All fill shall be placed as an engineered compacted fill in 9-inch thick layers and each layer shall be compacted to 95% of the maximum dry density of the fill material measured in the Modified Proctor Test (ASTM D-1557).

   d. Fill placed on sloping surfaces shall be keyed into the existing in-situ soil so as to prevent the development of a preferred surface of sliding along the contact of the in-situ soils and the engineered compacted fill. Keys shall consist of 12-inch high steps at the end of each lift.

e. Fill slope inclinations should not to exceed an inclination of 2.0(H):1.0(V). All fill slopes shall be promptly planted with appropriate vegetation in order to minimize soil erosion that could lead to slope instability.

f. Any springs encountered during site grading or other construction activities shall be provided with adequate drainage outlets (French drains or other appropriate measures) to prevent the buildup of excess pore pressures in the soil. Under no circumstance should a spring area be covered with soil or paved over without previously having constructed a drainage outlet. The project should be provided with adequate surface drainage measures to collect and conduct runoff to the project storm water system. Under no circumstance should water be allowed to accumulate anywhere within the project.

g. All earthwork should be supervised by a qualified soil technician working under the direct supervision of a Geotechnical Engineer to verify that the work is performed as described above, including the identification of any expansive soil that may be exposed in cut areas.

5. **Foundations:** The residential structures may be founded on conventional shallow foundations which may consist of independent or continuous spread footings bearing on engineered compacted fill or the natural in-situ earth materials (exclusive of plastic clay soils) at a minimum depth of 2.5 feet below final grade. The footings can be proportioned using an allowable soil bearing pressure (Q_{all}) of 3,000 pounds per square foot (psf) for the engineered compacted fill and the in-situ earth materials (again exclusive of plastic

clay). This allowable bearing pressure may be increased by 30 percent for short duration and transient loading such as wind and earthquake loads. Ground floor slabs may be designed as conventional slabs on grade bearing on compacted fill or the natural in-situ soils (also exclusive of plastic clay). Alternatively, the residential structures may be supported by "flexible" mat foundations (consisting of monolithic reinforced concrete slab with thicker sections under load bearing columns and walls) bearing on the engineered compacted fill or in-situ materials (with the clay exclusion given above). The mat may be designed using a Modulus of Subgrade Reaction (K_s) of 120 pounds per cubic inch (pci). A concrete apron shall be constructed around the perimeter of the mat extending to a minimum depth of 18 inches below final design grades.

6. **Foundation Preparation:** Prior to concrete placement, the foundation bearing surfaces shall be cleaned and any soil disturbed during the foundation excavation operations (or anytime thereafter) shall be removed so as to provide an undisturbed bearing surface. We further recommend that foundation excavation and construction be scheduled such that the casting of the footings or mats may be completed within a short period of time after their excavation to minimize disturbance of the foundation bearing soil or fill due to construction operations and/or weather conditions.

7. **Cut Slopes:** The preliminary grading plan shows permanent cuts with 1.0(H):1.0(V) slopes along the west property boundary. Our information concerning subsurface conditions in the general vicinity of the cuts is limited to several widely-spaced borings, none of which penetrated the full depth of the proposed excavation. If, as expected,

competent limestone is encountered during the excavations, the cuts are likely to be relatively free of stability problems. If, however, the cuts expose clay-rich strata or otherwise weak horizons (for example, poorly cemented sand or weathered limestone), cut slope stability will not be good. It is imperative that the cuts be reviewed by an engineering geologist and/or geotechnical engineer to verify that there are no materials or geologic features that will adversely impact cut slope stability.

8. **Bridge Structures in the Hicatea Creek Drainage - General Geotechnical and Foundation Recommendation:**

According to the preliminary grading plans, two crossings of the Hicatea Creek are proposed with an additional crossing over one of its tributary creeks (Figure 2). The plans show Bridges No.1 and 2 (**BR1** and **BR2**) crossing Hicatea Creek and Bridge No. 3 (**BR3**) for the crossing the tributary. Borings BC-1 and BC-2 and BC-3 to BC-6 were drilled along Hicatea Creek at the locations of **BR1** and **BR2**, respectively. The general subsoil profile consists of colluvial and alluvial materials underlain by weathered limestone. The upper colluvial/alluvial materials were encountered in a variable consistency mostly ranging from medium to occasionally soft as indicated by the recorded N-values. The vertical extension of the surficial soil ranges from 5 to 17 ft at **BR1** to 5 to 7 ft depth at **BR2**.

We anticipate that due to the weak soil thickness encountered at **BR1** and the location of the groundwater level, a pile foundation alternate is required to support the bridge structures to transfer the loads thought the compressible soil materials to the

underlying weathered limestone formation. We suggest providing precast, sectional concrete piles (12 inch square or circular) driven into the weathered rock formation. The medium to soft colluvial/alluvial materials are likely to compress (consolidate) under the new fill embankment loads, which will be up to 8 meters thick according to the proposed preliminary final grade elevations. We therefore recommend providing a surcharge embankment to preload the compressible deposit such that the expected consolidation-related settlements occur before the pile foundations are installed. Consolidation analyses, surcharge recommendations and pile capacity estimates will be provided in an Addendum to this report.

At the location of **BR2,** the colluvium/alluvium deposits extend to depths of 7 ft. The Designer may consider providing a continuous spread footing for the bridge abutments casted on the underlying weathered limestone. The foundation may be preliminary designed using an allowable bearing capacity of 4,000 psf. We recommend casting the west abutment foundation at an elevation of 121 meters. For the east abutment, a tapered foundation may be required to place the foundation to an elevation ranging from 123 to 120.5 meters, from south to north.

Borings BC-7 and BC-8 were drilled at the location of **BR3**. Soft to medium stiff soils were encountered to depths ranging from 17 to 25 ft. This material consists of alternate layers of silty sand and lean to plastic clays. A 7 to 8-meter fill embankment is proposed for the approach roadway; the new fill load would cause the soft clay materials to consolidate inducing excessive settlement. We recommend that a pile foundation also

be constructed for this bridge structure. As at **BR1**, the soft clay deposits shall be preloaded to provoke the consolidation-related settlement before constructing the bridge structure. Consolidation analyses and surcharge recommendations will be provided in an Addendum to this report. In addition, it is necessary to drill deeper than the 20 ft drilled at the location of Boring BC-8 in order to estimate the pile ultimate capacity.

It is assumed that the abutment walls and wing walls will act as foundations and retaining walls allowing rotation. The earth pressures acting on the walls shall be determined using a triangular earth pressure diagram acting on a vertical plane passing through the heel of the wall and extending from the bottom of the wall to the proposed ground surface. This triangular earth pressure diagram shall be calculated using an "active" lateral earth pressure coefficient (ka) for an angle of internal friction (ϕ) of 32 degrees and a unit weight of 130 pounds per cubic foot for the backfill material to be used. The bridge abutments and wing walls shall be designed to resist horizontal pressures from the backfill that will form part of the access ramps to the bridge. Any other surcharge loads acting on the ground surface at or near the wall must be added to the previously mentioned earth pressures to determine the final design lateral loads acting on the wall. The above lateral earth pressure recommendations assume that adequate drainage is provided behind the walls. We recommend that a geotextile fabric, crushed stone layer and perforated drainage pipe (or weep holes through the walls) be included in the design such that any water that may reach the back of the wall is disposed rapidly and efficiently to prevent the development of unbalanced water forces behind the wall. The

Geotechnical Engineer's field representative must inspect all foundation bearing surfaces to assure that the recommendations presented herein are implemented during construction.

Finally, we recommend that the Hydraulic-Hydrologic Engineer evaluate the scour potential at each of the bridge locations.

9. **Foundation Recommendations for the new Water Tank:** A new water tank is proposed at the location of Boring B-22. The grading plans indicate that 3.7-meters of fill material are required to achieve the 178m final grade elevation, so the new tank will be casted on an engineered compacted fill material. We recommend providing a mat foundation slab for the new water tank placed on the new fill material and designed as a slab on grade using a modulus of subgrade reaction of 125 pounds per cubic inch and an allowable bearing pressure of 3,000 pounds per square feet.

10. **Pavement Design:** We recommend using a California Bearing Ratio (CBR) of 10 for man-made fills and the in-situ soils after proof rolling to establish the design subbase and pavement thickness for the project and access roads. We further recommend that a flexible asphalt type pavement be used.

11. **UBC Subsoil Profile Characterization:** The site final subsoil profile was categorized as S_D according to soil descriptions presented in Table 16J of the 1997 Uniform Building Code (UBC).

12. We recommend deepening Borings B-8, B-9, B-12 to B-14, B-16, B-19, B-20, and BC-8 to obtain additional subsurface information necessary to complete the geotechnical analysis and recommendations.

VI- CLOSURE

The above stated conclusions and recommendations are based on geologic and engineering analysis and evaluation of a limited number of soil samples obtained from widely-spaced subsurface exploration sites and observations of existing surface conditions at the site. Although the evaluation approach used in this study is consistent with those used in ordinary geotechnical engineering and engineering geologic studies, variations in subsoil conditions or other unexpected conditions may be encountered during construction. The nature and extent of variations between the explored locations may not become evident until construction is underway or completed. Subsurface conditions different from those anticipated based on our investigation may necessitate re-evaluation of these recommendations and adjustments in project design. It is advised that GeoCim, Inc. be retained to observe geologic/geotechnical conditions during site grading in order to help confirm that our assumptions and recommendations are valid, to verify general compliance with design concepts and recommendations, and to assist in the development of design changes should subsurface conditions differ from those anticipated prior to the start of construction.

This report has been prepared for Caram Construction Corporation for use in the design of the Monte Arenas residential development project. In the event of any change in the nature of

the proposed project, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and the conclusions of this report are modified in writing by Geo Cim. Geo Cim will not be responsible for any claims or liability associated with interpretation of subsurface data or reuse of the subsurface data or engineering analysis contained herein without the express written authorization of Geo Cim, Inc.

We request to be consulted should there be any questions as to the intent and general scope of these recommendations. Likewise, we also request to be informed of any changes in the scope of the project that may require a revision of these recommendations or if any additional recommendations are required.

Respectfully Submitted,
GEO CIM – LUIS O. GARCIA & ASSOCIATES

Alejandro E. Soto, P.G.
Associate

James Baigés, P.E.
Principal

Geo Cim Job No. 3245-05
February 13, 2006

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Table 1: Exploratory Boring Data
Monte Arenas, Vega Baja, P.R.
G.C.I. JOB No: 3245-05

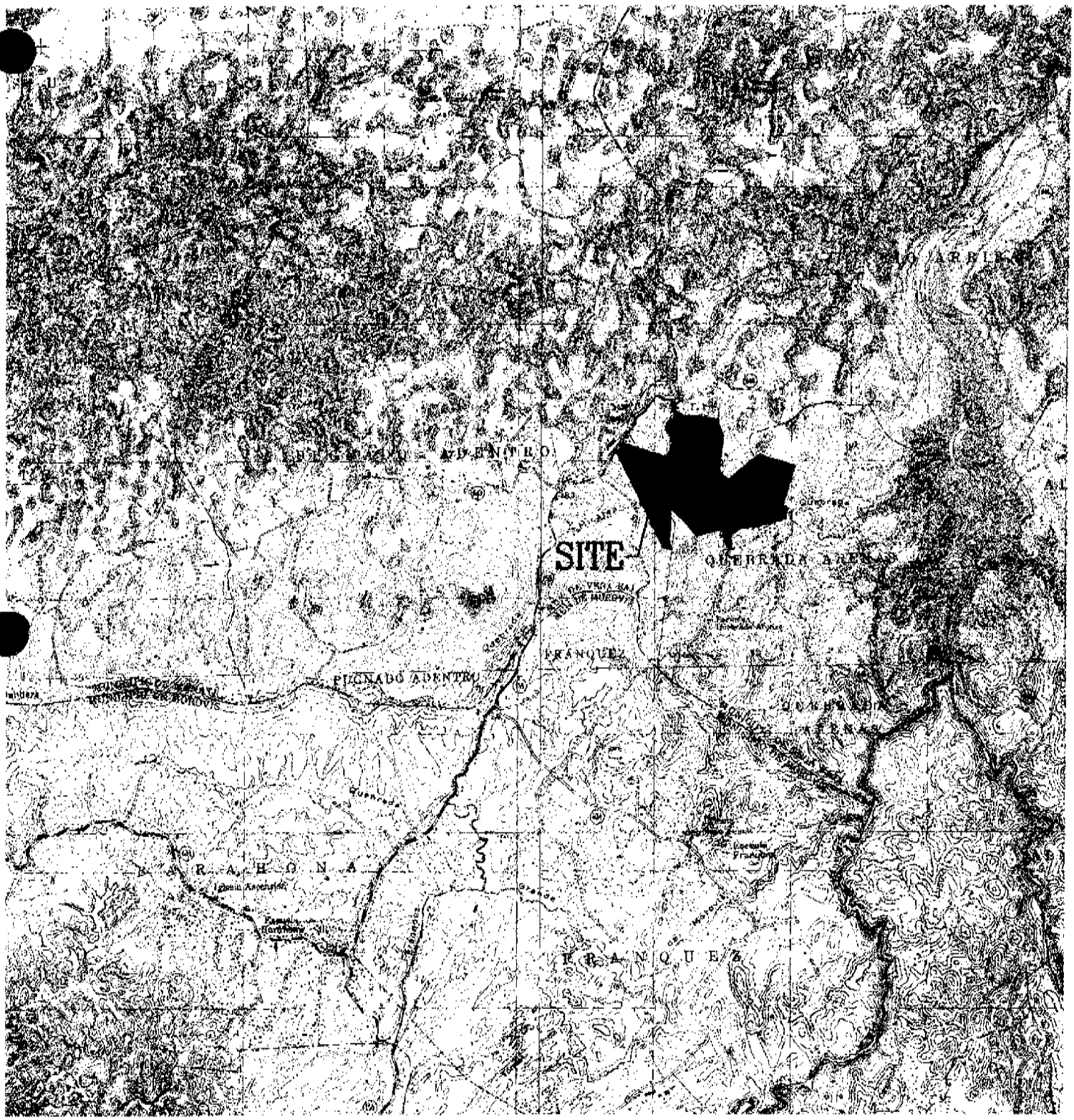
Boring No.	Coordinates (Mts.)		Existing Ground Elev. (M)	Proposed Ground Elev. (M)	Estimated Cut/Fill (-/+) (M)	Water level depth (ft)		Drilled Depth (ft)	Types of Drilling (ft)	
	North	East				During drill	at 24 hrs		N<100 bpf	N≥100 bpf
B-1	261,513.5	202,109.2	130.44	137.95	7.51	N/A	N/A	20.5	14.0	6.5
B-2	261,331.2	201,991.8	130.48	130.75	0.27	N/A	N/A	15.5	15.5	0.0
B-3	261,374.9	202,156.9	137.95	142.71	4.76	N/A	N/A	25.5	25.5	0.0
B-4	261,486.2	202,297.6	144.68	146.67	1.99	N/A	N/A	19.8	19.8	0.0
B-5	261,144.5	201,943.3	132.21	132.50	0.29	35.50	-----	35.5	35.5	0.0
B-6	261,193.8	202,055.7	133.66	135.96	2.30	N/A	N/A	25.5	25.5	0.0
B-7	261,330.5	202,312.3	148.61	150.00	1.39	N/A	N/A	24.9	20.0	4.9
B-8	261,203.8	202,201.7	162.44	146.50	-15.94	N/A	N/A	14.8	5.5	9.3
B-9	261,106.2	201,715.7	154.36	139.30	-15.06	N/A	N/A	25.5	25.5	0.0
B-10	261,177.7	201,853.4	130.38	136.08	5.70	24.00	-----	25.4	15.0	10.4
B-11	261,050.2	201,871.8	126.08	134.00	7.92	10.00	-----	25.5	25.5	0.0
B-12	260,811.9	201,862.8	165.11	144.50	-20.61	N/A	N/A	10.4	2.5	7.9
B-13	260,683.3	201,920.6	156.83	149.50	-7.33	N/A	N/A	10.5	3.0	7.5
B-14	260,962.8	201,964.9	145.92	140.00	-5.92	N/A	N/A	14.1	5.5	8.6
B-15	261,035.7	202,112.5	136.16	142.80	6.64	N/A	N/A	25.3	15.0	10.3
B-16	261,041.9	202,243.0	158.81	149.68	-9.13	N/A	N/A	25.5	14.0	11.5
B-17	260,919.2	202,165.0	142.94	149.74	6.80	N/A	N/A	25.5	25.5	0.0
B-18	261,746.6	202,255.0	142.09	153.59	11.50	19.50	-----	25.5	25.5	0.0
B-19	260,920.2	202,346.7	169.74	159.50	-10.24	N/A	N/A	24.9	20.0	4.9
B-20	261,090.7	202,456.7	168.96	160.40	-8.56	N/A	N/A	15.5	15.5	0.0
B-21	261,193.9	202,627.4	162.54	165.15	2.61	N/A	N/A	15.5	11.0	4.5
B-22	261,110.1	202,600.5	174.33	178.00	3.67	N/A	N/A	25.5	25.5	0.0
B-23	261,143.7	202,791.7	160.96	165.59	4.63	N/A	N/A	15.5	15.5	0.0
B-24	260,968.4	202,611.1	147.15	160.75	13.60	N/A	N/A	24.6	24.6	0.0

Table 1: Exploratory Boring Data
Monte Arenas, Vega Baja, P.R.
G.C.I. JOB No: 3245-05

Boring No.	Coordinates (Mts.)		Existing Ground Elev. (M)	Proposed Ground Elev. (M)	Estimated Cut/Fill (-/+) (M)	Water level depth (ft)		Drilled Depth (ft)	Types of Drilling (ft)	
	North	East				During drill	at 24 hrs		N<100 bpf	N≥100 bpf
B-25	260,935.7	202,742.1	139.14	139.14	0.00	N/A	N/A	19.4	14.4	5.0
B-26	260,796.2	202,642.0	138.17	138.17	0.00	N/A	N/A	24.3	16.3	8.0
B-27	260,839.0	202,466.6	154.13	156.55	2.42	N/A	N/A	20.3	14.0	6.3
B-28	260,704.1	202,375.4	160.49	157.00	-3.49	N/A	N/A	25.5	25.5	0.0
B-29	260,990.3	202,417.1	166.37	162.40	-3.97	N/A	N/A	10.8	8.0	2.8
BC-1	261,001.3	201,775.2	125.92	134.00	8.08	7.50	-----	24.3	14.0	10.3
BC-2	261,007.3	201,791.7	125.73	134.00	8.27	6.50	-----	24.7	24.7	0.0
BC-3	261,244.2	201,924.0	125.63	132.00	6.37	20.50	-----	24.9	10.5	14.4
BC-4	261,238.1	201,936.6	127.32	130.00	2.68	N/A	N/A	14.3	8.0	6.3
BC-5	261,265.9	201,936.6	124.45	130.00	5.55	14.00	-----	19.1	8.5	10.6
BC-6	261,262.1	201,956.3	124.26	130.00	5.74	10.00	-----	19.4	10.5	8.9
BC-7	261,103.7	202,049.5	127.47	135.52	8.05	5.00	-----	35.5	35.5	0.0
BC-8	261,085.2	202,055.7	127.78	135.52	7.74	10.00	-----	30.5	30.5	0.0
SC-1	261,231.8	201,706.0	142.79	141.20	-1.59	N/A	N/A	25.5	25.5	0.0
SC-2	261,267.4	201,687.8	141.63	141.20	-0.43	N/A	N/A	19.2	19.2	0.0
SC-3	261,291.1	201,740.9	145.22	141.20	-4.02	N/A	N/A	14.3	5.5	8.8
SS-2	261,327.2	201,637.9	140.00	140.00	0.00	N/A	N/A	25.3	20.0	5.3
SS-3	261,308.1	201,604.2	135.69	135.69	0.00	N/A	N/A	25.5	25.5	0.0
Total of Borings =		**42**				**Total linear feet =**		**919.4**	**746.4**	**173.0**

TABLE 2. Soil Classification Test Summary
Monte Arenas Vega Baja, P.R.
GCI Job No. 3245-05

SAMPLE IDENTIFICATION			INDEX PROPERTIES TEST								
BORING NO.	SAMPLE NO.	DEPTH (FT)	ATTERBERG LIMITS (%)			GRAIN SIZE			AASHTO	USCS	DESCRIPTION
			Plastic Limit	Liquid Limit	Plastic Index	Gravel %	Sand %	Fines %			
B-2	4	7.5-9.0	10.0	33.5	23.5	0.0	23.6	64.9	A-4(0)	CL	Clay, some sand, pale yellow, brown.
B-3	4	7.5-9.0	15.9	71.6	55.7	0.0	44.6	55.4	A-4(0)	ML	Sandy Silt, brown, very pale brown.
	5	10.0-11.5	18.0	85.2	67.2	0.0	14.7	85.3	A-4(0)	ML	Silt, little sand, reddish brown.
B-4	3	5.0-6.5	21.2	98.5	77.3	0.0	22.7	76.5	A-4(0)	ML	Silt, some sand, light gray.
B-5	2	2.5-4.0	24.3	78.0	53.7	0.0	18.8	80.4	A-4(0)	ML	Silt, little sand, brown, gray, yellow, red.
B-9	5	10.0-11.5				55.3	23.0	21.7		GM	Gravel, some sand and silt, yellow, pale yellow.
B-11	2	2.5-4.0	26.8	110.0	83.2	0.0	13.3	86.7	A-7-6(81)	CH	Clay, little sand, brownish yellow, red.
B-12	4	7.5-9.0	9.7	33.6	24.0	0.0	36.2	33.0	A-2-4(0)	SC	Sand, some clay, pale yellow.
B-13	3	5.0-6.5				54.8	22.5	22.7		GM	Gravel, some sand and silt, very pale yellow.
B-16	4	7.5-9.0	13.8	23.8	10.0	50.0	24.6	25.4	A-1-b	GC	Gravel, some sand and clay, pale yellow.
B-18	2	2.5-4.0	15.6	59.8	44.2	0.0	29.3	70.7	A-7-6(30)	CH	Clay, some sand, brownish yellow.
B-19	4	7.5-9.0	14.0	38.0	24.0	0.0	16.7	82.7	A-4(0)	CL	Clay, little sand, pale yellow, brownish yellow.
B-20	4	7.5-9.0	13.2	40.3	27.1	0.0	16.2	83.8	A-4(0)	CL	Clay, little sand, yellowish brown, white.
B-21	2	2.5-4.0	17.0	75.2	58.2	0.0	18.9	81.1	A-4(0)	CH	Clay, little sand, very pale brown.
B-24	2	2.5-4.0	18.3	79.5	61.2	0.0	20.3	71.7	A-4(0)	CH	Clay, some sand, olive yellow.
B-28	5	10.0-11.5	16.0	45.6	29.6	0.0	35.2	64.8	A-7-6(17)	CL	Sandy clay, light gray, yellow.
BC-2	5	10.0-11.5	16.2	71.2	55.0	17.2	13.9	68.9	A-4(0)	CH	Clay, little gravel and sand, brown, white.
BC-7	5	10.0-11.5	13.2	36.6	23.4	8.0	42.2	49.8	A-4(0)	SC	Sandy Clay, trace gravel, pale brown, very pale yellow.
BC-8	3	5.0-6.5	18.0	70.0	52.0	0.0	20.7	79.3	A-7-6(42)	CH	Clay, some sand, yellowish brown.
	7	19.0-20.5	10.3	37.2	26.9	0.0	33.5	58.3	A-4(0)	CL	Clay,some sand, brownish yellow.
SC-1	2	2.5-4.0	24.0	102.0	78.0	0.0	10.4	67.9	A-4(0)	CH	Clay, trace to little sand, brown.



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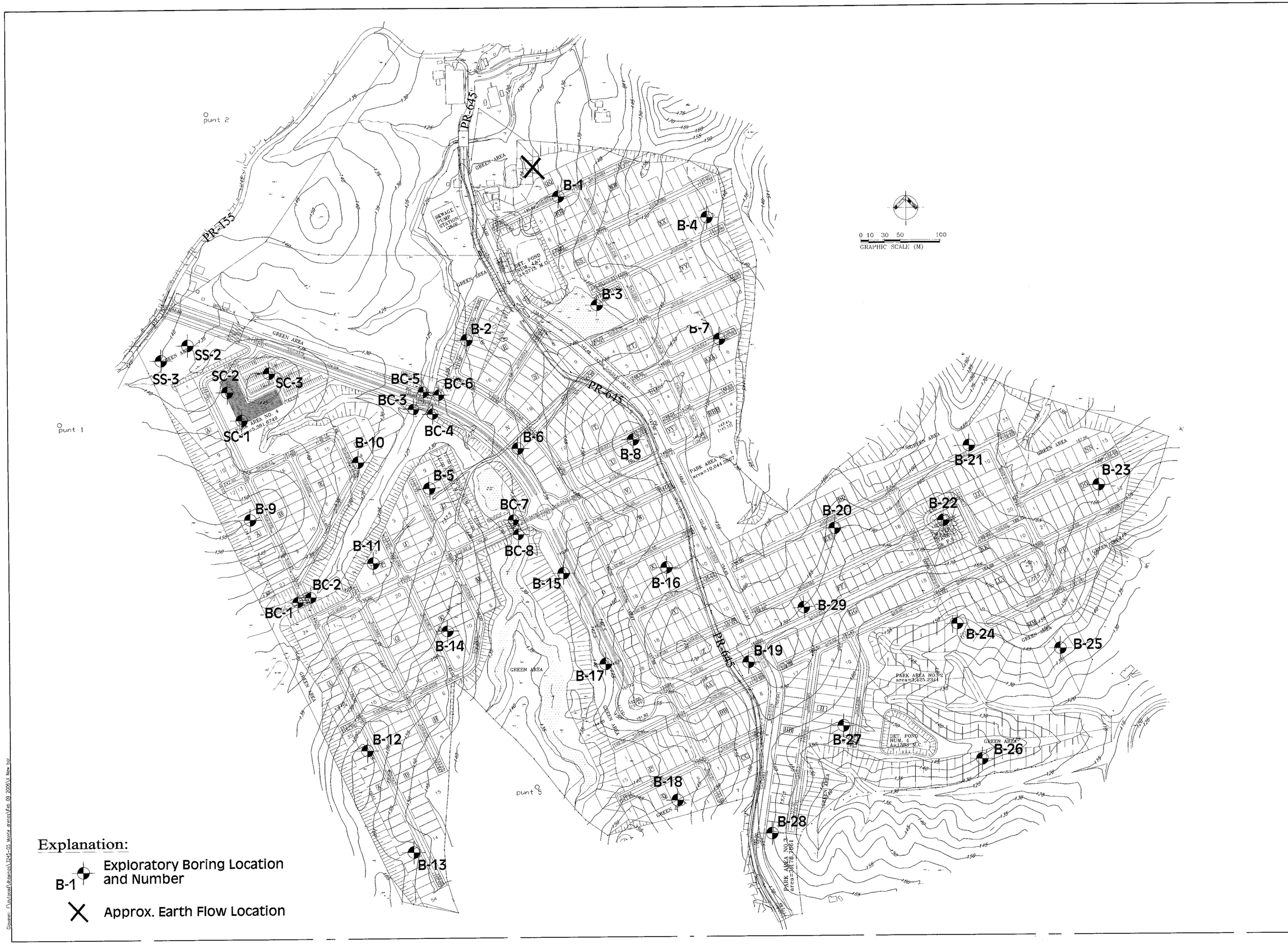
LUIS O. GARCIA & ASSOCIATES

SITE LOCATION MAP

MONTE ARENAS DEVELOPMENT, VEGA BAJA, P.R.

DRW. BY:	CHD. BY:	SCALE:	DATE:	JOB No.:	FIGURE NO:
G.O.G.	J.B.	N.T.S.	02/10/06	3245-05	1



Site topography and Boring Location Plan

NOTE:

MONTE ARENAS DEVELOPMENT
VEGA BAJA, P.R.

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LUIS O. GARCIA & ASSOCIATES
GEOTECHNICAL ENGINEERING CONSULTANTS
AMELIA DISTRIBUTION CENTER LOT 26 A EMMA ST.
GUAYNABO, PUERTO RICO 00966-8007

JOB. NO:	3245-05
DRW. BY:	G. ORTEGA
DATE:	02/10/06
CKD. BY:	J.B.
SCALE:	1:2000
FIGURE No.	2

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GEOLOGIC LOCATION MAP

MONTE ARENAS DEVELOPMENT, VEGA BAJA, P.R.

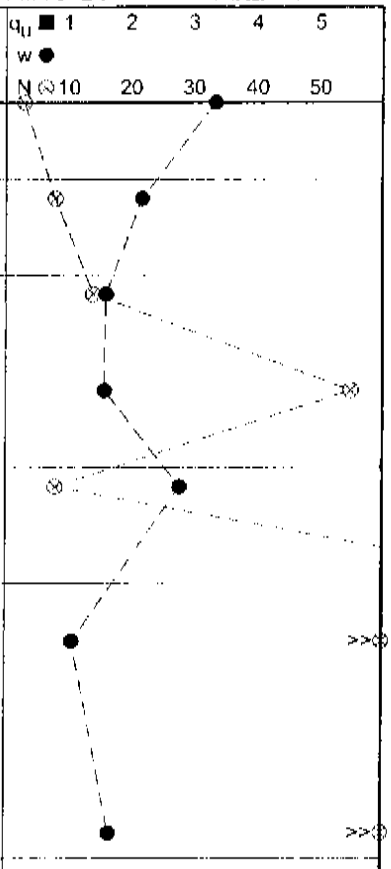
DRAWN BY	CHK BY	SCALE	DATE	JOB NO.	FIGURE NO.
G.O.G.	J.B.	N.T.S.	02/10/06	3245-05	3

APPENDIX A

BORING LOGS

BORING LOG No: **B-01**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-1-2	3	1.07	33.5				CLAY, plastic, soft, red, reddish yellow.
		2-3-5	8		21.8				SILT AND GRAVEL-sized limestone frags., trace sand, stiff, brownish yellow, pale yellow.
5		6-7-7	14		16.0				WEATHERED LIMESTONE sampled as gravel, some sand, medium to fine weathered limestone grained, little terrigenous silt, friable-weak, yellow, pale yellow.
		27-28-27	55		15.8				
10		3-5-3	8		27.9				CLAY, terrigenous, some limestone gravel, little sand, medium stiff, yellow, pale yellow, brown.
15		40-40-50/3"	140		10.7				-sampled as clay, abundant terrig.; little calcareous sand and gravel, fine to medium grained sand, compact, friable, yellow, pale yellow, brown.
		36-50/2"	200	(4.5)	16.7				-yellow, white, strong brown.
									END OF BORING NO. B-1 AT 19.67 FEET DEPTH. Note: No Groundwater observed during drilling.



DATE HOLE STARTED **12-13-05** COMPLETED **12-13-05**

ELEVATION TOP OF HOLE **427.84 (130.44 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,109.2 E 202,109.2**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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GEOTECHNICAL TESTING SERVICES
P.O. BOX 10872, SAN JUAN, P.R. 00922-0872

Monte Arena Residential Development, Vega Baja, PR

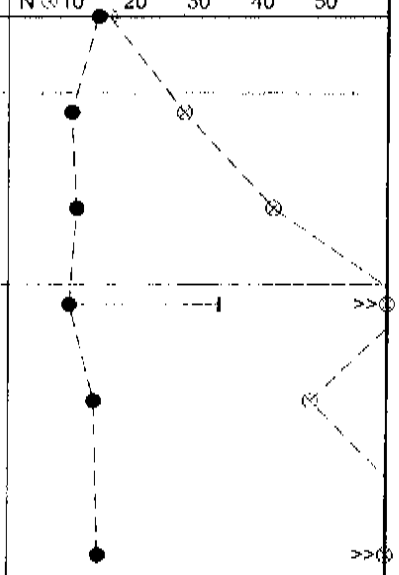
APPROVED | JOB No. **3245-05** | **1** OF **1** SHEETS | BORING No. **B-01**

BORING LOG No: **B-02**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		3-7-9	16	(4.5+)	14.3				Terrigenous SILT, little fine sand and wx. limestone frags., medium dense, yellow.
		8-10-18	28	(4.5)	10.1				Mixture of wx. limestone and terrig. silt and clay; medium dense, brown, white, pale yellow, light olive.
	5	13-19-23	42		10.9				
		23-33-31	64		9.7	33.5	23.5		WEATHERED LIMESTONE: sampled as silty clay (CL), trace limestone fragments and sand, white, pale yellow, brown.
	10	13-22-26	48		13.6				-trace terrig. clay
	15	16-31-41	72	4.35	14.3				-terrig. clay and silt, little wx. limestone frags.; orange brown.

END OF BORING NO. B-2 AT 15.5 FEET DEPTH.

Notes:
1. No groundwater observed during drilling.
2. Very hard drilling at 16 ft. depth.



DATE HOLE — STARTED **12-6-05** — COMPLETED **12-6-05**

ELEVATION TOP OF HOLE **427.97 (130.48 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,331.2 E 201,991.8**

NAME OF DRILLER **Rubén Nieves** — DRILLING EQUIPMENT **CME-55** — /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
∇	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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GEOTECHNICAL TESTING SERVICES
P.O. BOX 1087/2, SAN JUAN, P.R. 00922-0872

Monte Arena Residential Development, Vega Baja, PR

APPROVED

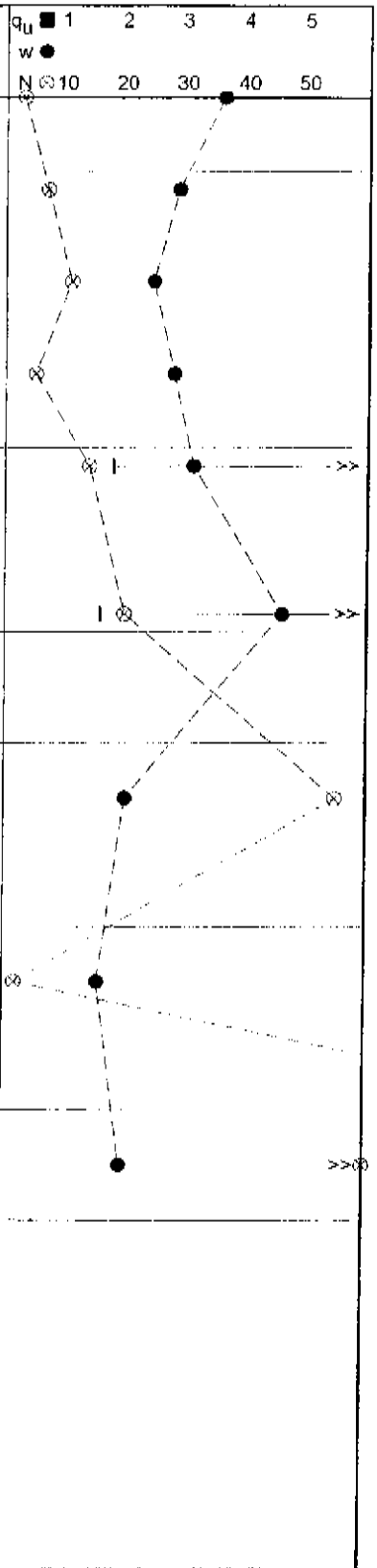
JOB No. **3245-05**

1 OF **1** SHEETS

BORING No. **B-02**

BORING LOG No: B-03

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-1-2	3	(1.0)	36.1				CLAY, trace silt, trace roots, soft, yellowish brown, very pale brown, gray.
		2-3-4	7	(2.0)	28.8				SILTY CLAY, trace sand, med. stiff, color as above.
	5	3-5-6	11	2.25	24.7				-brown
		1-2-3	5	(1.5)	28.1				-little to trace sand, trace gravel and roots.
	10	3-6-8	14	2.09	31.3	85.2	67.2		CLAY, little silt, trace sand; stiff; reddish brown sand. (CH)
	15	3-4-16	20	(1.5)	46.1	71.6	55.7		Begin as above (CH), then SILT, weakly calcareous, orange.
	20	14-21-34	55		20.2				Mixture of weathered limestone and plastic, terrig. clay; little limestone frags.; very dense, pale yellow, yellow.
	25	1-1-1	2		15.8				Terrigenous silt and limestone frags.; very soft, yellow, brown.
	30	7-48-50/3"	148		19.7				Mixture of terrigenous silt/clay and weathered limestone; hard, yellow.
									END OF BORING NO. B-3 AT 30.25 FEET DEPTH.
									Note: No groundwater observed during drilling.



DATE HOLE STARTED 12-9-05 COMPLETED 12-9-05

ELEVATION TOP OF HOLE 452.48 (137.95 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 261,374.9 E 202,156.9

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT /METHOD CME-55 SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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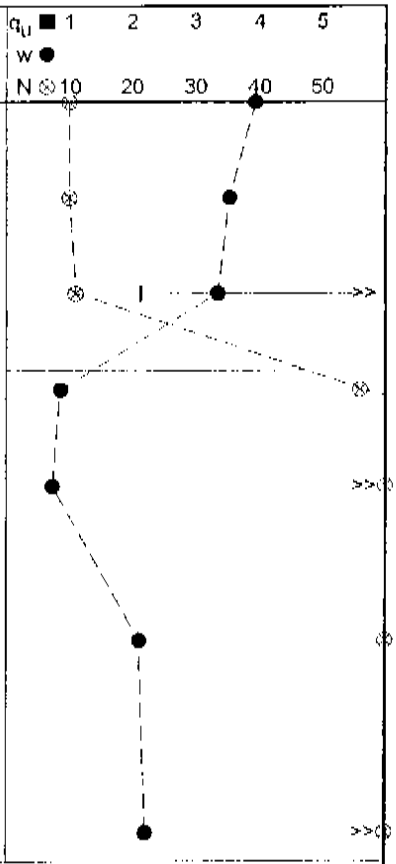
JOB No. 3245-05

1 OF 1 SHEETS

BORING No. B-03

BORING LOG No: **B-04**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-4-6	10	(2.0)	39.4				SILTY CLAY, trace roots, stiff, yellow, light brownish gray.
		3-4-6	10	(2.0)	35.3				-red, light brownish gray.
5		3-4-7	11	2.61	33.5	98.5	77.2		-light gray. (CH)
		9-25-31	56	(4.5+)	8.6				WEATHERED LIMESTONE: sampled as calc. silt, compact, friable, white, yellow.
10		28-47-50/4"	122		7.3				-trace-little limestone frags., trace terrig. fines.
15		18-21-39	60		21.1				-sampled as limestone fragments and cal./terrig. silt, trace clay, compact, friable, yellow, pale yellow.
		22-50/3"	200		22.1				-mixture of terrigenous silt, little clay, and wx. limestone, compact, friable, yellow, pale yellow.
									END OF BORING NO. B-4 AT 19.75 FEET DEPTH.
									Note: No groundwater observed during drilling.



DATE HOLE STARTED 12-8-05 COMPLETED 12-8-05

ELEVATION TOP OF HOLE 474.55 (144.68 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 261,486.2 E 202,297.6

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT /METHOD CME-55 SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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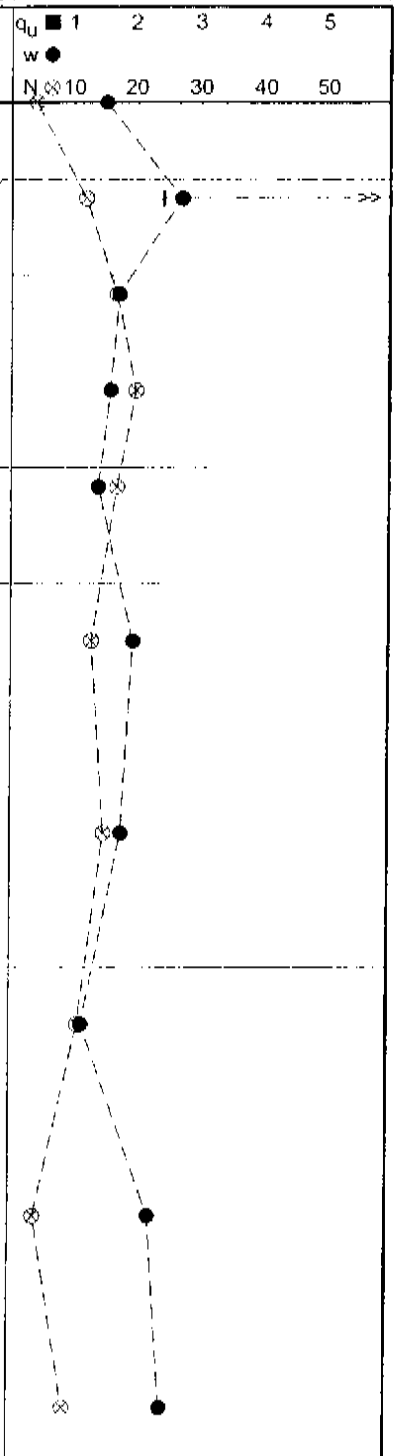
APPROVED | JOB No. 3245-05 | BORING No. B-04

1 OF 1 SHEETS

BORING LOG No: **B-05**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-2-2	4		15.3				SAND, trace silt, gravel, and roots, trace rounded gravel, loose, brown.
		4-6-6	12	5.41	27.2	78.0	53.7		CLAY, little silt, stiff to very stiff, brown, gray, yellow, red. (CH)
5		5-8-9	17	8.49	17.3				SANDY CLAY, fine qtz. sand; little silt, v. stiff; color as above.
		7-10-10	20	9.98	15.9				-little sand.
10		3-6-11	17	(1.0)	14.0				SILTY SAND; fine quartz; trace clay; very stiff, light gray, yellow, red.
15		4-5-8	13	5.02	19.6				SILT, little clay silt, stiff to very stiff, light gray, red, yellow, brown.
20		4-6-9	15	4.54	17.8				-trace fine qtz. sand, fine limestone frags.
25		5-7-4	11		11.6				WEATHERED LIMESTONE (?): sampled as limestone fragments, trace calcareous silt, friable-weak; yellow, pale yellow.
30		9-2-2	4		22.3				-trace brown terrig. clay masses.
35		2-5-4	9		24.4				-no brown clay masses.
									END OF BORING NO. B-5 AT 35.5 FEET DEPTH. NOTE: No groundwater observed at depth of 35.5 ft. during drilling.



DATE HOLE STARTED **11-23-05** COMPLETED **11-23-05**

ELEVATION TOP OF HOLE **433.65 (132.21 mts)**

ELEVATION GROUND WATER **398.15**

LOCATION (Coordinates or Station) **N 261,144.5 E 202,943.3**

NAME OF DRILLER **Carlos Calderón** DRILLING EQUIPMENT **CME-55** METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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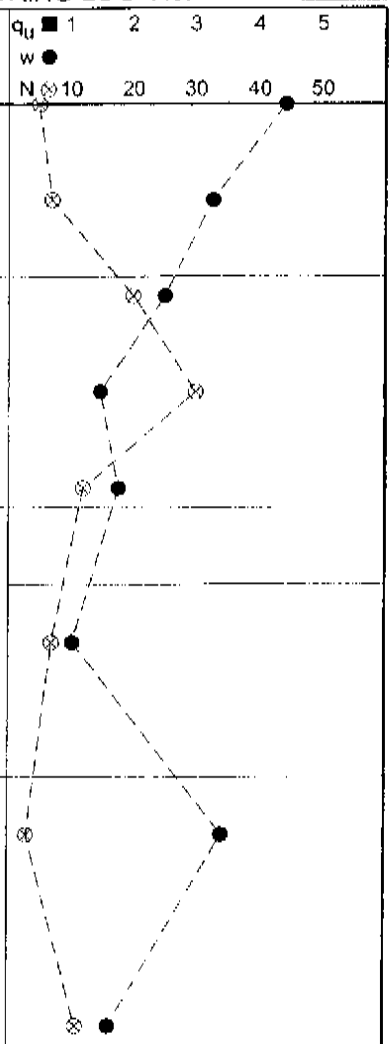
JOB No. **3245-05** BORING No. **B-05**

1 OF **1** SHEETS

BORING LOG No: **B-06**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-2-3	5	(2.0)	44.3				CLAY, trace roots, medium stiff to stiff, dark brown, red.
		2-3-4	7	2.61	32.8				-no roots; little silt
5		4-7-13	20	4.42	25.1				SILT, little clay, v. stiff; brownish yellow, light gray.
		10-12-18	30	(4.5+)	14.7				-trace fine qtz. sand; hard; locally cemented (Fe oxides?).
10		7-5-7	12	3.20	17.6				Begin as above, then SILTY CLAY, trace fine qtz. sand, stiff; subhoriz. banding; orange brown, gray.
15		4-5-2	7	(4.5+)	10.3				SANDY SILT, medium stiff, weakly cemented (calcite); little clay; light gray, brown.
20		3-2-1	3	(1.0)	34.2				Limestone fragments and calcareous silt, little sand, very loose to medium dense, pale yellow, yellow, brown.
25		12-7-4	11	(3.0)	16.2				END OF BORING NO. B-6 AT 25.5 FEET DEPTH. NOTE: No groundwater encountered during drilling.



DATE HOLE STARTED **11-23-05** COMPLETED **11-23-05**

ELEVATION TOP OF HOLE **438.40 (133.66 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,193.8 E 202,055.7**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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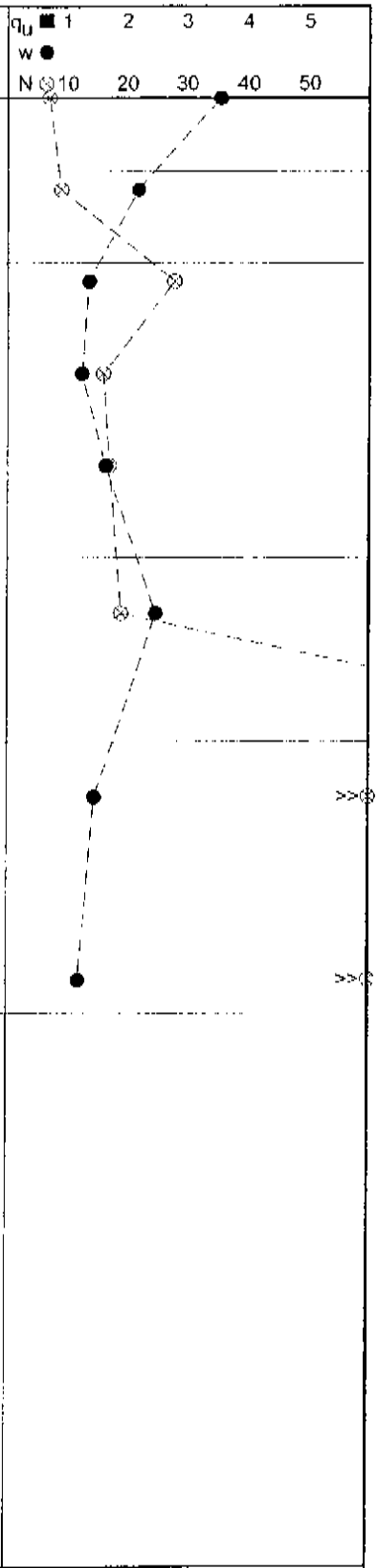
JOB No. **3245-05**

1 OF **1** SHEETS

BORING No. **B-06**

BORING LOG No: **B-07**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-3-4	7	(1.5)	35.6				SILTY CLAY, trace roots and sand, medium stiff, yellow, white.
		2-2-7	9		21.9				Silt, calc./terrig., some weathered limestone frags., light brown, brownish gray.
	5	14-13-15	28		13.6				WEATHERED LIMESTONE: sampled as calc. silt, trace terrig., little limestone frags.; very stiff, yellow, very pale yellow.
		5-7-9	16		12.4				
	10	7-8-9	17	(4.5+)	16.4				
	15	5-8-11	19	4.11	24.8				Silty clay, very stiff, lt. greenish gray, orange.
	20	30-38-50/2.5"	158	3.95	14.6				Weathered limestone: sampled as above, friable, yellow, very pale yellow.
		29-50/5"	120		12.0				- yellow, very pale red.
									END OF BORING NO. B-7 AT 24.92 FEET DEPTH. Note: No Groundwater observed during drilling.



DATE HOLE STARTED 12-7-05 COMPLETED 12-7-05

ELEVATION TOP OF HOLE 487.44 (148.61 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 261,330.5 E 202,312.3

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT CME-55 /METHOD SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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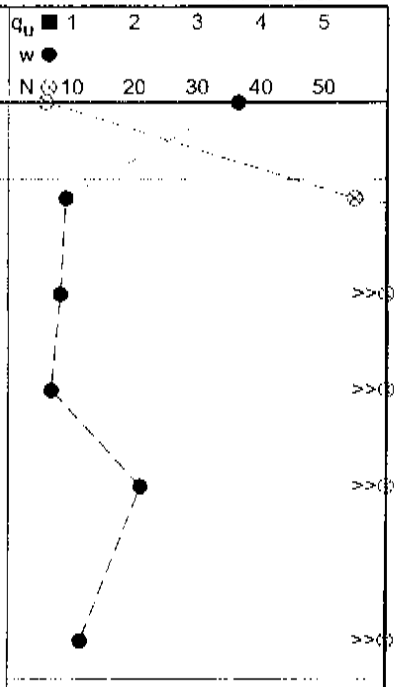
JOB No. 3245-05

1 OF 1 SHEETS

BORING No. B-07

BORING LOG No: **B-08**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-2-4	6	(1.75)	36.6				FILL: Clay, trace sand and roots, medium stiff, strong brown, yellow.
		6-19-36	55		9.2				WEATHERED LIMESTONE: sampled as calc./terrig. silt and limestone frags.; hard, yellow, very pale yellow.
5		25-50/4"	150		8.3				-predom. calcareous fines; compact, friable, very pale yellow, yellow.
		32-50/4"	150		6.8				
10		45-50/4"	150		21.1				-little clay.
		29-50/4"	150		11.5				
									END OF BORING NO. B-8 AT 14.83 FEET DEPTH.
									NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-5-05** COMPLETED **12-5-05**

ELEVATION TOP OF HOLE **532.80 (162.44 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,203.8 E 202,201.7**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PIREATIC LEVEL	PI	PLASTICITY INDEX IN %

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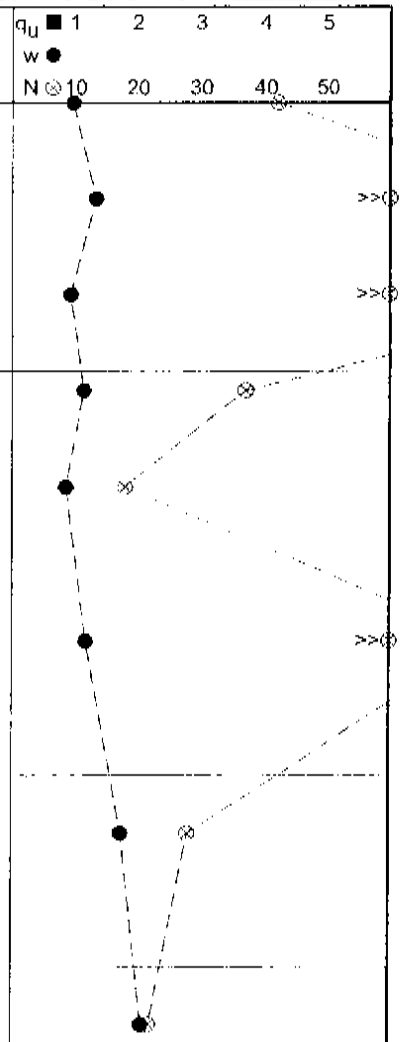
JOB No. **3245-05**

1 OF **1** SHEETS

BORING No. **B-08**

BORING LOG No: **B-09**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		7-17-25	42		9.7				WEATHERED LIMESTONE: sampled as sand, trace silt and limestone, trace clay, dense, pale yellow, brown.
		20-25-50/5"	85		13.4				-little silt and limestone fragments, no clay.
5		27-50/6"	100		9.3				-yellow, pale yellow.
		14-20-17	37		11.4				-sampled as sand, little silt, trace limestone fragments, dense to very dense pale yellow.
10		11-12-6	18		8.6				-little limestone fragments, trace silt, yellow, pale yellow.
15		7-25-50/6"	75		11.8				
20		5-11-17	28		17.4				-limestone fragments, trace sand, some terrig. clay masses, very stiff; yellow, pale yellow, light olive.
25		10-12-10	22		20.8				Limestone fragments, little terrig. silt and sand, medium dense, yellow, pale yellow. END OF BORING NO. B-9 AT 25.5 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **11-29-05** COMPLETED **11-29-05**

ELEVATION TOP OF HOLE **506.30 (154.36 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,106.2 E 201,715.7**

NAME OF DRILLER **Carlos Calderón** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PIRCATIC LEVEL	PI	PLASTICITY INDEX IN %

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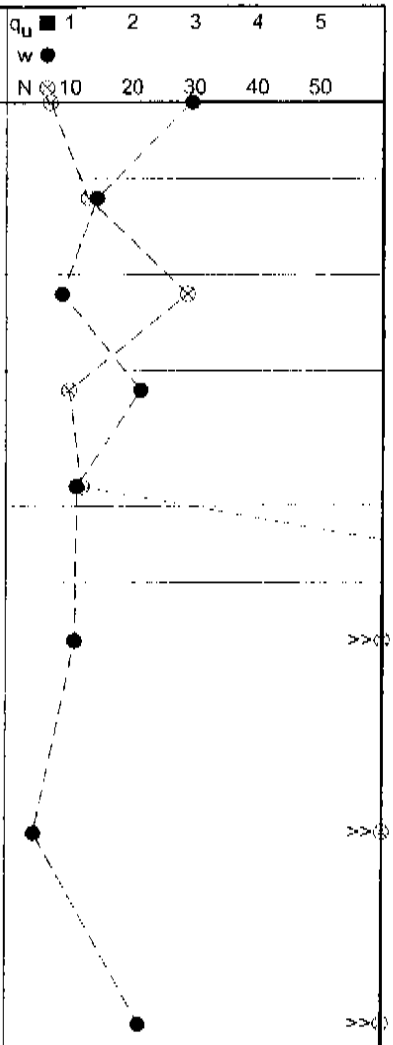
JOB No. **3245-05**

1 OF **1** SHEETS

BORING No. **B-09**

BORING LOG No: **B-10**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-3-4	7	(2.0)	29.7				CLAY, little silt, trace sand and roots, medium stiff, strong brown.
		4-7-6	13	(4.5+)	14.4				SANDY CLAY, trace calcareous gravel, stiff, yellowish brown, pale yellow.
	5	6-14-15	29		8.9				WEATHERED LIMESTONE: sampled as gravelly sand, medium to fine grained sand, compact, friable, yellow, white.
		2-3-7	10	1.86	21.5				Clay, terrigenous, trace sand, stiff, strong brown, trace pale yellow calcareous gravel.
	10	4-6-6	12		11.2				Mixture of terrigenous sandy silt and calcareous gravel, trace terrig. clay, medium dense, pale yellow, light olive.
	15	0-30-50/2"	150		10.9				-sampled as sand, coarse to fine grained, little gravel, trace silt, compact, friable, yellow, pale yellow.
	20	85/2"	200		4.5				-trace gravel.
	25	30-30-50/4"	105		21.4				- little terrigenous clay.
									END OF BORING NO. B-10 AT 25.33 FEET DEPTH.
									NOTE: Groundwater observed at a depth of 24 ft. during drilling.



DATE HOLE STARTED **12-2-05** COMPLETED **12-2-05**

ELEVATION TOP OF HOLE **427.65 (130.38 mts)**

ELEVATION GROUND WATER **403.65**

LOCATION (Coordinates or Station) **N 261,177.7 E 201,853.4**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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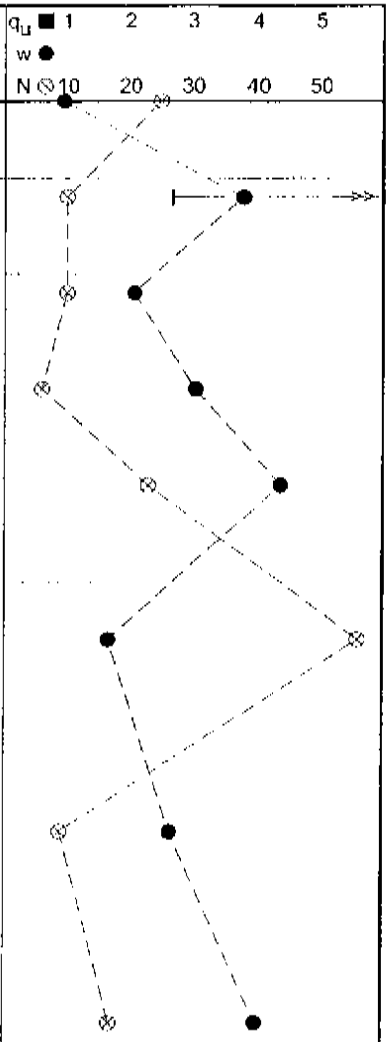
1 OF **1** SHEETS

BORING LOG No: **B-11**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		6-11-14	25		9.4				FILL: limestone fragments, little sand, trace silt and clay, medium dense, pale yellow, brown, brown.
		3-3-7	10	(1.75)	37.8	110.0	83.2		CLAY, little silt, stiff to very stiff, brownish yellow, red. (CH)
	5	3-5-5	10	2.01	20.7				SILT, little clay, trace fine qtz. sand; stiff; trace roots, brown, light gray, red.
		3-3-3	6	(1.50)	30.5				-little-trace clay, little sand, trace limestone fragments, no roots; trace Fe-oxide concretions; brown, pale yellow.
	10	6-10-13	23	(1.50)	43.7				-little limestone fragments and sand.
	15	35-37-19	56		16.6				WEATHERED LIMESTONE: sampled as calcareous silt and limestone fragments, very dense to medium dense, yellow, pale yellow; some terrig. silt and clay masses.
	20	8-5-4	9		26.5				
	25	7-6-11	17		40.0				-little clay.
									END OF BORING NO. B-11 AT 25.5 FEET DEPTH. NOTE: Groundwater observed at a depth of 10 ft. during drilling.



DATE HOLE STARTED **11-23-05** COMPLETED **11-23-05**

ELEVATION TOP OF HOLE **413.54 (126.08 mts)**

ELEVATION GROUND WATER **403.54**

LOCATION (Coordinates or Station) **N 261,050.2 E 201,871.8**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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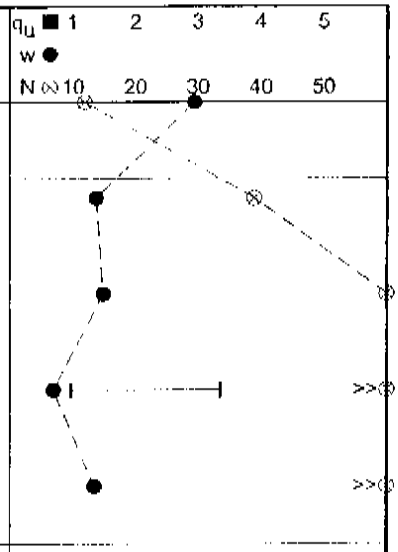
APPROVED | JOB No. **3245-05** | 1 OF 1 SHEETS | BORING No. **B-11**

BORING LOG No: **B-12**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		3-4-8	12	(2.5)	29.5				Fill: Clayey Silt, little limestone gravel, trace sand, stiff, brown.
		5-13-26	39		13.7				WEATHERED LIMESTONE: sampled as calcareous silt and clay and limestone gravel, compact, friable, pale yellow. -trace terrigenous fines
1.5	5	16-36-24	60	(4.5)	14.9				
		26-36-40	76		7.0	33.6	23.9		- no terrigenous material (CL)
3.0	10	33-35-50	85	(4.5)	13.4				
									END OF BORING NO. B-12 AT 11.5 FEET DEPTH. Note: No groundwater observed during drilling.



DATE HOLE STARTED **12-6-05** COMPLETED **12-6-05**

ELEVATION TOP OF HOLE **541.56 (165.11 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 260,811.9 E 201,862.8**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PI	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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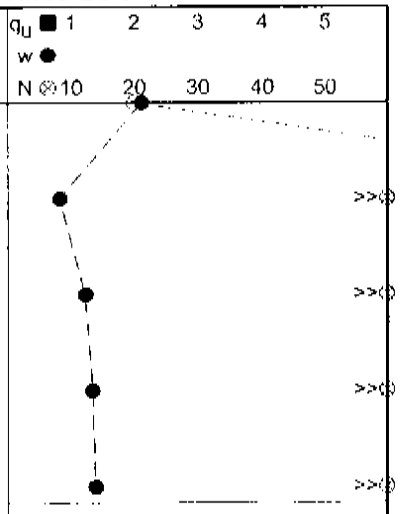
JOB No. **3245-05**

1 OF **1** SHEETS

BORING No. **B-12**

BORING LOG No: **B-13**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		7-7-13	20		21.2				WEATHERED LIMESTONE: sampled as calcareous silt and limestone frags., compact, friable, very pale yellow.
		50/5"	120		8.3				
	5	50/5"	120		12.3				
		50/5"	120		13.3				-little gravel.
	10	50/5"	120		13.8				END OF BORING NO. B-13 AT 10.42 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-7-05** COMPLETED **12-7-05**

ELEVATION TOP OF HOLE **514.40 (156.83 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 260,683.3 E 201,920.6**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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JOB No. **3245-05**

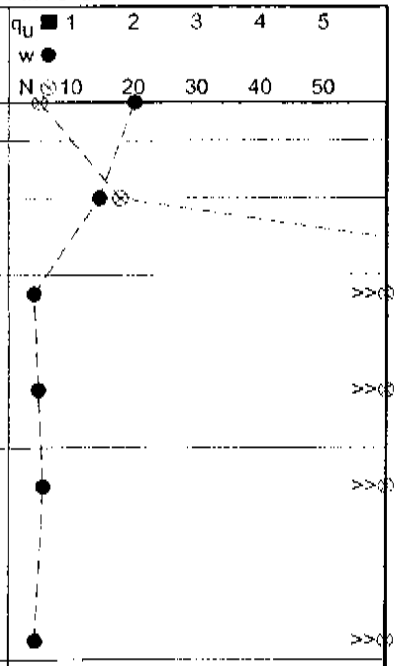
1 OF **1** SHEETS

BORING No. **B-13**

BORING LOG No: **B-14**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-2-3	5		20.3				FILL: Clay, little silt, trace gravel and roots, medium stiff, brown.
		4-8-10	18		14.6				CLAY, little silt, medium stiff to very stiff, brown, yellow, light gray.
	5	20-50/5"	120		4.1				CLAYEY GRAVEL (limestone), little silt, trace sand, medium dense, light gray, pale yellow, brown; trace roots.
		50/4.5"	112		4.8				WEATHERED LIMESTONE: sampled as gravel-sized limestone frags., some silt, very dense, yellow, pale yellow.
									-white, brown, trace silt, no clay.
	10	50/3.5"	200		5.5				Limestone fragments, little sand, trace silt, very dense, pale yellow, yellow.
		50/1.5"	200		4.2				END OF BORING NO. B-14 AT 14.13 FEET DEPTH.

NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **11-23-05** COMPLETED **11-23-05**

ELEVATION TOP OF HOLE **478.62 (145.92 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 260,962.8 E 201,964.9**

NAME OF DRILLER **Carlos Calderón** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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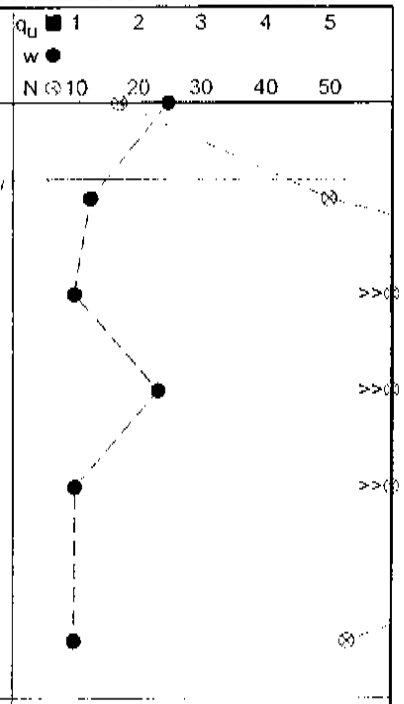
BORING No. **B-14**

BORING LOG No: B-15

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		3-7-10	17		24.9				WEATHERED LIMESTONE: sampled as limestone fragments, some silt, trace clay, medium dense, olive, white.
		12-16-34	50		12.3				-sampled as calcareous sand, little gravel, trace calcareous clay and silt, compact, friable, white, pale yellow.
1.5	5	40-47-50/5"	107		9.9				
		6-44-50/5"	104		23.3				-some clay.
3.0	10	50/5"	120	(3.0)	10.0				-little silt.
4.6	15	50-36-17	53		9.8				-little silt.
									END OF BORING NO. B-15 AT 15.5 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED 12-2-05 COMPLETED 12-2-05

ELEVATION TOP OF HOLE 446.60 (136.16 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 261,035.7 E 202,112.5

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT /METHOD CME-55 SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PIREATIC LEVEL	PI	PLASTICITY INDEX IN %

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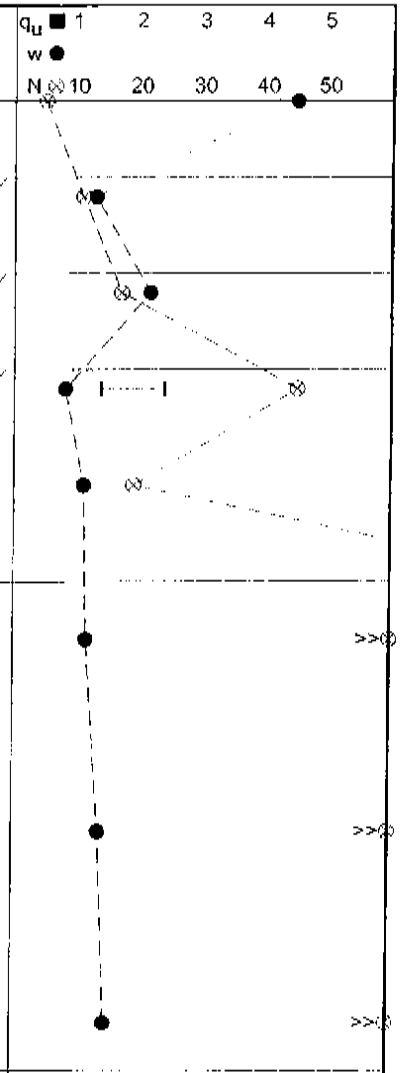
1 OF 1 SHEETS

BORING No. B-15

BORING LOG No: **B-16**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-2-3	5	(1.25)	44.9				FILL: Clay, trace sand and roots, medium stiff, olive, yellowish brown.
		5-4-7	11		13.0				SILT, terrig.; trace clay; and weathered limestone; stiff; brown, orange, white.
5		8-8-9	17		21.6				Mixture of terrig. clay, silt and limestone frags.; very stiff, yellow, white.
		21-26-19	45		8.2	23.8	10.0		CALCAREOUS SAND, coarse to fine grained, little gravel-sized limestone fragments, some silt and clay (CL), dense to medium dense white, pale yellow.
10		3-7-12	19		11.1				-little clay.
15		33-35-50/3"	135		11.6				WEATHERED LIMESTONE: sampled as gravelly sand, some fine qtz.; trace terrig. clay, compact, friable, yellow, pale yellow.
20		36-50/4"	150		13.7				-sampled as calcareous/terrig. silty sand, trace limestone frags.; compact, friable, yellow, pale yellow.
25		15-42-50/3"	200		14.8				-little clay.
									END OF BORING NO. B-16 AT 25.25 FEET DEPTH.
									NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-2-05** COMPLETED **12-2-05**

ELEVATION TOP OF HOLE **520.90 (158.81 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,041.9 E 202,243.0**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** METHOD **SPT**

w_n	WATER CONTENT IN %	q_t	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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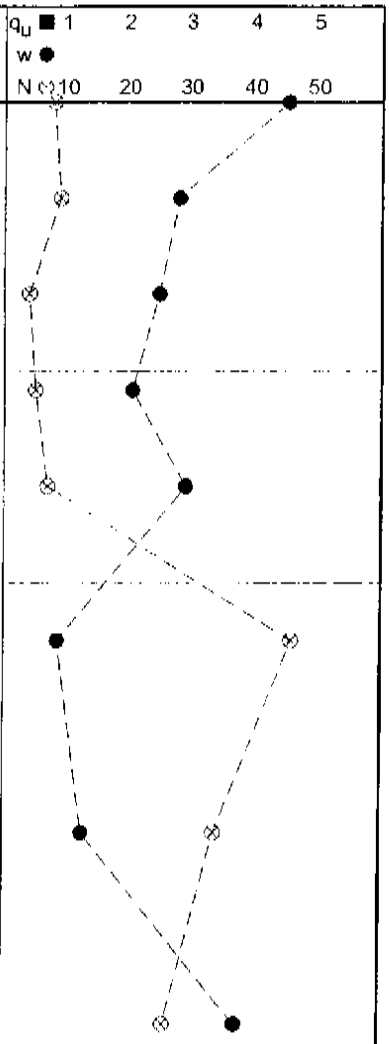
BORING No. **B-16**

BORING LOG No: **B-17**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-3-5	8	1.38	45.3				SILTY CLAY, trace fine sand, medium stiff, brownish yellow, white.
		4-4-5	9		28.2				-little-some gravel frags. (limestone)
5		2-2-2	4		25.0				
		HW-2-3	5		20.6				Gravel-sized limestone fragments, little terrig. silt, trace clay, loose, brownish yellow, white.
10		1-3-4	7		29.3				-little-some terrig. fines
15		11-17-29	46		8.6				WEATHERED LIMESTONE sampled as limestone frags. and calcareous silt, compact, friable, yellow, pale yellow.
20		7-15-19	34		12.7				-trace terrig. silt-clay
25		5-11-15	26	(3.0)	37.5				-as above, and clay, very stiff, plastic; brownish orange; cavity fill?
									END OF BORING NO. B-17 AT 25.5 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-2-05** COMPLETED **12-2-05**

ELEVATION TOP OF HOLE **468.84 (142.94 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 260,919.2 E 202,165.0**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PIEZOMETIC LEVEL	PI	PLASTICITY INDEX IN %

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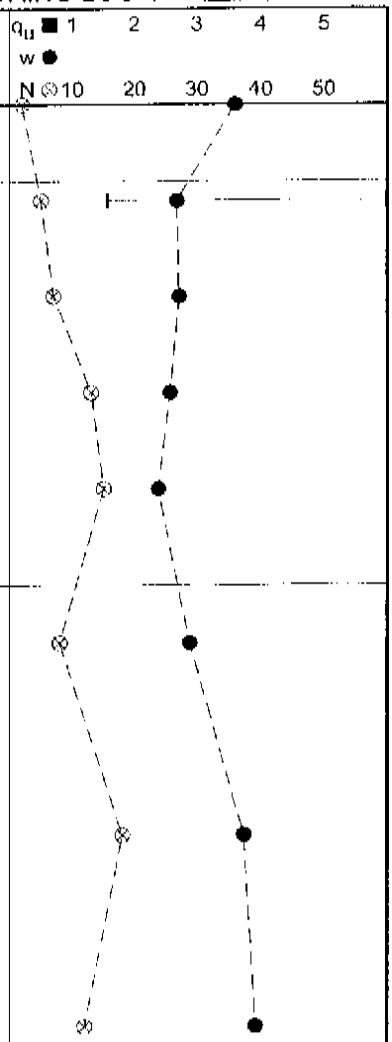
1 OF **1** SHEETS

BORING No. **B-17**

BORING LOG No: **B-18**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-1-1	2		36.1				FILL: Clay, trace silt and roots, very soft to soft, very dark brown.
		2-2-3	5	1.70	26.8	59.8	44.2		SILTY CLAY, trace fine qtz. sand, medium stiff to very stiff, brownish yellow. (CH)
1.5	5	3-3-4	7	(1.75)	27.2				-little fine sand
		4-5-8	13	1.78	25.7				
3.0	10	3-6-9	15	(3.0)	23.8				
		3-4-4	8	1.62	28.8				SILTY CLAY; trace fine qtz. sand; color as above.
4.5	15								
		15-7-11	18	(2.0)	37.4				▼ -no qtz. sand; trace limestone frags.
6.0	20								
		4-4-8	12	2.09	39.2				-no limestone
7.5	25								END OF BORING NO. B-18 AT 25.5 FEET DEPTH. NOTE: Groundwater observed at a depth of 19 feet during drilling.



DATE HOLE STARTED **12-5-05** COMPLETED **12-5-05**

ELEVATION TOP OF HOLE **466.06 (142.09 mts)**

ELEVATION GROUND WATER **446.56**

LOCATION (Coordinates or Station) **N 261,746.6 E 202,255.0**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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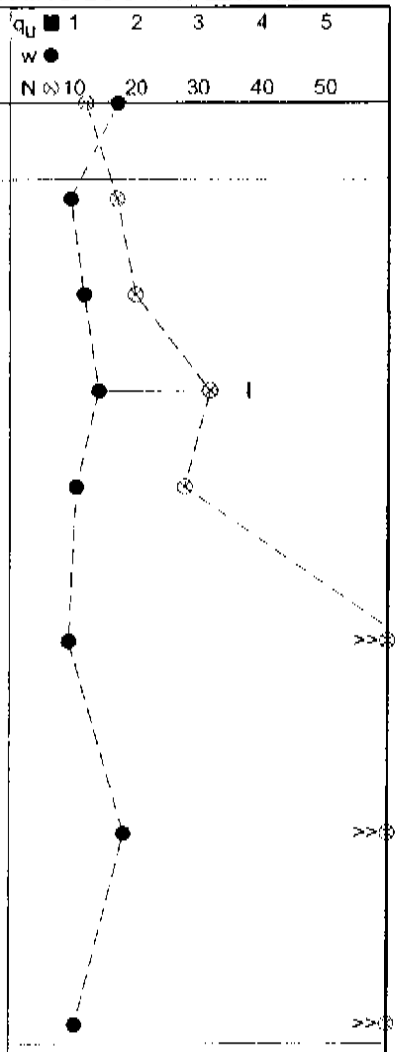
BORING LOG No: **B-19**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		4-5-7	12	(4.0)	17.1				SILT, calc./terrig., little clay, stiff, brownish yellow.
		6-7-10	17		9.6				WEATHERED LIMESTONE: sampled as silt and clay, little sand, trace terrig. fines; very stiff, very pale brown.
5		7-9-11	20	(4.0)	11.8				-as above
		9-15-17	32	(4.0)	14.1	38.0	24.0		-(CL)
10		6-12-16	28		10.6				-little limestone frags.
15		12-27-36	63		9.4				-some limestone frags. compact, friable, yellow, very pale yellow.
20		22-29-50/3"	129		18.1				-mixture of orange brown terrig. silt/clay and light-colored weathered limestone.
		50/5"	120		10.5				-sampled as calc. silt, little limestone frags., trace terrig. fines.
									END OF BORING NO. B-19 AT 24.42 FEET DEPTH.
									NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-8-05** COMPLETED **12-8-05**

ELEVATION TOP OF HOLE **556.75 (169.74 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 260,920.2 E 202,346.7**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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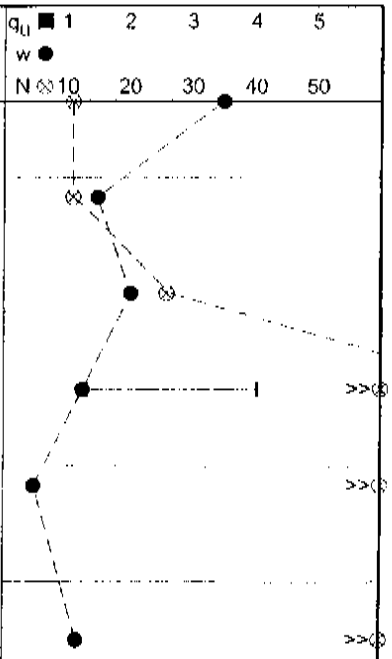
1 OF **1** SHEETS

BORING No. **B-19**

BORING LOG No: **B-20**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-6-5	11	(2.0)	35.0				Thin colluvial surface horizon: terrig. silt and weathered limestone frags., then terrig. silt, stiff, brown.
		5-6-5	11		14.9				Fine quartz SAND, trace silt medium dense, light yellowish brown, pale yellow.
5		10-11-15	26	(4.5+)	20.3				Begin as above, little silt; then SILTY CLAY, very stiff to hard, yellowish brown, white; calcareous masses locally (caliche?). -calcareous (CL)
		23-35-45	80	4.23	12.5	40.3	27.1		
10		15-25-39	64	8.33	4.9				Calcareous SILT; terrig. silt masses locally, lt. gray, brown.
15		23-24-50/6"	74		11.7				SILT, little clay locally, terrig.; abundant dispersed calcite and calcareous masses (caliche); very dense, yellowish brown, light gray. END OF BORING NO. B-20 AT 15.5 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-8-05** COMPLETED **12-8-05**

ELEVATION TOP OF HOLE **554.19 (168.96 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,090.7 E 202,456.7**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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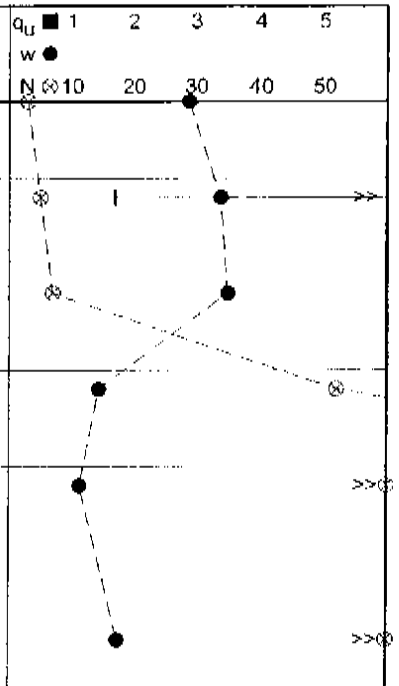
1 OF **1** SHEETS

BORING LOG No: **B-21**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-1-2	3	(1.0)	28.9				SILT, trace sand and roots, soft, very dark brown.
		1-2-3	5	1.46	33.9	75.2	58.2		CLAY, medium stiff, plastic; trace roots, yellow, very pale brown. (CH)
1.5	5	1-3-4	7	1.82	35.0				
		8-20-32	52	(2.5)	14.3				Quartz SAND, fine grained, little silt, very dense, olive yellow, light gray.
3.0	10	41-41-50/3"	141		11.3				WEATHERED LIMESTONE: sampled as calcareous-terrig. silt, little sand, compact, friable, brownish yellow, pale yellow.
4.5	15	15-26-58/6"	84	(4.5)	17.5				-trace sand.
									END OF BORING NO. B-21 AT 15.5 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-12-05** COMPLETED **12-12-05**

ELEVATION TOP OF HOLE **533.13 (162.54 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,193.9 E 202,627.4**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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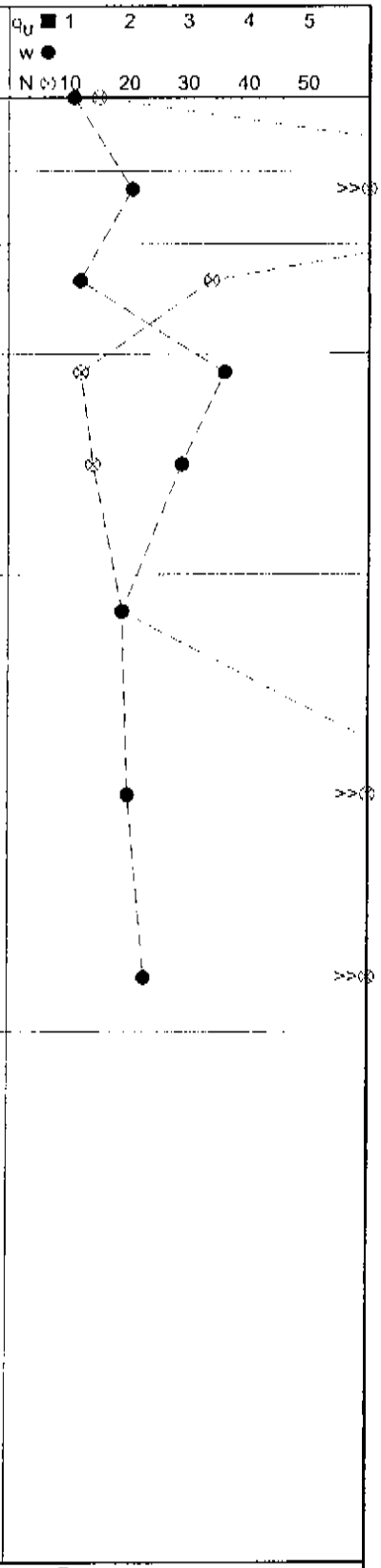
1 OF **1** SHEETS

BORING LOG No: B-22

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		6-9-6	15		10.8				Limestone fragments, little terrig./calcareous silt, pale yellow, weak red.
		16-50/5"	120		20.6				Calc. Silt, trace terrig. silt and limestone frags.; light gray, orange brown.
	5	19-20-14	34		11.9				Weathered limestone, sampled as calc. silt and limestone frags.; dense, white, pale yellow.
		4-4-8	12	(1.5)	36.1				CLAY, plastic, little silt, trace sand and roots, stiff to hard, red, pinkish gray; and silt, little fine sand; reddish brown.
	10	4-6-8	14	1.66	29.1				Terrigenous clay and clayey silt, trace-little weathered limestone; brown, yellowish brown.
	15	9-11-8	19	(2.5)	18.9				Silt, terrig.; weakly calcareous; v. stiff; yellow, pale yellow.
	20	9-18-50/5"	78	5.33	19.9				-trace-little clay; trace roots
	25	24-30-33	63	4.94	22.8				-Begin as above, little-some clay; then limestone frags., little brown terrig. silt.
									END OF BORING NO. B-22 AT 25.5 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED 12-9-05 COMPLETED 12-9-05

ELEVATION TOP OF HOLE 571.80 (174.33 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 261,110.1 E 202,600.5

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT /METHOD CME-55 SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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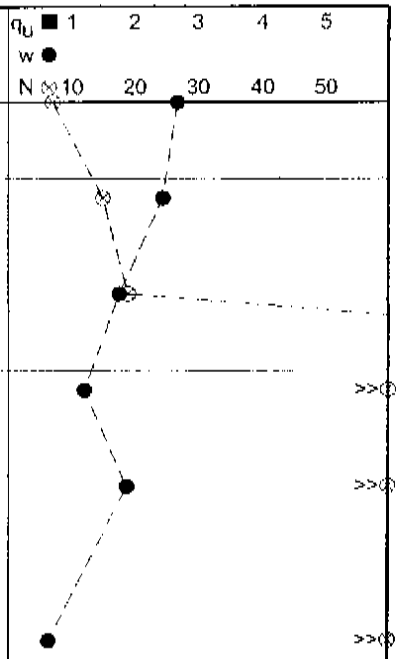
1 OF 1 SHEETS

BORING No. B-22

BORING LOG No: **B-23**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-3-4	7	(2.0)	26.8				CLAY, trace sand and roots, medium stiff, very dark brown.
		3-6-9	15		24.5				SILT little clay and sand, terrig.-calcareous, trace limestone gravel; very stiff, yellowish brown, very pale brown, white.
	5	4-7-12	19	2.88	17.6				-trace sand.
		2-50-50/2"	200	(4.5)	12.0				WEATHERED LIMESTONE: sampled as silt (calc.-terrig.) little limestone gravel, compact, friable, brownish yellow, white.
	10	48-50/2"	200		18.8				-some to little clay.
	15	19-25-46	71		6.3				-some gravel, subrounded to subangular, little silt.

END OF BORING NO. B-23 AT 15.5 FEET DEPTH.
NOTE: No groundwater observed during drilling.



DATE HOLE STARTED 12-12-05 COMPLETED 12-12-05

ELEVATION TOP OF HOLE 527.95 (160.96 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 261,143.7 E 202,791.7

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT /METHOD CME-55 SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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JOB No. 3245-05

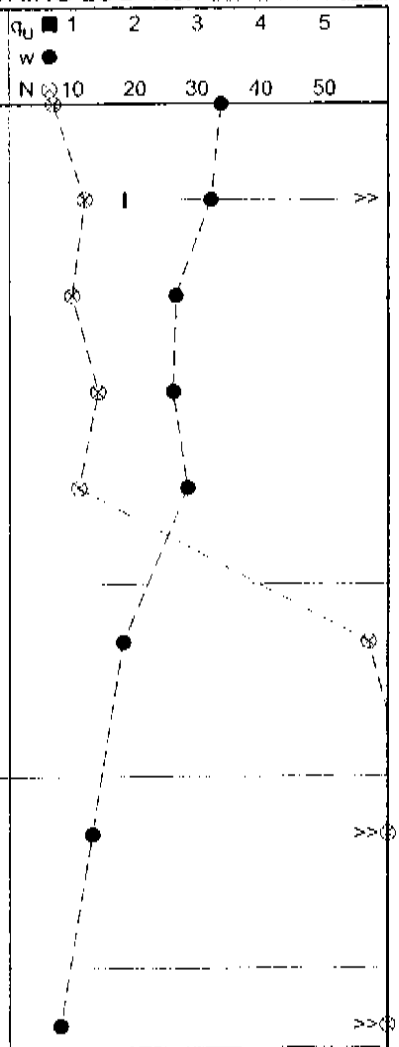
1 OF 1 SHEETS

BORING No. B-23

BORING LOG No: **B-24**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-2-5	7	(2.75)	33.8				CLAY, plastic, medium stiff, olive yellow.
		3-6-6	12	2.17	32.2	79.5	61.2		-trace-little fine limestone gravel. (CH)
5		4-4-6	10	(2.25)	26.6				-yellow, red, weak red; fine-med. limestone gravel
		7-9-5	14	(2.25)	26.1				-silty; little gravel/sand-sized limestone frags.
10		4-4-7	11	(3.25)	28.5				
15		12-22-35	57	9.95	18.0				SILT, little fine sand, terrigenous; trace fine limestone frags.; hard; weak calcite cementation; orange brown.
20		11-23-42	65		13.1				Fine quartz SAND, trace silt, very dense, white.
		39-50/1"	200		8.1				WEATHERED LIMESTONE: sampled as sand, little gravel, little terrig. fines; compact friable, yellow, pale yellow.

END OF BORING NO. B-24 AT 24.58 FEET DEPTH.
NOTE: No groundwater observed during drilling.



DATE HOLE STARTED 12-12-05 COMPLETED 12-12-05

ELEVATION TOP OF HOLE 482.65 (147.15 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 260,968.4 E 202,611.1

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT /METHOD CME-55 SPT

w_n WATER CONTENT IN %
N BLOWS FROM S. P. T. (ASTM D-1586)
q_u UNCONFIED COMPRESSIVE STRENGTH, TSF
▼ WATER TABLE OR PHREATIC LEVEL
q_u ( ) PENETROMETER, TSF
LL LIQUID LIMIT IN %
PL PLASTIC LIMIT IN %
PI PLASTICITY INDEX IN %

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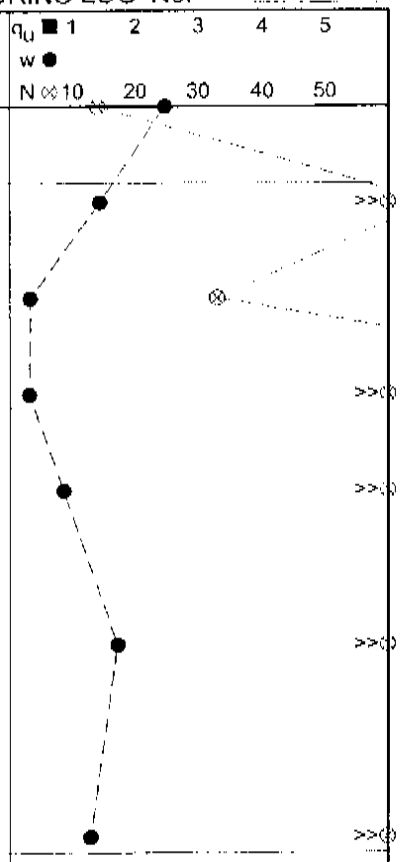
JOB No. 3245-05 BORING No. B-24

1 OF 1 SHEETS

BORING LOG No: **B-25**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		5-6-8	14	4.38	24.8				FILL: Clay, trace limestone frags., stiff, brown yellow.
		12-22-45	67		14.4				WEATHERED LIMESTONE: sampled as limestone frags., little terrig. clay and silt, very dense, yellow, white, brown.
5		18-18-15	33		3.3				
		50/5"	120		3.1				
10		34-50/5"	120		8.7				
		30-33-35	68	(1.75)	17.2				
15									
		50/5"	120		12.9				END OF BORING NO. B-25 AT 19.42 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-14-05** COMPLETED **12-14-05**

ELEVATION TOP OF HOLE **456.38 (139.14 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 260,935.7 E 202,742.1**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55 SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFINED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▽	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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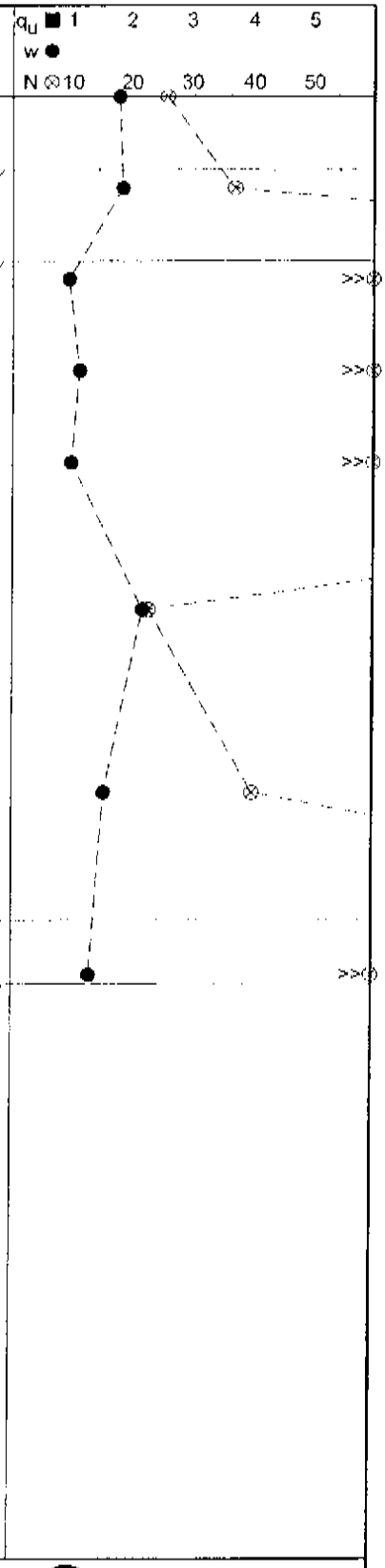
APPROVED | JOB No. **3245-05** | **1** OF **1** SHEETS | BORING No. **B-25**

BORING LOG No: **B-26**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		4-6-20	26	(4.5+)	17.9				FILL: Clay, little silt and limestone fragments, very stiff, brown, yellow.
		12-22-15	37		18.5				LIMESTONE: sampled as calcareous silt, little limestone fragments, hard, yellow, brown.
5		50/4"	200		9.5				-limestone fragments, little calc. silt and sand, very dense, yellow.
		50/5"	150		11.2				-predom. calc. silt
10		50/3"	200		9.8				
15		30-11-12	23		21.9				-predom. limestone frags.
20		39-30-10	40		15.4				-little silt, trace sand, dense, yellow.
		50/3"	200		13.0				-sampled as silt, trace sand, very dense, yellow. END OF BORING NO. B-26 AT 24.25 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-14-05** COMPLETED **12-14-05**

ELEVATION TOP OF HOLE **453.20 (138.17 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 260,796.2 E 202,642.0**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n WATER CONTENT IN %
N BLOWS FROM S. P. T. (ASTM D-1586)
q_u UNCONFIED COMPRESSIVE STRENGTH, TSF
▼ WATER TABLE OR PIREATIC LEVEL

q_u ( ) PENETROMETER, TSF
LL LIQUID LIMIT IN %
PL PLASTIC LIMIT IN %
PI PLASTICITY INDEX IN %

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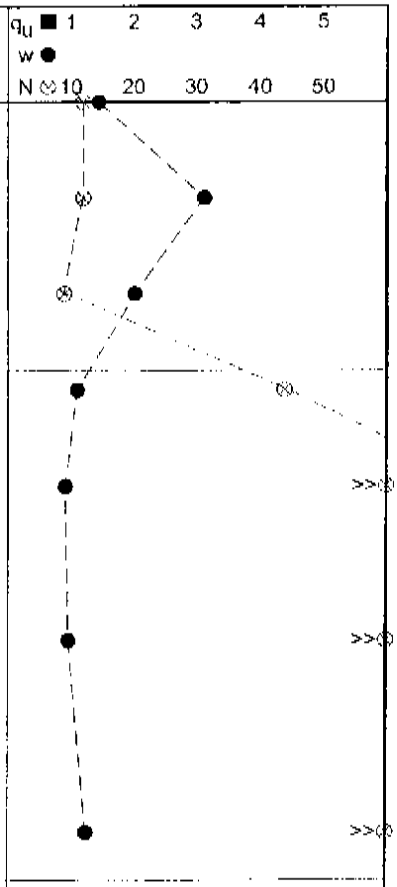
BORING No. **B-26**

BORING LOG No: **B-27**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		5-6-6	12		14.5				FILL or Colluvium(?): Clay, little silt, trace sand and gravel (limestone), stiff, brown.
		6-6-6	12		31.3				
1.5	5	3-4-5	9		20.2				-and gravel-sized limestone frags.; medium stiff, brown, yellow.
		11-14-30	44		11.1				LIMESTONE: sampled as gravel-sized frags., little calcareous silt and sand, dense, brown, yellow.
3.0	10	24-36-39	75		9.2				
		50/5"	120		9.7				
4.6	15								
		50-45-50/3"	145		12.4				-sampled as calc. silt, little limestone gravel; little terrig. silt-clay.
6.2	20								END OF BORING NO. B-27 AT 20.25 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-14-05** COMPLETED **12-14-05**

ELEVATION TOP OF HOLE **505.55 (154.13 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 260,839.0 E 202,466.6**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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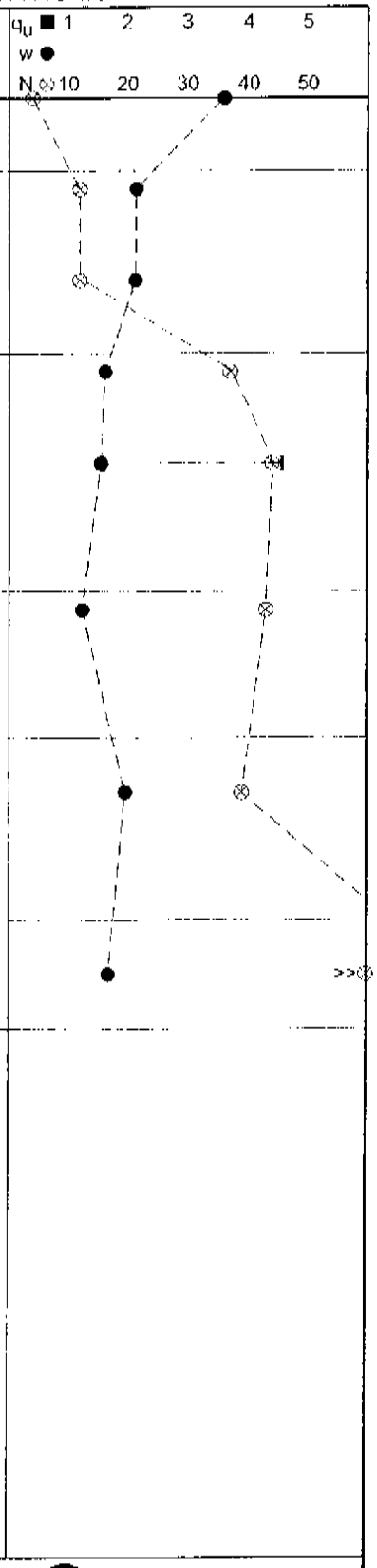
JOB No. **3245-05** BORING No. **B-27**

1 OF **1** SHEETS

BORING LOG No: **B-28**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-1-3	4		36.0				FILL: Clay, trace silt and sand, soft, brown, yellow.
		4-5-7	12		21.5				SILT, little clay, trace sand and gravel (wx. limestone), stiff, yellow, pale yellow.
5		6-6-6	12		21.3				-some sand-gravel, as above.
		13-15-22	37		16.2				SANDY CLAY; fine qtz. sand; hard; light gray, yellow. (CL)
10		16-20-24	44		15.5	45.6	29.6		
15		13-18-25	43		12.4				Gravelly Clay, rounded-subrounded dark and light rock fragments; light gray clay matrix; hard.
20		8-14-25	39		19.6				SILTY CLAY, terrig.; brown, yellow, gray; trace caliche; weathered limestone frags. in lower part.
25		19-25-50	75		16.8				CLAY, hard, brown, gray; little limestone fragments.
									END OF BORING NO. B-28 AT 25.5 FEET DEPTH.
									NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **12-14-05** COMPLETED **12-14-05**

ELEVATION TOP OF HOLE **526.41 (160.49 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 260,704.1 E 202,375.4**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PIREATIC LEVEL	PI	PLASTICITY INDEX IN %

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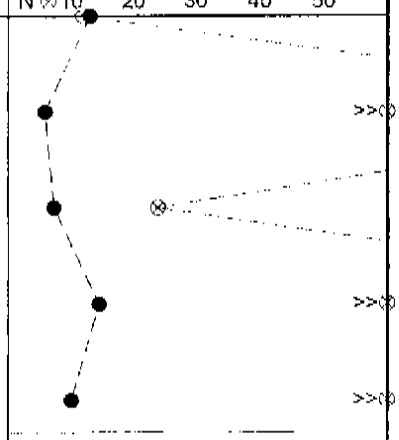
JOB No. **3245-05**

1 OF 1 SHEETS

BORING No. **B-28**

BORING LOG No: **B-29**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		3-3-9	12		13.1				WEATHERED LIMESTONE: sampled as mixture of calc./terrig. silt, little limestone frags.; trace roots, medium dense, yellow, very pale brown.
		50/5"	120		5.9				-as above, no roots; friable, yellow, pale yellow
1.5	5	40-16-8	24		7.3				-little terrig. material
		6-50-50/4"	125		14.5				-no terrig. material, pale yellow -sampled as silt, little sand, fine grained, compact, friable, white.
3.0	10	42-50/4"	150		10.1				END OF BORING NO. B-29 AT 10.83 FEET DEPTH. NOTE: No groundwater observed during drilling.



DATE HOLE STARTED 12-8-05 COMPLETED 12-8-05

ELEVATION TOP OF HOLE 545.69 (166.37 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 260,990.3 E 202,417.1

NAME OF DRILLER Rubén Nieves

DRILLING EQUIPMENT /METHOD CME-55 SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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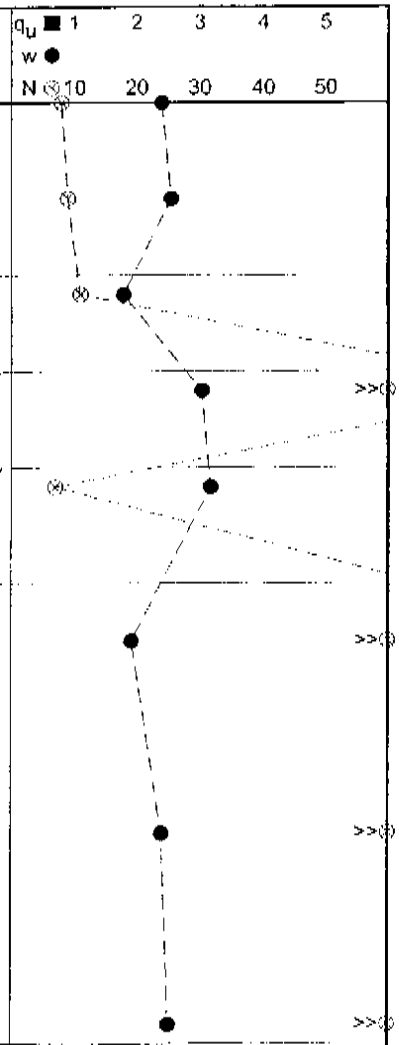
JOB No. 3245-05

1 OF 1 SHEETS

BORING No. B-29

BORING LOG No: **BC-1**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-3-5	8	(2.0)	24.1				CLAYEY SILT, little sand, trace limestone fragments and carbonaceous material; stiff, brown, pale yellow.
		2-3-6	9	(2.5)	25.6				-no carbonaceous matter.
	5	4-4-7	11		17.9				Weathered rock frags., little clay and sand, trace silt, medium dense, yellow, pale yellow.
		6-12-50/4"	87		30.3				LIMESTONE: sampled as little sand and terrig. clay, trace silt, very dense, brown, white, pale yellow.
	10	6-2-5	7	(1.25)	31.7				CLAY, terrigenous, little limestone fragments and silt, trace sand, medium stiff, brown, pale yellow.
	15	50/6"	100		19.1				-sampled as limestone fragments, little sand, trace silt, very dense, yellow, brown.
	20	2-26-50/3"	126		24.0				
		50/4"	150		25.1				END OF BORING NO. BC-1 AT 24.33 FEET DEPTH. NOTE: Groundwater observed at a depth of 7.5 ft. during drilling.



DATE HOLE STARTED 11-28-05 COMPLETED 11-28-05

ELEVATION TOP OF HOLE 413.02 (125.92 mts)

ELEVATION GROUND WATER 405.52

LOCATION (Coordinates or Station) N 261,001.3 E 201,775.2

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT /METHOD CME-55 SPT

w_n	WATER CONTENT IN %	q_u	() PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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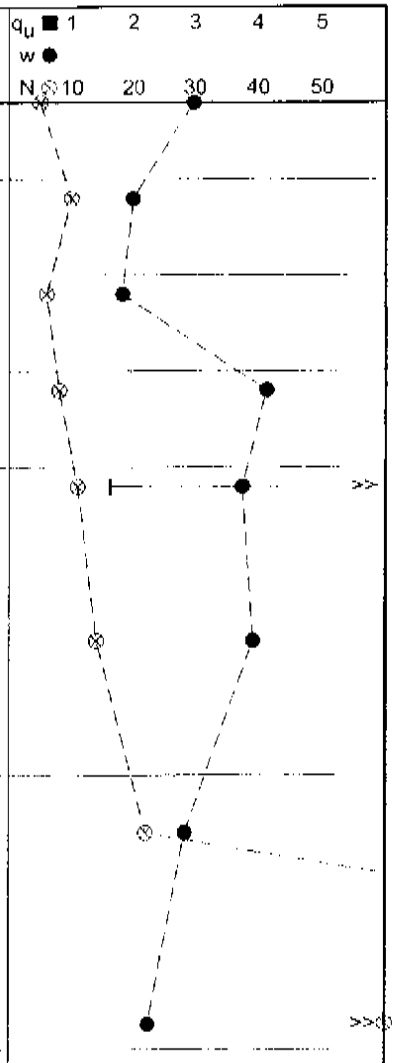
APPROVED | JOB No. 3245-05 | 1 OF 1 SHEETS | BORING No. BC-1

BORING LOG No: **BC-2**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-2-3	5	(2.25)	29.9				COLLUVIUM: CLAY, trace silt and roots, trace limestone fragments, medium stiff, dark brown, yellow.
		2-3-7	10	(3.0)	19.9				Terrigenous silt (brown) and limestone frags. (pale yellow), medium dense.
5		3-3-3	6		18.2				Mixture of gravel sized, rounded terrig. frags. (rock, qtz.) and clayey silt; little qtz. sand; loose, brown, pale yellow.
		2-4-4	8		41.4				Mixture of terrig. silt, trace clay, and limestone fragments, loose, brown, white, pale yellow.
10		3-5-6	11	0.59	37.6	71.2	55.0		Mixture of terrigenous clay (CH) and limestone fragments, plastic; trace silt and sand, stiff to medium dense, brown, white.
15		3-4-10	14	(2.25)	39.3				
20		23-11-11	22		28.4				WEATHERED LIMESTONE: sampled as limestone fragments, little sand and silt (trace terrigenous); medium dense, white, pale yellow, yellow.
		17-50/2"	200		22.4				-little sand, trace silt, very dense, pale yellow, yellow.

END OF BORING NO. BC-2 AT 24.67 FEET DEPTH.
NOTE: Groundwater observed at a depth of 6.5 ft. during drilling.



DATE HOLE STARTED **11-28-05** COMPLETED **11-28-05**

ELEVATION TOP OF HOLE **412.39 (125.73 mts)**

ELEVATION GROUND WATER **405.89**

LOCATION (Coordinates or Station) **N 261,007.3 E 201,791.7**

NAME OF DRILLER **Carlos Calderón** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PIEZOMETRIC LEVEL	PI	PLASTICITY INDEX IN %

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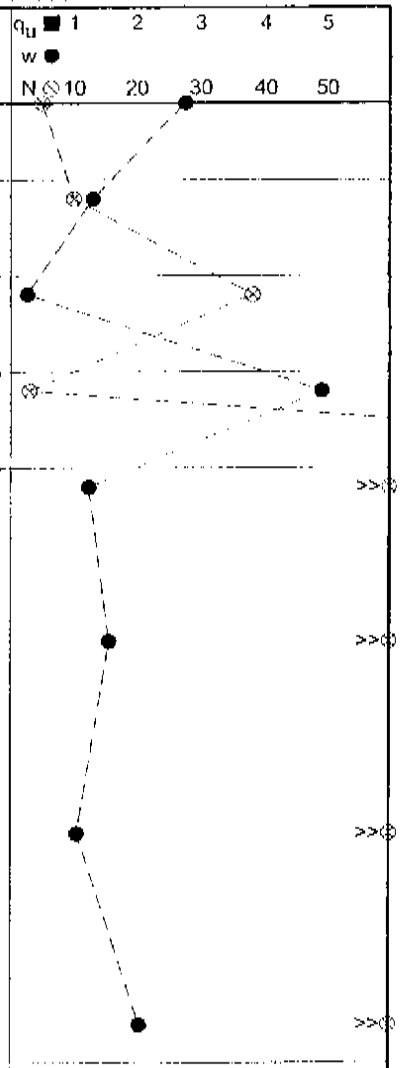
JOB No. **3245-05**

1 OF **1** SHEETS

BORING No. **BC-2**

BORING LOG No: **BC-3**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-2-3	5	(2.5)	27.7				CLAY, trace sand, silt and roots, medium stiff, olive, strong brown.
		3-5-5	10		13.0				SAND, little clay, medium grained, trace calcareous gravel, yellowish brown.
	5	8-18-20	38		2.6				GRAVEL-sized frags., calcareous; angular to sub-angular, trace clay, little sand, coarse to medium grained, white, light gray.
		2-1-2	3	(1.0)	49.0				CLAY, terrigenous; little sand, medium to fine grained, trace silt, soft, plastic, reddish yellow.
	10	25-50/3"	200		12.3				WEATHERED LIMESTONE: sampled as clayey sand, medium to fine grained, little silt and calcareous gravel, angular to sub-angular, compact, friable, white, light gray.
	15	16-50/5"	120		15.5				-sampled as sandy clay, coarse grained sand, little calcareous gravel, trace silt, compact, friable, white, light gray.
	20	50/6"	100		10.5				-little sand, medium to fine grained.
		20-50/5"	120		20.5				-sampled as gravelly sand, coarse to medium grained, angular to sub-angular gravel, little clay, compact, friable, yellow.
									END OF BORING NO. BC-3 AT 24.92 FEET DEPTH. NOTE: Groundwater observed at a depth of 20.5 ft. during drilling.



DATE HOLE STARTED **11-30-05** COMPLETED **11-30-05**

ELEVATION TOP OF HOLE **412.07 (125.63 mts)**

ELEVATION GROUND WATER **391.57**

LOCATION (Coordinates or Station) **N 261,244.2 E 201,924.0**

NAME OF DRILLER **Carlos Calderón** DRILLING EQUIPMENT **CME-55** METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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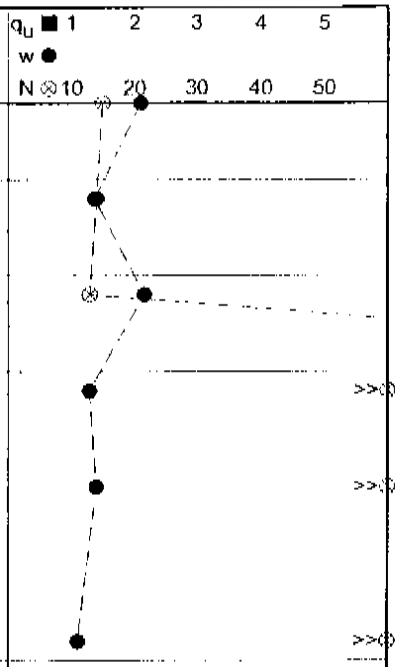
JOB No. **3245-05**

1 OF **1** SHEETS

BORING No. **BC-3**

BORING LOG No: **BC-4**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		4-7-8	15	(4.5+)	21.0				FILL: Silt, trace clay and roots, stiff, brown.
		6-7-7	14	(4.5+)	13.7				Fine SANDY SILT, stiff, brownish yellow, red.
1.5	5	6-6-7	13	(4.5)	21.6				CLAY, terrig. trace silt, stiff, brownish yellow, light gray, little calcareous frags.
		23-50/2"	200	(3.0)	12.9				WEATHERED LIMESTONE: sampled as sand, some fine quartz; little silt and gravel, compact, friable, yellow, white.
3.0	10	41-50/5"	120	(2.0)	14.0				-some silt -calcareous silt, friable, white; little limestone gravel
4.37	14.33	50/4"	150		11.1				END OF BORING NO. BC-4 AT 14.33 FEET DEPTH. NOTE: No. groundwater observed during drilling.



DATE HOLE — STARTED 12-6-05 — COMPLETED 12-6-05

ELEVATION TOP OF HOLE 417.61 (127.32 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 261,238.1 E 201,936.6

NAME OF DRILLER Rubén Nieves — DRILLING EQUIPMENT CME-55 — METHOD SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▽	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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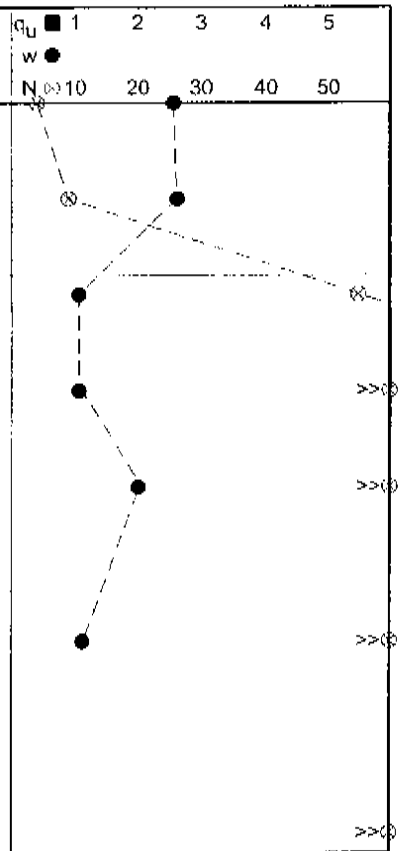
JOB No. 3245-05 — 1 OF 1 SHEETS — BORING No. BC-4

BORING LOG No: **BC-5**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-2-2	4	(2.5)	25.7				FILL: Clay, trace silt, medium stiff to stiff, dark brown, yellowish brown.
		2-4-5	9	(3.0)	26.3				-trace sand and gravel (limestone frags.)
5		10-20-35	55		10.7				WEATHERED LIMESTONE: sampled as gravel-shaped limestone frags., some terrig. silt and clay, very dense, white, light gray.
		13-50/5.5"	104		10.7				-sampled as sand, medium to fine grained, little gravel and silt, compact, friable, white.
10		26-50/6"	100	(1.0)	20.1				-little clay.
		50/2"	200		11.2				
15		50/1"	200						-NO RECOVERY.
									END OF BORING NO. BC-5 AT 19.08 FEET DEPTH.
									NOTE: Groundwater observed at a depth of 14 ft. during drilling.



DATE HOLE STARTED **11-30-05** COMPLETED **11-30-05**

ELEVATION TOP OF HOLE **408.20 (124.45 mts)**

ELEVATION GROUND WATER **394.20**

LOCATION (Coordinates or Station) **N 261,265.9 E 201,936.6**

NAME OF DRILLER **Carlos Calderón** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PIREATIC LEVEL	PI	PLASTICITY INDEX IN %

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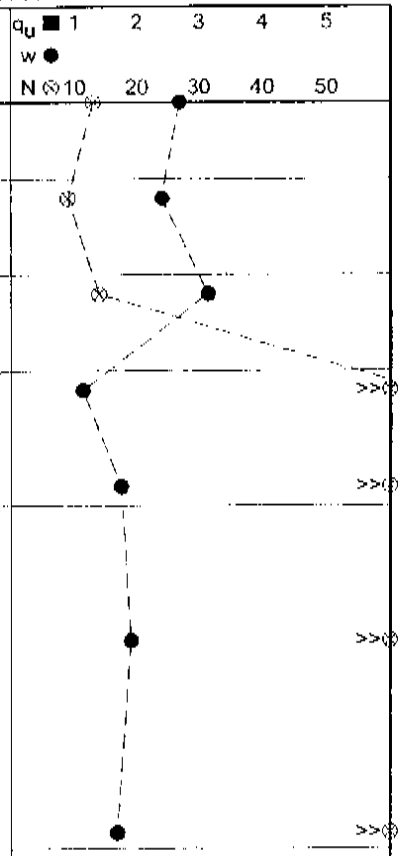
APPROVED | JOB No. **3245-05** | **1** OF **1** SHEETS | BORING No. **BC-5**

BORING LOG No: **BC-6**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-5-8	13	(2.5)	26.9				CLAY, terrigenous, trace silt and limestone fragments, trace roots, stiff, brown.
		3-4-5	9	2.37	24.0				CLAYEY SILT, terrig., little sand, no limestone brown.
5		6-7-7	14		31.5				Mixture of terrig. clay/silt and limestone fragments, brown, pale yellow.
		22-22-43	65	(2.0)	11.4				WEATHERED LIMESTONE: sampled as angular gravel, little calcareous silt, trace terrig. clay; very dense, white, pale yellow, brown.
10		30-50/4"	150		17.5				Limestone fragments, trace silt and sand, very dense, white, pale yellow, yellow.
15		64/5"	156		19.0				
		52/5"	125		16.8				END OF BORING NO. BC-6 AT 19.42 FEET DEPTH. Note: Groundwater was observed at a depth of 10 ft. during drilling.



DATE HOLE STARTED 12-6-05 COMPLETED 12-6-05

ELEVATION TOP OF HOLE 407.57 (124.26 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 261,262.1 E 201,956.3

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT CME-55 METHOD SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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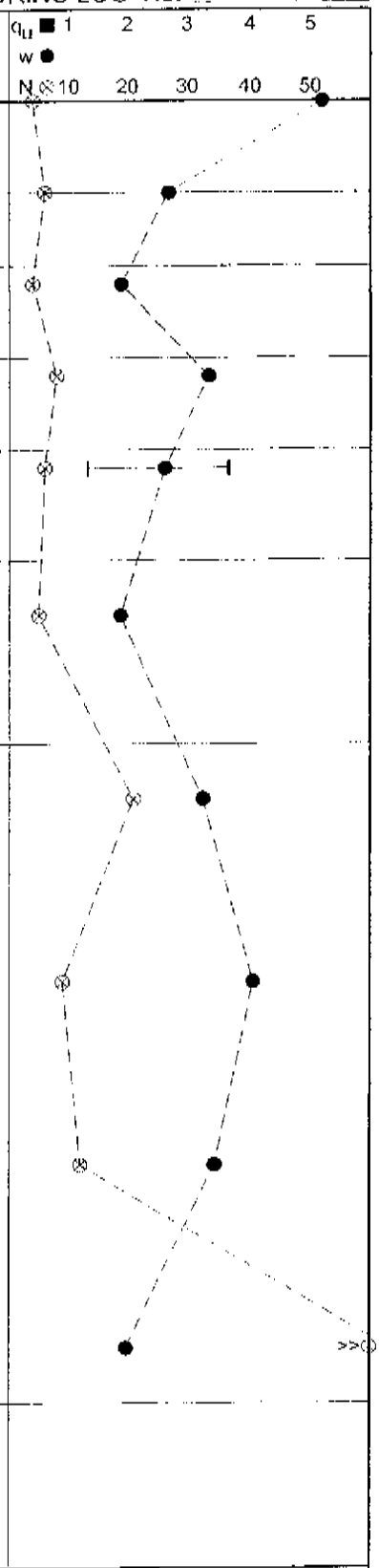
JOB No. 3245-05

1 OF 1 SHEETS

BORING No. **BC-6**

BORING LOG No: **BC-7**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-2-2	4	0.83	52.0				CLAYEY SILT, trace limestone frags., roots, and land shell fragments, soft, dark brown.
		2-3-3	6	(1.25)	27.0				Fine SANDY (quartz) SILT; trace clay and roots; med. stiff; brown.
5		3-2-2	4		19.0				SILTY SAND (predom. qtz.) trace limestone frags., soft, dark brown.
		2-5-3	8	(0.75)	33.5				CLAYEY fine SAND (as above); little coarse limestone gravel frags.; medium stiff, pale brown, very pale yellow; colluvium?
10		3-2-4	6		26.4	36.6	23.4		CLAY, some sand, medium to fine grained, trace gravel; med. stiff; color as above.
15		7-2-3	5		18.8				SILTY fine SAND (as above) little-some limestone gravel; med. stiff; lt. brown.
20		23-9-12	21		32.5				WEATHERED LIMESTONE, friable-weak; sampled as limestone frags., brownish yellow; brown terrig. clay masses locally.
25		1-1-8	9		40.6				Mixture of angular limestone frags. and terrigenous clay/silt; wet.
30		4-4-8	12		34.4				
35		42-36-27	63		19.8				-sampled as limestone frags., little terrig. fines; yellowish brown. END OF BORING NO. BC-7 AT 35.5 FEET DEPTH. NOTE: Groundwater observed at a depth of 5 ft. during drilling.



DATE HOLE STARTED **12-5-05** COMPLETED **12-5-05**

ELEVATION TOP OF HOLE **418.10 (127.47 mts)**

ELEVATION GROUND WATER **413.10**

LOCATION (Coordinates or Station) **N 261,103.7 E 202,049.5**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PIREATIC LEVEL	PI	PLASTICITY INDEX IN %

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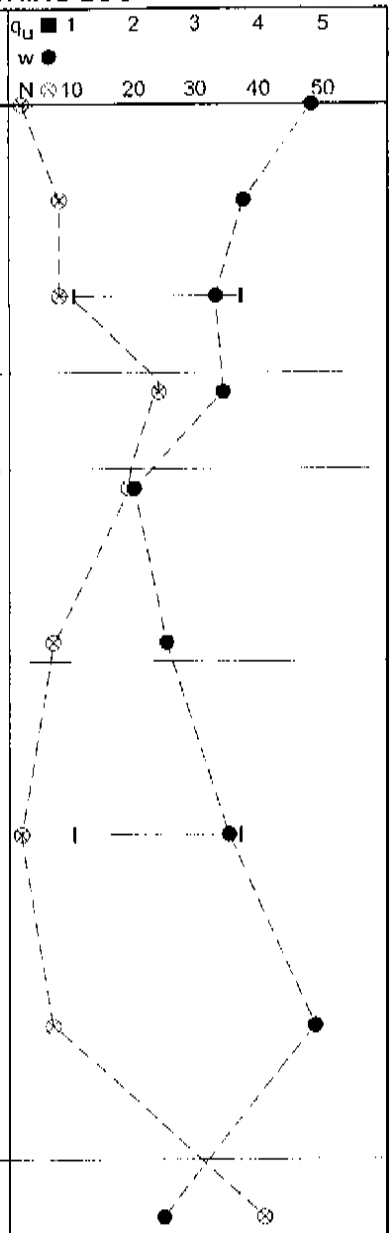
APPROVED | JOB No. **3245-05** | **1** OF **1** SHEETS | BORING No. **BC-7**

BORING LOG No: **BC-8**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-1-1	2	(0.5)	48.2				SILTY CLAY, trace roots and sand-sized limestone frags., very soft to medium stiff, dark brown.
		2-4-4	8	(1.5)	37.7				-no roots, trace carbonaceous matter
5		2-3-5	8	1.66	33.2	37.2	26.9		-no carbonaceous matter, trace roots, medium stiff, yellowish brown. (CH)
		13-8-16	24	(2.25)	34.4				Terrigenous CLAY and SILT, trace-fine qtz. sand, and wx. limestone gravel; very stiff, olive, pale yellow; colluvium (?).
10		11-10-9	19		19.9				Limestone fragments; weak-mod. strong; little terrigenous silt, medium dense, white.
15		4-3-4	7	2.17	25.3				Begin as above, then fine SANDY CLAY (quartz); little silt; medium stiff to very soft, brownish yellow. (CL)
20		1-1-1	2	(0.75)	35.4	37.2	26.9		
25		2-5-2	7		48.9				-trace-little limestone frags
30		4-14-27	41		24.8				WEATHERED LIMESTONE, sampled as silt and limestone frags., dense, yellow.
									END OF BORING NO. BC-8 AT 30.5 FEET DEPTH.
									NOTE: Groundwater observed at a depth of 10 ft. during drilling.



DATE HOLE STARTED **12-5-05** COMPLETED **12-5-05**

ELEVATION TOP OF HOLE **419.12 (127.78 mts)**

ELEVATION GROUND WATER **409.12**

LOCATION (Coordinates or Station) **N 261,085.2 E 202,055.7**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFINED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PIREATIC LEVEL	PI	PLASTICITY INDEX IN %

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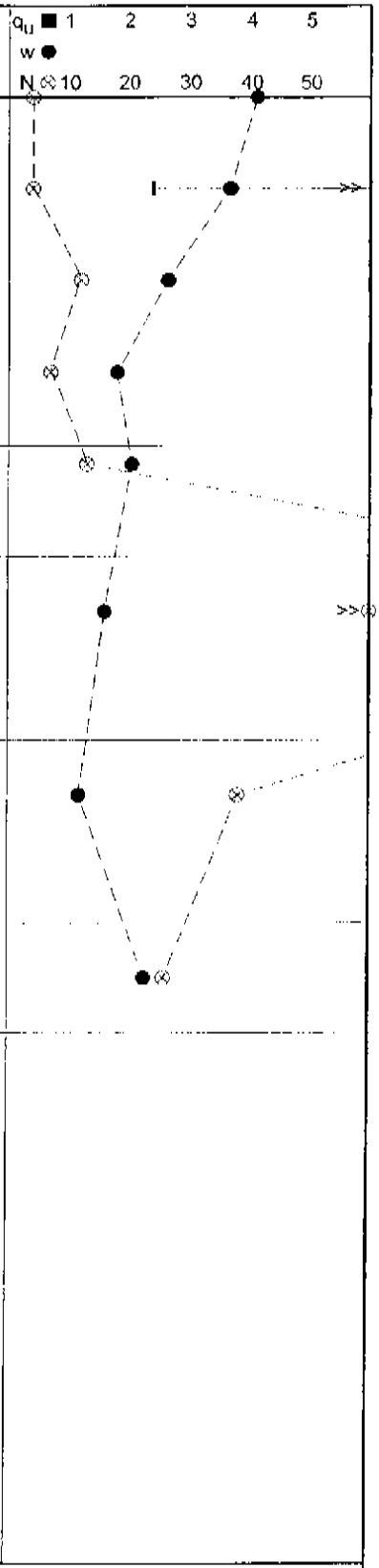
APPROVED | JOB No. **3245-05** | BORING No. **BC-8**

1 OF **1** SHEETS

BORING LOG No: **SC-1**

DEPTH M	DEPTH Ft	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-2-2	4	(.75)	40.9				CLAY, trace silt and roots, soft to stiff, brown.
		2-2-2	4	1.07	36.5	102.0	78.0		-(CH)
5		4-5-7	12		26.5				-some angular limestone fragments, trace roots, brown, pale yellow.
		4-3-4	7		18.0				-no roots, predom. limestone frags.
10		4-6-7	13	(3.5)	20.5				WEATHERED LIMESTONE: sampled as silt and trace limestone fragments; varicolored: brown, gray, white, pale orange.
15		2-40-50/3"	140		16.0				-sampled as sand, little limestone fragments, little terrigenous silt very dense, reddish yellow, yellow, pale yellow.
20		18-18-20	38		11.8				-sampled as sand, little silt, trace limestone fragments, dense, yellow.
25		7-10-16	26		22.7				-terrigenous clay, little silt and limestone fragments, trace sand, very stiff, pale yellow, yellow, brown.
									END OF BORING NO. SC-1 AT 25.5 FEET DEPTH.
									NOTE: No groundwater observed during drilling.



DATE HOLE — STARTED **11-29-05** — COMPLETED **11-29-05**

ELEVATION TOP OF HOLE **468.35 (142.79 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,231.8 E 201,706.0**

NAME OF DRILLER **Carlos Calderón** — DRILLING EQUIPMENT **CME-55** — METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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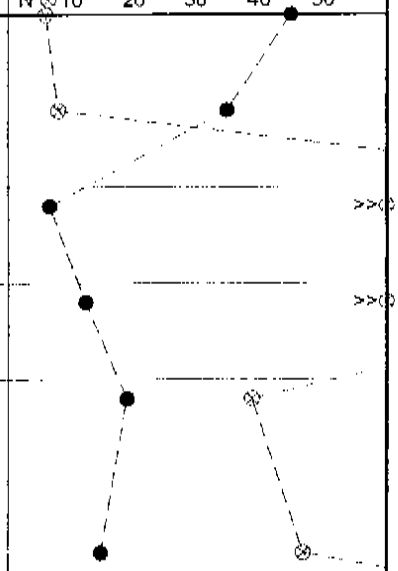
JOB No. **3245-05**

1 OF **1** SHEETS

BORING No. **SC-1**

BORING LOG No: **SC-2**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		1-2-4	6	1.70	45.0				CLAY, trace silt, medium stiff, trace roots; brown-dark brown.
		3-4-4	8		35.1				-little limestone fragments, brown, yellow, pale yellow.
5		3-29-50/3"	129		6.6				WEATHERED LIMESTONE: sampled as sand, little silt, very dense, pale yellow, yellow.
		15-46-50/5"	106	(4.5+)	12.3				-sampled as Silt, little sand, hard, yellow, pale yellow.
10		11-15-24	39	4.54	18.9				Mixture of terrig. clay/silt and limestone fragments, hard, yellow, pale yellow, brown.
15		9-19-28	47		14.7				-angular limestone fragments.
		50/2"	200						-very dense, yellow, brown, pale yellow.
									END OF BORING NO. SC-2 AT 19.17 FEET DEPTH.
									NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **11-30-05** COMPLETED **11-30-05**

ELEVATION TOP OF HOLE **464.55 (141.63 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,267.4 E 201,687.8**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT **CME-55** /METHOD **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
¥	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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JOB No. **3245-05**

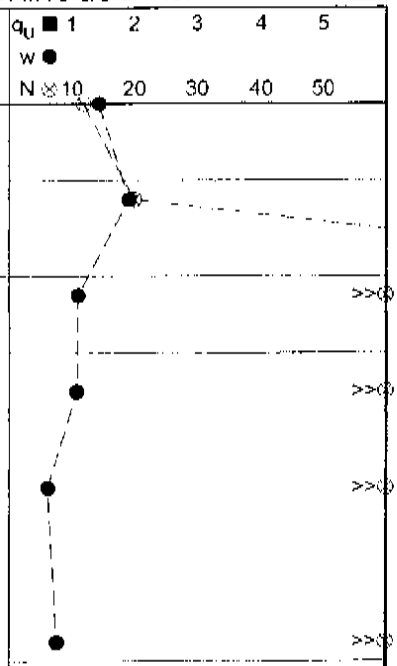
1 OF **1** SHEETS

BORING No. **SC-2**

BORING LOG No: **SC-3**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		4-5-7	12		14.5				WEATHERED LIMESTONE: sampled as sand, little silt and limestone fragments, medium dense, pale yellow, brown.
		9-10-10	20		19.2				-sampled as silt, trace sand, very stiff, pale yellow
	5	30-50/4"	150		11.1				-sampled as sand, trace silt, very dense, pale yellow, brown
		50/5"	120		10.9				-sampled as limestone fragments, little carbonate sand, trace silt, very dense, pale yellow
	10	50/3.5"	172		6.2				
		50/3"	200		7.6				END OF BORING NO. SC-3 AT 14.25 FEET DEPTH.

NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **11-29-05** COMPLETED **11-29-05**

ELEVATION TOP OF HOLE **476.32 (145.22 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,291.1 E 201,740.9**

NAME OF DRILLER **Carlos Calderón** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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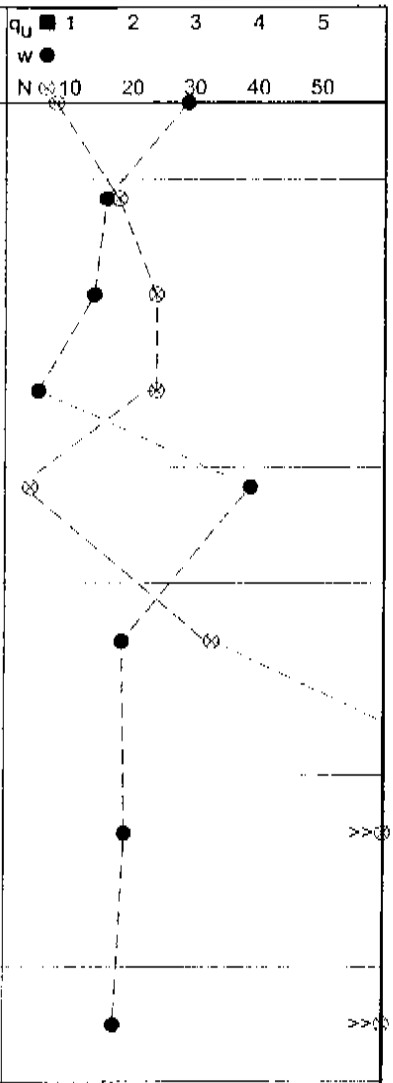
1 OF **1** SHEETS

BORING No. **SC-3**

BORING LOG No: SS-2

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		4-4-4	8	2.17	29.1				CLAYEY SILT, little fine sand, trace roots, stiff, yellow, red, brown.
		3-7-11	18		16.0				WEATHERED LIMESTONE: sampled as silt, trace sand and clay, some terrigenous, trace limestone fragments, medium dense, pale yellow, yellow, light gray, white.
5		6-9-15	24		14.1				-little sand and limestone fragments.
		8-14-10	24		5.3				-little terrigenous clay, trace sand.
10		5-2-2	4	(1.0)	39.0				-silt, little clay and sand, soft, red, brown
15		15-14-19	33		18.5				-limestone fragments, friable-mod. strong; little terrigenous silt and sand, dense, yellow, brown
20		17-36-50/5"	96	(4.5)	19.1				-silt and limestone fragments, trace sand, hard, light olive, gray, yellow, brown.
25		34-42-50/3"	142	(4.5+)	17.4				-silt, terrig., trace dispersed calcite; trace small limestone frags.; pale yellow, yellow.

END OF BORING NO. SS-2 AT 25.25 FEET DEPTH.
NOTE: No groundwater observed during drilling.



DATE HOLE STARTED 12-1-05 COMPLETED 12-1-05

ELEVATION TOP OF HOLE 459.20 (140.00 mts)

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) N 261,327.2 E 201,637.9

NAME OF DRILLER Rubén Nieves DRILLING EQUIPMENT CME-55 METHOD SPT

w_n	WATER CONTENT IN %	q_u	( ) PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▼	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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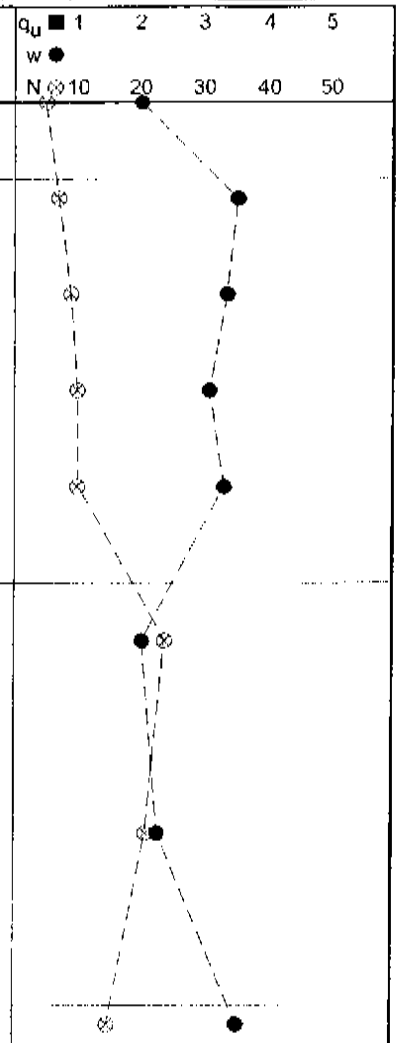
1 OF 1 SHEETS

BORING No. SS-2

BORING LOG No: **SS-3**

DEPTH M	DEPTH FT	BLOWS ON SAMPLER	N	q_u	w_n	LL	PI	Symbol	DESCRIPTION
		2-2-3	5	(2.5)	20.3				SILT, little clay and sand, trace roots, medium stiff, brown, red.
		2-3-4	7	1.86	35.3				CLAY, trace silt and roots, medium stiff, varicolored: light gray, red, brown.
5		3-4-5	9	(2.0)	33.7				-no roots, locally silty clay-clayey silt; predom. red
		3-5-5	10	(2.0)	30.9				-clay, light gray.
10		3-5-5	10	(2.5)	33.2				-varicolored
15		6-9-15	24	(4.5+)	20.3				CLAYEY SILT, little fine sand; very stiff, brown, red.
20		3-9-12	21	4.35	22.9				-locally clay, plastic
25		5-6-9	15	2.65	35.4				CLAY, trace silt, fine sand; stiff, yellow, red, brown.
									END OF BORING NO. SS-3 AT 25.5 FEET DEPTH.
									NOTE: No groundwater observed during drilling.



DATE HOLE STARTED **11-30-05** COMPLETED **11-30-05**

ELEVATION TOP OF HOLE **445.06 (135.69 mts)**

ELEVATION GROUND WATER

LOCATION (Coordinates or Station) **N 261,308.1 E 201,604.2**

NAME OF DRILLER **Rubén Nieves** DRILLING EQUIPMENT /METHOD **CME-55** **SPT**

w_n	WATER CONTENT IN %	q_u	() PENETROMETER, TSF
N	BLOWS FROM S. P. T. (ASTM D-1586)	LL	LIQUID LIMIT IN %
q_u	UNCONFIED COMPRESSIVE STRENGTH, TSF	PL	PLASTIC LIMIT IN %
▽	WATER TABLE OR PHREATIC LEVEL	PI	PLASTICITY INDEX IN %

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P.O. BOX 10872, SAN JUAN, P.R. 00922-0872

Monte Arena Residential Development, Vega Baja, PR

APPROVED | JOB No. **3245-05** | BORING No. **SS-3**

1 OF 1 SHEETS

APPENDIX B

FIELD AND LABORATORY TEST PROCEDURES

Appendix B

Field and Laboratory Test Procedures

I. DRILLING METHODS

A. Hollow Stem Auger Boring - Dry Sample method (ASTM-D-1452)

In the auger method, borings are advanced by turning a hydraulic powered auger into the ground in 5 feet increments or less. As the auger penetrates the cuttings rise to the surface on the spirals. The depth from which the material comes, however, cannot be accurately determined. Therefore, soil samples are not taken from the spiral augers. With the use of a hollow stem auger, a sampling apparatus may be inserted in the hollow stem to the bottom of the auger, eliminating the need for casings. The sampling procedures are described in the following paragraphs. Geo Cim, Inc. normally uses CME (Central Mining Equipment) drilling rigs which are trailer mounted and pulled with a 4 x 4 wheel drive F-350 or equivalent truck. The drilling rigs are either CME-45 or CME-55 models.

B. Wash Boring - Dry Sample Method

For inaccessible locations a portable drilling unit is used which consists of a tripod mounted motorized cathead which is used to drive casings and sampling rods to conduct this method of drilling. Borings are advanced into the ground by the wash-boring-dry sample method. The borings are normally cased through most of this length by the drop of either a 350 or 140 lbs. hammer from a height of 30 inches. The casing diameter is 2-1/2 inches. The number of blows for every foot of penetration the casing advanced is recorded and is reported in the boring logs. When driving of the casing becomes too difficult due to the hardness of the soils encountered, and the hole does not cave-in, the boring may be advances without casing by continuous washing out of the soils with the drill rods. The color and nature of the soils washed out (gravel, sand, silts or clay) is examined and recorded in order to determine the extent of each soil strata this is complemented with the sampling operations which are regularly made every five feet.

C. Core Borings (ASTM-D-2113)

Core Borings are used when necessary to penetrate into rock and obtain a continuous rock sample. The sample is obtained by means of a core barrel which is attached to the drill rods. At the end of the core barrel is a special bit studded with industrial diamonds which cuts into the rock. The drill rod, and hence the core barrel and diamond bit are rotated as downward pressure is applied. As the bit cuts into the rock, the rock core is free to move into the inner core barrel head, which is suspended on a swivel and therefore does not follow the motion of the outer core barrel with its bit. Cooling water or bentonite slurry is circulated through the drill rod and the core barrel. Penetration depends on the length of the core barrel and the quality of the rock (amount of joints or

fractures). Rock discontinuities such as joints and fractures affect the length of penetration in a given core run. The runs are longer as the rock quality increases. As the core barrel is withdrawn, the core lifter, located inside the diamond bit, wedges itself around the bottom of the rock core and thus permits it to be pulled free from the underlying rock. The two most common core sizes are NWM which produces a core of 2.15 inches diameter and HWM which produces a core 3.00 inches in diameter.

II. SAMPLING IN SOILS

A. Standard Penetration Test (ASTM-D-1586)

The standard penetration tests are made with a split-spoon sampler 2.0 inches/O.D. diameter, 1,375 inches I.D. diameter, 18 inches long. The sampler is driven into the ground by the drop of a 140 pounds hammer from a height of 30 inches. The number of blows from the three consecutive six inches of penetration of the sampler is recorded and the number of blows for the last foot of penetration is reported as the N-value. The samples are stored and sealed in glass jars for future classification tests in the laboratory.

The standard penetration test has been correlated with the consistency of fine grained soils and with the angle of internal friction or the relative density of sands. Such correlations can be used for preliminary estimates and to aid in the stratigraphic classification of the soil strata at a given site.

In the case of fine grained soils, the correlations of the SPT with the undrained shear strength of medium and stiff silts and clays of low sensitivity have been found to be fairly good; however, in the case of the soft silts and clays the SPT gives poor estimates of the undrained shear strength. Testing in undisturbed samples and vane shear tests are recommended in such cases.

B. Undisturbed Sampling

Undisturbed Samples are obtained using thin wall brass or zinc coated steel shelby tubes 2" to 3"O.D. by 24" to 30" long. The sampler is forced to penetrate the soil by static force or downward pressure and is pulled out also using static pull. The samplers are sealed in the field and shipped to the laboratory where the samples are extruded at the time of testing by pushing in the same direction that the sample penetrated the sampler. Special care is taken in packing and handling these samples to avoid disturbance.

III. LABORATORY TESTING

A. Atterberg Limits (ASTM-D-2166)

The Atterberg limits and related indices are very commonly used in soil mechanics works mainly for soil identification and classification purposes. They are also used in connection with some semi-empirical methods of design for preliminary estimates.

B. Unconfined Compression Test (ASTM-D-2166)

The best quality samples recovered in the split-spoon sampler are subjected to unconfined compression to failure. These samples cannot be regarded as "undisturbed" and the strengths obtained are lower than the "true" in-situ value due to the effect of disturbances and sensitivity of the soil. Furthermore, increased brittleness of friability of the soil structure results in strength values lower than the in-situ undrained strength. Therefore, the unconfined strength values measured in the split-spoon samples are used only as an index property for classification and identification purposes. When more accurate values of strength are needed, undisturbed samples from thin-wall shelby tubes are used.

C. Natural Moisture Content (ASTM-D-2216)

The natural moisture content is the water content of the soil in-situ. The soil sample is obtained from the SPT sampler or shelby tubes. Approximately 40 gms. of soil are weighed and then placed in an oven for 24 hours at a temperature of 105□ - 110□C. The natural moisture content, "Wn" is obtained from the difference between the weights in the natural state and after oven drying, divided by the dry weight of the sample and expressed in percentage.

IV. SOIL DESCRIPTION (ASTM-D-2488)

The description of the soils include the type (gravel, sand, silt, clay, organic), consistency (if a fine grained soil), size and roundness (if a coarse grained soil), color, and some other special characteristic which can aid in the identification and classification of the soil such as presence of rubbish, organic matter, shells and fossils, stratification and structure, cementation, mineral composition, relict structures, stains and others.

To aid in the preparation of these descriptions some simple tests are made such as those recommended by the Unified Soil Classification system for field classification (dilatancy, dry strength, shine, toughness). To approximate the consistency of fine grained soils (soft, medium, stiff, hard), a simple test is performed with the hand: a hard fine grained soil is difficult to indent with the thumbnail, stiff soils are readily indented with the thumb, medium soils can be penetrated by moderate thumb pressure and soft soils are easily penetrated with the thumb.

The description of coarse grained soils (sands and gravel) includes size (fine, medium coarse) and roundness (angular, sub-angular, sub-rounded, rounded and well-rounded).

The relative amount of coarse fractions in fine grained soils is estimated by placing a representative sample or some 50 gms. in a graduated cylinder filled with water. The mix is shaken and allowed to settle. Particles of a size larger than a fine sand are visible to the naked eye while
silts and clays are not. In this manner, estimates of the relative amounts of the coarse

fraction are made and reported as:

Trace	1	10%
Little	10	20%
Some	20	35%
Sandy, gravelly, silty or clayey	35	50%

The relative density of sands has been correlated with the results of the Standard Penetration Test, as follows:

For Granular Soils

N-Blows/ft.	Relative Density
0 – 4	Very loose
4 – 10	Loose
10 – 30	Medium
30 – 50	Dense
over 50	Very dense

These are very approximate correlations which vary with, among other factors, overburden pressure (Gibbs and Holtz, 1957, and Peck and Bazaraa, 1967). These correlations are meaningless in soils with a significant amount of gravel or cobbles.

The relative amounts of the fine grained soils is estimated based on the reaction of the soils to the dilatancy, shine, dry strength and toughness tests, with adjective indicating the less active fraction i.e. a sandy clay behaves more like a clay than a sand.

The consistency of cohesive soils has also been correlated to the results of the Standard Penetration Test, as shown below. The correlation, however, is greatly affected by the clay structure and factors such as sensitivity.

For Cohesive Soils

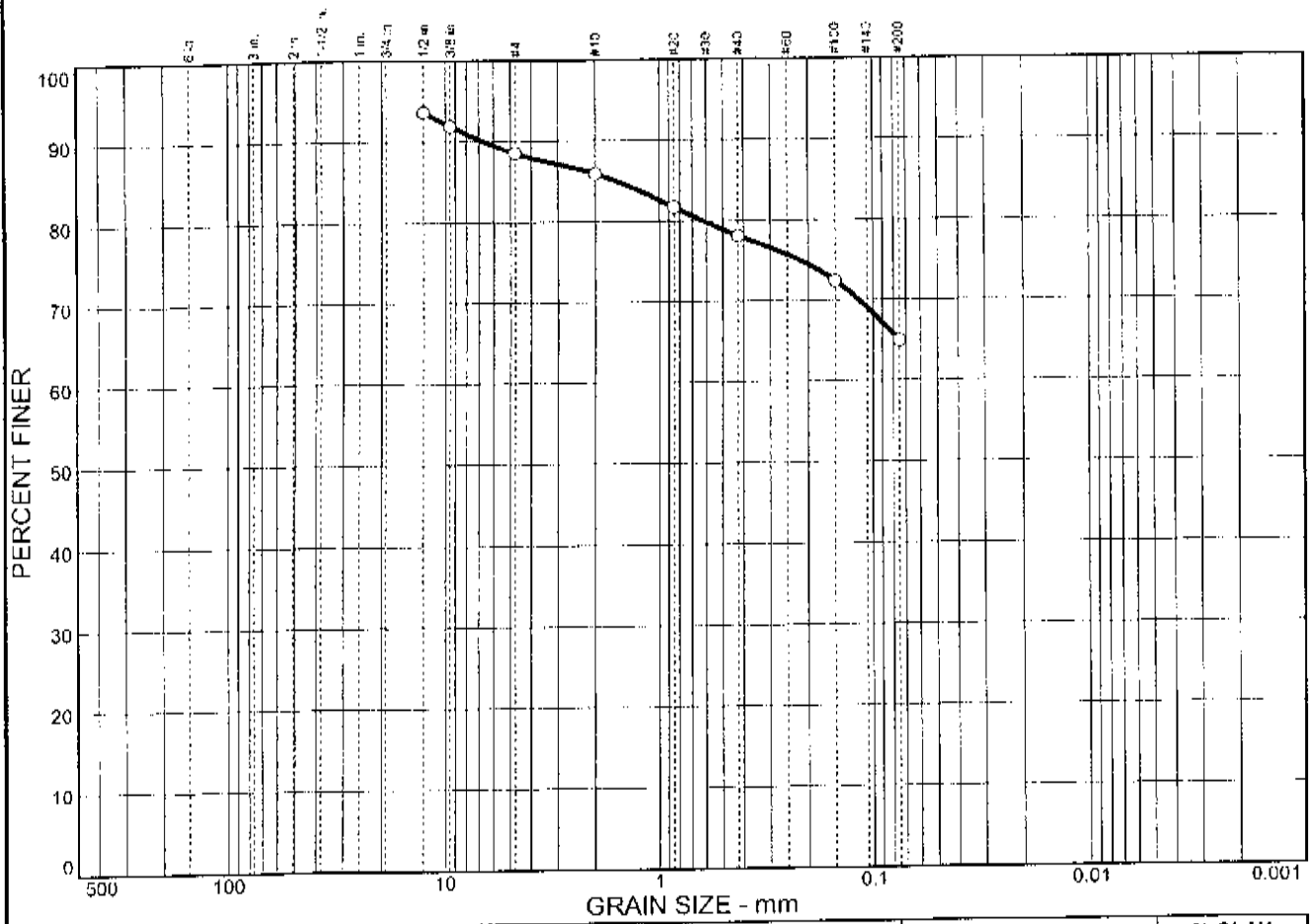
Unconfined Compressive Strength (T.S.F.)	N-Blows/Ft.	Consistency
Less than 0.25	Less than 2	Very soft
0.25 – 0.50	2 – 4	Soft
0.50 – 1.00	4 – 8	Medium
1.00 – 2.00	8 – 15	Stiff
2.00 – 4.00	15 – 30	Very stiff
More than 4.00	More than 30	Hard

Once the soil samples have been tested, they are stored for three months after the date of our final report, and then destroyed, unless required in writing by the client to store them for a longer period.

APPENDIX C

RESULTS OF SOIL CLASSIFICATION TESTS

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
		23.6	64.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	93.6		
.375 in.	91.9		
#4	88.5		
#10	85.9		
#20	81.7		
#40	78.1		
#100	72.4		
#200	64.9		

* (no specification provided)

Soil Description

Clay, some sand, pale yellow, brown.

Atterberg Limits

PL= 10.0 LL= 33.5 PI= 23.5

Coefficients

D_{85}= 1.61 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-4(0)

Remarks

Sample No.: 4 **Source of Sample:** Boring No. B-2 **Date:** 01-28-06
Location: **Elev./Depth:** 7.5' 9.0'

GEO CIM, INC.

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-2
Sample No.: 4
Elev. or Depth: 7.5'-9.0' Sample Length (in./cm.):
Location:
Description: Clay, some sand, pale yellow, brown.
Date: 01-28-06 PL: 10.0 LL: 33.5 PI: 23.5
USCS Classification: CL AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	129.30	70.72
Tare =	39.07	39.07
Dry sample weight =	90.23	31.65

Minus #200 from wash= 64.9 %
Sieve tare method

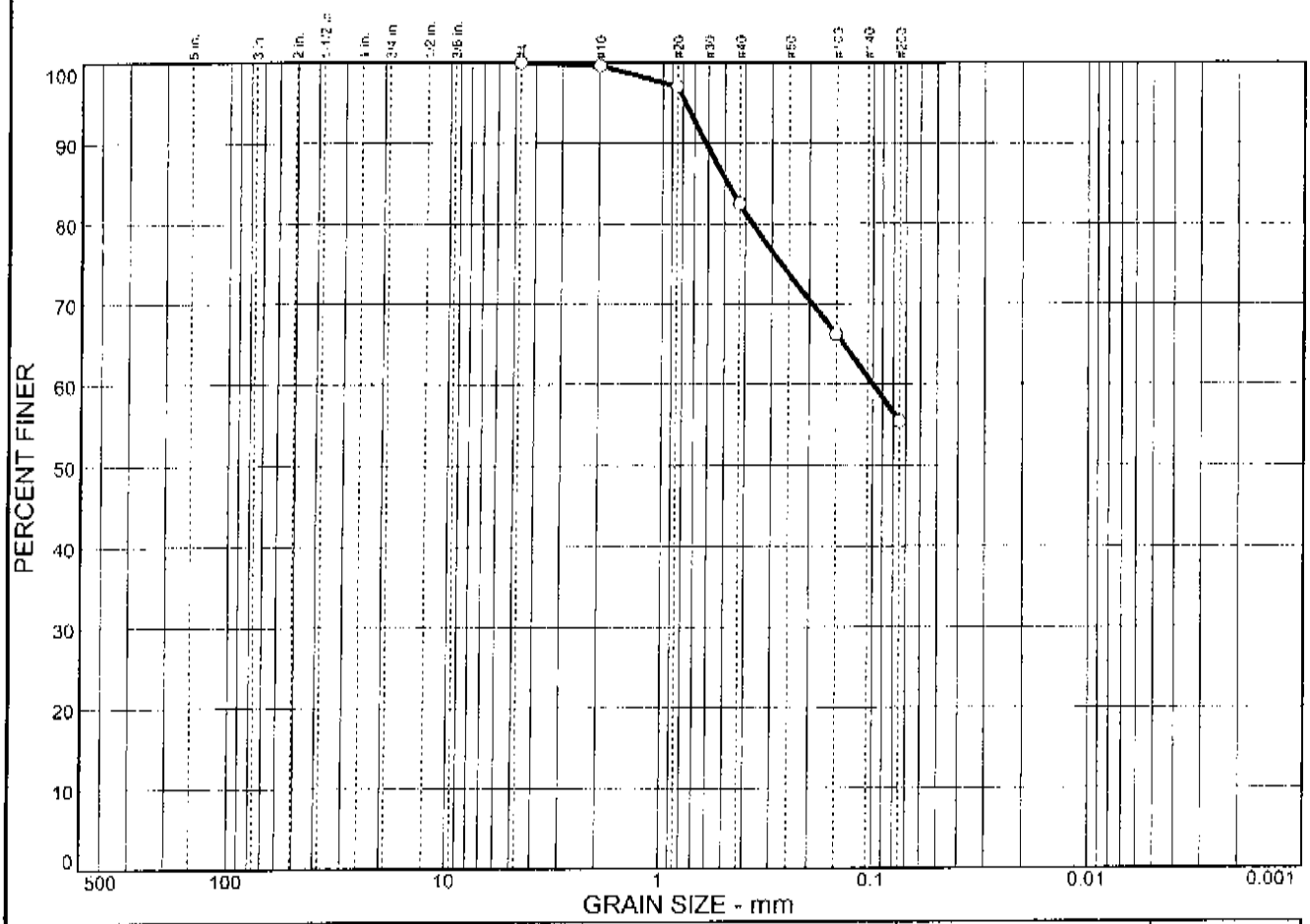
Sieve	Weight retained	Sieve tare	Percent finer
.5 inch	5.75	0.00	93.6
.375 inch	1.53	0.00	91.9
#4	3.08	0.00	88.5
# 10	2.41	0.00	85.9
# 20	3.77	0.00	81.7
# 40	3.20	0.00	78.1
# 100	5.16	0.00	72.4
# 200	6.75	0.00	64.9

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 23.6
% FINES = 64.9

D_{85}= 1.61

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	44.6	55.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	97.0		
#40	82.5		
#100	66.2		
#200	55.4		

* (no specification provided)

Soil Description

Sandy silt, brown, very pale brown

Atterberg Limits

PL= 15.9 LL= 71.6 PI= 55.7

Coefficients

D_{85}= 0.484 D_{60}= 0.100 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Sample No.: 4 **Source of Sample:** Boring No. B-3 **Date:** 01-28-06
Location: **Elev./Depth:** 7.5'-9.0'

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GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
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Project Number: 3245-05

Sample Data

Source: Boring No. B-3
Sample No.: 4
Elev. or Depth: 7.5'-9.0' Sample Length (in./cm.):
Location:
Description: Sandy silt, brown, very pale brown
Date: 01-28-06 PL: 15.9 LL: 71.6 PI: 55.7
USCS Classification: ML AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	113.40	72.95
Tare =	40.13	40.13
Dry sample weight =	73.27	32.82
Minus #200 from wash=	55.2 %	

Sieve tare method

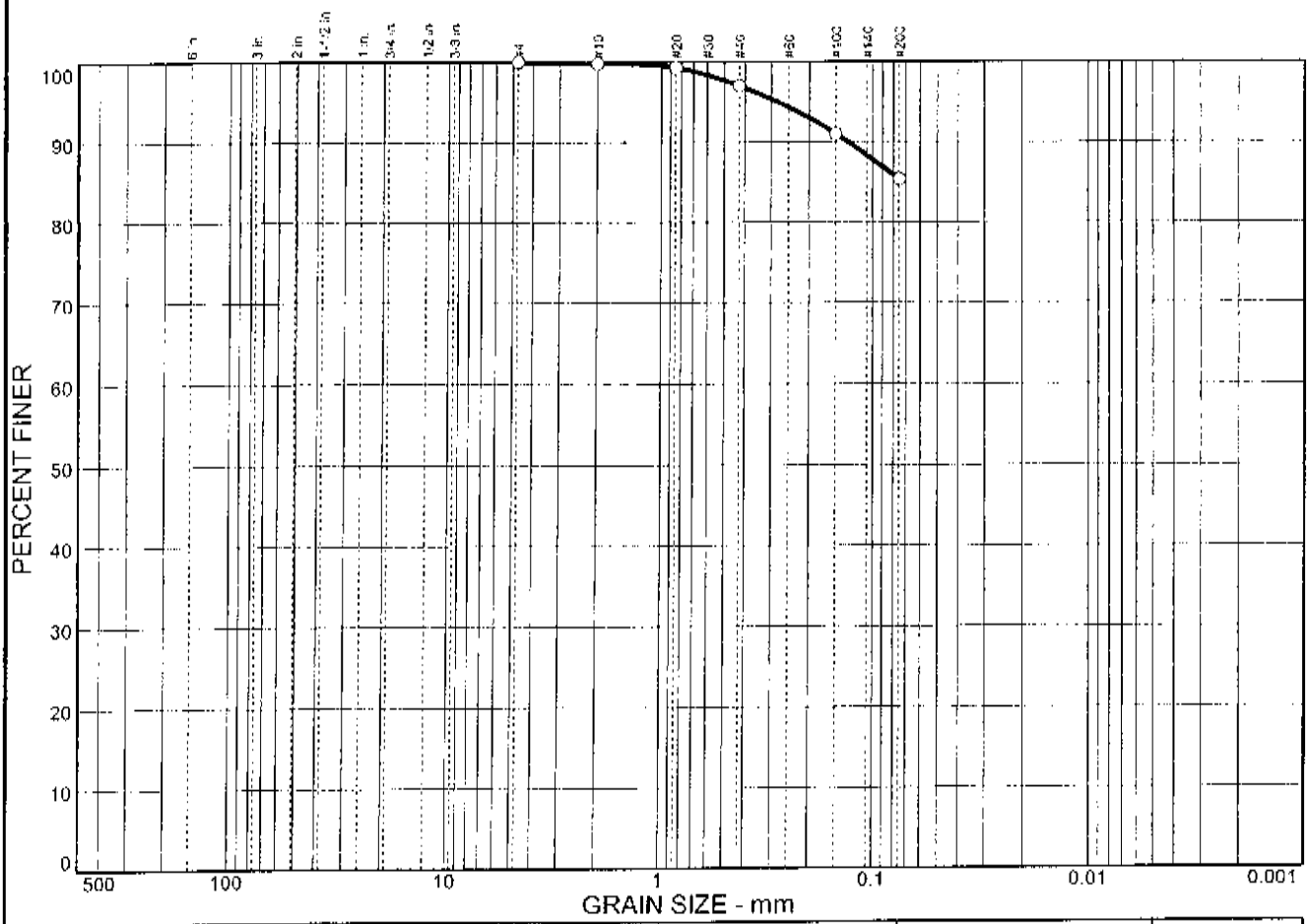
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.28	0.00	99.6
# 20	1.90	0.00	97.0
# 40	10.62	0.00	82.5
# 100	11.98	0.00	66.2
# 200	7.87	0.00	55.4

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 44.6
% FINES = 55.4

D_{85}= 0.48 D_{60}= 0.10

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	14.7	85.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	99.3		
#40	97.0		
#100	91.0		
#200	85.3		

* (no specification provided)

Soil Description

Silt, little sand, reddish brown.

Atterberg Limits

PL= 18.0 LL= 85.2 PI= 67.2

Coefficients

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

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Sample No.: 5 **Source of Sample:** Boring No. B-3 **Date:** 01-28-06
Location: **Elev./Depth:** 10.0'-11.5'

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GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
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Project Number: 3245-05

Sample Data

Source: Boring No. B-3
Sample No.: 5
Elev. or Depth: 10.0'-11.5' Sample Length (in./cm.):
Location:
Description: Silt, little sand, reddish brown.
Date: 01-28-06 PL: 18.0 LL: 85.2 PI: 67.2
USCS Classification: ML AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	80.41	39.19
Tare =	31.97	31.97
Dry sample weight =	48.44	7.22
Minus #200 from wash=	85.1 %	

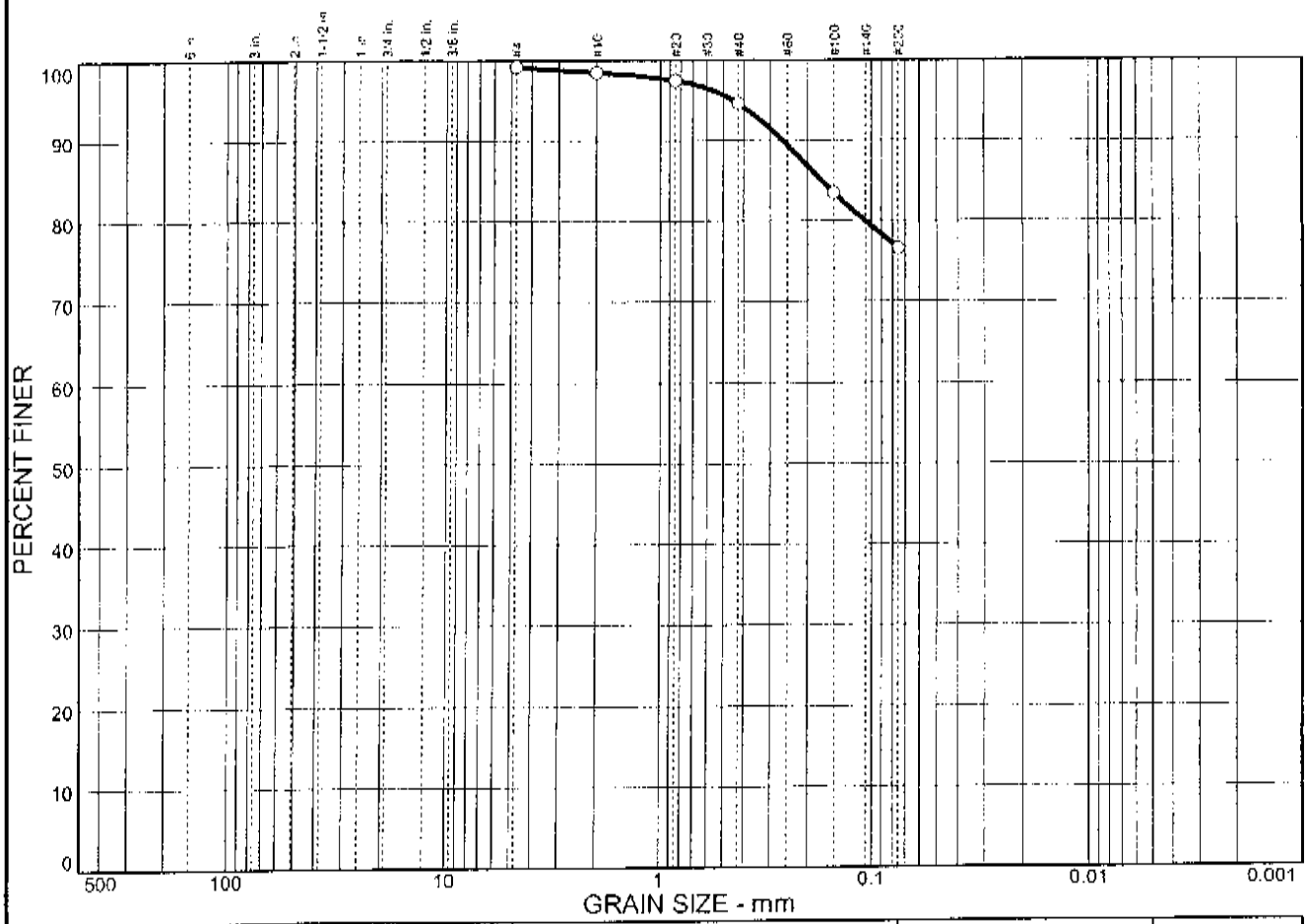
Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.10	0.00	99.8
# 20	0.25	0.00	99.3
# 40	1.09	0.00	97.0
# 100	2.90	0.00	91.0
# 200	2.80	0.00	85.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 14.7
% FINES = 85.3

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
		22.7	76.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	99.2		
#10	98.5		
#20	97.5		
#40	94.6		
#100	83.4		
#200	76.5		

* (no specification provided)

Soil Description

SILT, some sand, light gray.

Atterberg Limits

PL= 21.2 LL= 98.5 PI= 77.3

Coefficients

D_{85}= 0.173 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Sample No.: 3 **Source of Sample:** Boring No. B-4 **Date:** 01-28-06
Location: **Elev./Depth:** 5.0'-6.5'

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VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-4
Sample No.: 3
Elev. or Depth: 5.0'-6.5' Sample Length (in./cm.):
Location:
Description: SILT, some sand, light gray.
Date: 01-28-06 PL: 21.2 LL: 98.5 PI: 77.3
USCS Classification: ML AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	80.37	44.06
Tare =	33.02	33.02
Dry sample weight =	47.35	11.04
Minus #200 from wash=	76.7 %	

Sieve tare method

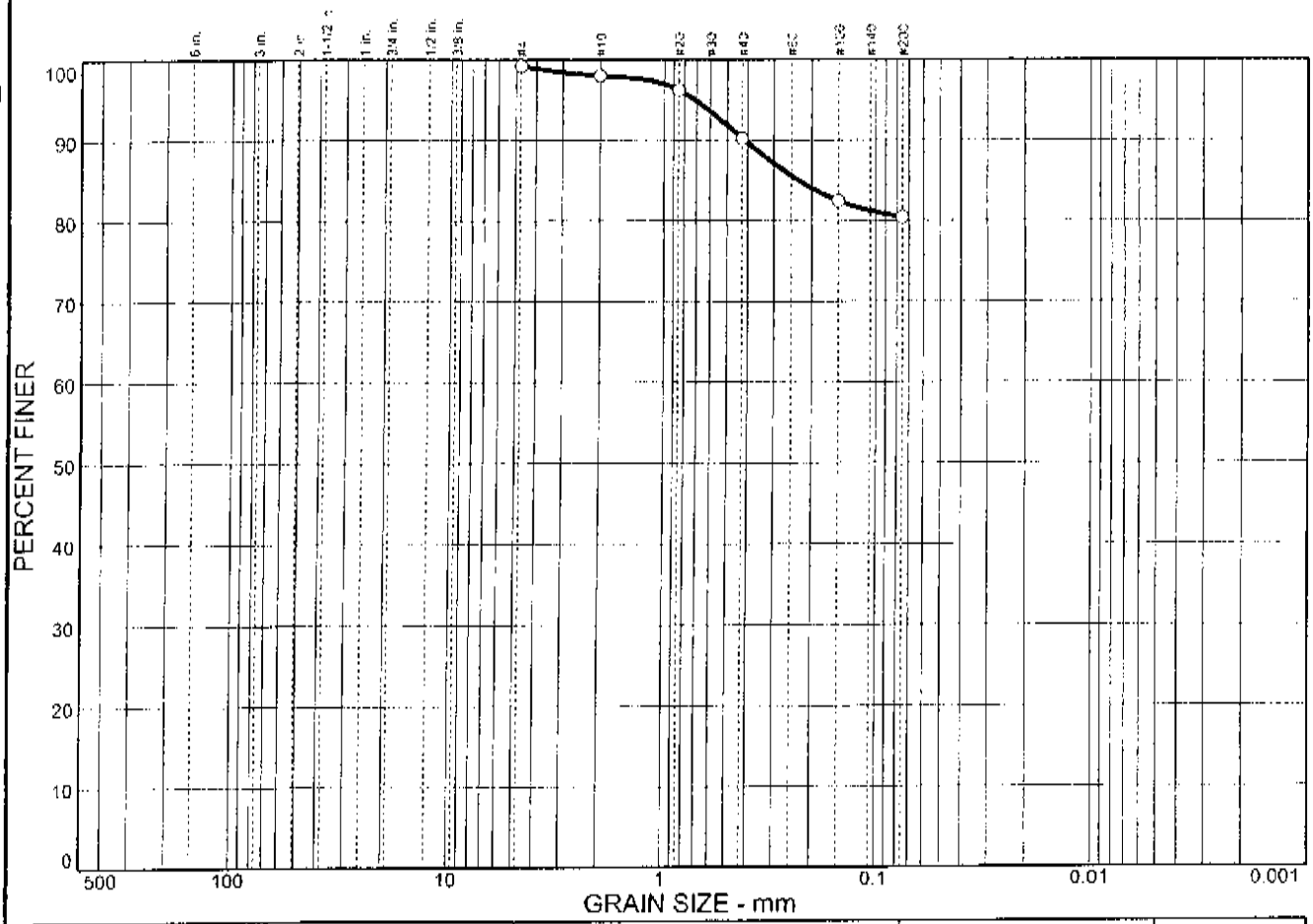
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.38	0.00	99.2
# 10	0.32	0.00	98.5
# 20	0.50	0.00	97.5
# 40	1.36	0.00	94.6
# 100	5.30	0.00	83.4
# 200	3.26	0.00	76.5

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 22.7
% FINES = 76.5

D_{85}= 0.17

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
		18.8	80.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	99.2		
#10	98.0		
#20	96.2		
#40	90.2		
#100	82.4		
#200	80.4		

* (no specification provided)

Soil Description

SILT, little sand, brown, gray, yellow, red.

Atterberg Limits

PL= 24.3 LL= 78.0 PI= 53.7

Coefficients

D_{85}= 0.232 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Sample No.: 2 **Source of Sample:** Boring No. B-5 **Date:** 01-28-06
Location: **Elev./Depth:** 2.5'-4.0'

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Client: CARAM CONSTRUCTION
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Project No: 3245-05 **R. Davila-Lab.**

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-5
Sample No.: 2
Elev. or Depth: 2.5'-4.0' Sample Length (in./cm.):
Location:
Description: SILT, little sand, brown, gray, yellow, red.
Date: 01-28-06 PL: 24.3 LL: 78.0 PI: 53.7
USCS Classification: ML AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	109.93	47.47
Tare =	31.97	31.97
Dry sample weight =	77.96	15.50
Minus #200 from wash=	80.1 %	

Sieve tare method

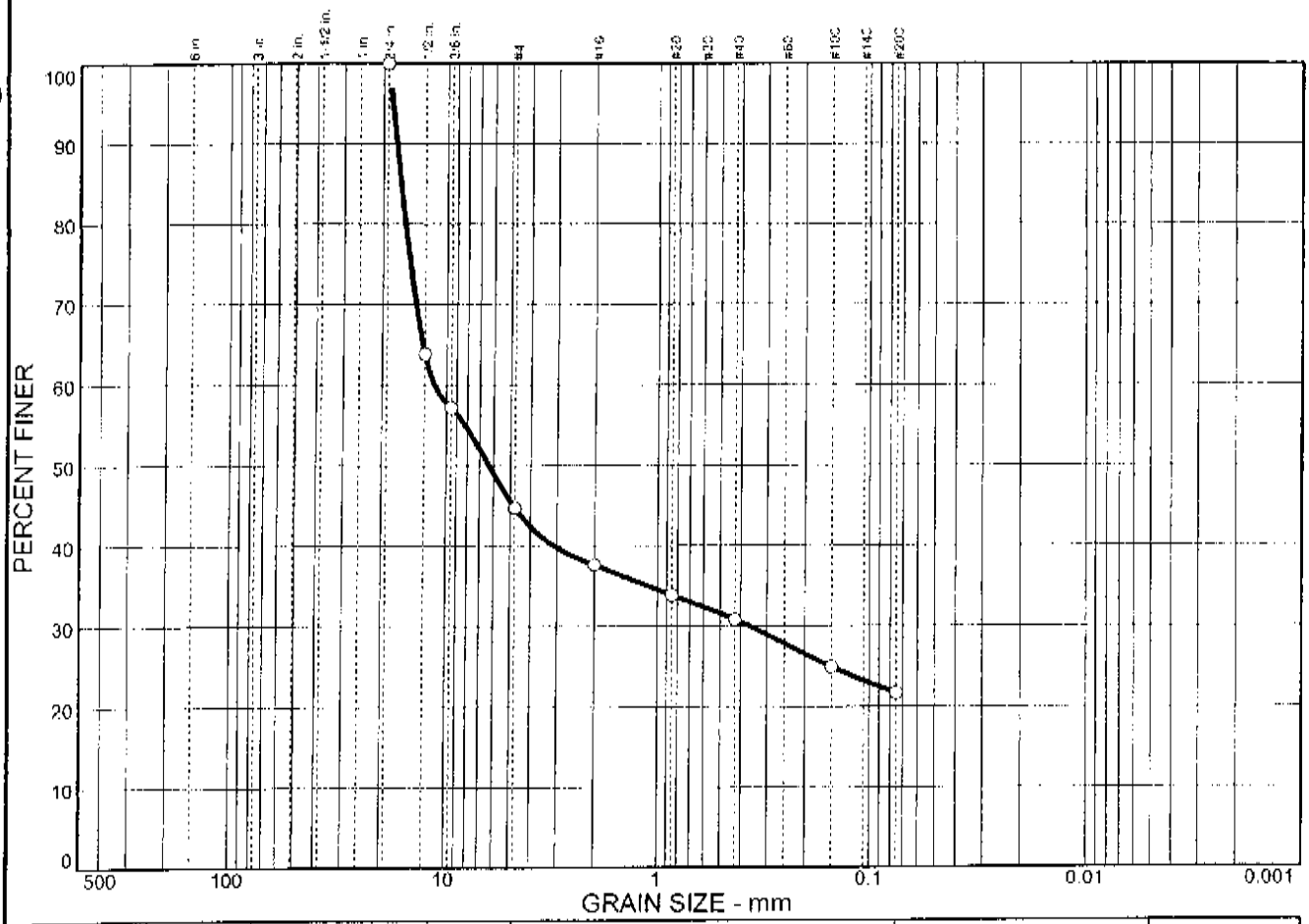
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.60	0.00	99.2
# 10	0.95	0.00	98.0
# 20	1.42	0.00	96.2
# 40	4.70	0.00	90.2
# 100	6.03	0.00	82.4
# 200	1.55	0.00	80.4

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 18.8
% FINES = 80.4

D_{85}= 0.23

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	55.3	23.0	21.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	63.8		
.375 in.	57.2		
#4	44.7		
#10	37.6		
#20	33.8		
#40	30.8		
#100	24.9		
#200	21.7		

* (no specification provided)

Soil Description

Gravel, some sand and silt, yellow, pale yellow.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 16.6 D_{60}= 11.4 D_{50}= 6.31
D_{30}= 0.365 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GM AASHTO=

Remarks

Sample No.: 5 **Source of Sample:** Boring No. B-9 **Date:** 1/28/06
Location: **Elev./Depth:** 10.0'- 11.5'

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Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-9
Sample No.: 5
Elev. or Depth: 10.0'- 11.5' Sample Length (in./cm.):
Location:
Description: Gravel, some sand and silt, yellow, pale yellow.
Date: 1/28/06 PL: LL: PI:
USCS Classification: GM AASHTO Classification:
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	141.25	119.36
Tare =	40.19	40.19
Dry sample weight =	101.06	79.17

Minus #200 from wash= 21.7 %
Sieve tare method

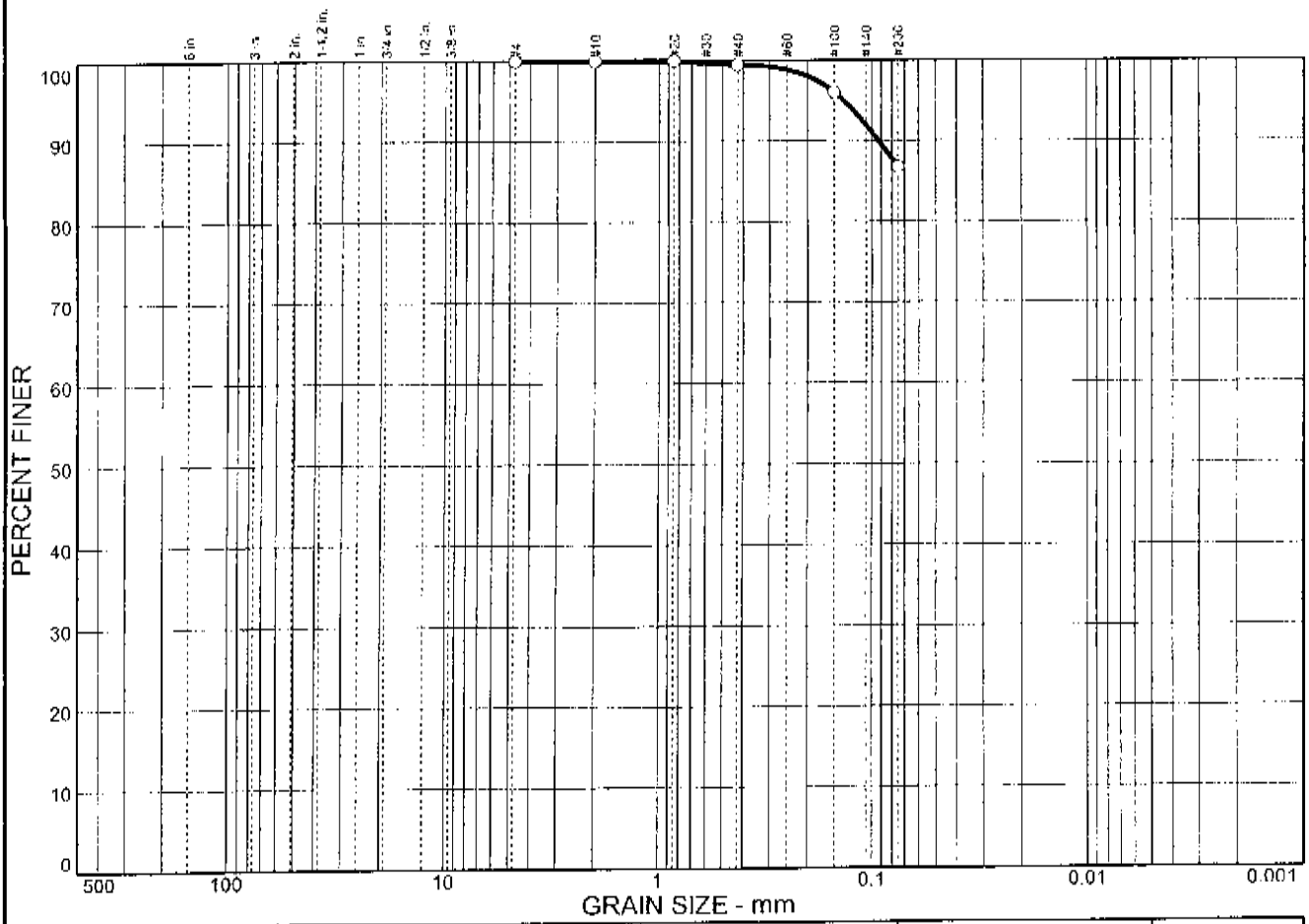
Sieve	Weight retained	Sieve tare	Percent finer
.75 inch	0.00	0.00	100.0
.5 inch	36.62	0.00	63.8
.375 inch	6.65	0.00	57.2
# 4	12.67	0.00	44.7
# 10	7.10	0.00	37.6
# 20	3.91	0.00	33.8
# 40	2.95	0.00	30.8
# 100	5.96	0.00	24.9
# 200	3.30	0.00	21.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 55.3 % SAND = 23.0
% FINES = 21.7

D_{85}= 16.55 D_{60}= 11.43 D_{50}= 6.31
D_{30}= 0.36

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	13.3	86.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.5		
#100	96.0		
#200	86.7		

* (no specification provided)

Soil Description

Clay, little sand, brownish yellow, red.

Atterberg Limits

PL= 26.8 LL= 110.0 PI= 83.2

Coefficients

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

Classification

USCS= CH AASHTO= A-7-6(81)

Remarks

Sample No.: 2 **Source of Sample:** Boring No. B-11 **Date:** 01/28/06
Location: **Elev./Depth:** 2.5' 4.0'

GEO CIM, INC.

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-11
Sample No.: 2
Elev. or Depth: 2.5'-4.0' Sample Length (in./cm.):
Location:
Description: Clay, little sand, brownish yellow, red.
Date: 01/28/06 PL: 26.8 LL: 110.0 PI: 83.2
USCS Classification: CH AASHTO Classification: A-7-6(81)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	91.36	48.31
Tare =	41.49	41.49
Dry sample weight =	49.87	6.82
Minus #200 from wash=	86.3 %	

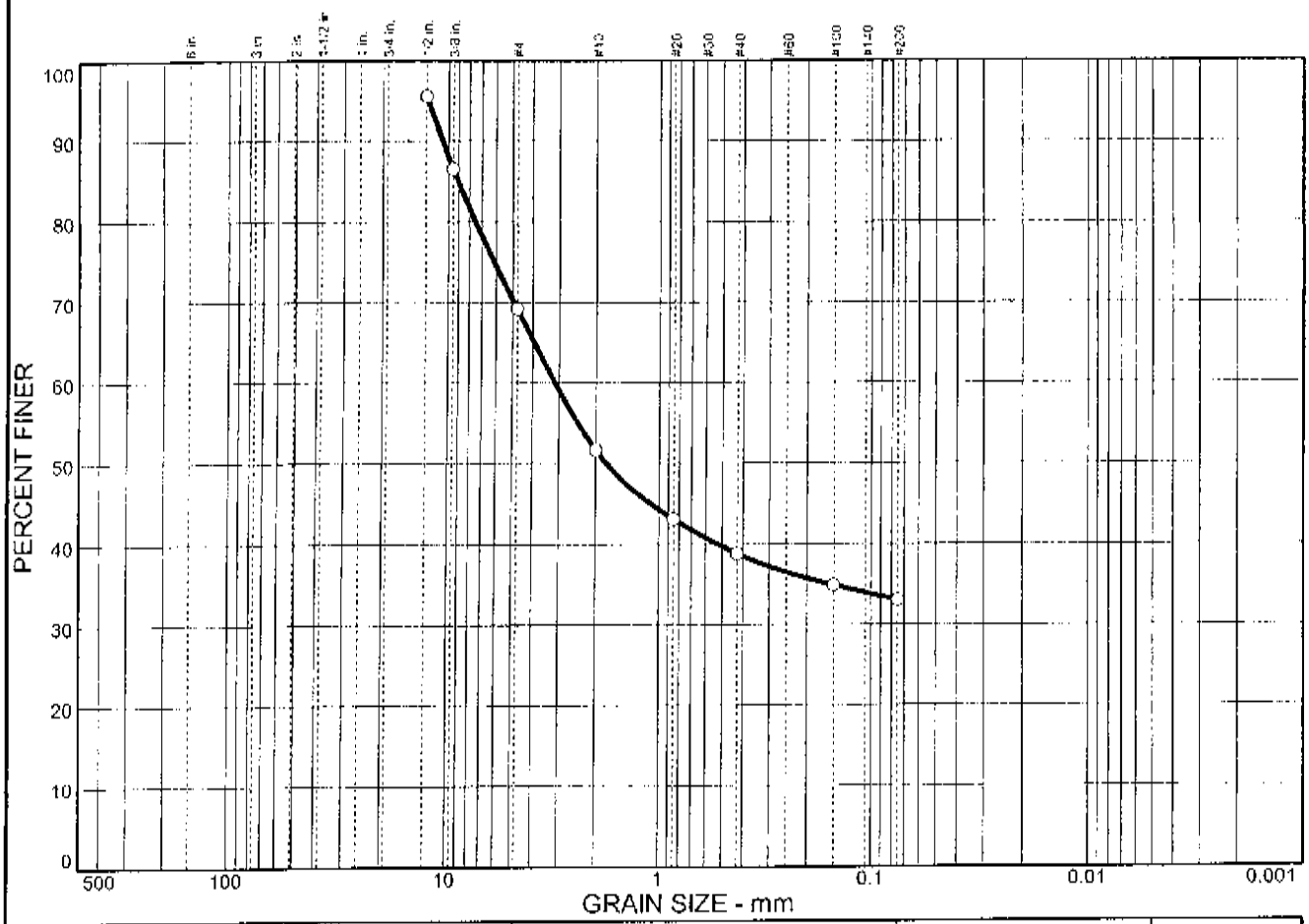
Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.00	0.00	100.0
# 20	0.00	0.00	100.0
# 40	0.24	0.00	99.5
# 100	1.75	0.00	96.0
# 200	4.64	0.00	86.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 13.3
% FINES = 86.7

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
		36.2	33.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	95.6		
.375 in.	86.5		
#4	69.2		
#10	51.6		
#20	43.1		
#40	38.8		
#100	34.9		
#200	33.0		

* (no specification provided)

Soil Description

Sand, some clay, pale yellow.

Atterberg Limits

PL= 9.7 LL= 33.6 PI= 24.0

Coefficients

D_{85}= 9.05 D_{60}= 3.14 D_{50}= 1.79
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO= A-2-4(0)

Remarks

Sample No.: 4 **Source of Sample:** Boring No.B-12 **Date:** 01/28/06
Location: **Elev./Depth:** 7.5'-9.0'

GEO CIM, INC.

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No.B-12
Sample No.: 4
Elev. or Depth: 7.5'-9.0' Sample Length (in./cm.):
Location:
Description: Sand, some clay, pale yellow.
Date: 01/28/06 PL: 9.7 LL: 33.6 PI: 24.0
USCS Classification: SC AASHTO Classification: A-2-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	122.63	95.97
Tare =	41.53	41.53
Dry sample weight =	81.10	54.44
Minus #200 from wash=	32.9 %	

Sieve tare method

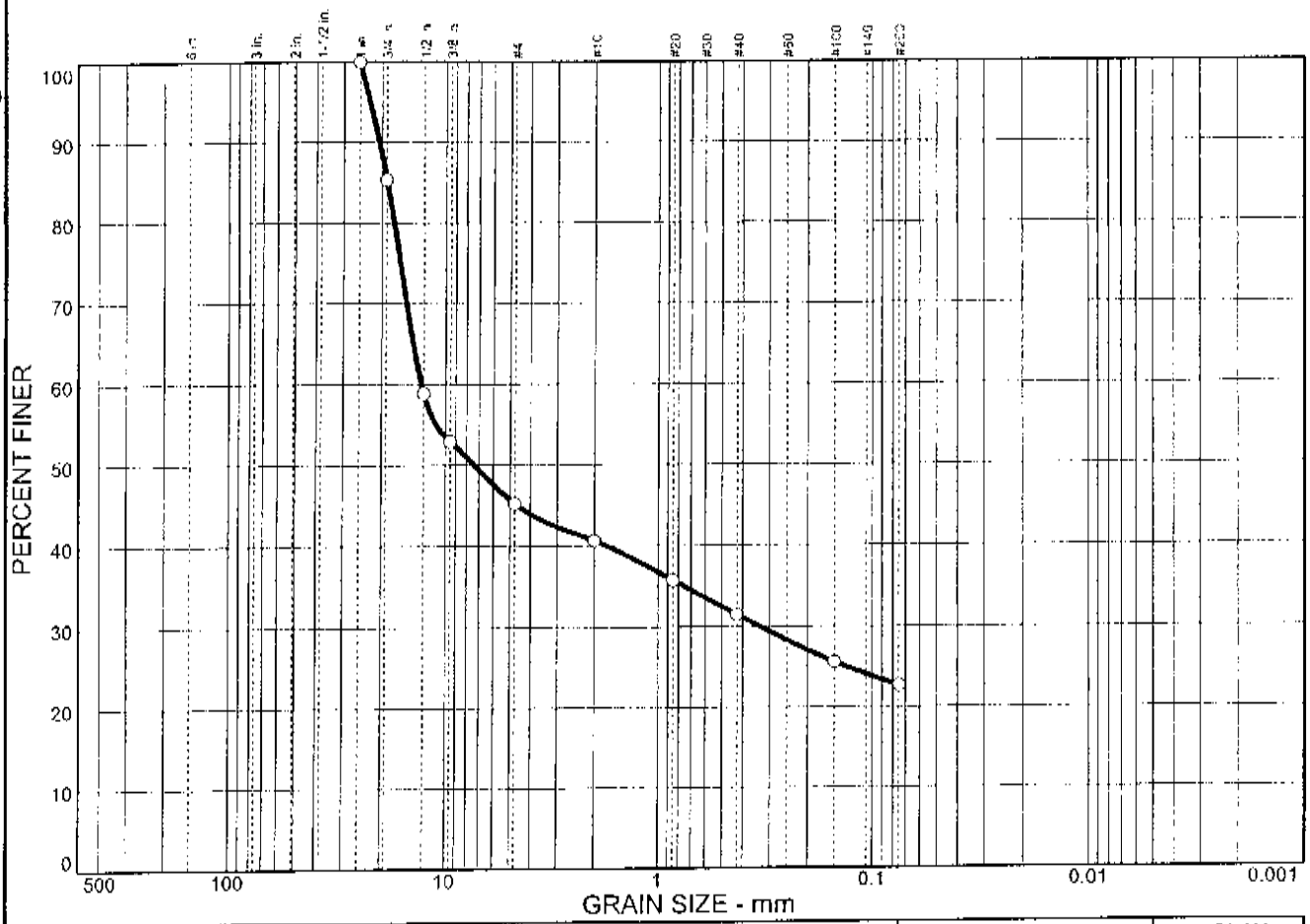
Sieve	Weight retained	Sieve tare	Percent finer
.5 inch	3.60	0.00	95.6
.375 inch	7.35	0.00	86.5
#4	14.02	0.00	69.2
# 10	14.30	0.00	51.6
# 20	6.85	0.00	43.1
# 40	3.52	0.00	38.8
# 100	3.20	0.00	34.9
# 200	1.49	0.00	33.0

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 36.2
% FINES = 33.0

D_{85}= 9.05 D_{60}= 3.14 D_{50}= 1.79

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	54.8	22.5	22.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
.75 in.	85.3		
.5 in.	58.9		
.375 in.	52.9		
#4	45.2		
#10	40.6		
#20	35.7		
#40	31.5		
#100	25.6		
#200	22.7		

* (no specification provided)

Soil Description

Gravel, some sand and silt, very pale yellow.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 19.0 D_{60}= 13.0 D_{50}= 7.39
D_{30}= 0.332 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GM AASHTO=

Remarks

Sample No.: 3 **Source of Sample:** Boring No. B-13 **Date:** 1/28/06
Location: **Elev./Depth:** 5.0'- 6.5'

GEO CIM, INC.

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-13
Sample No.: 3
Elev. or Depth: 5.0'- 6.5' Sample Length (in./cm.):
Location:
Description: Gravel, some sand and silt, very pale yellow.
Date: 1/28/06 PL: LL: PI:
USCS Classification: GM AASHTO Classification:
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	99.63	86.48
Tare =	41.09	41.09
Dry sample weight =	58.54	45.39
Minus #200 from wash=	22.5 %	

Sieve tare method

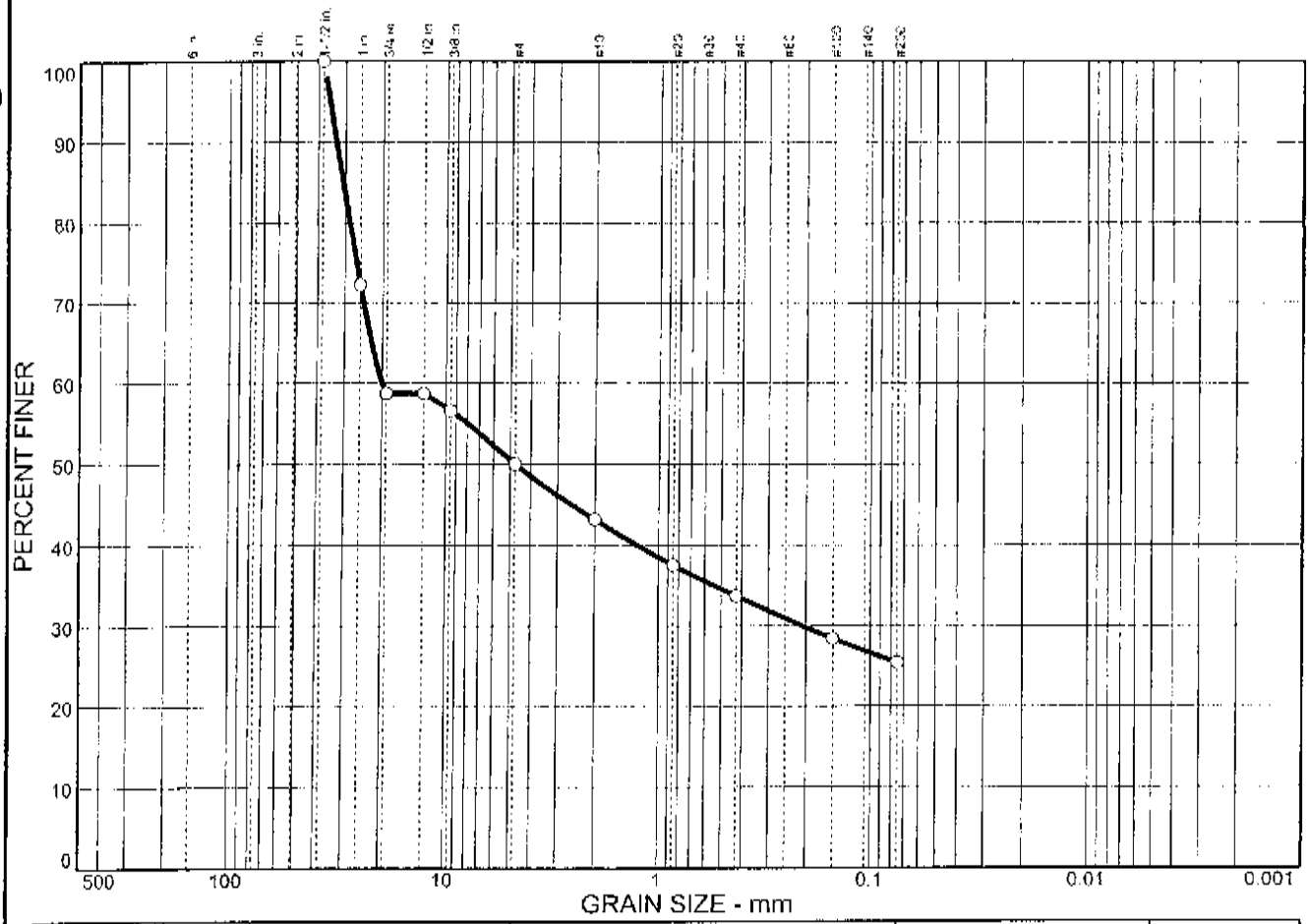
Sieve	Weight retained	Sieve tare	Percent finer
1 inch	0.00	0.00	100.0
.75 inch	8.60	0.00	85.3
.5 inch	15.48	0.00	58.9
.375 inch	3.49	0.00	52.9
# 4	4.50	0.00	45.2
# 10	2.72	0.00	40.6
# 20	2.88	0.00	35.7
# 40	2.44	0.00	31.5
# 100	3.46	0.00	25.6
# 200	1.69	0.00	22.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 54.8 % SAND = 22.5
% FINES = 22.7

D_{85}= 18.96 D_{60}= 13.01 D_{50}= 7.39
D_{30}= 0.33

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	50.0	24.6	25.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	72.3		
.75 in.	58.7		
.5 in.	58.7		
.375 in.	56.6		
#4	50.0		
#10	43.2		
#20	37.5		
#40	33.7		
#100	28.4		
#200	25.4		

* (no specification provided)

Soil Description

Gravel,some sand and clay, pale yellow.

Atterberg Limits

PL= 13.8 LL= 23.8 PI= 10.0

Coefficients

D_{85}= 30.8 D_{60}= 19.9 D_{50}= 4.75
D_{30}= 0.209 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GC AASHTO= A-1-b

Remarks

Sample No.: 4 **Source of Sample:** Boring No. B-16 **Date:** 01/28/04
Location: **Elev./Depth:** 7.5'-9.0'

GEO CIM, INC.

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-16
Sample No.: 4
Elev. or Depth: 7.5'-9.0' Sample Length (in./cm.):
Location:
Description: Gravel, some sand and clay, pale yellow.
Date: 01/28/04 PL: 13.8 LL: 23.8 PI: 10.0
USCS Classification: GC AASHTO Classification: A-1-b
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	141.03	115.69
Tare =	40.92	40.92
Dry sample weight =	100.11	74.77
Minus #200 from wash=	25.3 %	

Sieve tare method

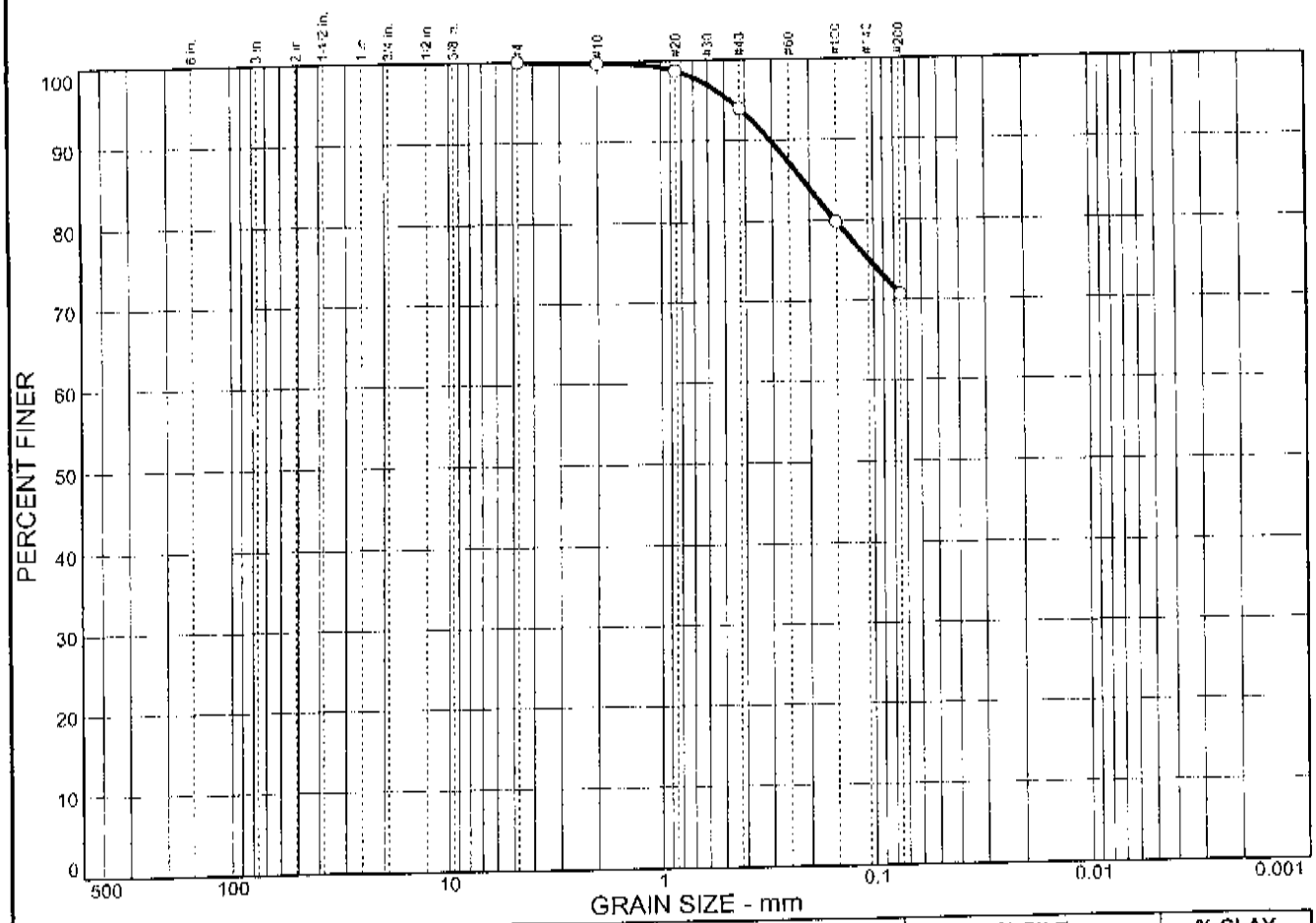
Sieve	Weight retained	Sieve tare	Percent finer
1.5 inch	0.00	0.00	100.0
1 inch	27.78	0.00	72.3
.75 inch	13.60	0.00	58.7
.5 inch	0.00	0.00	58.7
.375 inch	2.10	0.00	56.6
# 4	6.60	0.00	50.0
# 10	6.80	0.00	43.2
# 20	5.70	0.00	37.5
# 40	3.79	0.00	33.7
# 100	5.31	0.00	28.4
# 200	2.97	0.00	25.4

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 50.0 % SAND = 24.6
% FINES = 25.4

D_{85}= 30.80 D_{60}= 19.94 D_{50}= 4.75
D_{30}= 0.21

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	29.3	70.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	98.7		
#40	93.9		
#100	79.8		
#200	70.7		

* (no specification provided)

Soil Description

Clay, some sand, brownish yellow.

Atterberg Limits

PL= 15.6 LL= 59.8 PI= 44.2

Coefficients

D_{85}= 0.215 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(30)

Remarks

Sample No.: 2 **Source of Sample:** Boring No. B-18 **Date:** 1/28/06

Location: **Elev./Depth:** 2.5'- 4.0'

GEO CIM, INC.

Client: CARAM CONSTRUCTION

Project: MONTE ARENAS
VEGA BAJA, PR

Project No: 3245-05 **R. Davila-Lab.**

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-18
Sample No.: 2
Elev. or Depth: 2.5'- 4.0' Sample Length (in./cm.):
Location:
Description: Clay, some sand, brownish yellow.
Date: 1/28/06 PL: 15.6 LL: 59.8 PI: 44.2
USCS Classification: CH AASHTO Classification: A-7-6(30)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	81.30	50.66
Tare =	37.85	37.85
Dry sample weight =	43.45	12.81
Minus #200 from wash=	70.5 %	

Sieve tare method

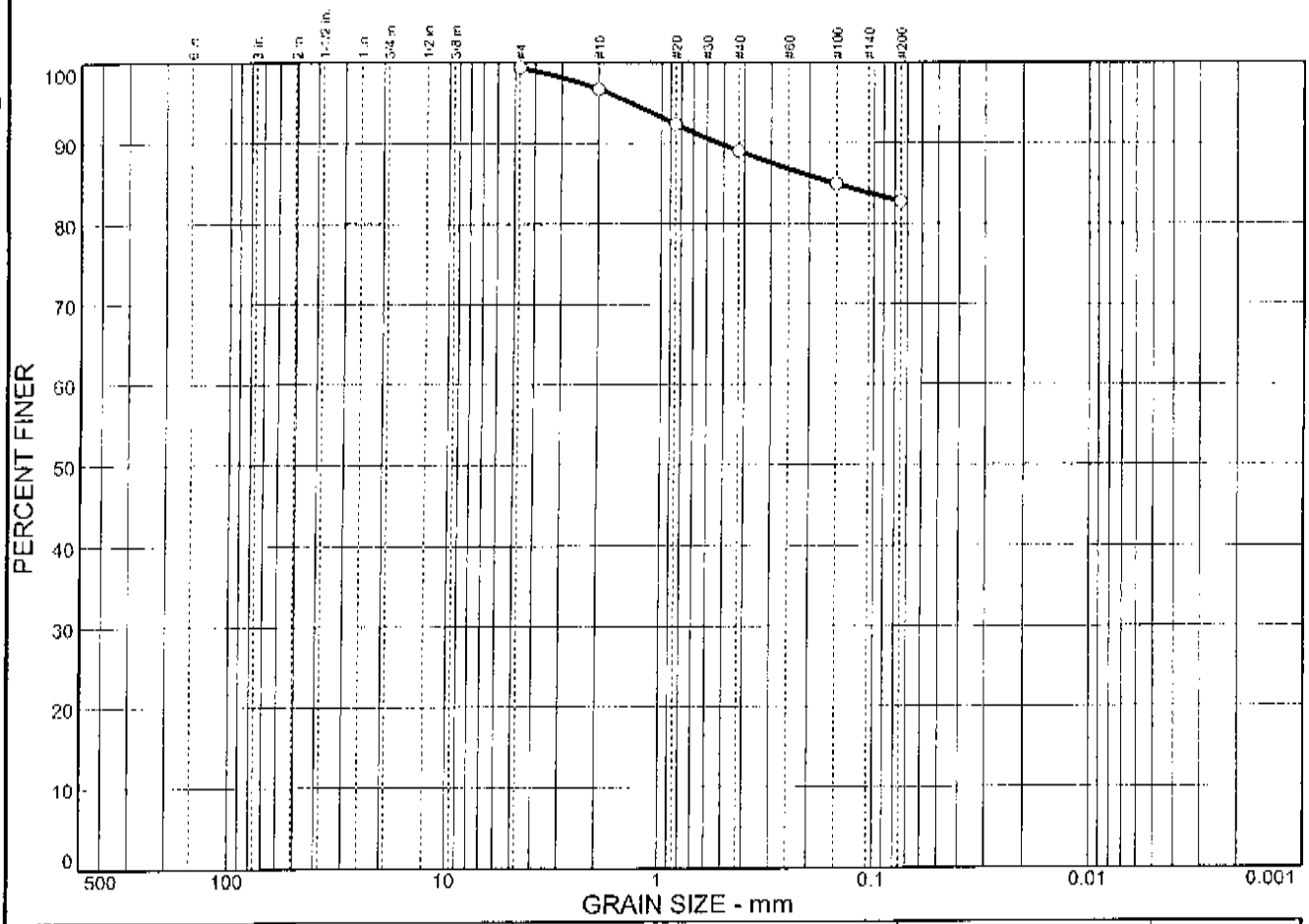
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.12	0.00	99.7
# 20	0.45	0.00	98.7
# 40	2.10	0.00	93.9
# 100	6.11	0.00	79.8
# 200	3.95	0.00	70.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 29.3
% FINES = 70.7

D_{85}= 0.21

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
		16.7	82.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	99.4		
#10	96.7		
#20	92.3		
#40	89.0		
#100	84.9		
#200	82.7		

* (no specification provided)

Soil Description

Clay, little sand, pale yellow, brownish yellow.

Atterberg Limits

PL= 14.0 LL= 38.0 PI= 24.0

Coefficients

D_{85}= 0.154 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-4(0)

Remarks

Sample No.: 4 **Source of Sample:** Boring No. B-19 **Date:** 01/28/06
Location: **Elev./Depth:** 7.5'-9.0'

GEO CIM, INC.

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-19
Sample No.: 4
Elev. or Depth: 7.5'-9.0' Sample Length (in./cm.):
Location:
Description: Clay, little sand, pale yellow, brownish yellow.
Date: 01/28/06 PL: 14.0 LL: 38.0 PI: 24.0
USCS Classification: CL AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	109.87	47.60
Tare =	34.53	34.53
Dry sample weight =	75.34	13.07
Minus #200 from wash=	82.7 %	

Sieve tare method

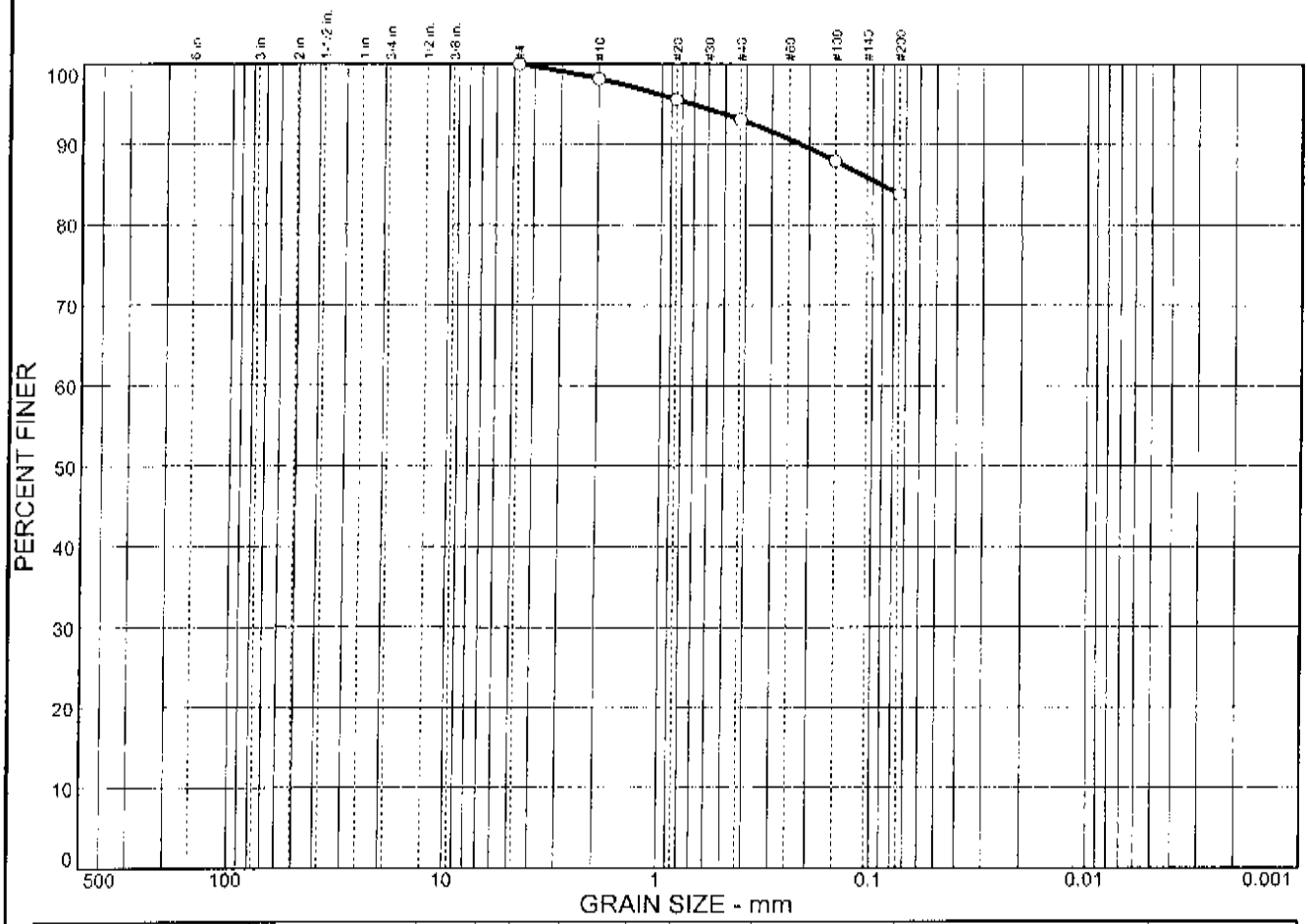
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.47	0.00	99.4
# 10	2.05	0.00	96.7
# 20	3.25	0.00	92.3
# 40	2.51	0.00	89.0
# 100	3.12	0.00	84.9
# 200	1.60	0.00	82.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 16.7
% FINES = 82.7

D_{85}= 0.15

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	16.2	83.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.2		
#20	95.6		
#40	93.1		
#100	87.9		
#200	83.8		

* (no specification provided)

Soil Description

Clay, little sand, yellowish brown, white.

Atterberg Limits

PL= 13.2 LL= 40.3 PI= 27.1

Coefficients

D_{85}= 0.0915 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-4(0)

Remarks

Sample No.: 4 **Source of Sample:** Boring No. B-20 **Date:** 01/28/06
Location: **Elev./Depth:** 7.5'-9.0'

GEO CIM, INC.

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 **R. Davila-Lab.**

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245 05

Sample Data

Source: Boring No. B-20
Sample No.: 4
Elev. or Depth: 7.5'-9.0' Sample Length (in./cm.):
Location:
Description: Clay, little sand, yellowish brown, white.
Date: 01/28/06 PL: 13.2 LL: 40.3 PI: 27.1
USCS Classification: CL AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	114.05	53.11
Tare =	40.89	40.89
Dry sample weight =	73.16	12.22
Minus #200 from wash=	83.3 %	

Sieve tare method

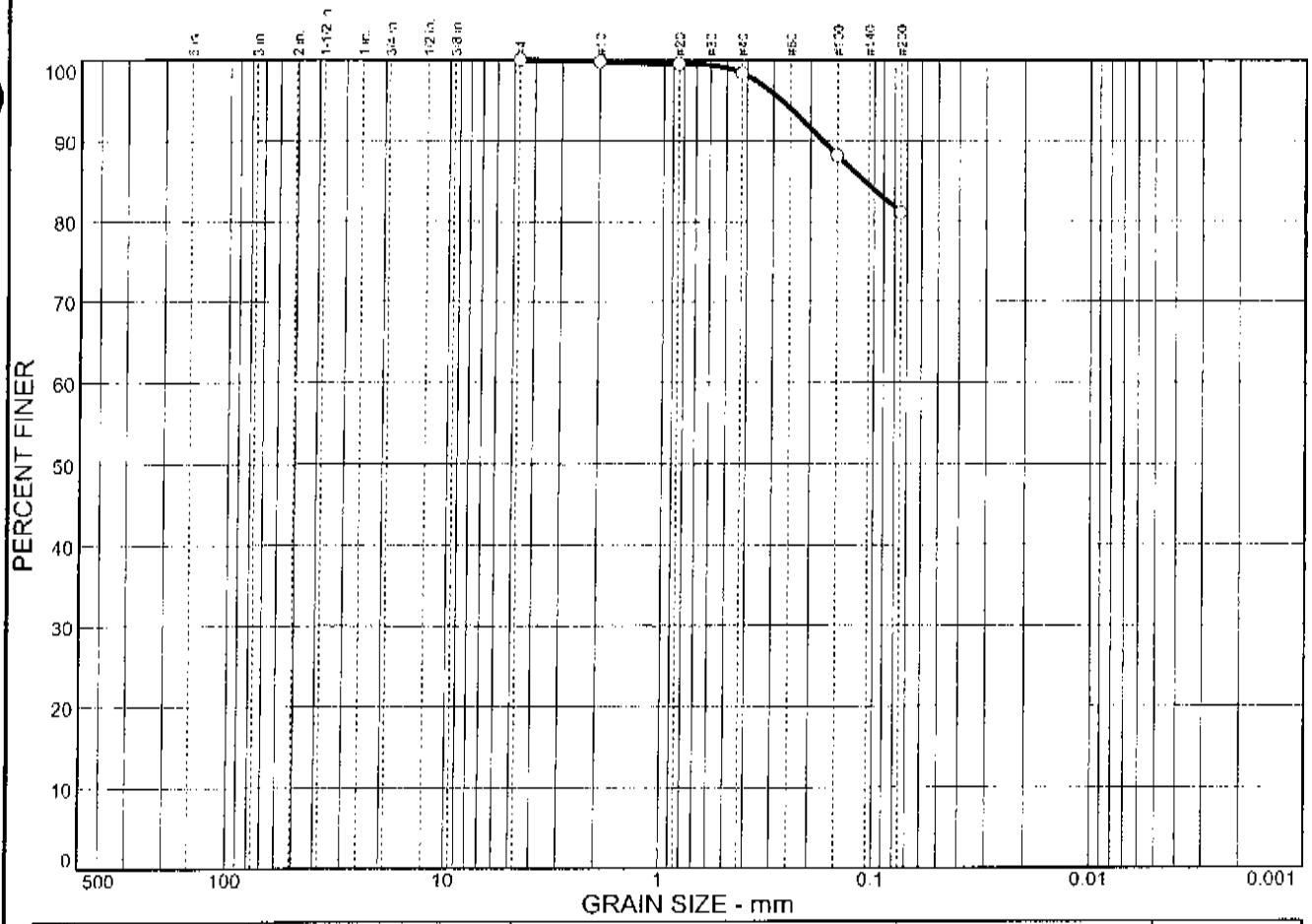
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	1.34	0.00	98.2
# 20	1.85	0.00	95.6
# 40	1.83	0.00	93.1
# 100	3.86	0.00	87.9
# 200	3.00	0.00	83.8

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 16.2
% FINES = 83.8

D_{85}= 0.09

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	18.9	81.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	99.5		
#40	98.4		
#100	88.2		
#200	81.1		

* (no specification provided)

Soil Description

Clay, little sand, very pale brown.

Atterberg Limits

PL= 17.0 LL= 75.2 PI= 58.2

Coefficients

D_{85}= 0.111 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-4(0)

Remarks

Sample No.: 2 **Source of Sample:** Boring No. B-21 **Date:** 01/28/06
Location: **Elev./Depth:** 2.5'-4.0'

GEO CIM, INC.

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-21
Sample No.: 2
Elev. or Depth: 2.5'-4.0' Sample Length (in./cm.):
Location:
Description: Clay, little sand, very pale brown.
Date: 01/28/06 PL: 17.0 LL: 75.2 PI: 58.2
USCS Classification: CH AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	98.21	50.59
Tare =	39.34	39.34
Dry sample weight =	58.87	11.25
Minus #200 from wash=	80.9 %	

Sieve tare method

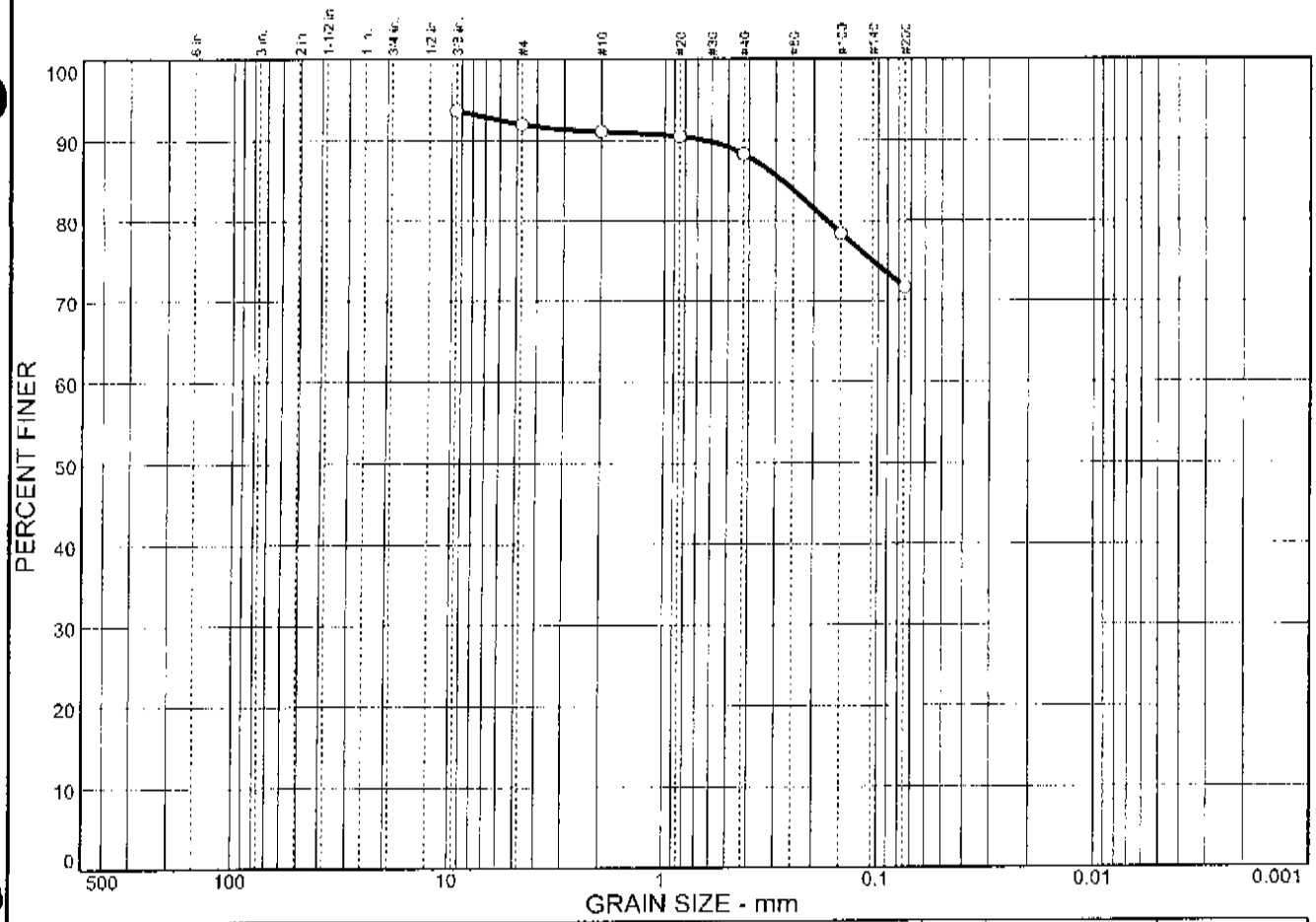
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.15	0.00	99.8
# 20	0.16	0.00	99.5
# 40	0.63	0.00	98.4
# 100	6.00	0.00	88.2
# 200	4.20	0.00	81.1

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 18.9
% FINES = 81.1

D_{85}= 0.11

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
		20.3	71.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	93.7		
#4	92.0		
#10	91.1		
#20	90.5		
#40	88.3		
#100	78.4		
#200	71.7		

* (no specification provided)

Soil Description

Clay, some sand, olive yellow.

Atterberg Limits

PL= 18.3 LL= 79.5 PI= 61.2

Coefficients

D_{85}= 0.282 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-4(0)

Remarks

Sample No.: 2 **Source of Sample:** Boring No. B-24 **Date:** 01/28/06
Location: **Elev./Depth:** 2.5'-4.0'

GEO CIM, INC.

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-24
Sample No.: 2
Elev. or Depth: 2.5'-4.0' Sample Length (in./cm.):
Location:
Description: Clay, some sand, olive yellow.
Date: 01/28/06 PL: 18.3 LL: 79.5 PI: 61.2
USCS Classification: CH AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	90.21	54.44
Tare =	40.19	40.19
Dry sample weight =	50.02	14.25

Minus #200 from wash= 71.5 %
Sieve tare method

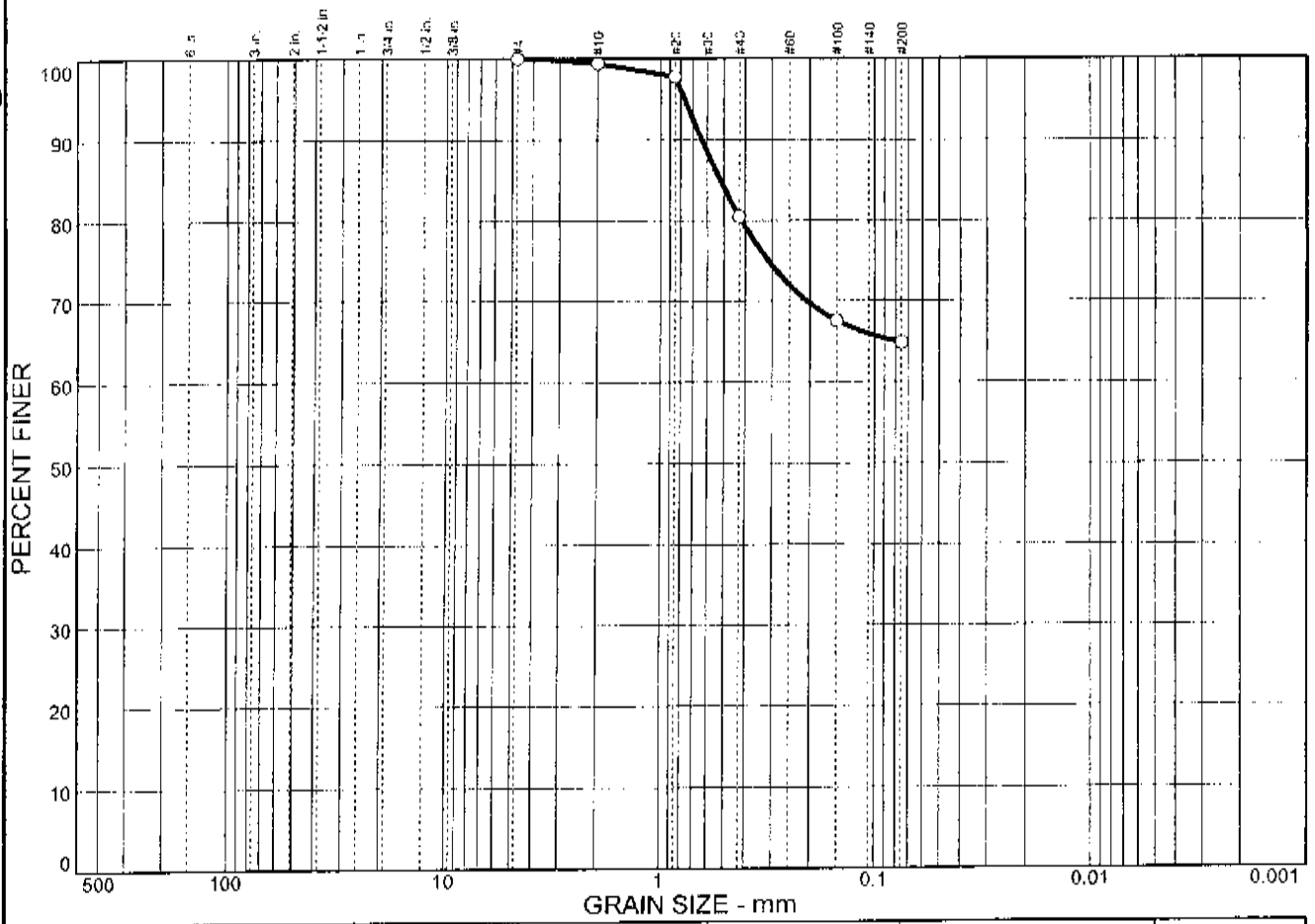
Sieve	Weight retained	Sieve tare	Percent finer
.375 inch	3.17	0.00	93.7
# 4	0.82	0.00	92.0
# 10	0.46	0.00	91.1
# 20	0.31	0.00	90.5
# 40	1.07	0.00	88.3
# 100	4.98	0.00	78.4
# 200	3.37	0.00	71.7

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 20.3
% FINES = 71.7

D_{85}= 0.28

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	35.2	64.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	97.8		
#40	80.5		
#100	67.5		
#200	64.8		

* (no specification provided)

Soil Description

Sandy clay, light gray, yellow.

Atterberg Limits

PL= 16.0 LL= 45.6 PI= 29.6

Coefficients

D_{85}= 0.520 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(17)

Remarks

Sample No.: 5 **Source of Sample:** Boring No. B-28 **Date:** 1/28/06
Location: **Elev./Depth:** 10.0'- 11.5'

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Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 **R. Davila-Lab.**

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. B-28
Sample No.: 5
Elev. or Depth: 10.0'- 11.5' Sample Length (in./cm.):
Location:
Description: Sandy clay, light gray, yellow.
Date: 1/28/06 PL: 16.0 LL: 45.6 PI: 29.6
USCS Classification: CL AASHTO Classification: A-7-6(17)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	118.88	68.96
Tare =	41.43	41.43
Dry sample weight =	77.45	27.53
Minus #200 from wash=	64.5 %	

Sieve tare method

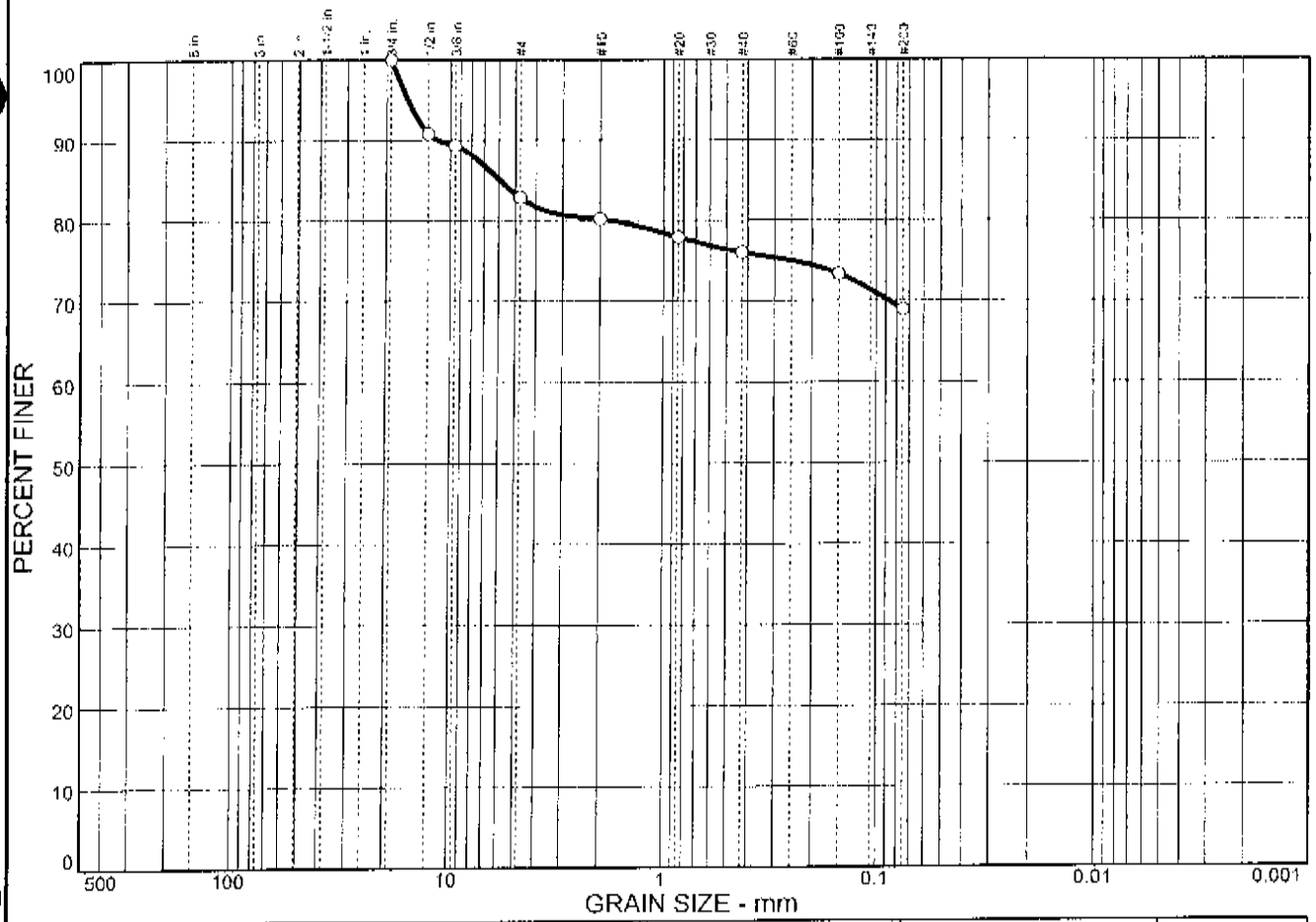
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.43	0.00	99.4
# 20	1.24	0.00	97.8
# 40	13.40	0.00	80.5
# 100	10.08	0.00	67.5
# 200	2.10	0.00	64.8

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 35.2
% FINES = 64.8

D85= 0.52

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	17.2	13.9	68.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	90.8		
.375 in.	89.3		
#4	82.8		
#10	80.2		
#20	77.9		
#40	76.0		
#100	73.3		
#200	68.9		

* (no specification provided)

Soil Description

Clay, little gravel and sand, brown, white.

Atterberg Limits

PL= 16.2 LL= 71.2 PI= 55.0

Coefficients

D_{85}= 5.93 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-4(0)

Remarks

Sample No.: 5 **Source of Sample:** Boring No. BC-2 **Date:** 01/28/06
Location: **Elev./Depth:** 10.0'-11.5'

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Project: MONTE ARENAS
VEGA BAJA, PR
Project No: 3245-05 **R. Davila-Lab.**

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. BC-2
Sample No.: 5
Elev. or Depth: 10.0'-11.5' **Sample Length (in./cm.):**
Location:
Description: Clay, little gravel and sand, brown, white.
Date: 01/28/06 **PL:** 16.2 **LL:** 71.2 **PI:** 55.0
USCS Classification: CH **AASHTO Classification:** A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	95.46	57.73
Tare =	40.44	40.44
Dry sample weight =	55.02	17.29
Minus #200 from wash=	68.6 %	

Sieve tare method

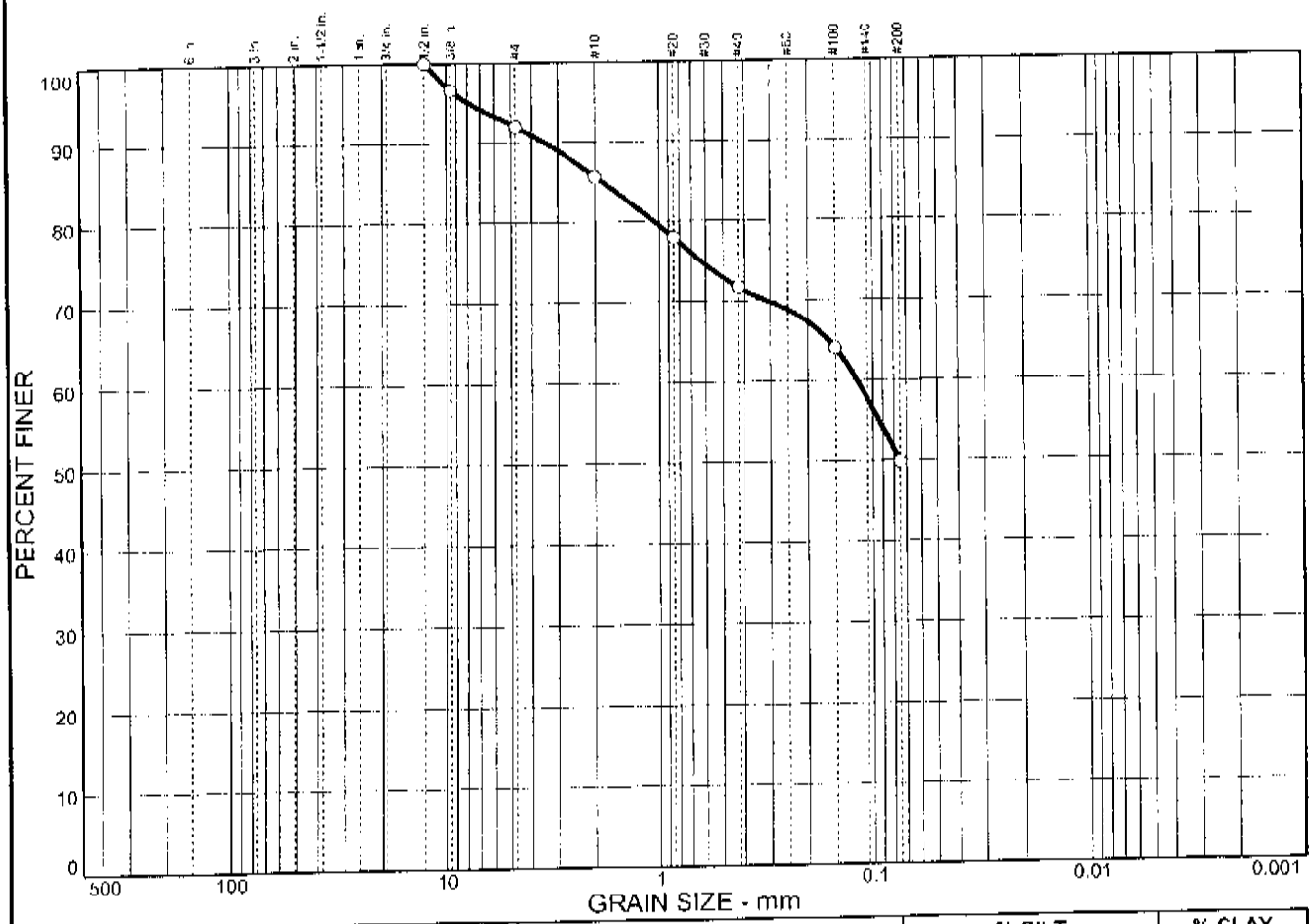
Sieve	Weight retained	Sieve tare	Percent finer
.75 inch	0.00	0.00	100.0
.5 inch	5.08	0.00	90.8
.375 inch	0.80	0.00	89.3
# 4	3.56	0.00	82.8
# 10	1.47	0.00	80.2
# 20	1.27	0.00	77.9
# 40	1.04	0.00	76.0
# 100	1.47	0.00	73.3
# 200	2.42	0.00	68.9

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 17.2 % SAND = 13.9
% FINES = 68.9

D_{85}= 5.93

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	8.0	42.2	49.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
.375 in.	96.6		
#4	92.0		
#10	85.6		
#20	77.9		
#40	71.7		
#100	64.0		
#200	49.8		

* (no specification provided)

Soil Description

Sandy clay, trace gravel, pale brown, very pale yellow.

Atterberg Limits

PL= 13.2 LL= 36.6 PI= 23.4

Coefficients

D_{85}= 1.86 D_{60}= 0.119 D_{50}= 0.0756
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO= A-4(0)

Remarks

Sample No.: 5 **Source of Sample:** Boring No. BC-7 **Date:** 01/28/06
Location: **Elev./Depth:** 10.0'-11.5'

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Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. BC-7
Sample No.: 5
Elev. or Depth: 10.0'-11.5' Sample Length (in./cm.):
Location:
Description: Sandy clay, trace gravel, pale brown, very pale yellow.
Date: 01/28/06 PL: 13.2 LL: 36.6 PI: 23.4
USCS Classification: SC AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	114.74	79.32
Tare =	42.30	42.30
Dry sample weight =	72.44	37.02
Minus #200 from wash=	48.9 %	

Sieve tare method

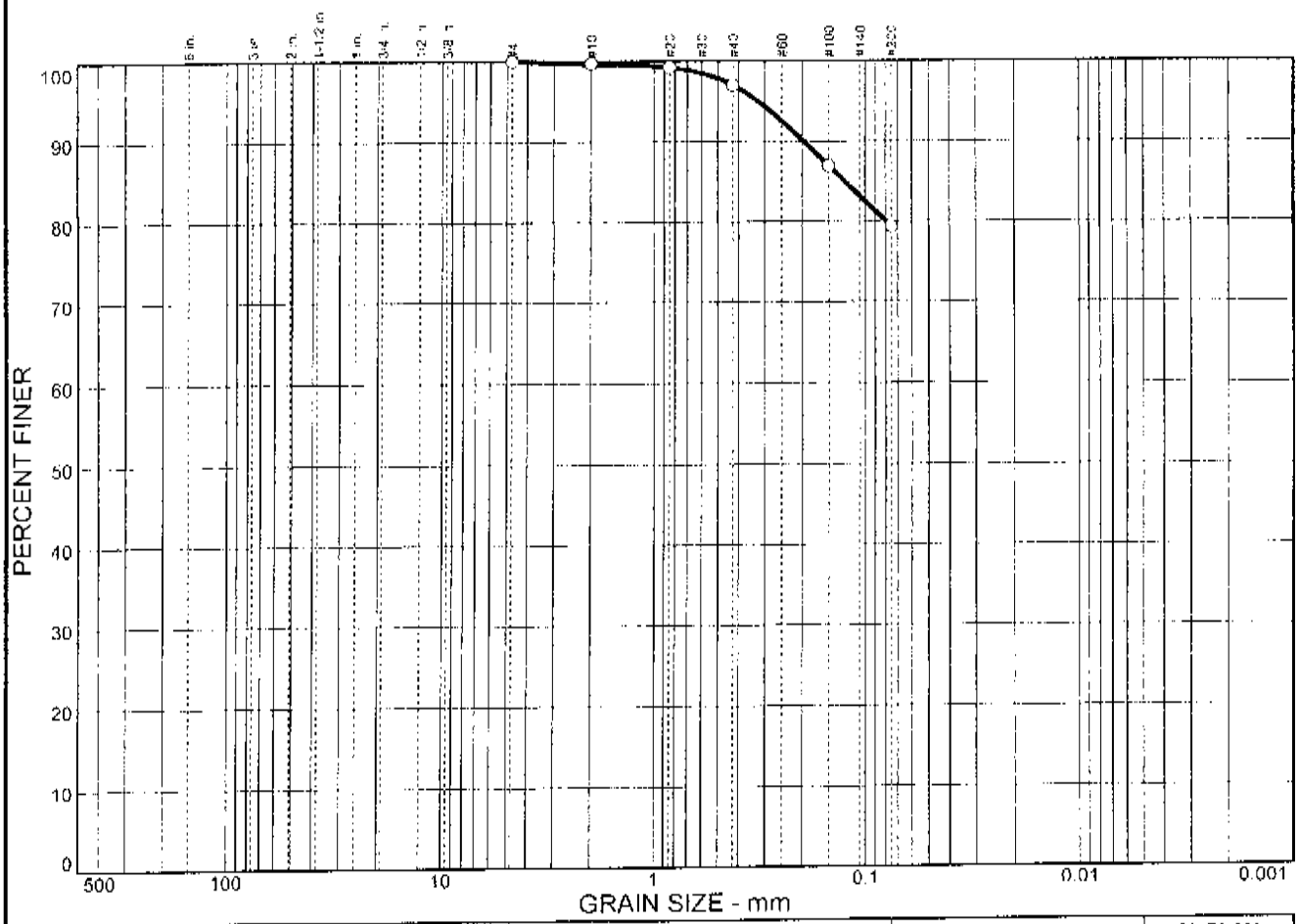
Sieve	Weight retained	Sieve tare	Percent finer
.5 inch	0.00	0.00	100.0
.375 inch	2.45	0.00	96.6
#4	3.36	0.00	92.0
# 10	4.65	0.00	85.6
# 20	5.55	0.00	77.9
# 40	4.52	0.00	71.7
# 100	5.58	0.00	64.0
# 200	10.24	0.00	49.8

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = 8.0 % SAND = 42.2
% FINES = 49.8

D_{85}= 1.86 D_{60}= 0.12 D_{50}= 0.08

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	20.7	79.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	99.2		
#40	97.0		
#100	86.9		
#200	79.3		

* (no specification provided)

Soil Description

Clay, some sand, yellowish brown.

Atterberg Limits

PL= 18.0 LL= 70.0 PI= 52.0

Coefficients

D_{85}= 0.126 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(42)

Remarks

Sample No.: 3 **Source of Sample:** Boring No. BC-8 **Date:** 2/8/06
Location: **Elev./Depth:** 5.0'- 6.5'

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Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. BC-8
Sample No.: 3
Elev. or Depth: 5.0'- 6.5' Sample Length (in./cm.):
Location:
Description: Clay, some sand, yellowish brown.
Date: 2/8/06 PL: 18.0 LL: 70.0 PI: 52.0
USCS Classification: CH AASHTO Classification: A-7-6(42)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	88.24	50.55
Tare =	40.89	40.89
Dry sample weight =	47.35	9.66

Minus #200 from wash= 79.6 %
Sieve tare method

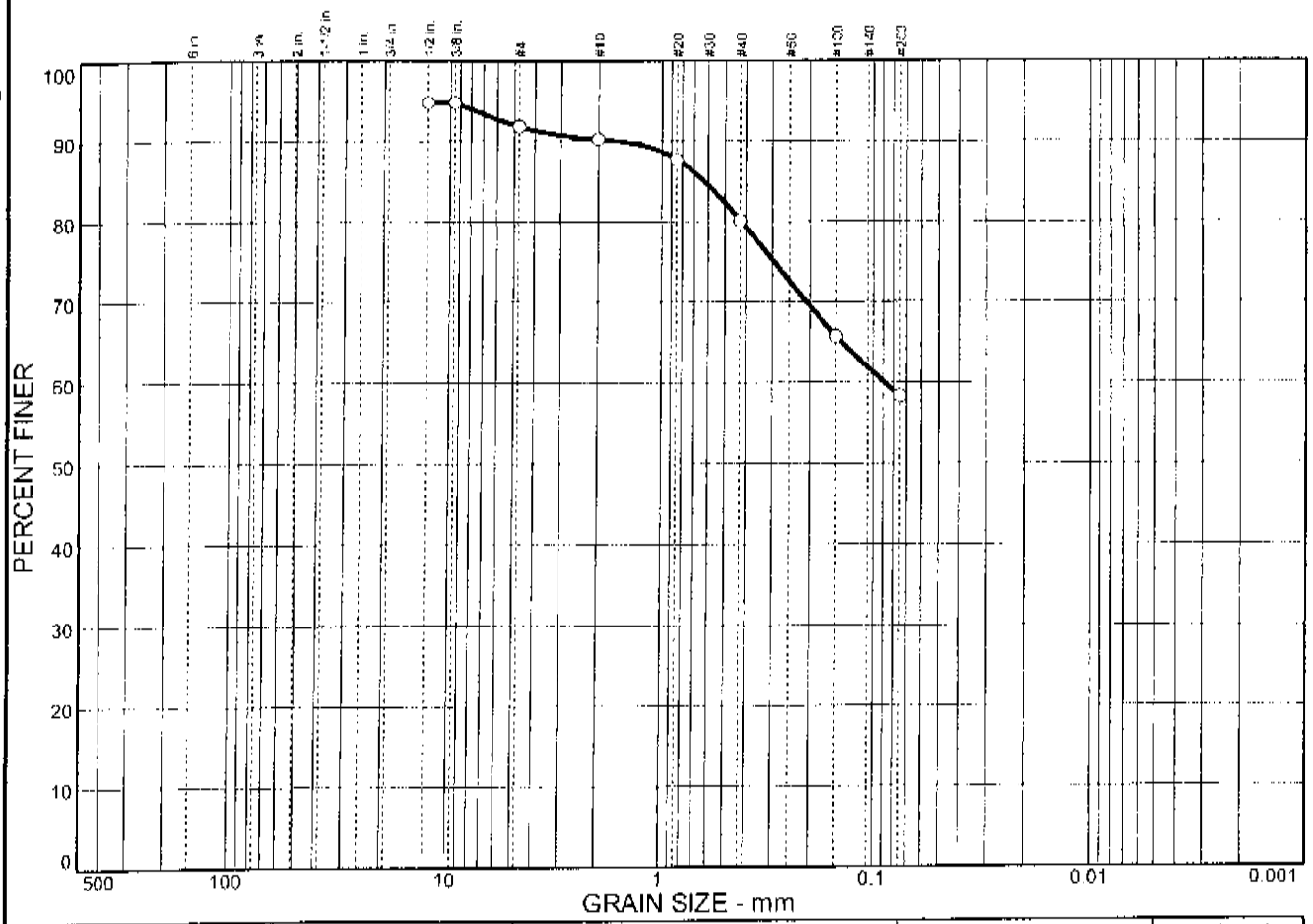
Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.16	0.00	99.7
# 20	0.20	0.00	99.2
# 40	1.07	0.00	97.0
# 100	4.79	0.00	86.9
# 200	3.58	0.00	79.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 20.7
% FINES = 79.3

D_{85}= 0.13

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
		33.5	58.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	94.8		
.375 in.	94.8		
#4	91.8		
#10	90.2		
#20	87.7		
#40	80.1		
#100	65.7		
#200	58.3		

* (no specification provided)

Soil Description

Clay, some sand, brownish yellow.

Atterberg Limits

PL= 10.3 LL= 37.2 PI= 26.9

Coefficients

D_{85}= 0.631 D_{60}= 0.0890 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-4(0)

Remarks

Sample No.: 7 **Source of Sample:** Boring No. BC-8 **Date:** 01/28/06
Location: **Elev./Depth:** 19.0'-20.5'

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Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. BC-8
Sample No.: 7
Elev. or Depth: 19.0'-20.5' Sample Length (in./cm.):
Location:
Description: Clay, some sand, brownish yellow.
Date: 01/28/06 PL: 10.3 LL: 37.2 PI: 26.9
USCS Classification: CL AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	137.13	81.74
Tare =	41.49	41.49
Dry sample weight =	95.64	40.25

Minus #200 from wash= 57.9 %
Sieve tare method

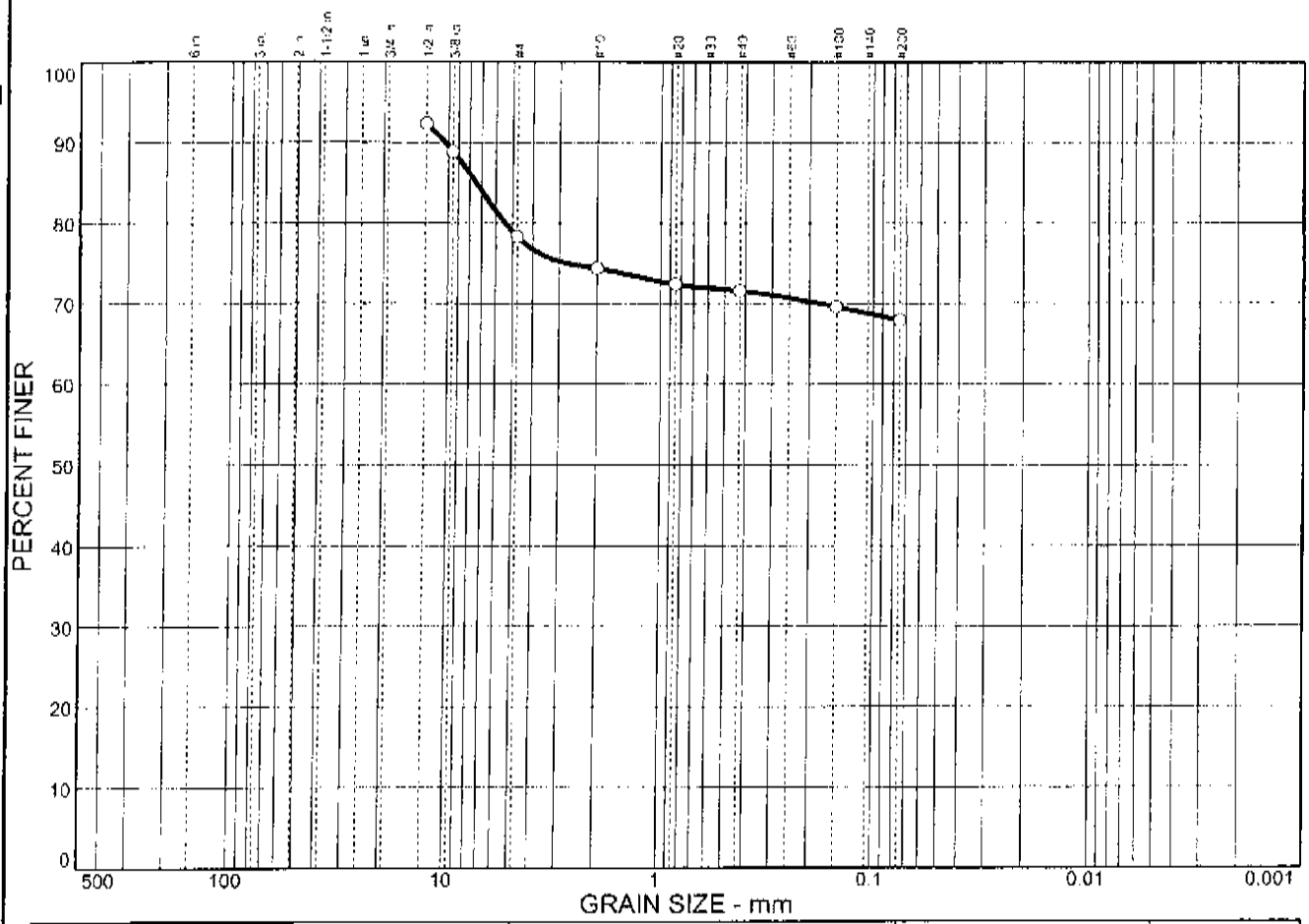
Sieve	Weight retained	Sieve tare	Percent finer
.5 inch	4.97	0.00	94.8
.375 inch	0.00	0.00	94.8
# 4	2.85	0.00	91.8
# 10	1.60	0.00	90.2
# 20	2.38	0.00	87.7
# 40	7.26	0.00	80.1
# 100	13.79	0.00	65.7
# 200	7.07	0.00	58.3

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 33.5
% FINES = 58.3

D_{85}= 0.63 D_{60}= 0.09

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
		10.4	67.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	92.3		
.375 in.	88.8		
#4	78.3		
#10	74.4		
#20	72.4		
#40	71.6		
#100	69.6		
#200	67.9		

* (no specification provided)

Soil Description

Clay, trace to little sand, brown.

Atterberg Limits

PL= 24.0 LL= 102.0 PI= 78.0

Coefficients

D_{85}= 7.45 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-4(0)

Remarks

Sample No.: 2 **Source of Sample:** Boring No. SC-1 **Date:** 01/28/06
Location: **Elev./Depth:** 2.5'-4.0'

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Project: MONTE ARENAS
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Project No: 3245-05 R. Davila-Lab.

GRAIN SIZE DISTRIBUTION TEST DATA

Client: CARAM CONSTRUCTION
Project: MONTE ARENAS
VEGA BAJA, PR
Project Number: 3245-05

Sample Data

Source: Boring No. SC-1
Sample No.: 2
Elev. or Depth: 2.5'-4.0' Sample Length (in./cm.):
Location:
Description: Clay, trace to little sand, brown.
Date: 01/28/06 PL: 24.0 LL: 102.0 PI: 78.0
USCS Classification: CH AASHTO Classification: A-4(0)
Testing Remarks:

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	112.06	62.73
Tare =	39.34	39.34
Dry sample weight =	72.72	23.39
Minus #200 from wash=	67.8 %	

Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
.5 inch	5.62	0.00	92.3
.375 inch	2.53	0.00	88.8
#4	7.61	0.00	78.3
# 10	2.83	0.00	74.4
# 20	1.45	0.00	72.4
# 40	0.65	0.00	71.6
# 100	1.43	0.00	69.6
# 200	1.25	0.00	67.9

Fractional Components

Gravel/Sand based on #4
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 10.4
% FINES = 67.9

D_{85}= 7.45

Apéndice 10:

Delimitación Jurisdiccional de Humedales

-ANÁLISIS ECOLÓGICO-BACTERIOLÓGICO
DIAGNÓSTICO AMBIENTAL
CONTROL BIOLÓGICO, CORP.

JURISDICTIONAL DETERMINATION

FOR A PROJECT LOCATED AT
PR-645, QUEBRADA ARENAS WARD
VEGA BAJA, PUERTO RICO

SAJ-2005-6494 (JD-VG)

NOVEMBER 2005

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1.0 INTRODUCTION

Our client, Río Piedras Housing Management Corp., represented by Mr. Mark González is presently engaged in the preliminary design for a residential project located at state road PR-155, Km. 159.0 Quebrada Arenas ward in the Municipality of Vega Baja, Puerto Rico.

The project site has at north the PR-155 and Mr. Joaquín Villanova, at south the following adjoining owners: Mr. Nemesio Rosado, Mr. Guillermo Alicea and Mr. Reinaldo Lozano. At west have the properties of Sucesión Benito Hernández Laureano and Mr. Manuel Martínez; and at east El Toro Creek and the following adjoining owners: Mr. Nicolás Laureano, Mr. Angel Rolon, Mr. Raimundo Lozano, Mr. Natalio Mac Adams and Sucesión Manuel Martinez. The property extends to both sides of State Road PR-645 with an extension of 1.2 km.

A total of 166.00 acres will be use on this project. The proposed action is the construction of 800 houses in a land state of approximately 652,446.1616 square meters. The project will have the facilities and infrastructure necessary to satisfy the future residents.

In a letter dated as for August 29, 2005 the United States Army Corps of Engineers indicated that the proposed project may require a Department of the Army permit. ADC, Corp. was retained to perform a Jurisdictional Determination (JD) to establish the land availability for the proposed project.

The purpose of this study was to identify and delineate a potential wetland area present on the site. The wetland determination was conducted following the guidelines of the Corps of Engineer's Wetland Delineation Manual (Technical Report Y-87, January 1987). The On-Site Inspection Necessary Method of the Routine Determination Section was the selected approach to perform this JD. The fieldwork was conducted during November 2005.

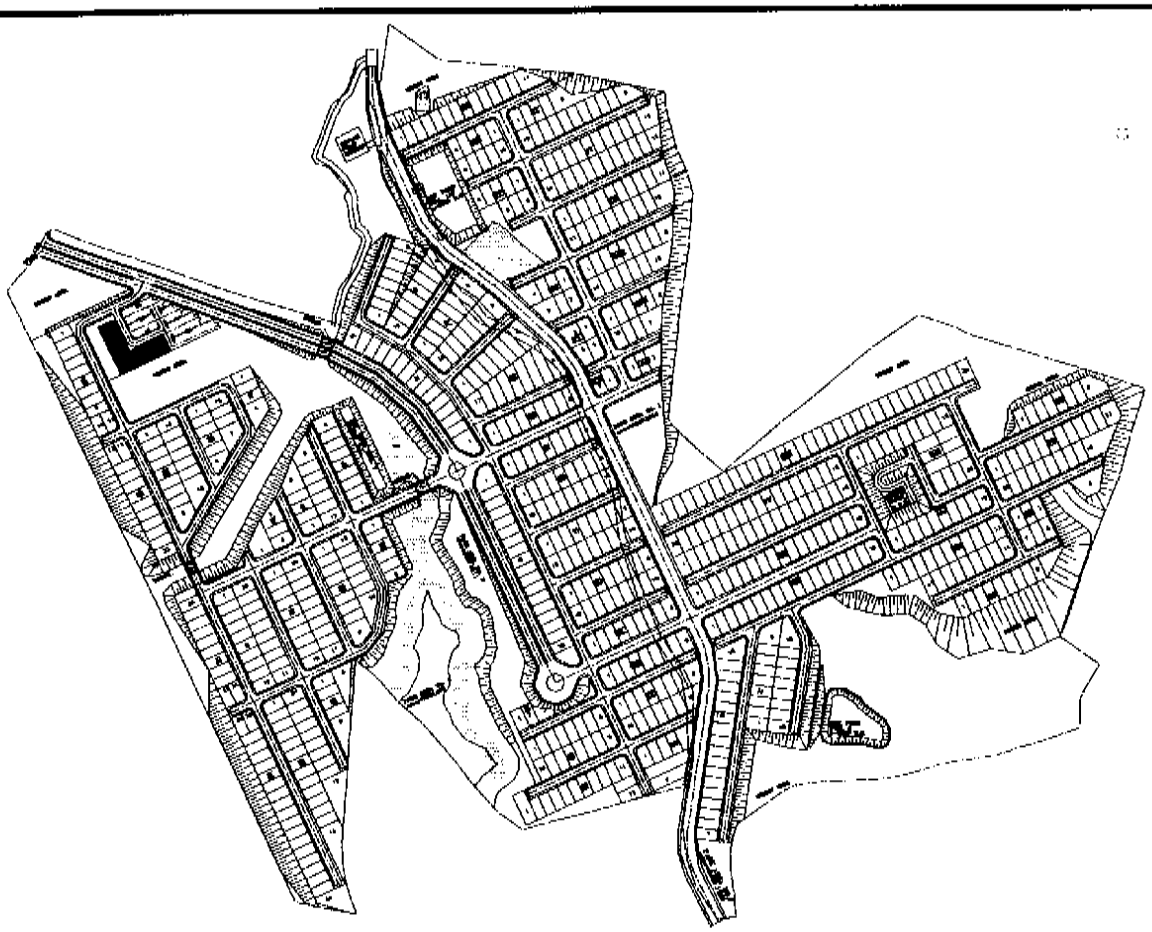

Figure 1	**Project Layout** **Monte Arenas** **PR- 645 Quebrada Arenas Ward** **Vega Baja, Puerto Rico**

2.0 LOCATION & TOPOGRAPHY

2.1 Location

The study area is located to the east of State Road PR-155 in Quebrada Arenas Ward, Municipality of Vega Baja, Puerto Rico (Figure 2). Vega Baja is located in the northern coast, it is bordered by: the Atlantic Ocean to the north, Morovis to the south, the municipality of Manatí to the west, and Vega Alta to the east, Quebrada Arenas ward is located south of Vega Baja municipality (Figure 2).

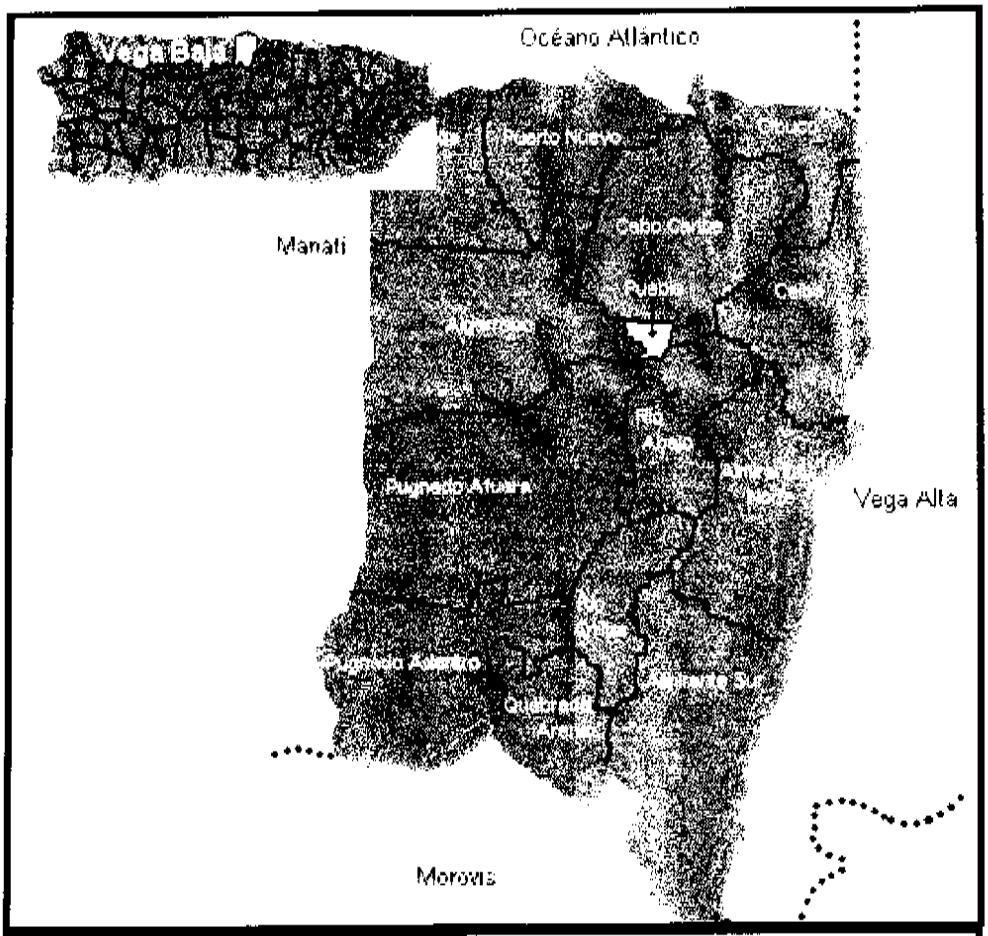

Figure 2	Vega Baja Location Map Monte Arenas PR- 645 Quebrada Arenas Ward Vega Baja, Puerto Rico

2.2 Topography

The municipality of Vega Baja is located between the central mountain range and the north coastal plains. It is also located in northen karst belt of Puerto Rico. Towards the southern part of Vega Baja the topography becomes irregular with the presence of sinkholes and mogotes (Figure 3). The municipality of Vega Baja is watered by several rivers: Cibuco, Indio, Unibón and Morovis. Tortuguero and the Puerto Nuevo Lagoons are the only waterbodies in this municipality.

The study area is located in the area that comprises the superior karst acquifer and the valley alluvial acquifer (Figure 4). The site has slopes in which the elevation range varies from 280 to 310 meters above mean sea level.

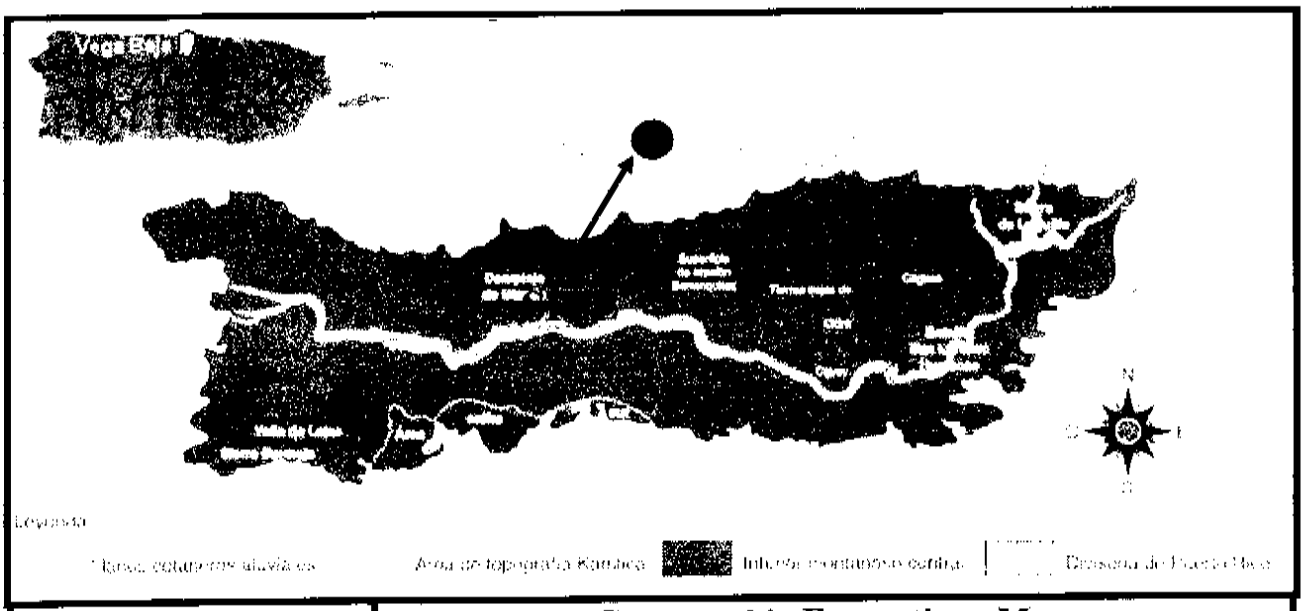

Figure 3	**Geomorphic Formations Map Mansiones de Vega Baja PR- 129 Quebrada Arenas Ward Vega Baja, Puerto Rico**

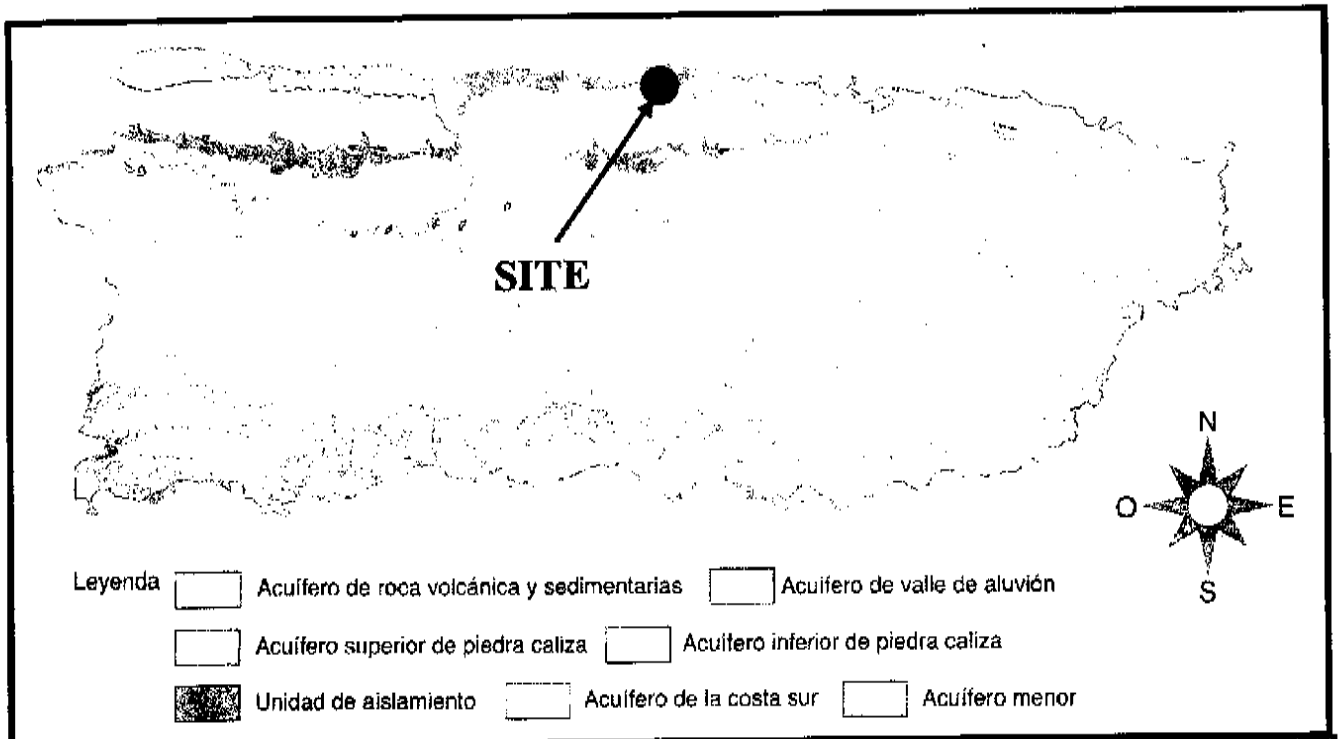

Figure 4	**Puerto Rico Acquifer Map** **Monte Arenas** **PR-645, Quebrada Arenas Ward** **Vega Baja, Puerto Rico**

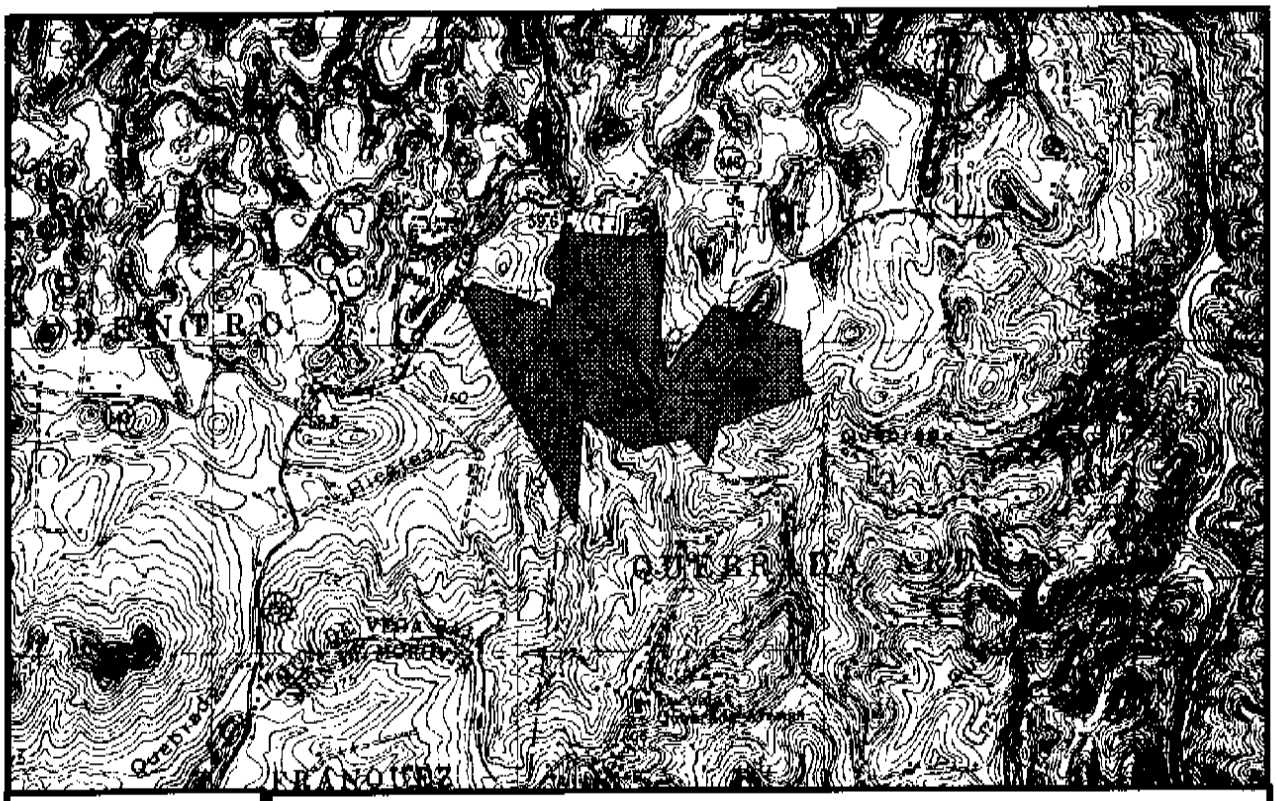

Figure 5	**Topography Map** **Monte Arena** **PR- 645 Quebrada Arenas Ward** **Vega Baja, Puerto Rico**

Photo 1	**Study Site** **Monte Arenas** **PR- 645 Quebrada Arenas Ward** **Vega Baja, Puerto Rico**

Photo 2	**Study Site** **Monte Arenas** **PR-645, Quebrada Arenas Ward** **Vega Baja, Puerto Rico**

3.0 TRANSECTS AND SAMPLING POINTS

A preliminary observation was performed in the JD area. On a flat area, wetland indicators were observed to proceed with JD delineation. This study was performed using the standard procedures of the Corp of Engineers 1987 Wetlands Delineation Manual. The On-Site Inspection Necessary Method of the Routine Determination Section was the selected approach to perform this JD. The West boundary of the area was selected as the study baseline.

A total of six (6) transects, were traced on the area in a form in which they cross the possible wetlands in this area (Figure 6). A total of seventeen (17) sampling points were assessed for vegetation, soil, and hydrology (Table 1). Some sampling points of transect C, D, E and F were excluded due the topography of the site, they were located in the area that comprises the top of hills and/or mogotes. The photos 3 to 22 shows transect and the locations of sampling points in this study area.

The transect location and/or distances from the starting point are as follows:

- Transect A (TA) was located at 150.00 meters from the starting point with three (3) sampling points.
- Transect B (TB) was located at 300.00 meters from the starting point with six (6) sampling points.
- Transect C (TC) was located at 450.00 meters from the starting point with three (3) sampling points.
- Transect D (TD) was located at 600.00 meters from the starting point with three (3) sampling points.
- Transect E (TE) was located at 750.00 meters from the starting point with one (1) sampling point.
- Transect F (TF) was located at 900.00 meters from the starting point with one (1) sampling point.

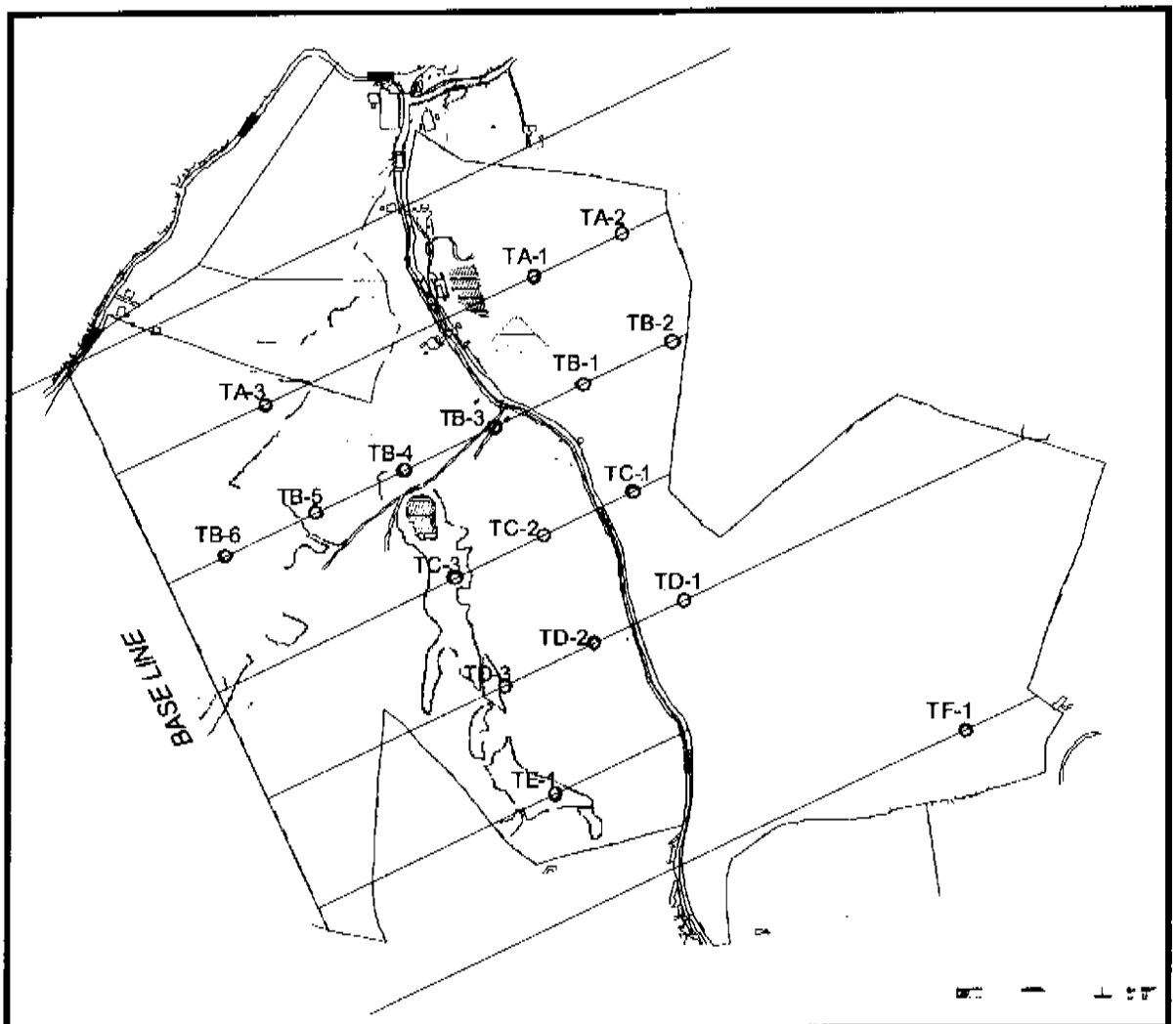

Figure 6	**Positional Location Of The Sampling Points** **Monte Arenas** **PR-645, Quebrada Arenas Ward** **Vega Baja, Puerto Rico**

Table 1. Positional Location of the Sampling Points.

Transect	Condition	Coordinates	Elevation (m)	Distance (m) from base line
TA-1	UPLAND	18° 23.287' N 066° 24.773' W	145.73	579.38
TA-2	UPLAND	18° 23.321' N 066° 24.710' W	148.47	704.38
TA-3	UPLAND	18° 23.196' N 066° 24.011' W	135.67	204.38
TB-1	UPLAND	18°23.253'N 066°24.745' W	141.37	579.49
TB-2	UPLAND	18°23.280'N 066°24.7100' W	152.8	704.49
TB-3	UPLAND	18°23.194'N 066°24.8070' W	129.32	454.49
TB-4	UPLAND	18°23.176'N 066°24.866' W	109.60	329.49
TB-5	UPLAND	18°23.120'N 066°24.941' W	115.24	204.39
TB-6	UPLAND	18°23.068'N 066°24.973' W	122.56	79.49
TC-1	UPLAND	18°23.144'N 066°24.679' W	155.21	579.49
TC-2	UPLAND	18°23.118'N 066°24.864' W	129.20	454.49
TC-3	UPLAND	18°23.050'N 066°24.964' W	124.51	329.49
TD-1	UPLAND	18°23.074'N 066°24.655' W	154.23	579.49
TD-2	UPLAND	18°23.141'N 066°24.748' W	152.74	454.49
TD-3	UPLAND	18°23.110'N 066°24.815' W	134.14	329.49
TE-1	UPLAND	18°23.321'N 066°24.710' W	148.47	329.49
TF-1	UPLAND	18°22.984'N 066°24.413' W	114.42	830.30

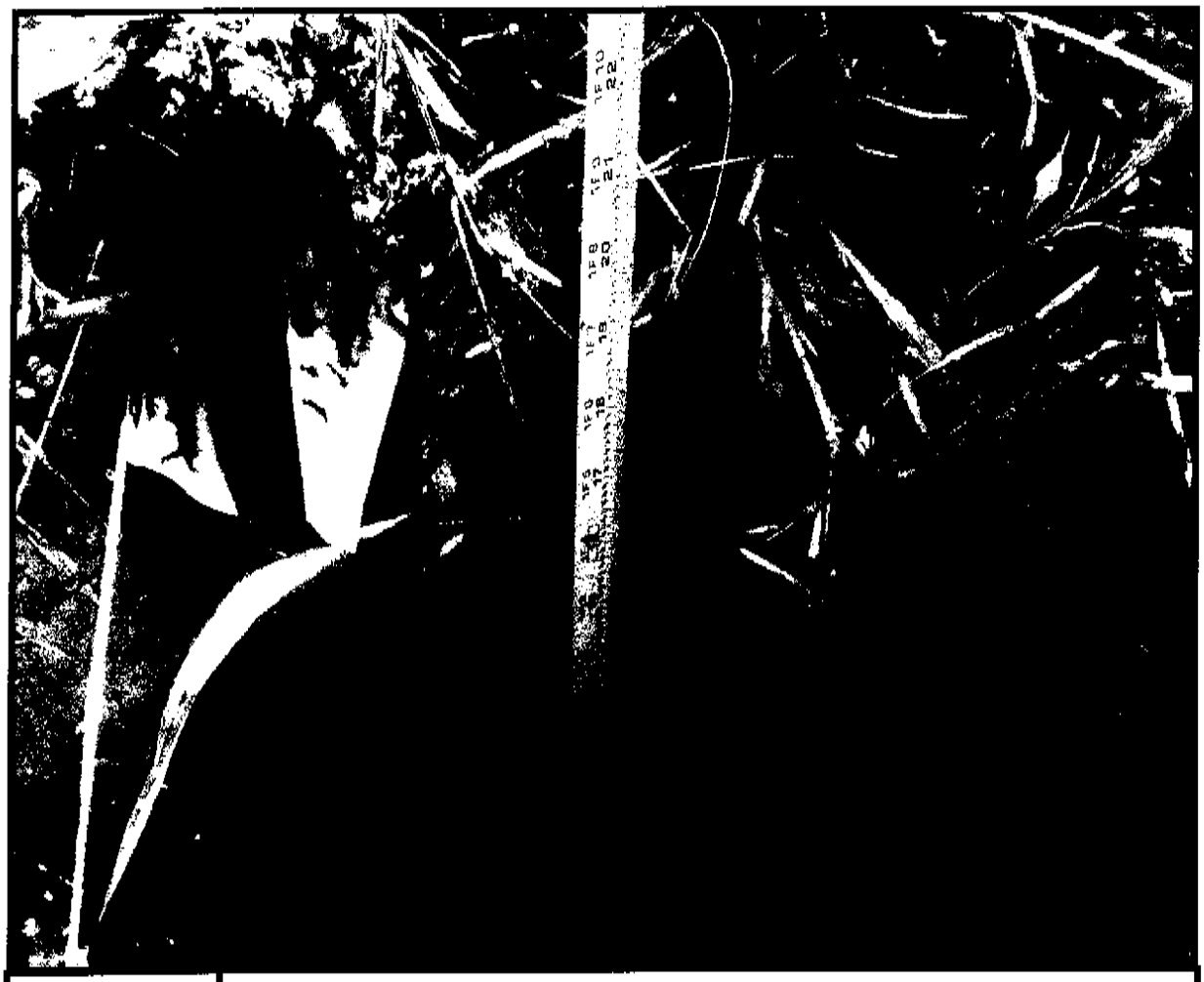

Photo 3	Sampling point TA-1 Monte Arenas PR-645, Quebrada Arenas Ward Vega Baja, Puerto Rico

Photo 4	Sampling point TA-1 Monte Arenas PR-645, Quebrada Arenas Ward Vega Baja, Puerto Rico

Photo 5	**Sampling point TA-2** **Monte Arenas** **PR-645, Quebrada Arenas Ward** **Vega Baja, Puerto Rico**

Photo 6	Sampling point TA-2 Monte Arenas PR- 645 Quebrada Arenas Ward Vega Baja, Puerto Rico

Photo 7	Sampling point TA-3 Monte Arenas PR- 645 Quebrada Arenas Ward Vega Baja, Puerto Rico

Photo 8	**Sampling point TB-1** **Monte Arenas** **PR- 645 Quebrada Arenas Ward** **Vega Baja, Puerto Rico**

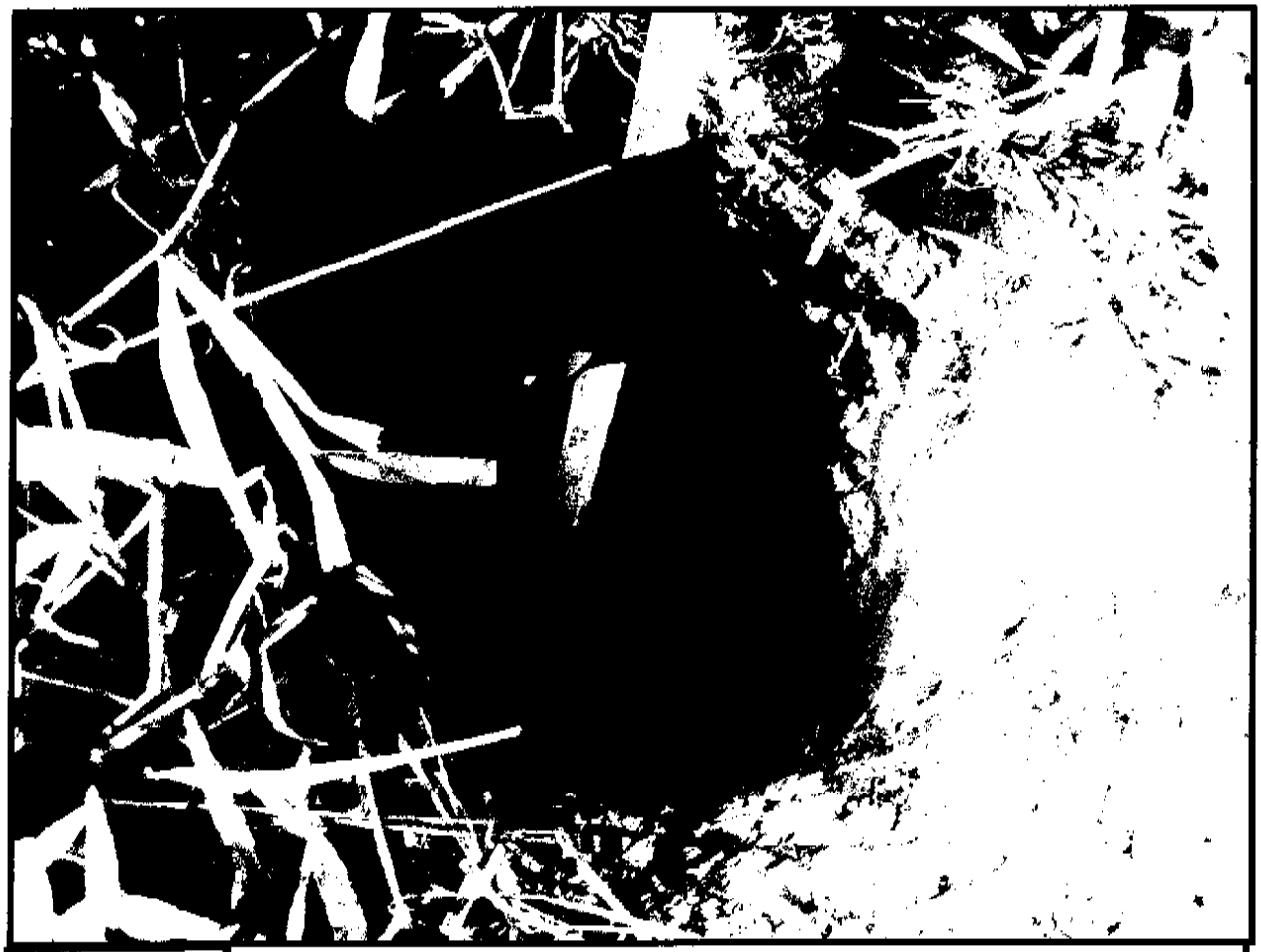

Photo 9	Sampling point TB-2 Monte Arenas PR- 645 Quebrada Arenas Ward Vega Baja, Puerto Rico