RIO CULEBRINAS AT AGUADILLA AND AGUADA, PUERTO RICO
SECTION 205
FINAL DETAILED PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

APPENDIX B
GEOTECHNICAL STUDIES

SECTION 205 DETAILED PROJECT REPORT
RIO CULEBRINAS
AGUADILLA, PUERTO RICO

APPENDIX B
GEOTECHNICAL

TABLE OF CONTENTS

List of Plates

CORE BORING LOGS, TEST PIT LOGS,
AND LABORATORY TEST DATA

GEOTECHNICAL

1. Purpose. This appendix presents the results of the subsurface investigations, laboratory work, and subsequent Geotechnical analysis and design for each major feature of the Rio Culebrinas flood control project.

2. General. The study area is located on the northwest coast of Puerto Rico between the community of Espinar and the town of Aguadilla. The main feature of this flood control project will be the construction of two separate levee segments identified as Aguadilla and Espinar and the proposed drainage structures passing through them. These levees will cross three existing highways and as a result, two road ramps will be required along the alignment of the Aguadilla levee and one along the alignment of the Espinar levee. A short "cutoff" channel is also proposed to mitigate the impact of the Aguadilla levee crossing two oxbows of the Cano Madre Vieja channel. All stationing is in meters. For clarity, various measurements and other engineering properties will be reported in English units with the metric equivalent following in parentheses.

3. Investigations Performed.

a. Core Borings. For use in the design of the project features, 15 core borings were performed in June of 1998. Eight borings were drilled along the proposed Aguadilla levee alignment, six borings along the proposed Espinar levee alignment, and one boring along the proposed cutoff channel alignment. A single boring was also drilled within the limits of a potential borrow site located just to the southwest of the study area. These borings were drilled to depths ranging from 15 feet (4.57 m) to 49.5 feet (15.09 m). The average spacing between the levee borings was 800 feet (243.8 m).

Standard Penetration Tests (SPT) were performed during the drilling to determine the consistency, relative density, and approximate strength of the materials sampled. The test consists of dropping a hammer weighing 140 pounds (63.5 kg) onto the drill rod from a height of 30 inches (0.76 m). The number of blows (N) necessary to produce a penetration of 1 foot (0.3 m) is regarded as the Standard Penetration Resistance. To avoid seating errors, the blows for the first 6 inches (0.15 m) of penetration are not taken into account; those required to increase the penetration from 6 to 18 inches (0.15 to 0.46 m) constitute the N-value. The split-spoon sampler is 24 inches (0.61 m) long with an outside diameter of 2 inches (5.08 cm) and an inside diameter of 1-3/8 inch (3.49 cm). The relation between the number of blows, the

consistency of the cohesive soils, and the relative density of noncohesive soils (from Terzaghi and Peck, 1948) are as follows:

(N)	Density	(N)	Consistency
< 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium	4 - 8	Medium
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

A site plan showing the core boring locations is shown on Plates B-1 and B-2. Copies of the boring logs are included at the end of this appendix.

b. Undisturbed Sampling. Three undisturbed samples were obtained during the core drilling phase of the subsurface investigation. Each sample was obtained by pushing a 3-inch diameter (7.62 cm) Shelby Tube into the soil for a distance of two feet (0.61 m) beginning at a pre-selected depth. The site location for the sampling was within 5 feet (1.52 m) of core boring CB-CUL-05, CB-CUL-13, and CB-CUL-14.

c. Bulk Sampling. As a part of the subsurface investigation program, a potential borrow site was examined to determine the suitability of the subsurface material for embankment fill. This site is located approximately 2.45 kilometers southwest of the center of the study area. In addition to the core boring performed there, two test pits were excavated within the limits of the site and bulk samples were obtained for laboratory testing. A copy of the test pit logs is included at the end of this appendix.

d. Laboratory Testing. Laboratory tests were performed on a number of soil samples obtained at various depths from each core boring and test pit. A combination of two or more "classification" tests (moisture content, Atterberg Limits, grain size distribution, specific gravity) were performed on each sample selected for testing. Each bulk sample also received a Standard Proctor compaction test in a 6-inch (15.24 cm) diameter mold. Classification tests, triaxial shear tests, and consolidation tests were performed on each undisturbed sample obtained. One Q test (unconsolidated-undrained test) and one

consolidation test were performed on the undisturbed sample obtained next to core boring CB-CUL-13 and on the undisturbed sample obtained next to boring CB-CUL-14. One R-bar test (consolidated-undrained test with pore pressure measurements during testing) and one consolidation test were performed on the undisturbed sample obtained next to core boring CB-CUL-05. The laboratory test results are included at the end of this appendix.

4. Materials Encountered.

a. Aguadilla Levee Segment - Station 1+00 to 7+00. Core borings CB-CUL-01 and CB-CUL-03 found a layer of low-plasticity clay (with sand) overlying a deposit of well-graded sand with gravel. Core boring CB-CUL-02 encountered silty sand and well-graded sand overlying a deposit of poorly-graded sand. The consistency of the low-plasticity clay ranged from soft to medium stiff. The density of the sand layers ranged from very loose to medium.

b. Aguadilla Levee Segment - Station 7+00 to 18+00. Core borings CB-CUL-05 through CB-CUL-08 encountered interbedded layers of high-plasticity clay, clayey sand, low-plasticity clay, low-plasticity silt, high-plasticity silt, silty sand, well-graded sand, and well-graded gravel. Root and/or plant fragments were present in all silt and clay layers sampled. The consistency of these soils ranged from very soft to medium stiff. The density of the coarse-grained soils ranged from very loose to medium.

c. Proposed Channel Cut. Core boring CB-CUL-04 found a brown-and-gray layer of high-plasticity silt overlying a loose deposit of well-graded gravelly sand. The consistency of the silt ranged from very soft to medium stiff and was 2.74 meters in thickness.

d. Espinar Levee Segment - Station 0+00 to 5+00. Core boring CB-CUL-13 found a layer of brown-and-gray high-plasticity silt overlying a thin layer of low-plasticity clay and well-graded gravelly sand. The consistency of the high-plasticity silt layer was soft to very soft and was 3.66 meters in thickness. Boring CB-CUL-14 found interbedded layers of silty sand, well-graded sand, high-plasticity clay, and clayey sand overlying a layer of high-plasticity clay (1.37 m thick). Below this clay layer, the boring encountered a layer of well-graded sand with gravel to the end of the boring. The density of the sand layer ranged from loose to medium.

e. Espinar Levee Segment - Station 5+00 to 14+96. Borings CB-CUL-09 through CB-CUL-12 encountered silty sand, well-graded

sand, and clayey sand overlying a layer of poorly-graded coarse-grained sand. The coarse-grained sand contained calcite cemented sand nodules (up to gravel size) and was sampled to the end of each boring. The density of the upper sand layers ranged from very loose to dense while the density of the lower sand layer ranged from medium to dense.

f. Potential Borrow Site. Core boring CB-CUL-15 encountered slightly to thoroughly weathered limestone to the depth of the boring. The classification of the material recovered varied with depth (well-graded gravel, clayey gravel, silty gravel, low and high-plasticity silt, and low and high-plasticity clay) but was fairly uniform with respect to density (dense to very dense). Test pits TP-CUL-01 and TP-CUL-02 sampled the same limestone formation to a depth of 1.37 meters and 2.90 meters respectively. The excavated material was classified as clayey gravel and silty gravel.

A geologic section has been prepared along the proposed centerline for each levee. All applicable boring logs have been shown at their respective station locations. These geologic sections are shown on Plates B-3 and B-4. It should be noted that the sections do not indicate any specific material type limits other than that shown by the individual borings, as any reasonable interpretation made from the boring logs could at best be a poor representation of the actual subsurface conditions.

5. Embankment Material. Fill material for the proposed embankments will most likely come from a commercial borrow source located near the project site. Suitable fill for the road ramps will be limited to only course-grained soils with less than 15 percent by weight passing the number 200 sieve. Materials classified by the Unified Soil Classification System as GW, GP, GM, GC, SW, SP, SC, SM, CL, and CH may be used for levee fill. As discussed in paragraph 4f above, one potential borrow site was examined to determine the suitability of the subsurface material for embankment fill. Based on the findings from core boring CB-CUL-15 and test pits TP-CUL-01 and TP-CUL-02, material from this site may be used for the levees as long as care is taken in accurately classifying the materials excavated.

6. Stability Analysis. Slope stability analyses were performed using the UTEXAS-3 Slope Stability Program available through the U.S. Army Engineer Waterways Experiment Station, Corps Program Library. The slopes for the proposed road ramp and levee embankments and cutoff channel were analyzed under the following conditions - End of Construction and Long Term. Shear strength values for the foundation soils and overlying embankment fill were based on Standard Penetration Test (SPT) N-Values and

laboratory test results. Applicable unit weights for each soil type were determined by using laboratory test results. Two different embankment cross sections and soil profiles were modeled for stability (one Aguadilla levee section and one Espinar levee section). In each model a gravel-sand-clay/gravel-sand-silt mixture was assumed for the embankment fill while the underlying soil layers reflected those found where the section was chosen. For the cutoff channel, one cross section was modeled for stability. The shear strength values and unit weights used in each model are shown on Plates B-5 through B-7.

With the End of Construction (EOC) condition, unconsolidated-undrained shear strengths were used and a side slope of 1 vertical to 2.5 horizontal was analyzed as a starting point. The stability of the embankments and channel was also checked with a seismic event occurring at the same time. The results of the analyses were as follows:

END OF CONSTRUCTION CONDITION	Minimum Factor of Safety Computed	Minimum Factor of Safety Required*
Aguadilla Levee		
Station 13+30	1.669	1.3
Espinar Levee		
Station 2+40	1.523	1.3
Cutoff Channel	5.506	1.3
END OF CONSTRUCTION CONDITION WITH SEISMIC ACTIVITY		
Aguadilla Levee		
Station 13+30	1.023	1.0
Espinar Levee		
Station 2+40	1.005	1.0
Cutoff Channel	2.289	1.0

*Per EM-1110-2-1913, Design & Construction of Levees

As the computed factor of safety for each slope was greater than the minimum required, the EOC analyses were ended. Steepening the embankment slopes beyond 1 vertical to 2.5 horizontal would also make the operation of maintenance equipment difficult if not impossible. For each modeled section, the critical failure arc is shown on Plates B-5 through B-7.

With the Long Term (LT) condition, consolidated-drained shear strengths were used and a side slope of 1 vertical to 2.5 horizontal was again analyzed. The results of the analyses were as follows:

LONG TERM CONDITION	Minimum Factor of Safety Computed	Minimum Factor of Safety Required*
Aguadilla Levee		
Station 13+30	1.571	1.4
Espinar Levee		
Station 2+40	1.545	1.4
Cutoff Channel	1.105	1.4
LONG TERM CONDITION WITH SEISMIC ACTIVITY		
Aguadilla Levee		
Station 13+30	1.072	1.0
Espinar Levee		
Station 2+40	1.081	1.0
Cutoff Channel	---	1.0

*Per EM-1110-2-1913, Design & Construction of Levees

Under long term conditions, the embankment sections were stable but the computed factor of safety for the channel slope was less than that required by EM 1110-2-1913. As a result, the stability of the proposed channel cut was reanalyzed with a side slope of 1 vertical to 3.5 horizontal. The results were as follows:

Cutoff Channel	Minimum Factor of Safety Computed	Minimum Factor of Safety Required*
END OF CONSTRUCTION CONDITION	5.676	1.3
EOC COND. W SEISMIC ACTIVITY	2.284	1.0
LONG TERM CONDITION	1.446	1.4
LT CONDITION W SEISMIC ACTIVITY	0.971	1.0

*Per EM-1110-2-1913, Design & Construction of Levees

At a 1 vertical to 3.5 horizontal side slope, the proposed channel cut would be stable under all but the long-term condition with a seismic event. Considering the purpose and location for the cutoff channel, failure of the channel slopes into the flow-way would not threaten human life. As a result, the computed factor of safety for this condition was considered to be acceptable and the stability analyses were ended. The critical failure arc for each modeled section is shown on Plates B-5 through B-7.

Hydraulic analyses show that the effects of the 100-year event will be present on the levee slope for approximately 20 hours or less. Considering both levees, seepage through either levee section is unlikely due to the high percentage of GM/GC type material available for levee fill and the short duration of a saturating pool. Based on the above, a long-term condition with steady-state seepage was not analyzed. Partial Pool and Sudden Drawdown cases were also not analyzed as they were considered to be nonapplicable as well. Once constructed, the vegetative cover on both levees should hold most of the soil (on the slopes) in place during a high water event. Should any loss of material occur due to erosion or saturation, repairs can be made as needed.

7. Embankment Geometry. Based on the slope stability analyses, a side slope of 1 vertical to 2.5 horizontal is recommended for the road ramp and levee embankments. The crest width along both levees will be 3 meters. A maximum vertical height of 3.56 meters occurs along the Aguadilla levee alignment near station 17+15. The combined width of the travel lanes and shoulders on the road ramps will be at least 10.97 meters.

8. Embankment Seepage Analysis. While through seepage should not occur from the 100-year event in either levee, seepage *under* the embankments could occur along portions of both levees. From station 9+00 to 14+96 along the Espinar levee alignment (approx.), a layer of well-graded sand (SW) exists at and near the ground surface. This material was also encountered near the ground surface around station 3+80 along the Aguadilla levee alignment. (Where the boring logs did not show SW material at the ground surface, a layer of silty sand was present.) With a calculated horizontal permeability of 86 ft/day (26.21 meters/day), this well-graded sand could act as a conduit for the removal of embankment material during high water events. As a result, a cross section through each levee was modeled using GMS (version 2.1) for the purpose of analyzing the underseepage. With each section, a high ground water table was assumed to exist during the 100-year event. Using total-head values from program's solution file, the exit gradients (in both the horizontal and vertical direction) were calculated for a rectangular area located directly below the "landside" levee toe. The factor of safety against piping in both directions was then calculated by dividing the respective critical gradient by the respective exit gradient.

The results of the seepage analyses, shown below, indicate that the potential for loss of material due to piping is the greatest underneath the Aguadilla levee around station 3+80.

Levee	Station	Calculated Exit Gradient in the Horizontal Direction	Calculated Exit Gradient in the Vertical Direction	Factor of Safety in the Horizontal Direction	Factor of Safety in the Vertical Direction	Minimum Factor of Safety Required*
Aguadilla	3+80	0.282	0.45	1.964	2.05	2.5 -- 3
Espinar	9+60	0.0645	0.106	8.59	8.7	2.5 -- 3

* Per Cedergren 1977

Even though the duration of the 100-year event is expected to be relatively short, over time the cumulative effects of high-water events against the levee could lead to the production of seepage cavities directly below the levee. To prevent the loss of material from piping along the toe in this area, a gravel filter should be placed below the "landside" toe for a length that will be determined prior to the preparation of plans and specifications.

9. Embankment Settlement. Due to the anticipated loading from each levee upon the ground surface, long-term consolidation of the silt and clay layers located below portions of each levee is expected. As a result, settlement calculations were performed to determine the magnitude of this post-construction consolidation and the amount of overbuild that will be necessary to account for it. Settlement calculations were based on cross sections made at selected locations along both of the proposed levee alignments. Each modeled section consisted of a levee section bearing on the soils encountered by one of the project core borings. All calculations were performed by hand. The following equation from Das (see reference "b") was used to calculate the settlement.

$$S = [C_c * H/(1 + e_o)] * \log((p_o - \Delta p)/p_o) \qquad \text{(Equ. 7.20)}$$

where:

C_c = the compression index (obtained from the empirical expression $C_c = 0.30[e_o - 0.27]$)

H = initial thickness of the compressible sublayer

e_o = the initial void ratio (obtained from laboratory test results)

p_o = initial average effective overburden pressure on the compressible sublayer

Δp = increase in vertical pressure on the compressible sublayer due to the construction of the levee

The results of the settlement calculations, shown below, indicate that settlement will be the greatest where the levee alignment passes near or crosses over the Cano Madre Vieja

channel. The recommended amount of overbuild for each levee is simply the calculated amount of settlement rounded up to the nearest half-foot (15.24 cm) increment.

Levee	Modeled Station	Core Boring used for Foundation Conditions	Calculated Settlement (inches)	Recommended Amount of Overbuild (inches)	Application Range (levee station)
Aguadilla	6+00	CB-CUL-03	4.66	6	4+40 to 7+00
Aguadilla	8+30	CB-CUL-05	9.79	12	7+00 to 9+60
Aguadilla	10+50	CB-CUL-06	4.93	6	9+60 to 14+60
Aguadilla	13+40	CB-CUL-07	5.3	6	9+60 to 14+60
Espinar	---	CB-CUL-14	8.89	12	0+00 to 0+80 and 3+40 to 5+00
Espinar	2+40	CB-CUL-13	17.85	18	0+80 to 3+40

10. Foundation Conditions for Structures. Three 60-inch diameter (1.52 m) corrugated metal pipe (CMP) culverts will be placed through the Aguadilla levee at station 1+39.50 (see Plate B-1). The design invert elevation for these culverts is -0.3 meters. Based on core boring CB-CUL-01, the subgrade material below this elevation is a fine-to-medium-grained well-graded sand with a density ranging from loose to medium. The ground-water table was recorded at an elevation of -0.79 meters. Based on the above information, no special foundation preparation measures should be necessary outside of running a vibratory compactor over the cleared subgrade surface to increase the density of the existing subgrade material.

Six 60-inch diameter (1.52 m) CMP culverts will be placed through the Aguadilla levee at station 6+05.50 (see Plate B-1). The design invert elevation for these culverts is -0.3 meters. Based on boring CB-CUL-03, the subgrade material below this elevation is a well-graded sand/gravel mix to a depth of 1.37 meters. Below the well-graded sand, a 0.91-meter layer of clayey sand exists followed by a small silt layer and then another well-graded sand layer to the end of the boring. The ground-water table was recorded at an elevation of +1.97 meters. Based on the above information, dewatering may be necessary at the time of construction to insure that the backfill around the culvert is placed and compacted in the dry. A vibratory compactor should also be run over the cleared subgrade surface prior to installing the culverts.

Three 60-inch diameter (1.52 m) CMP culverts will be placed through the Aguadilla levee at station 10+52.90 (see Plate B-1). The design invert elevation for these culverts is -0.3 meters.

Based on boring CB-CUL-06, the subgrade material below this elevation is a very-soft layer of high-plasticity silt to a depth of 0.91 meters. Below the silt layer, a 3.2-meter layer of medium-dense clayey sand exists followed by a layer of well-graded sand to the end of the boring. The ground-water table was recorded at an elevation of -1.74 meters. Based on the above information, the culvert subgrade should be undercut by 1.07 meters and then backfilled with select materials (in compacted lifts) to the invert elevation.

Two 60-inch diameter (1.52 m) CMP culverts will be placed through the Espinar levee at station 2+50 (see Plate B-1). The design invert elevation for these culverts is also -0.3 meters. Based on boring CB-CUL-13, the subgrade material below this elevation will be a very-soft layer of high-plasticity silt to an elevation of -2.74 meters. Below the silt layer, a small layer of low-plasticity clay was encountered overlying a layer of well-graded gravelly sand. The ground-water table was recorded at an elevation of +0.60 meters. Based on the above information, the culvert subgrade should be undercut by 2.44 meters and then backfilled with select materials (in compacted lifts) to the invert elevation. The required excavation will most likely require dewatering in order to insure that the backfill is placed and compacted in the dry.

All of the above mentioned culverts will have a flapgate installed on the floodplain side of the levee.

11. Foundation Preparation and Embankment Construction. After all clearing and grubbing has been completed and prior to any fill placement, the foundation area for each levee should be thoroughly broken to a depth of 15 cm. This will help to insure a good bond between the first lift of fill and the existing natural ground surface. All scarifying and breaking of the ground surface should be done parallel to the proposed centerline of the levee.

Fill material selected for the levee embankments should be spread by bulldozers (or other approved means) in horizontal layers to the final grade. Prior to compaction, these layers should not exceed 1 foot (0.3 m) in thickness when coarse-grained materials are being placed and 8 inches (20.3 cm) in thickness when fine-grained materials are being placed. The levee fill should be compacted to at least 95 percent of the maximum dry density obtained at optimum moisture, as defined by the Standard Proctor Compaction Test. Compaction may be accomplished by using a sheepsfoot roller, rubber-tire roller, or other approved device well suited to the type of material being compacted.

Fill material for the road-ramp embankments should be placed in horizontal layers of loose material no greater than 8 inches (20.3 cm) in thickness. Each layer should be compacted to at least 95 percent of the maximum dry density obtained at optimum moisture, as defined by the Modified Proctor Compaction Test. Compaction may be accomplished by using a vibratory steel-wheel roller or other approved device well suited to the type of material being compacted.

12. Geotechnical Design References.

a. Das, Braja. Principles of Geotechnical Engineering. Boston: PWS Publishers, 1985.

b. Department of the Army, Office of the Chief of Engineers. Engineering Manual EM 1110-2-1913: Design and Construction of Levees, 31 March 1978.

c. Duncan, J. M., R. C. Horz, and T. L. Yang. Shear Strength Correlations For Geotechnical Engineering, Virginia Tech Department of Civil Engineering, Geotechnical Engineering. Virginia: Virginia Polytechnic Institute and State University, 1989.

N

BAHIA DE AGUADILLA

CENTERLINE
AQUADILLA LEVEE (AL)

DRAINAGE STRUCTURE
AL-S-1

CB-CUL-1

CB-CUL-2

CENTERLINE
ESPINAR LEVEE (EL)

CB-CUL-14

CB-CUL-3

DRAINAGE STRUCTURE
AL-S-2

CUTOFF CHANNEL

CB-CUL-4

CB-CUL-13

DRAINAGE STRUCTURE
EL-S-1a

CB-CUL-5

ESPINAR LEVEE SPUR

DRAINAGE STRUCTURE
AL-S-3

CB-CUL-12

CB-CUL-6

PR HWY 115
RAMP

CB-CUL-11

CB-CUL-7

PR HWY 442
RAMP

CB-CUL-10

CB-CUL-8

CB-CUL-9

PR HWY 418
RAMP

RIO CULEBRINAS

0 500

SCALE (METERS)

LEGEND

CB-CUL-9
CORE BORING LOCATION

PLATE
B-1

RIO CULEBRINAS at AGUADA/AGUADILLA
PUERTO RICO
SITE PLAN and BORING LOCATION

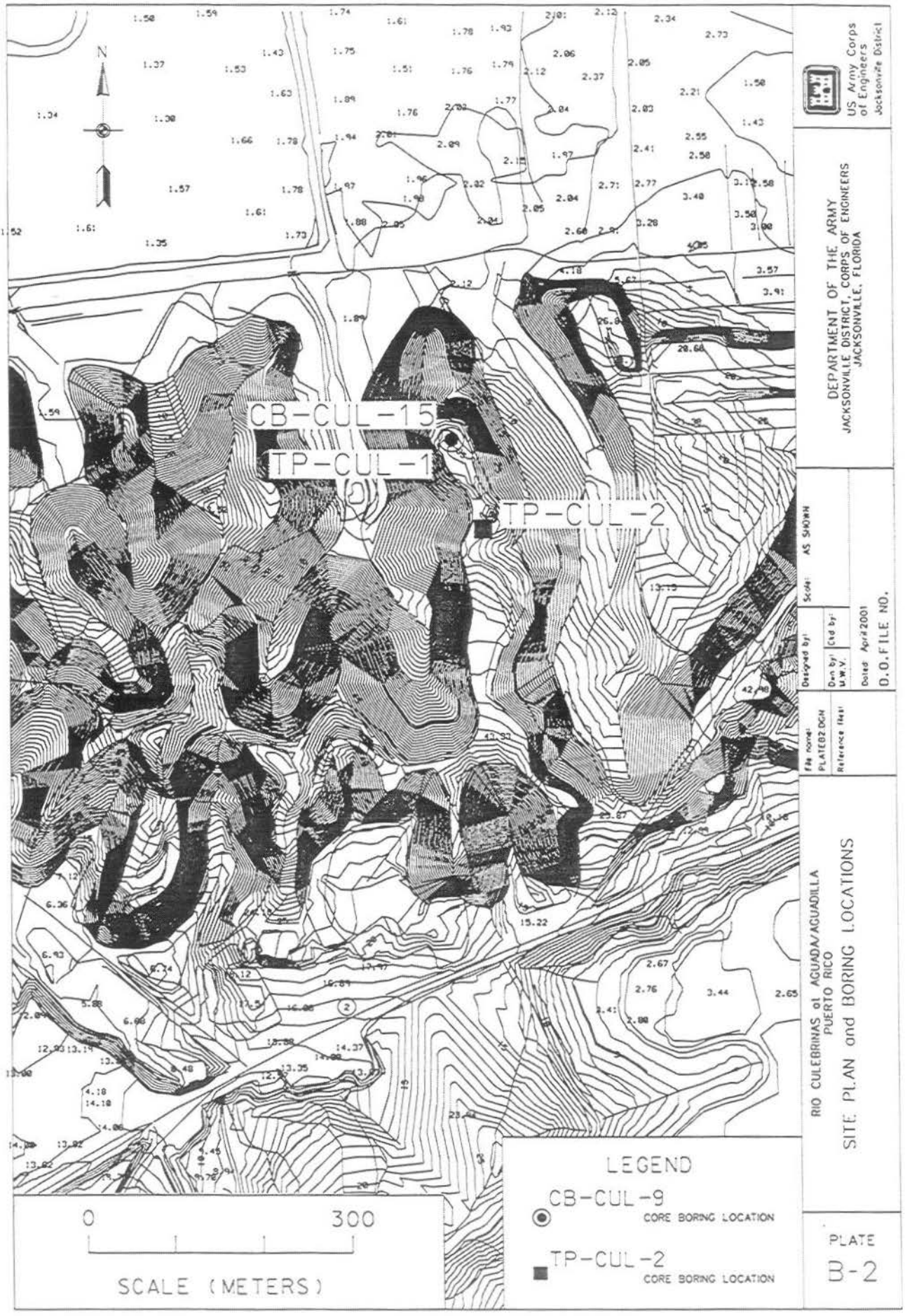
File name: PLATEBIR.DGN
Reference files:

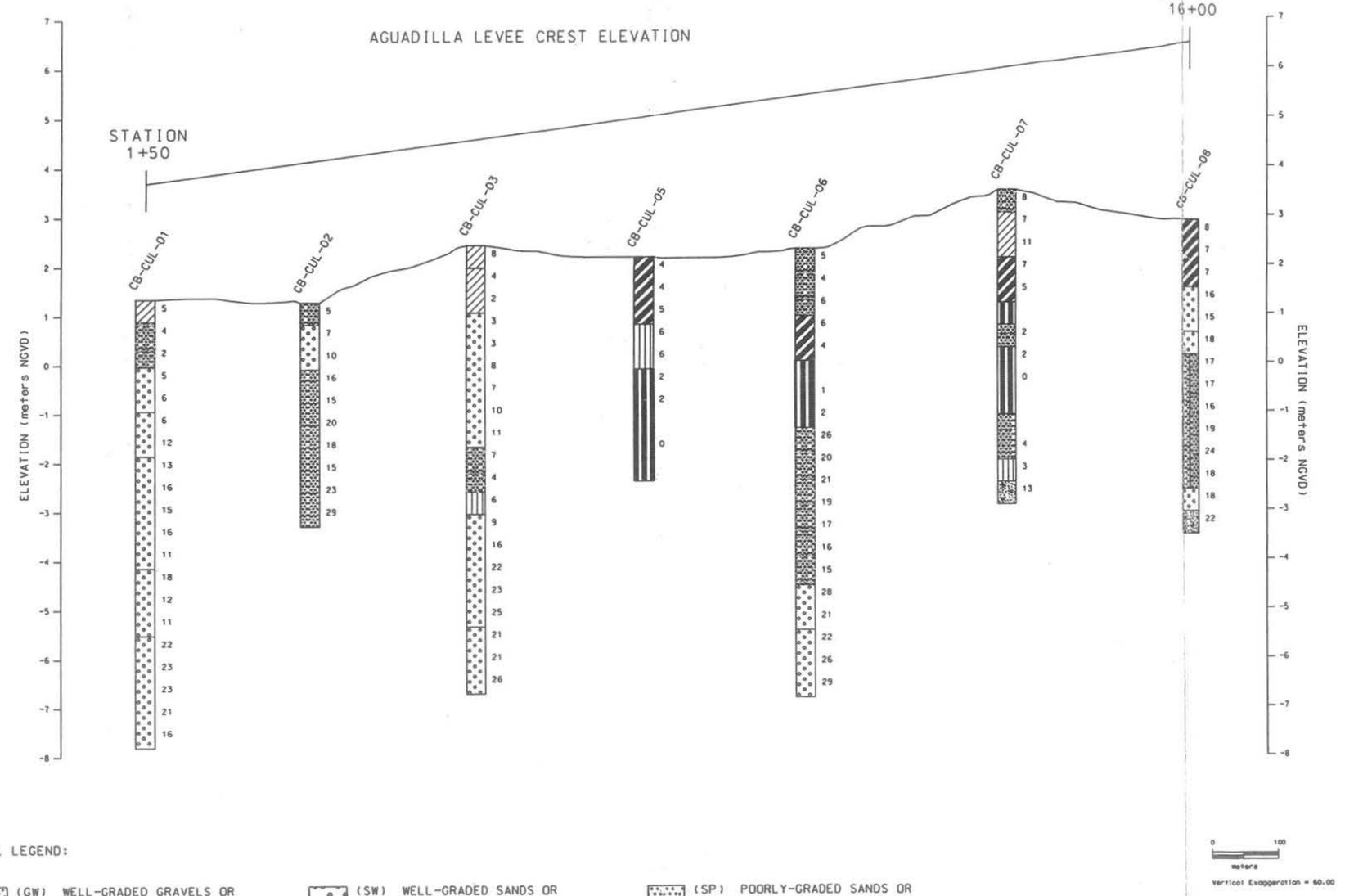
Designed by:
Drn by: M.W.V.
Chkd by:
Dated: April 2001
D.O.FILE NO.

Scale: AS SHOWN
Plot date:
Plot scale:

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

US Army Corps of Engineers
Jacksonville District


CB-CUL-15
TP-CUL-1
TP-CUL-2
N
0
300
SCALE (METERS)
LEGEND
CB-CUL-9
CORE BORING LOCATION
TP-CUL-2
CORE BORING LOCATION
US Army Corps of Engineers
Jacksonville District
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
Scale: AS SHOWN
Designed by:
Drn by: M.W.V.
Chd by:
Dated: April 2001
D.O.FILE NO.
File name: PLATE02.DGN
Reference files:
RIO CULEBRINAS at AGUADA/AGUADILLA
PUERTO RICO
SITE PLAN and BORING LOCATIONS
PLATE
B-2



SOIL LEGEND:

(GW) WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES

(SW) WELL-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES

(SP) POORLY-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.

(SM) SILTY SANDS, SAND-SILT MIXTURES

(SC) CLAYEY-SANDS, SAND-SILT MIXTURES

(ML) INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS

(CL) INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS

(MH) INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS

(CH) INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS

NOTES:

1. THE GEOLOGIC SECTION SHOWN REFLECTS THE FIELD VISUAL CLASSIFICATION (SHOWN ON THE CORE BORING LOGS) AND LABORATORY CLASSIFICATION OF SELECTED SOIL SAMPLES.
2. NUMBERS SHOWN ON BORINGS ARE STANDARD PENETRATION TEST RESULTS IN BLOWS PER FOOT.
3. FOR A COMPLETE PLAN VIEW WITH LEGEND, SEE PLATES B-1 AND B-2.

US Army Corps of Engineers
Jacksonville District

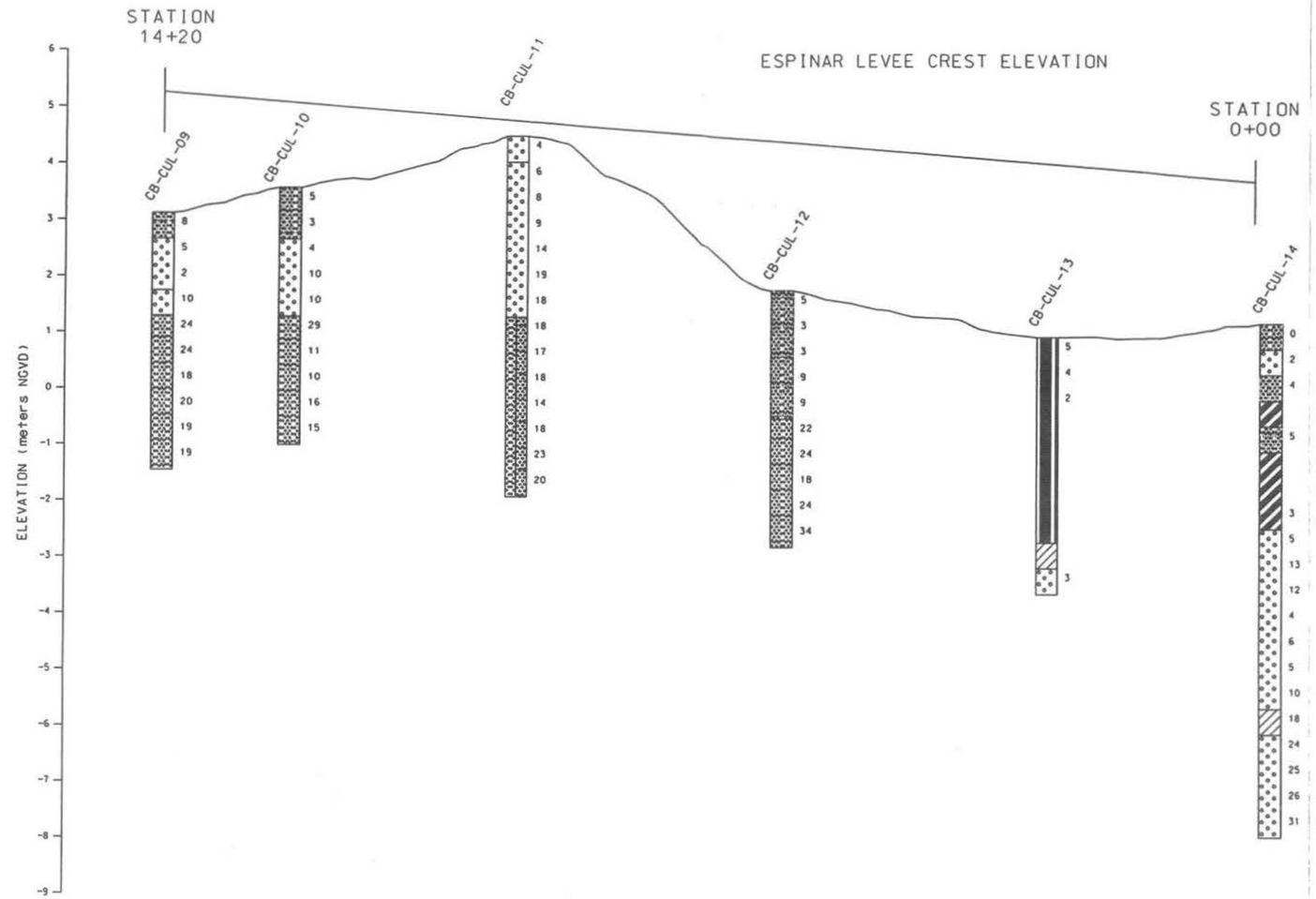
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by:
Drn by: M.W.V.
Ckd by:
Scale: AS SHOWN
Plot date:
Plot scale:
Dated: April 2001
D.O. FILE NO.
File name: PLATEB3.DGN
Reference files:

RIO CULEBRINAS at AGUADA/AGUADILLA
PUERTO RICO

GEOLOGIC SECTION -- AGUADILLA LEVEE

PLATE
B-3



SOIL LEGEND:

(SW) WELL-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES

(SP) POORLY-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.

(SM) SILTY SANDS, SAND-SILT MIXTURES

(SC) CLAYEY-SANDS, SAND-SILT MIXTURES

(CL) INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS

(MH) INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS

(CH) INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS

NOTES:

1. THE GEOLOGIC SECTION SHOWN REFLECTS THE FIELD VISUAL CLASSIFICATION (SHOWN ON THE CORE BORING LOGS) AND LABORATORY CLASSIFICATION OF SELECTED SOIL SAMPLES.
2. NUMBERS SHOWN ON BORINGS ARE STANDARD PENETRATION TEST RESULTS IN BLOWS PER FOOT.
3. FOR A COMPLETE PLAN VIEW WITH LEGEND, SEE PLATES B-1 AND B-2.

US Army Corps of Engineers
Jacksonville District

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by: | Scale: AS SHOWN
Dwn by: M.W.V. | Ckd by: | Plot date: | Plot scale:
Dated: April 2001
D.O.FILE NO.

File name: PLATEB4R.DGN
Reference files:

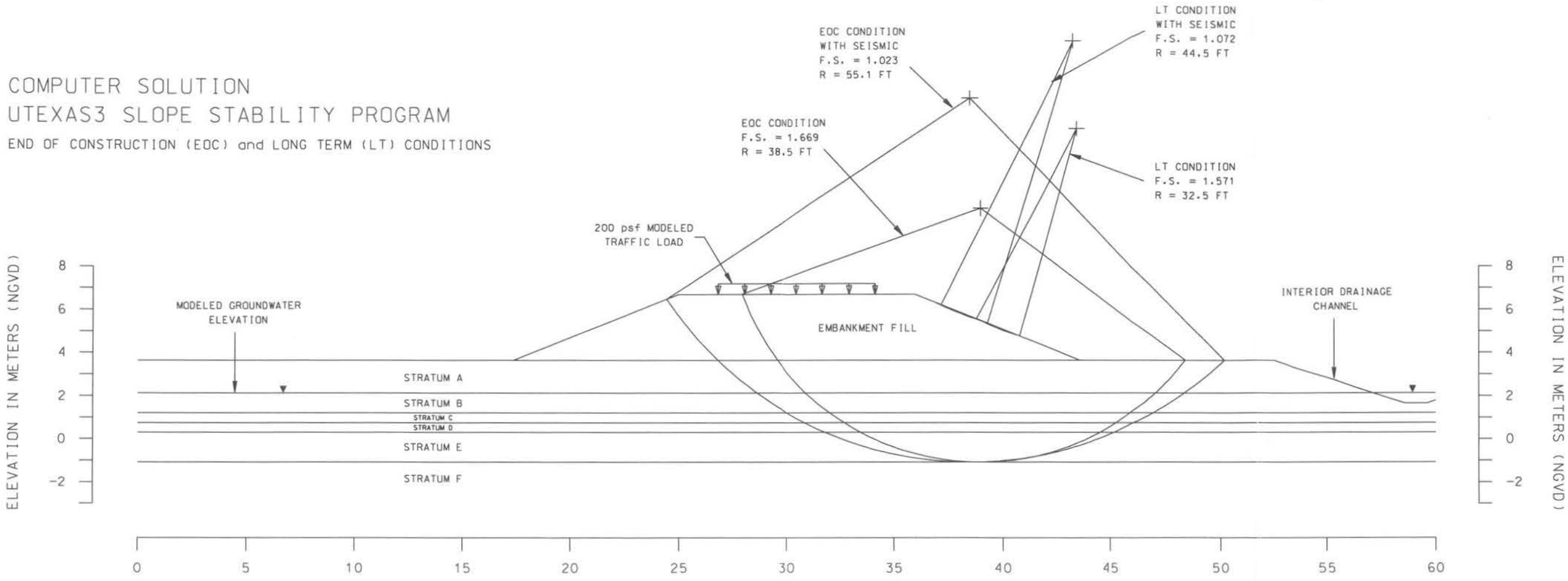
RIO CULEBRINAS at AGUADA/AGUADILLA
PUERTO RICO

GEOLOGIC SECTION -- ESPINAR LEVEE

PLATE
B-4

COMPUTER SOLUTION
UTEXAS3 SLOPE STABILITY PROGRAM

END OF CONSTRUCTION (EOC) and LONG TERM (LT) CONDITIONS



DESIGN DATA				Q		S	
STRATUM	GENERALIZED STRATUM TYPE	MOIST WT. PCF	SATURATED WT. PCF	COHESION PSF	Ø DEGREES	COHESION PSF	Ø DEGREES
EMB. FILL	(GM/GC)	127		0	32	0	32
A	(CH)	110		500	0	0	25
B	(CH)		104	750	0	0	23
C	(MH)		92	300	0	0	30
D	(SM)		107	0	28	0	28
E	(MH)		103	300	0	0	27
F	(SM)		107	0	28	0	28

LEGEND:

F.S. = FACTOR OF SAFETY
R = RADIUS
Ø = ANGLE OF INTERNAL FRICTION
Q = UNCONSOLIDATED-UNDRAINED SHEAR STRENGTH
S = CONSOLIDATED-DRAINED SHEAR STRENGTH
WT. = WEIGHT
PCF = POUNDS PER CUBIC FOOT
PSF = POUNDS PER SQUARE FOOT

NOTES:

1. SECTION MODELED NEAR CORE BORING CB-CUL-07. SEE PLATE B-1 FOR THE CORE BORING LOCATION.
2. EMBANKMENT SIDE SLOPES ARE 1 VERTICAL TO 2.5 HORIZONTAL.

US Army Corps of Engineers
Jacksonville District

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by:
Scale: AS SHOWN
Drawn by: M.W.V.
Ckd by:
Dated: July 2002
D.O.FILE NO.

File name: PLATEB5R.DGN
Reference files:

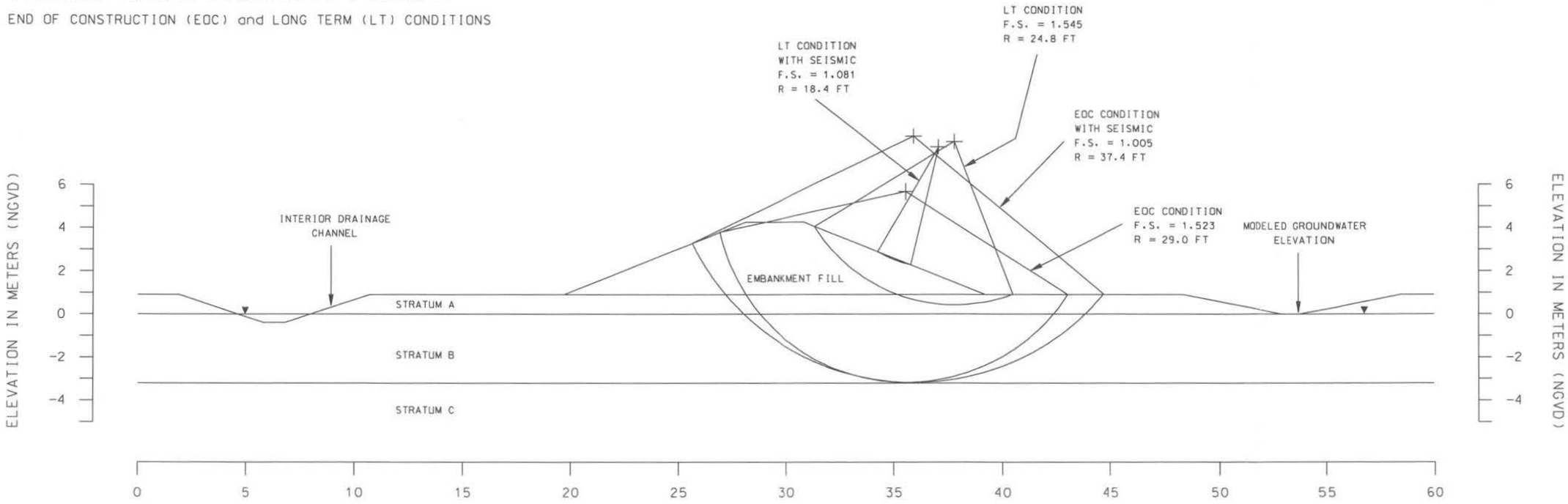
RIO CULEBRINAS at AGUADA/AGUADILLA
PUERTO RICO

SLOPE STABILITY ANALYSIS - SECTION NO. 1

PLATE
B-5

COMPUTER SOLUTION
UTEXAS3 SLOPE STABILITY PROGRAM

END OF CONSTRUCTION (EOC) and LONG TERM (LT) CONDITIONS



DESIGN DATA				Q		S	
STRATUM	GENERALIZED STRATUM TYPE	MOIST WT. PCF	SATURATED WT. PCF	COHESION PSF	Ø DEGREES	COHESION PSF	Ø DEGREES
EMB. FILL	(GM/GC)	127		0	32	0	32
A	(MH)	98		500	0	0	24
B	(MH)		97	350	0	0	25
C	(SW)		125	0	28	0	28

LEGEND:

F.S. = FACTOR OF SAFETY
R = RADIUS
Ø = ANGLE OF INTERNAL FRICTION
Q = UNCONSOLIDATED-UNDRAINED SHEAR STRENGTH
S = CONSOLIDATED-DRAINED SHEAR STRENGTH
WT. = WEIGHT
PCF = POUNDS PER CUBIC FOOT
PSF = POUNDS PER SQUARE FOOT

NOTES:

1. SECTION MODELED NEAR CORE BORING CB-CUL-13. SEE PLATE B-1 FOR THE CORE BORING LOCATION.
2. EMBANKMENT SIDE SLOPES ARE 1 VERTICAL TO 2.5 HORIZONTAL.

US Army Corps of Engineers
Jacksonville District

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by:
Drawn by: M.W.V.
Ckd by:
Scale: AS SHOWN
Dated: July 2002
D.O.FILE NO.
File name: PLATEB6R.DGN
Reference files:

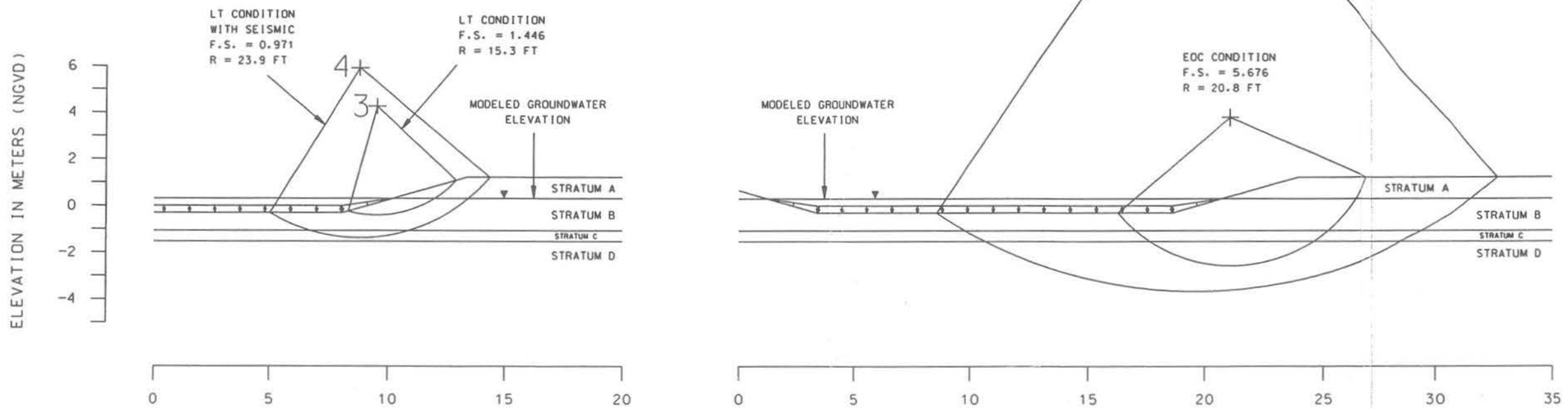
RIO CULEBRINAS at AGUADA/AGUADILLA
PUERTO RICO

SLOPE STABILITY ANALYSIS - SECTION NO. 2

PLATE
B-6

COMPUTER SOLUTION
UTEXAS3 SLOPE STABILITY PROGRAM

END OF CONSTRUCTION (EOC) and LONG TERM (LT) CONDITIONS



DESIGN DATA				Q		S	
STRATUM	GENERALIZED STRATUM TYPE	MOIST WT. PCF	SATURATED WT. PCF	COHESION PSF	Ø DEGREES	COHESION PSF	Ø DEGREES
A	(MH)	105		750	0	0	28
B	(MH)		100	350	0	0	26
C	(MH)		110	600	0	0	28
D	(SW)		125	0	32	0	32

LEGEND:

F.S. = FACTOR OF SAFETY
R = RADIUS
Ø = ANGLE OF INTERNAL FRICTION
Q = UNCONSOLIDATED-UNDRAINED SHEAR STRENGTH
S = CONSOLIDATED-DRAINED SHEAR STRENGTH
WT. = WEIGHT
PCF = POUNDS PER CUBIC FOOT
PSF = POUNDS PER SQUARE FOOT

NOTES:

1. SECTION MODELED NEAR CORE BORING CB-CUL-04. SEE PLATE B-1 FOR THE CORE BORING LOCATION.
2. CHANNEL SIDE SLOPES ARE 1 VERTICAL TO 3.5 HORIZONTAL.

US Army Corps of Engineers
Jacksonville District

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by:
Drawn by: M.W.V.
Checked by:
Dated: April 2001
Scale: AS SHOWN
File name: PLATEB8.DGN
Reference files:
D.O.FILE NO.

RIO CULEBRINAS at AGUADA/AGUADILLA
PUERTO RICO

SLOPE STABILITY ANALYSIS - SECTION NO. 3

PLATE
B-7

CORE BORING LOGS

Hole No.CB-CUL-01

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Jacksonville District

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.
2. LOCATION (Coordinates or Station): X=248,651 Y=212,523
3. DRILLING AGENCY: GEO CIM, INC.
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-01
5. NAME OF DRILLER: Evaristo Santiago
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 30.0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 30.0 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 20 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1
15. ELEVATION GROUND WATER: -2.60
16. DATE HOLE STARTED: 06/18/98 COMPLETED: 06/18/98
17. ELEVATION TOP OF HOLE: 4.40 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 52.2 %
19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
4.4	0.0					4.4	
			Sandy CLAY, medium stiff, brown, some root and plant fragments. (CL)	55.6	1	SPLIT SPOON	1 2 3
2.9	1.5					2.9	
			Clayey Sand, very loose, olive green. (SC)	61.1	2	SPLIT SPOON	2 2 2
			-brown			1.4	
				61.1	3	SPLIT SPOON	2 1 1
-.1	4.5					-.1	
			Terrigenous SAND, medium dense, medium to fine-grained, subangular, gray; little beach sand. (SW)	50	4	SPLIT SPOON	2 2 3
			-medium-grained			-1.6	
				55.6	5	SPLIT SPOON	3 3 3
-3.1	7.5					-3.1	
			SAND, trace silt, medium to fine, loose, dark gray. (SW-SM)	55.6	6	SPLIT SPOON	2 3 3
			-little silt, little gravel (consisting mostly of white coral fragments)			-4.6	
				44.4	7	SPLIT SPOON	3 6 6
-6.1	10.5					-6.1	
			Gravelly SAND, trace silt, mostly very coarse-grained, well graded, subrounded, medium dense, dark gray. (SW)	55.6	8	SPLIT SPOON	4 6 7
			-trace silt			-7.6	
				50	9	SPLIT SPOON	6 8 8
			-as above			-9.1	
				50	10	SPLIT SPOON	4 7 8
			-as above			-10.6	
				55.6	11	SPLIT SPOON	6 8 8
			-no recovery			-12.1	
				0	12	SPLIT SPOON	5 5 6
-13.6	18.0					-13.6	
			Terrigenous SAND, mostly fine-grained, medium dense, well-graded, subrounded to angular, dark gray; some beach sand. (SW)	61.1	13	SPLIT SPOON	8 9 9
			-medium-grained			-15.1	
				55.6	14	SPLIT SPOON	4 6 6
			-fine-grained			-16.6	
				50	15	SPLIT SPOON	5 5 6
-18.1	22.5					-18.1	
						(continued)	

Hole No.CB-CUL-01

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE: 4.40 Ft.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
-18.1	22.5					-18.1	
			Terrigenous SAND, medium dense, well-graded, medium to coarse-grained, subrounded to angular, dark olive green; some beach sand. (SW)	55.6	16	SPLIT SPOON	1 11 11
			-medium to fine			-19.6	
				55.6	17	SPLIT SPOON	12 12 11
			-medium sand			-21.1	
				55.6	18	SPLIT SPOON	10 11 12
			-as above			-22.6	
				44.4	19	SPLIT SPOON	11 11 10
						-24.1	
				72.2	20	SPLIT SPOON	6 7 9
-25.6	30.0					-25.6	
			END OF BORING CB-CUL-01 AT 30.0 FEET DEPTH.				
			NOTES:				
			Soils are field visually classified in accordance with the Unified Soils Classification System.				
			140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)				
			X and Y Coordinates are given in feet.				

Sample No.	Moisture Content%	Spec Gravity	Att. Limits L.L.	P.I.
2	33.4	2.71	50.0	24.9
6	32.4	2.77	--	--

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

HOLE NUMBER: CB-CUL-01

Hole No.CB-CUL-02

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 1

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=248,795 Y=211,804	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
3. DRILLING AGENCY: GEO CIM, INC.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-02	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 10 undisturbed: 0
5. NAME OF DRILLER: Evaristo Santiago	14. TOTAL NUMBER OF CORE BOXES: 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 0.19
7. THICKNESS OF BURDEN: 15.0 Ft.	16. DATE HOLE STARTED: 06/17/98 COMPLETED: 06/17/98
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 4.19 Ft.
9. TOTAL DEPTH OF HOLE: 15.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 62.8 %
	19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
4.2	0.0					4.2	
			SAND, well-graded, some silt, some root fragments, loose, subrounded to subangular, dark brown. (SM)	83.3	1	SPLIT SPOON	1, 2, 3
2.7	1.5					2.7	
			Beach SAND, well-graded, loose, subrounded to subangular, yellowish brown. (SW)	72.2	2	SPLIT SPOON	3, 3, 4
			-medium to coarse, trace calcite cemented sand nodules			1.2	
				88.9	3	SPLIT SPOON	4, 5, 5
-.3	4.5					-.3	
			SAND, coarse-grained, medium dense, brown. (SP)	72.2	4	SPLIT SPOON	6, 8, 8
			-as above, trace silt			-1.8	
				72.2	5	SPLIT SPOON	7, 7, 8
			-little calcite cemented sand nodules			-3.3	
				66.7	6	SPLIT SPOON	8, 10, 10
			-as above			-4.8	
				50	7	SPLIT SPOON	6, 9, 9
			-coarse to very coarse-grained			-6.3	
				50	8	SPLIT SPOON	5, 7, 8
			-as above			-7.8	
				72.2	9	SPLIT SPOON	12, 11, 12
			-no recovery			-9.3	
				0	10	SPLIT SPOON	13, 13, 16
-10.8	15.0					-10.8	
			END OF BORING CB-CUL-02 AT 15.0 FEET DEPTH.				

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
5	27.7	2.73	--	--

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R. | HOLE NUMBER: CB-CUL-02

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Jacksonville District

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=248,955 Y=211,084	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
3. DRILLING AGENCY: GEO CIM, INC.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-03	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 20 undisturbed: 0
5. NAME OF DRILLER: Evaristo Santiago	14. TOTAL NUMBER OF CORE BOXES: 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 6.48 Ft.
7. THICKNESS OF BURDEN: 30.0 Ft.	16. DATE HOLE STARTED: 06/12/98 COMPLETED: 06/15/98
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 7.98 Ft.
9. TOTAL DEPTH OF HOLE: 30.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 49.4 %
	19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
8.0	0.0					8.0	
			CLAY, trace silt and trace sand, stiff, dark brown; little root fragments. (CL)	77.8	1	SPLIT SPOON	2, 4, 4
6.5	1.5					6.5	
			Sandy Clay, low plasticity, sand is very fine-grained, soft to medium stiff, dark gray to brown. (CL)	44.4	2	SPLIT SPOON	2, 2, 2
			-little very fine-grained terrigenous sand, very soft.			5.0	
				33.3	3	SPLIT SPOON	1, 1, 1
3.5	4.5					3.5	
			SAND, some gravel, trace silt, loose, well-graded, sub-rounded, dark gray; sand and gravel consists of terrigenous sediments. (SW)	44.4	4	SPLIT SPOON	1, 2, 1
			-as above			2.0	
				55.6	5	SPLIT SPOON	2, 1, 2
.5	7.5					.5	
			Sandy GRAVEL, subrounded, loose, dark gray. (SW)	61.1	6	SPLIT SPOON	3, 4, 4
			-no recovery			-1.0	
				0	7	SPLIT SPOON	3, 3, 4
						-2.5	
				44.4	8	SPLIT SPOON	4, 5, 5
-4.0	12.0					-4.0	
			Terrigenous SAND, well-graded, trace gravel, medium dense, subrounded, to subangular, olive green, trace beach sand. (SW)	55.6	9	SPLIT SPOON	4, 5, 6
-5.5	13.5					-5.5	
			-sand, little gravel, little clay, loose, olive green (SC)	55.6	10	SPLIT SPOON	3, 3, 4
			-no recovery			-7.0	
				0	11	SPLIT SPOON	2, 2, 2
-8.5	16.5					-8.5	
			SILT, little clay and trace sand, medium stiff, gray to dark brown. (ML)	55.6	12	SPLIT SPOON	2, 3, 3
-10.0	18.0					-10.0	
			Beach SAND, coarse to very coarse, medium dense, well-graded, subrounded to subangular, brown to gray. (SW)	50	13	SPLIT SPOON	4, 4, 5
			-medium to coarse-grained			-11.5	
				83.3	14	SPLIT SPOON	7, 8, 8
			-coarse-grained			-13.0	
				55.6	15	SPLIT SPOON	9, 10, 12
						-14.5	
						(continued)	

0 · 2.5 · 5 · 7.5 · 10 · 12.5 · 15 · 17.5 · 20 · 22.5

Hole No.CB-CUL-03

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 7.98 Ft.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
-14.5	22.5		~~as above~~			-14.5	
				55.6	16	SPLIT SPOON	10 11 12
			-no recovery			-16.0	
				0	17	SPLIT SPOON	11 12 13
-17.5	25.5					-17.5	
			Beach SAND, medium dense, well-graded, subrounded to subangular, gray to brown. (SW)	50	18	SPLIT SPOON	10 10 11
			-medium to coarse-grained			-19.0	
				66.7	19	SPLIT SPOON	10 11 10
						-20.5	
				100	20	SPLIT SPOON	11 13 13
-22.0	30.0					-22.0	
			END OF BORING CB-CUL-03 AT 30.0 FEET DEPTH.				

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
2	37.9	2.86	47.8	24.9
5	18.1	2.72	--	--
10	19.9	2.72	--	--

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

Hole No.CB-CUL-04

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Jacksonville District	SHEET 1 OF 1

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=248,336 Y=210,707	11. DATUN FOR ELEVATION SHOWN (TBM or MSL): MSL
3. DRILLING AGENCY: GEO CIM, INC.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-04	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 10 undisturbed: 0
6. NAME OF DRILLER: Evaristo Santiago	14. TOTAL NUMBER OF CORE BOXES: 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 1.11 Ft.
7. THICKNESS OF BURDEN: 15.0 Ft.	16. DATE HOLE STARTED: 06/12/98 COMPLETED: 06/12/98
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 4.11 Ft.
9. TOTAL DEPTH OF HOLE: 15.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 47.2 %
	19. SIGNATURE OFENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5
4.1	0.0					4.1	
			High Plasticity SILT, little root fragments, trace sand, medium stiff, dark brown. (MH)	55.6	1	SPLIT SPOON	2 3 5
			-some sand, soft to medium			2.6	
				55.6	2	SPLIT SPOON	2 2 2
1.1	3.0					1.1	
			High Plasticity, trace very fine terrigenous sand, very soft, dark gray; trace decomposing fragments. (MH)	50	3	SPLIT SPOON	1 1 1
			-no clay, no plant fragments			-.4	
				50	4	SPLIT SPOON	1 1 1
			-little terrigenous sand			-1.9	
				55.6	5	SPLIT SPOON	P P P
-3.4	7.5					-3.4	
			Sandy SILT, medium stiff, dark gray; sand consist of medium to coarse terrigenous sand. (MH)	61.1	6	SPLIT SPOON	1 2 3
-4.9	9.0					-4.9	
			Gravelly SAND, little silt, medium dense, well-graded, subrounded to subangular, coarse to very coarse, loose, dark gray; sand consists of terrigenous sediments. (SW)	50	7	SPLIT SPOON	3 4 4
			-as above			-6.4	
			-very coarse	22.2	8	SPLIT SPOON	3 4 5
						-7.9	
				33.3	9	SPLIT SPOON	4 5 5
			-as above.			-9.4	
				38.9	10	SPLIT SPOON	5 5 6
-10.9	15.0					-10.9	
			END OF BORING CB-CUL-04 AT 15.0 FEET DEPTH.				

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
2	46.9	2.78	73.0	32.3
5	66.3	2.70	87.0	42.3

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

HOLE NUMBER: CB-CUL-04

Hole No.CB-CUL-05

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Jacksonville District	SHEET 1 OF 1
1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.		10. SIZE AND TYPE OF BIT: See Remarks	
2. LOCATION (Coordinates or Station): X=249,055 Y=210,334		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: GEO CIM, INC.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45	
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-05		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 10 undisturbed: 0	
5. NAME OF DRILLER: Evaristo Santiago		14. TOTAL NUMBER OF CORE BOXES: 1	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED		15. ELEVATION GROUND WATER	
7. THICKNESS OF BURDEN: 15.0 Ft.		16. DATE HOLE STARTED: 06/22/98 COMPLETED: 06/22/98	
8. DEPTH DRILLED INTO ROCK: 0 Ft.		17. ELEVATION TOP OF HOLE: 7.19 Ft.	
9. TOTAL DEPTH OF HOLE: 15.0 Ft.		18. TOTAL CORE RECOVERY FOR BORING: 60.5 %	
		19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5"
7.2	0.0					7.2	
			High Plasticity CLAY, soft to medium stiff, dark brown; some root and plant fragments. (CH)	66.7	1	SPLIT SPOON	1, 2, 2
			-little sand, brown to dark brown			5.7	
				61.1	2	SPLIT SPOON	2, 2, 2
			-medium stiff, trace gravel, trace root and plant fragments, gray to brown			4.2	
				38.9	3	SPLIT SPOON	2, 2, 3
2.7	4.5					2.7	
			SILT to Clayey SILT, medium stiff, brown to grayish brown to black, trace root fragments, trace disseminated oxides. (ML)	66.7	4	SPLIT SPOON	2, 3, 3
			-as above			1.2	
				72.2	5	SPLIT SPOON	2, 3, 3
-.3	7.5					-.3	
			SILT to Clayey SILT, very soft, dark gray, some black decomposing plant fragments. (MH)	38.9	6	SPLIT SPOON	1, 1, 1
-1.8	9.0					-1.8	
			SILT, some sand, very soft to soft, dark gray. (MH)	44.4	7	SPLIT SPOON	1, 1, 1
			-some to little sand, some wood and plant fragments			-3.3	
				44.4	8	SPLIT SPOON	1, 1/12
			-no wood fragments, trace plant fragments			-4.8	
				72.2	9	SPLIT SPOON	1/18
			-some to little clay, gray and brown			-6.3	
				100	10	SPLIT SPOON	1/18
-7.8	15.0					-7.8	
			END OF BORING CB-CUL-05 AT 15.0 FEET DEPTH.				
			NOTES:				
			Soils are field visually classified in accordance with the Unified Soils Classification System.				
			140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)				
			Groundwater was not observed during drilling.				
			X and Y Coordinates are given in feet.				

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
2	38.5	2.77	76.0	41.9
7	53.2	2.68	61.6	21.8

0 -2.5 -5 -7.5 -10 -12.5 -15 -17.5 -20 -22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R. | HOLE NUMBER: CB-CUL-05

Hole No.CB-CUL-06

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Jacksonville District

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=249,180 Y=209,626	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
3. DRILLING AGENCY: GEO CIM, INC.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-06	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 20 undisturbed: 0
5. NAME OF DRILLER: Evaristo Santiago	14. TOTAL NUMBER OF CORE BOXES: 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: -5.73 Ft.
7. THICKNESS OF BURDEN: 30.0 Ft.	16. DATE HOLE STARTED: 06/22/98 COMPLETED: 06/22/98
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 7.72 Ft.
9. TOTAL DEPTH OF HOLE: 30.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 55.8 %
	19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'	
7.7	0.0					7.7		
			Clayey SAND, loose to medium dense, well-graded, mostly medium sand, black brown; some root fragments. (SC)	55.6	1	SPLIT SPOON	2 3 2	0
			-loose, trace gravel			6.2		
				27.8	2	SPLIT SPOON	3 2 2	2.5
			-no recovery			4.7		
				0	3	SPLIT SPOON	3 3 3	
3.2	4.5					3.2		
			High Plasticity CLAY, medium stiff, brown to gray, trace root fragments. (CH)	66.7	4	SPLIT SPOON	3 3 3	5
			-soft, trace to little silt, little root fragments, trace sand, gray			1.7		
				77.8	5	SPLIT SPOON	2 2 2	
.2	7.5					.2		7.5
			High Plasticity SILT, traace sand, very soft, graay; some decomposing wood fragments. (MH)	94.4	6	SPLIT SPOON	1 1/12	
			-as above			-1.3		
				100	7	SPLIT SPOON	1/12 1	10
			-little to some sand			-2.8		
				100	8	SPLIT SPOON	1 1 1	
-4.3	12.0					-4.3		
			Beach SAND, some clay, medium dense, well-graded, medium to coarse, brown to gray; some decomposing plant fragments. (SC)	83.3	9	SPLIT SPOON	3 11 15	12.5
			-no clay, subangular			-5.8		
				44.4	10	SPLIT SPOON	7 10 10	15
			-no recovery			-7.3		
				0	11	SPLIT SPOON	5 10 11	
			-medium to very coarse			-8.8		
				55.6	12	SPLIT SPOON	9 9 10	17.5
			-some calcite cemented sand nodules			-10.3		
				55.6	13	SPLIT SPOON	9 9 8	
			-as above			-11.8		
				44.4	14	SPLIT SPOON	6 8 8	20
			-little sand nodules			-13.3		
				50	15	SPLIT SPOON	6 7 8	
-14.8	22.5					-14.8		22.5
						(continued)		

Hole No.CB-CUL-06

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 7.72 Ft.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
-14.8	22.5					-14.8	
			Calcite cemented Beach Sand, some loose sand, medium dense, well- graded,coarse to medium sand, brown. (SW)	55.6	16	SPLIT SPOON	14 15 13
			-medium coarse			-16.3	
				44.4	17	SPLIT SPOON	9 10 11
-17.8	25.5					-17.8	
			Beach SAND, calcite cemented sand nodules, medium dense, well-graded, fine to medium, brown. (SW)	50	18	SPLIT SPOON	10 10 12
			-as above			-19.3	
				55.6	19	SPLIT SPOON	10 13 13
			-medium to coarse			-20.8	
				55.6	20	SPLIT SPOON	11 14 15
-22.3	30.0					-22.3	
			END OF BORING CB-CUL-06 AT 30.0 FEET DEPTH.				

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Groundwater level was taken during drilling.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
5	58.1	2.69	92.6	62.7
7	55.7	2.71	73.0	30.3

Hole No.CB-CUL-07

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Jacksonville District

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.
2. LOCATION (Coordinates or Station): X=249,301 Y=208,733
3. DRILLING AGENCY: GEO CIM, INC.
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-07
5. NAME OF DRILLER: Evaristo Santiago
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 21.0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 21.0 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 14 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1
15. ELEVATION GROUND WATER: 10.06 Ft.
16. DATE HOLE STARTED COMPLETED: 06/17/98 06/17/98
17. ELEVATION TOP OF HOLE: 11.56 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 74.9 %
19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5"
11.6	0.0					11.6	
			FILL - Clayey SAND, some gravel and asphalt fragments, medium dense, well-graded, medium sand, dark brown. (SC)	50	1	SPLIT SPOON	3 4 4
10.1	1.5					10.1	
			FILL - CLAY, some limestone fragments, stiff, pale brown. (CL)	50	2	SPLIT SPOON	4 3 4
			-as above			8.6	
				66.7	3	SPLIT SPOON	6 6 5
7.1	4.5					7.1	
			CLAY, little gravel, little sand, medium stiff, very dark brown. (CH)	83.3	4	SPLIT SPOON	3 3 4
			-medium stiff, trace gravel, trace sand, some decomposing plant fragments			5.6	
				72.2	5	SPLIT SPOON	2 2 3
4.1	7.5					4.1	
			High Plasticity SILT, some fine-grained sand, some decomposing plants, very soft, dark gray. (MH)	83.3	6	SPLIT SPOON	1 1/12
2.6	9.0					2.6	
			Silty SAND, some wood and plant fragments, very loose, fine, well-graded, dark gray. (SM)	83.3	7	SPLIT SPOON	1 1 1
1.1	10.5					1.1	
			High Plasticity SILT, some sand, little wood and plant fragments, very soft, dark gray. (MH)	83.3	8	SPLIT SPOON	1 1 1
			-some root fragments			-.4	
				83.3	9	SPLIT SPOON	1/18
			-little sand, brown to dark gray (MH)			-1.9	
				100	10	SPLIT SPOON	P P P
-3.4	15.0					-3.4	
			Silty SAND, some decomposing wood and plant fragments, very loose, well-graded, coarse, dark gray. (SM)	77.8	11	SPLIT SPOON	P P P
			-very coarse, loose, little decomposing wood and plant fragments			-4.9	
				83.3	12	SPLIT SPOON	1 1 3
-6.4	18.0					-6.4	
			SILT, some gravel and sand, soft, dark gray; some root fragments. (ML)	50	13	SPLIT SPOON	3 1 2
-7.9	19.5					-7.9	
			Gravel, some sand and silt, medium dense, well-graded, subrounded, dark gray. (GW)	83.3	14	SPLIT SPOON	3 6 7
-9.4	21.0					-9.4	
			END OF BORING CB-CUL-07 AT 21.0 FEET DEPTH.				
						(continued)	

0 · 2.5 · 5 · 7.5 · 10 · 12.5 · 15 · 17.5 · 20 · 22.5

Hole No.CB-CUL-07

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 11.56 Ft.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
3	20.3	2.72	33.8	20.8
5	60.0	2.78	87.0	57.2
6	90.5	2.60	86.0	17.8
8	74.5	2.73	60.0	14.2
10	51.2	2.74	62.8	28.3

22.5
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

HOLE NUMBER: CB-CUL-07

Hole No.CB-CUL-08

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Jacksonville District

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=249,555 Y=207,932	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
3. DRILLING AGENCY: GEO CIM, INC.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-08	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 14 undisturbed: 0
5. NAME OF DRILLER: Evaristo Santiago	14. TOTAL NUMBER OF CORE BOXES: 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 5.55 Ft.
7. THICKNESS OF BURDEN: 21.0 Ft.	16. DATE HOLE STARTED: 06/15/98 COMPLETED: 06/15/98
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 9.55 Ft.
9. TOTAL DEPTH OF HOLE: 21.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 66.72 %
	19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
9.6	0.0					9.6	
			High Plasticity CLAY, little silt and trace sand, stiff, dark brown; some root fragments. (CH)	66.7	1	SPLIT SPOON	2, 4, 4
			-as above, some sand			8.1	
				66.7	2	SPLIT SPOON	2, 3, 4
			-some beach sand found in the lower 2 inches of penetration			6.6	
				72.2	3	SPLIT SPOON	2, 3, 4
5.1	4.5					5.1	
			Beach SAND, well-graded, medium dense, well-graded, subangular to subrounded, brown, some calcite cemented sand nodules. (SW)	83.3	4	SPLIT SPOON	5, 8, 8
			-little sand nodules			3.5	
				66.7	5	SPLIT SPOON	6, 7, 8
2.0	7.5					2.0	
			Gravelly Sand, medium dense, well-graded, subrounded to subangular, brown; gravel consist of calcite cemented beach sand nodules. (SW)	77.8	6	SPLIT SPOON	7, 9, 9
.6	9.0					.6	
			Gravelly Sand, fine to medium-grained, trace silt, light brown. (SP-SM)	72.2	7	SPLIT SPOON	7, 8, 9
			-fine to medium sand, trace silt			-.9	
				72.2	8	SPLIT SPOON	6, 8, 9
			-coarse sand, little terrigenous gravel			-2.5	
				83.3	9	SPLIT SPOON	7, 8, 8
			-little silt			-3.9	
				66.7	10	SPLIT SPOON	4, 9, 10
			-gravel consist of terrigenous rock fragments			-5.4	
				66.7	11	SPLIT SPOON	6, 11, 13
			-no recovery			-6.9	
				0	12	SPLIT SPOON	7, 8, 10
-8.4	18.0					-8.4	
			Beach SAND, medium to fine, medium dense, well-graded, subangular, brown. (SW)	100	13	SPLIT SPOON	8, 8, 10
-9.9	19.5					-9.9	
			Terrigenous GRAVEL, trace sand, medium dense, well-graded, subrounded, brown to black. (GW)	38.9	14	SPLIT SPOON	6, 10, 12
-11.4	21.0					-11.4	
			END OF BORING CB-CUL-08 AT 21.0 FEET DEPTH.				

(continued)

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

HOLE NUMBER: CB-CUL-08

Hole No.CB-CUL-08

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 9.55 Ft.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
2	31.9	2.79	61.9	33.5
8	15.7	2.77	--	--

22.5
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

HOLE NUMBER: CB-CUL-08

Hole No.CB-CUL-09

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 1

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=246,627 Y=207,832	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
3. DRILLING AGENCY: GEO CIM, INC.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-09	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 10 undisturbed: 0
5. NAME OF DRILLER: Evaristo Santiago	14. TOTAL NUMBER OF CORE BOXES: 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 3.24 Ft.
7. THICKNESS OF BURDEN: 15.0 Ft.	16. DATE HOLE STARTED: 06/16/98 COMPLETED: 06/16/98
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 10.23 Ft.
9. TOTAL DEPTH OF HOLE: 15.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 71.1 %
	19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
10.2	0.0					10.2	
			Silty SAND, loose, well-graded, dark brown, some root fragments. (SM)	72.2	1	SPLIT SPOON	1, 4, 4
8.7	1.5					8.7	
			SAND, loose, little to trace silt, dark brown. (SW)	77.8	2	SPLIT SPOON	2, 2, 3
			-very loose, lower 8 inches of sample consisted of clean beach sand			7.2	
				72.2	3	SPLIT SPOON	1, 1, 1
5.7	4.5					5.7	
			Beach SAND, medium dense, well-graded, subangular to subrounded, brown; trace calcite cemented sand nodules. (SW)	77.8	4	SPLIT SPOON	3, 4, 6
4.2	6.0					4.2	
			-coarse-grained, little to some calcite cemented sand nodules (SP)	88.9	5	SPLIT SPOON	6, 11, 13
			-some calcite cemented sand nodules (gravel-sized)			2.7	
				83.3	6	SPLIT SPOON	9, 11, 13
			-as above, trace silt			1.2	
				83.3	7	SPLIT SPOON	7, 8, 10
			-coarse to very coarse-grained			-.3	
				55.6	8	SPLIT SPOON	9, 9, 11
			-as above			-1.8	
				50	9	SPLIT SPOON	8, 9, 10
			-as above.			-3.3	
				50	10	SPLIT SPOON	8, 9, 10
-4.8	15.0					-4.8	
			END OF BORING CB-CUL-09 AT 15.0 FEET DEPTH.				

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
7	17.3	2.70	--	--

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R. | HOLE NUMBER: CB-CUL-09

Hole No.CB-CUL-10

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 1

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.
2. LOCATION (Coordinates or Station): X=247,099 Y=207,984
3. DRILLING AGENCY: GEO CIM, INC.
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-10
5. NAME OF DRILLER: Evaristo Santiago
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 15.0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 15.0 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 10 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1
15. ELEVATION GROUND WATER: 3.69 Ft.
16. DATE HOLE STARTED: 06/16/98 COMPLETED: 06/16/98
17. ELEVATION TOP OF HOLE: 11.69 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 63.3 %
19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
11.7	0.0					11.7	
			SAND, little silt, loose, well-graded, subangular to subrounded, dark brown, some root fragments. (SM)	77.8	1	SPLIT SPOON	2 2 3
			-very loose			10.2	
				72.2	2	SPLIT SPOON	2 2 1
8.7	3.0					8.7	
			Beach SAND, loose, well-graded, subangular to subrounded, brown. (SW)	55.6	3	SPLIT SPOON	2 1 3
			-medium dense			7.2	
				50	4	SPLIT SPOON	4 4 6
			-as above			5.7	
				50	5	SPLIT SPOON	4 4 6
4.2	7.5					4.2	
			SAND, very coarse-grained, little calcite cemented sand nodules, poorly-graded (SP)	77.8	6	SPLIT SPOON	7 16 13
			-coarse-grained			2.7	
				72.2	7	SPLIT SPOON	4 5 6
			-medium sand, trace silt, trace gravel (cemented sand)			1.2	
				72.2	8	SPLIT SPOON	4 4 6
			-coarse-grained, little calcite cemented sand nodules			-.3	
				55.6	9	SPLIT SPOON	7 8 8
			-as above.			-1.8	
				50	10	SPLIT SPOON	5 7 8
-3.3	15.0					-3.3	
			END OF BORING CB-CUL-10 AT 15.0 FEET DEPTH.				

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
2	12.1	2.69	19.1	2.9
8	25.4	2.69	--	--

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R. | HOLE NUMBER: CB-CUL-10

Hole No.CB-CUL-11

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.
2. LOCATION (Coordinates or Station): X=247,805 Y=208,506
3. DRILLING AGENCY: GEO CIM, INC.
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-11
5. NAME OF DRILLER: Evaristo Santiago
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 21.0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 21.0 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 14 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1
15. ELEVATION GROUND WATER: 5.66 Ft.
16. DATE HOLE STARTED: 06/11/98 COMPLETED: 06/11/98
17. ELEVATION TOP OF HOLE: 14.66 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 79.4 %
19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
14.7	0.0				14.7	
		SAND, litt to some silt, well-graded, loose, subrounded, dark; little root fragments. (SW)	83.3	1	SPLIT SPOON	2 2 2
13.2	1.5				13.2	
		Beach SAND, loose, well graded, medium to fine sand, sub-rounded, brown. (SW)	72.2	2	SPLIT SPOON	2 2 4
		medium sand			11.7	
			83.3	3	SPLIT SPOON	3 4 4
		-medium to coarse-grained			10.2	
			66.7	4	SPLIT SPOON	3 4 5
		-trace calcite cemented sand nodules (gravel-sized)			8.7	
			77.8	5	SPLIT SPOON	4 6 8
		-coarse, little calcite cemented sand nodules			7.2	
			83.3	6	SPLIT SPOON	9 9 10
		-as above			5.7	
			94.4	7	SPLIT SPOON	7 8 10
4.2	10.5				4.2	
		SAND, rounded to subrounded, little gravel (cemented sand fragments), trace silt. (SP-SM)	100	8	SPLIT SPOON	6 9 9
		-as above			2.7	
			83.3	9	SPLIT SPOON	5 8 9
		-coarse to very coarse			1.2	
			88.9	10	SPLIT SPOON	6 9 9
		-as above			-.3	
			66.7	11	SPLIT SPOON	6 7 7
		-very coarse			-1.8	
			61.1	12	SPLIT SPOON	7 9 9
		-as above			-3.3	
			83.3	13	SPLIT SPOON	9 11 12
		-as above			-4.8	
			66.7	14	SPLIT SPOON	7 9 11
-6.3	21.0				-6.3	
		END OF BORING CB-CUL-11 AT 21.0 FEET DEPTH.				
					(continued)	

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R. | HOLE NUMBER: CB-CUL-11

Hole No.CB-CUL-11

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 14.66 Ft.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
8	14.5	2.74	--	--

22.5
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

HOLE NUMBER: CB-CUL-11

Hole No.CB-CUL-12

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 1

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=247,326 Y=209,438	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
3. DRILLING AGENCY: GEO CIM, INC.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-12	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 10 undisturbed: 0
5. NAME OF DRILLER: Evaristo Santiago	14. TOTAL NUMBER OF CORE BOXES: 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 1.16 Ft.
7. THICKNESS OF BURDEN: 15.0 Ft.	16. DATE HOLE STARTED: 06/11/98 COMPLETED: 06/11/98
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 5.66 Ft.
9. TOTAL DEPTH OF HOLE: 15.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 74.4 %
	19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
5.7	0.0					5.7	
			Clayey SAND, loose, dark brown; sand is medium to coarse-grained. (SC)	94.4	1	SPLIT SPOON	3 3 2
			-soft			4.2	
				83.3	2	SPLIT SPOON	2 2 1
			-as above			2.7	
				83.3	3	SPLIT SPOON	1 1 2
1.2	4.5					1.2	
			Beach SAND, some clay and little silt, loose, coarse to medium, well- graded, subrounded to subangular, gray to brown, little calcite cemented sand nodules. (SC)	72.2	4	SPLIT SPOON	2 4 5
						-.3	
				83.3	5	SPLIT SPOON	2 4 5
-1.8	7.5					-1.8	
			Beach SAND, trace silt, medium dense, medium sand, subangular, gray to brown. (SP)	72.2	6	SPLIT SPOON	7 10 12
			-no silt, medium to coarse			-3.3	
				55.6	7	SPLIT SPOON	7 11 13
			-as above			-4.8	
				83.3	8	SPLIT SPOON	6 9 9
			-coarse			-6.3	
				44.4	9	SPLIT SPOON	9 12 12
			-little to some calcite cemented sand nodules			-7.8	
				72.2	10	SPLIT SPOON	13 18 16
-9.3	15.0					-9.3	
			END OF BORING CB-CUL-12 AT 15.0 FEET DEPTH.				
			NOTES:				
			Soils are field visually classified in accordance with the Unified Soils Classification System.				
			140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)				
			X and Y Coordinates are given in feet.				

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
2	22.3	2.68	35.5	19.7
5	27.7	2.70	N/P	N/P

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R. | HOLE NUMBER: CB-CUL-12

Hole No.CB-CUL-13

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 1

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.
2. LOCATION (Coordinates or Station): X=247,092 Y=210,444
3. DRILLING AGENCY: GEO CIM, INC.
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-13
5. NAME OF DRILLER: Evaristo Santiago
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 15.0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 15.0 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 10 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1
15. ELEVATION GROUND WATER: 1.97 Ft.
16. DATE HOLE STARTED: 06/18/98 COMPLETED: 06/18/98
17. ELEVATION TOP OF HOLE: 2.97 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 77.2 %
19. SIGNATURE OFENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
3.0	0.0					3.0	
			High Plasticity SILT, trace sand and gravel, medium stiff, dark brown; plant fragments. (MH)	61.1	1	SPLIT SPOON	3 2 3
			-gray, no sand			1.5	
				61.1	2	SPLIT SPOON	1 2 2
			-very soft			0.0	
				66.6	3	SPLIT SPOON	1 1 1
-1.5	4.5					-1.5	
			High Plasticity SILT, trace sand, very soft, darl gray; trace decomposing roots and plant fragments. (MH)	100	4	SPLIT SPOON	P P P
						-3.0	
				100	5	SPLIT SPOON	P P P
-4.5	7.5					-4.5	
				72.2	6	SPLIT SPOON	P P P
-6.0	9.0					-6.0	
			High Plasticity SILT, very soft, dark gray. (MH)	83.3	7	SPLIT SPOON	P P P
			-trace sand, little decomposing plant fragments			-7.5	
				100	8	SPLIT SPOON	P P P
-9.0	12.0					-9.0	
			CLAY, some gravel and sand, soft, dark gray. (CL)	44.4	9	SPLIT SPOON	P P 3
-10.5	13.5					-10.5	
			Gravelly SAND, trace silt, loose, mostly very coarse, well-graded, subrounded to subangular, dark gray. (SW)	83.3	10	SPLIT SPOON	1 2 1
-12.0	15.0					-12.0	
			END OF BORING CB-CUL-13 AT 15.0 FEET DEPTH.				

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
2	55.8	2.58	90.0	47.3
4	76.2	2.64	84.5	35.8
8	70.0	2.72	71.5	34.6

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT: Rio Culebrinas Project, Aguadilla, P.R. | HOLE NUMBER: CB-CUL-13

Hole No.CB-CUL-14

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Jacksonville District

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.
2. LOCATION (Coordinates or Station): X=246,988 Y=211,306
3. DRILLING AGENCY: GEO CIM, INC.
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-14
5. NAME OF DRILLER: Evaristo Santiago
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 30.0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 30.0 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 20 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1
15. ELEVATION GROUND WATER: 2.79 Ft.
16. DATE HOLE STARTED: 06/19/98 COMPLETED: 06/19/98
17. ELEVATION TOP OF HOLE: 3.79 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 65.3 %
19. SIGNATURE OF ENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5"
3.8	0.0					3.8	
2.3	1.5		Beach SAND, some silt, very loose, well-graded, medium sand, brown; some root fragments. (SM)	72.2	1	SPLIT SPOON 2.3	1/18
.8	3.0		-no silt (SW)	72.2	2	SPLIT SPOON .8	2, 1, 1
-.7	4.5		-loose, little to some silt (SM)	94.4	3	SPLIT SPOON -.7	1, 2, 2
-2.2	6.0		High Plasticity CLAY, trace sand, very soft, dark gray; some wood and fragments. (CH)	94.4	4	SPLIT SPOON -2.2	P, P, P
-3.7	7.5		SAND, some clay, loose, mostly medium sand, well-graded, dark gray. (SC)	88.9	5	SPLIT SPOON -3.7	3, 3, 2
-5.2	9.0		High Plasticity CLAY, very soft, dark gray; little decomposing plant fragments. (CH)	100	6	SPLIT SPOON -5.2	P, P, P
-6.7	10.5		-some sand	100	7	SPLIT SPOON -6.7	P, P, P
-8.2	12.0		-little sand, soft	94.4	8	SPLIT SPOON -8.2	1, 2, 1
			Terrigenous SAND, some clay, medium dense, mostly coarse-grained, well-graded, dark gray. (SW)	38.9	9	SPLIT SPOON -9.7	2, 2, 3
			-very coarse, little clay, some gravel	44.4	10	SPLIT SPOON -11.2	5, 7, 6
			-no clay	83.3	11	SPLIT SPOON -12.7	4, 6, 6
			-loose, gravelly	50	12	SPLIT SPOON -14.2	3, 2, 2
			-medium dense, little clay	38.9	13	SPLIT SPOON -15.7	2, 2, 4
			-some clay, little gravel	44.4	14	SPLIT SPOON -17.2	2, 2, 3
			-no clay	55.6	15	SPLIT SPOON -18.7	3, 5, 5
-18.7	22.5					(continued)	

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5

Hole No.CB-CUL-14

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 3.79 Ft.

SHEET 2 OF 2

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
-18.7	22.5					-18.7	
			Sandy CLAY, trace gravel, very stiff, dark gray; little decomposing plant fragments. (CL)	50	16	SPLIT SPOON	4 8 10
-20.2	24.0					-20.2	
			Terrigenous SAND, trace silt, mostly fine-grained, medium dense, well-graded, subangular, dark gray. (SW) subangular, dark gray.	55.6	17	SPLIT SPOON	8 12 12
			-as above			-21.7	
				66.7	18	SPLIT SPOON	10 12 13
			-as above			-23.2	
				61.1	19	SPLIT SPOON	9 13 13
			-no recovery			-24.7	
				0	20	SPLIT SPOON	9 15 16
-26.2	30.0					-26.2	
			END OF BORING CB-CUL-14 AT 30.0 FEET DEPTH.				

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
4	96.6	2.71	114.5	72.2
8	92.0	2.74	97.9	59.6

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

HOLE NUMBER: CB-CUL-14

Hole No.CB-CUL-15

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 3

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.
2. LOCATION (Coordinates or Station): X=243,605 Y=204,360
3. DRILLING AGENCY: GEO CIM, INC.
4. HOLE NO. (As shown on drawing title and file number): CB-CUL-15
5. NAME OF DRILLER: Evaristo Santiago
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 49.5 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 49.5 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 34 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE STARTED: 06/23/98 COMPLETED: 06/25/98
17. ELEVATION TOP OF HOLE: 112.76 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 49.3 %
19. SIGNATURE OF ENGINEER: Jorge R. Parra. P.E.

ELEV.	DEPTH	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5"
112.8	0.0				112.8	
		Limestone Formation, (Wackestone), slightly weathered, moderately hard to hard, moderately strong, reddish brown to brown to pink; some recrystallization and trace red clay. (GW)	72.2	1	SPLIT SPOON	28 33 50
111.3	1.5				111.3	
		Sampled as CLAYEY GRAVEL thoroughly weathered limestone fragments, hard, brown. (GC)	72.2	2	SPLIT SPOON	33 28 35
		-as above.	77.8	3	SPLIT SPOON	13 13 34
108.3	4.5				108.3	
		-hard rock encountered, refusal to penetration of the split spoon sampler	0	4	SPLIT SPOON	50/0
		-as above	0	5	SPLIT SPOON	50/0
		-as above	0	6	SPLIT SPOON	50/0
105.3	7.5				105.3	
		Limestone (Packstone), hard, strong to moderately strong, slightly weathered, brown to pink, some recrystallization. (GW)	16.7	7	SPLIT SPOON	50/3
103.8	9.0				103.8	
		Limestone (Grainstone), hard to moderately hard, moderately strong, slightly to moderately weathered, brown to pink. (GW)	22.2	8	SPLIT SPOON	50/5
102.3	10.5				102.3	
		Limestone sampled as calcareous SILT with some limestone fragments, hard, pale brown. (MH)	33.3	9	SPLIT SPOON	63/6
100.8	12.0				100.8	
		Limestone (Packstone), sampled as Silty-Clayey Sand and Gravel, moderately hard, moderately strong, moderately weathered, pale brown. (SC-SM)	22.2	10	SPLIT SPOON	50/4
		-as above.	16.7	11	SPLIT SPOON	50/4
		-brown to pink.	16.7	12	SPLIT SPOON	50/5
		-little calcareous silt and trace clay.	27.8	13	SPLIT SPOON	50/5
		-some calcareous silt.	22.2	14	SPLIT SPOON	50/5
93.3	19.5				93.3	
		Sampled as Calcareous SILT with some highly weathered limestone fragments, hard, very pale brown. (ML)	94.4	15	SPLIT SPOON	15 28 28
		-trace clay.	94.4	16	SPLIT SPOON	15 22 16
					90.3	
					(continued)	

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R. | HOLE NUMBER: CB-CUL-15

Hole No.CB-CUL-15

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE: 112.76 Ft.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'
90.3	22.5		~~as above.~~			90.3	
				33.3	17	SPLIT SPOON	50/6
			-little brown clay, limestone fragments are slightly weathered and hard.			88.8	
				61.1	18	SPLIT SPOON	50/6
			-as above.			87.3	
				83.3	19	SPLIT SPOON	19 20 30
			-limestone fragments are moderately weathered.			85.8	
				83.3	20	SPLIT SPOON	26 26 30
84.3	28.5					84.3	
			Thoroughly weathered limestone sampled as calcareous silty Sand and Gravel, hard, pink to brown. (SM)	33.3	21	SPLIT SPOON	50/6
			-highly to moderately weathered.			82.8	
				27.8	22	SPLIT SPOON	50/5
			-thoroughtly weathered.			81.3	
				22.2	23	SPLIT SPOON	50/4
			-as above.			79.8	
				27.8	24	SPLIT SPOON	50/6
78.3	34.5					78.3	
			Sampled as CLAY with some hard limestone fragments, hard, brown. (CL)	94.4	25	SPLIT SPOON	16 30 29
76.8	36.0					76.8	
			Thoroughly to highly weathered limestone (packstone), sampled as calcareous SILT with some moderately hard limestone fragments, hard, brown. (ML)	83.3	26	SPLIT SPOON	25 31 40
75.3	37.5					75.3	
			Sampled as CLAY with some hard limestone fragments, hard, brown. (CH)	33.3	27	SPLIT SPOON	50/6
73.8	39.0					73.8	
			Thoroughly weathered limestone (Packstone) sampled as calcareous SILT with little limestone fragments, hard, very pale brown. (ML)	94.4	28	SPLIT SPOON	16 22 35
72.3	40.5					72.3	
			Limestone (Packstone) with some clay, moderately hard, moderately weathered, weak, brown. (GC)	5.6	29	SPLIT SPOON	50/6
70.8	42.0					70.8	
			Thoroughly weathered limestone (Packstone) sampled as calcareous SILTY GRAVEL, hard, very pale brown. (GM)	83.3	30	SPLIT SPOON	32 50/6
			-little limestone fragments.			69.3	
				100	31	SPLIT SPOON	28 30 35
			-highly weathered.			67.8	
				77.8	32	SPLIT SPOON	23 50/6
			-thoroughly weathered.			66.3	
				94.4	33	SPLIT SPOON	14 20 26
			-some clay.			64.8	
				50	34	SPLIT SPOON	20 20 40
63.3	49.5					63.3	
			END OF BORING CB-CUL-15 AT 49.5 FEET DEPTH.			(continued)	

Hole No.CB-CUL-15

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 112.76 Ft.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel	BLOWS/.5'

NOTES:

Soils are field visually classified in accordance with the Unified Soils Classification System.

140# Hammer with 30" drop used on 2.0 foot split spoon (1-3/8" I.D. x 2" O.D.)

X and Y Coordinates are given in feet.

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
3	14.0	2.80	38.7	23.9
12	13.1	2.69	15.5	3.3
23	13.8	2.68	--	--
30	14.3	2.79	--	--

50
52.5
55
57.5
60
62.5
65
67.5
70
72.5
75
77.5

TEST PIT LOGS

Hole No.TP-CUL-01

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Jacksonville District

SHEET 1 OF 1

1. PROJECT: Rio Culebrinas Project, Aguadilla, P.R.	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=243,609 Y=204,370	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
3. DRILLING AGENCY: GEO CIM, INC.	12. MANUFACTURER'S DESIGNATION OF DRILL: John Deere 310-digger
4. HOLE NO. (As shown on drawing title and file number): TP-CUL-01	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 1 undisturbed: 0
5. NAME OF DRILLER: Evaristo Santiago	14. TOTAL NUMBER OF CORE BOXES: 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF BURDEN: 4.5 Ft.	16. DATE HOLE STARTED: 06/24/98 COMPLETED: 06/24/98
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 112.64 Ft.
9. TOTAL DEPTH OF HOLE: 4.5 Ft.	18. TOTAL CORE RECOVERY FOR BORING: %
	19. SIGNATURE OFENGINEER: Jorge R. Parra, P.E.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit or Barrel
112.6	0.0					112.6
			Limestone Formation sampled as Crystalline Limestone, gravel-sized, some clay, little sand, hard, moderately strong, lightly to moderatley weathered, intensely to closely fractured, brown; large amount of cavities filled with clay. (GC)		1	BACKHOE
108.1	4.5					108.1
			END OF TEST PIT TP-CUL-01 AT 4.5 FEET DEPTH.			
			NOTES:			
			Soils are field visually classified in accordance with the Unified Soils Classification System.			
			Backhoe could not penetrate deeper than 4'6" due to the presence of very hard and very strong cristalline limestone unit.			
			X and Y Coordinates are given in feet.			

Sample No.	Moisture Content%	Spec. Gravity	Att. Limits L.L.	P.I.
1	17.9	2.74	63.6	43.6

Sample No.	Max. Dry Density (pcf)	Opt. Moisture Content
1	111.9	15.2%

0 2.5 5 7.5 10 12.5 15 17.5 20 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Rio Culebrinas Project, Aguadilla, P.R.

HOLE NUMBER: TP-CUL-01

GEO CIM, INC.

GEOTECHNICAL TESTING SERVICES

Prepared by: C. Santoni Reviewed by: R. Davila Date: 11/13/97

JRD

LABORATORY TEST DATA SUMMARY TABLE

PROJECT: Rio Culebrinas Project LOCATION: San Juan, P.R. JOB NO.: 2174-98

SAMPLE IDENTIFICATION			INDEX PROPERTIES TESTS									ENGINEERING PROPERTY TESTS										REMARKS
			ATTERBERG LIMITS			GRAIN SIZE									STRENGTH					CONSOLIDATION			
																				INITIAL COND.			
BORING NO.	SAMPLE NO.	DEPTH (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Gravel %	Sand %	Silt %	Clay %	USCS CLASIFICATION	SPECIFIC GRAVITY	ORGANIC CONTENT %	WATER CONTENT %	TOTAL UNIT WEIGHT (pcf)	TORVANE Su (tsf)	POCKET PENETRO-METER q (tsf)	Type Test	PEAK DEVIATOR STRESS (tsf)	AXIAL STRAIN @ PEAK STRESS %	VOID RATIO	SATURA-TION %	Est.max. Past Pressure (tsf)	
CB-CUL-1	2-A	1.5-3.0	50.0	25.0	24.9		51.5	48.5		SC	2.71		33.4										
	6-A	7.5-9.0					93.2	6.8		SP-SM	2.77		32.4										
CB-CUL-2	5-A	6.0-7.5					98.9	1.2		SP	2.73		27.7										
CB-CUL-3	2-A	1.5-3.0	47.8	22.9	24.9		49.5	50.5		CL	2.86		37.9										
	5-A	6.0-7.5				30.5	61.9	7.6		SW-SM	2.72		18.1										
	10-A	13.5-15.0				13.6	69.1	17.3		SM	2.72		19.9										
CB-CUL-4	2-A	1.5-3.0	73.0	40.7	32.3		19.9	80.1		MH	2.78		46.9										
	5-A	6.0-7.5	87.0	44.7	42.3	0.1	11.2	88.7		MH	2.70		66.3										
CB-CUL-5	2-A	1.5-3.0	76.0	34.0	41.9		14.8	85.2		CH	2.77		38.5										
	7-A	9.0-10.5	61.6	39.8	21.8		26.0	74.0		MH	2.68		53.2										
CB-CUL-6	5-A	6.0-7.5	92.6	29.9	62.7		1.3	98.7		CH	2.69		58.1										
	7-A	9.0-10.5	73.0	42.7	30.3		8.8	91.2		MH	2.71		55.7										
CB-CUL-7	3-A	3.0-4.5	33.8	13.0	20.8	19.3	41.9	38.8		SC	2.72		20.3										
	5-A	6.0-7.5	87.0	29.8	57.2	0.3	6.9	92.8		CH	2.78		60.0										
	6-A	7.5-9.0	86.0	68.2	17.8		32.8	67.2		MH	2.60		90.5										
	8-A	10.5-12.0	60.0	45.8	14.2		20.8	79.2		MH	2.73		74.5										
	10-A	13.5-15.0	62.8	34.5	28.3		19.9	80.1		MH	2.74		51.2										
CB-CUL-8	2-A	1.5-3.0	61.9	28.4	33.5		25.7	74.3		CH	2.79		31.9										
	8-A	10.5-12.0				41.3	50.0	8.7		SP-SM	2.77		15.7										
CB-CUL-9	7-A	9.0-10.5				22.2	73.3	4.5		SP	2.70		17.3										
CB-CUL-10	2-A	1.5-3.0	19.1	16.2	2.9		82.5	17.5		SM	2.69		12.1										
	8-A	10.5-12.0				4.2	91.1	4.7		SP	2.69		25.4										
CB-CUL-11	8-A	10.5-12.0				18.6	74.3	7.1		SP-SM	2.74		14.5										

Amelia Distribution Center - Lot 26-A EmmaStreet - Guaynabo, PR 00968 - *Tel. (787) 792-2626 - *Fax. (787) 782-5990

GEO CIM, INC.

GEOTECHNICAL TESTING SERVICES

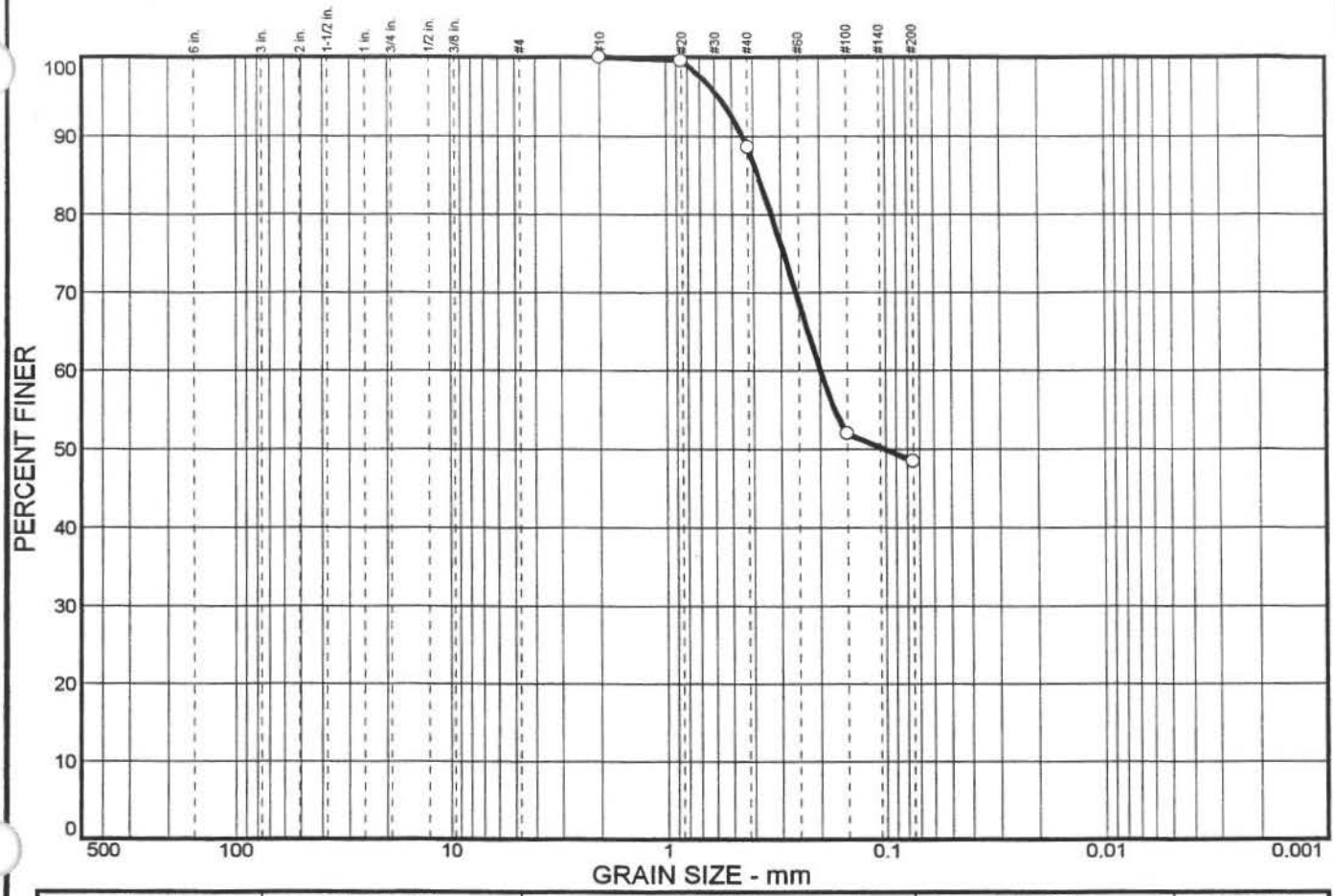
LABORATORY TEST DATA SUMMARY TABLE

PROJECT: Rio Culebrinas Project LOCATION: San Juan, P.R. JOB NO.: 2174-98

SAMPLE IDENTIFICATION			INDEX PROPERTIES TESTS									ENGINEERING PROPERTY TESTS										REMARKS
			ATTERBERG LIMITS			GRAIN SIZE									STRENGTH					CONSOLIDATION			
																				INITIAL COND.			
BORING NO.	SAMPLE NO.	DEPTH (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Gravel %	Sand %	Silt %	Clay %	USCS CLASIFICATION	SPECIFIC GRAVITY	ORGANIC CONTENT %	WATER CONTENT %	TOTAL UNIT WEIGHT (pcf)	TORVANE Su (tsf)	POCKET PENETRO-METER q (tsf)	Type Test	PEAK DEVIATOR STRESS (tsf)	AXIAL STRAIN @ PEAK STRESS %	VOID RATIO	SATURA-TION %	Est.max. Past Pressure (tsf)	
CB-CUL-12	2-A	1.5-3.0	35.5	16.5	19.7		65.4	34.6		SC	2.68		22.3										
	5-A	6.0-7.5	(*)	(*)	(*)	16.6	80.6	2.8		SP	2.70		27.7										
CB-CUL-13	2-A	1.5-3.0	90.0	42.7	47.3	2.0	5.7	92.3		MH	2.58		55.8										
	4-A	4.5-6.0	84.5	48.7	35.8		0.6	99.4		MH	2.64		76.2										
	8-A	10.5-12.0	71.5	36.9	34.6		0.3	99.7		MH	2.72		70.0										
CB-CUL-14	4-A	4.5-6.0	114.5	42.3	72.2		5.9	94.1		CH	2.71		96.6										
	8-A	10.5-12.0	97.9	38.3	59.6		13.7	86.3		CH	2.74		92.0										
CB-CUL-15	3-A	3.0-4.5	38.7	14.8	23.9	42.9	19.7	37.4		GC	2.80		14.0										
	12-A	19.5-21.0	15.5	12.2	3.3	13.6	37.7	48.7		SC-SM	2.69		13.1										
	23-A	36.0-37.6				31.2	31.8	37.0		SM	2.68		13.8										
	30-A	46.5-48.0				45.9	20.7	27.1		GM	2.79		14.3										
TP-CUL-1	1-A	0.0-4.5	63.6	20.0	43.6	53.4	19.5	27.1		GC	2.74		17.9										Max Dry Dens 111.9pcf @ 15.2% OPt Moisture
TP-CUL-2	1-A	0.0-4.16				67.0	17.1	15.9		GM	2.75		4.0										Max Dry Dens 116.3pcf @ 11.3% Opt Moisture
	2-A	4.16-9.5	34.0	14.1	19.9	56.6	18.8	24.6		GC	2.79		20.7										Max Dry Dens 111.7pcf @ 12.3% Opt Moisture

REMARKS: (*) (N/P) Non Plastic

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	51.5	48.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.6		
#40	88.6		
#100	52.0		
#200	48.5		

* (no specification provided)

Soil Description

Clayey SAND, olive green.

Atterberg Limits

PL= 25.0 LL= 50.0 PI= 24.9

Coefficients

D_{85}= 0.379 D_{60}= 0.198 D_{50}= 0.101
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

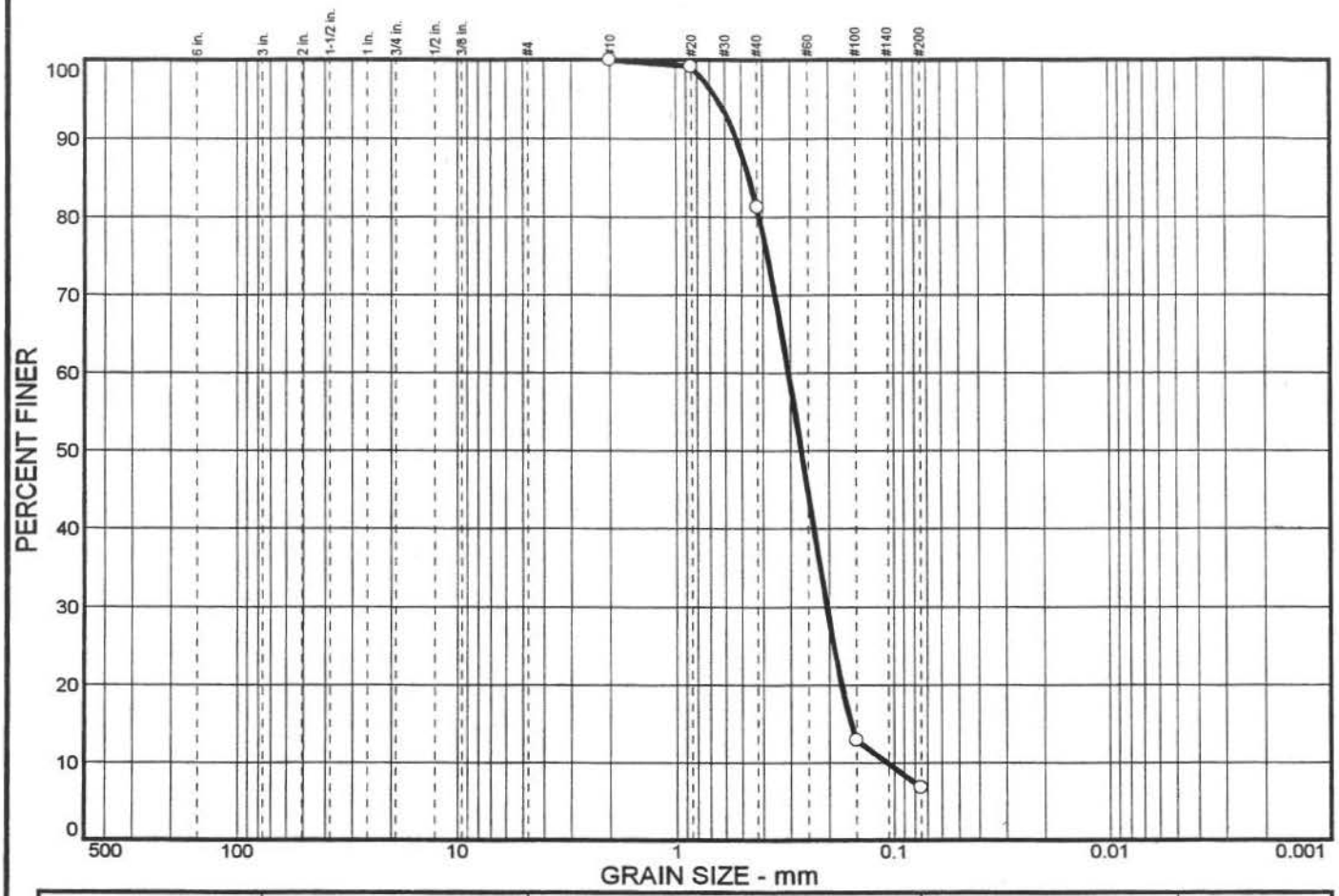
Remarks

Sample No.: 2-A **Source of Sample:** CB-CUL-1 **Date:** 7/13/98
Location: X=248651.1010 Y=212522.8620 **Elev./Depth:** 1.5' @ 3.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	93.2	6.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.2		
#40	81.3		
#100	12.9		
#200	6.8		

* (no specification provided)

Soil Description

SAND, trace silt, dark gray.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.460 D_{60}= 0.305 D_{50}= 0.268
D_{30}= 0.204 D_{15}= 0.158 D_{10}= 0.108
C_u= 2.83 C_c= 1.26

Classification

USCS= SP-SM AASHTO=

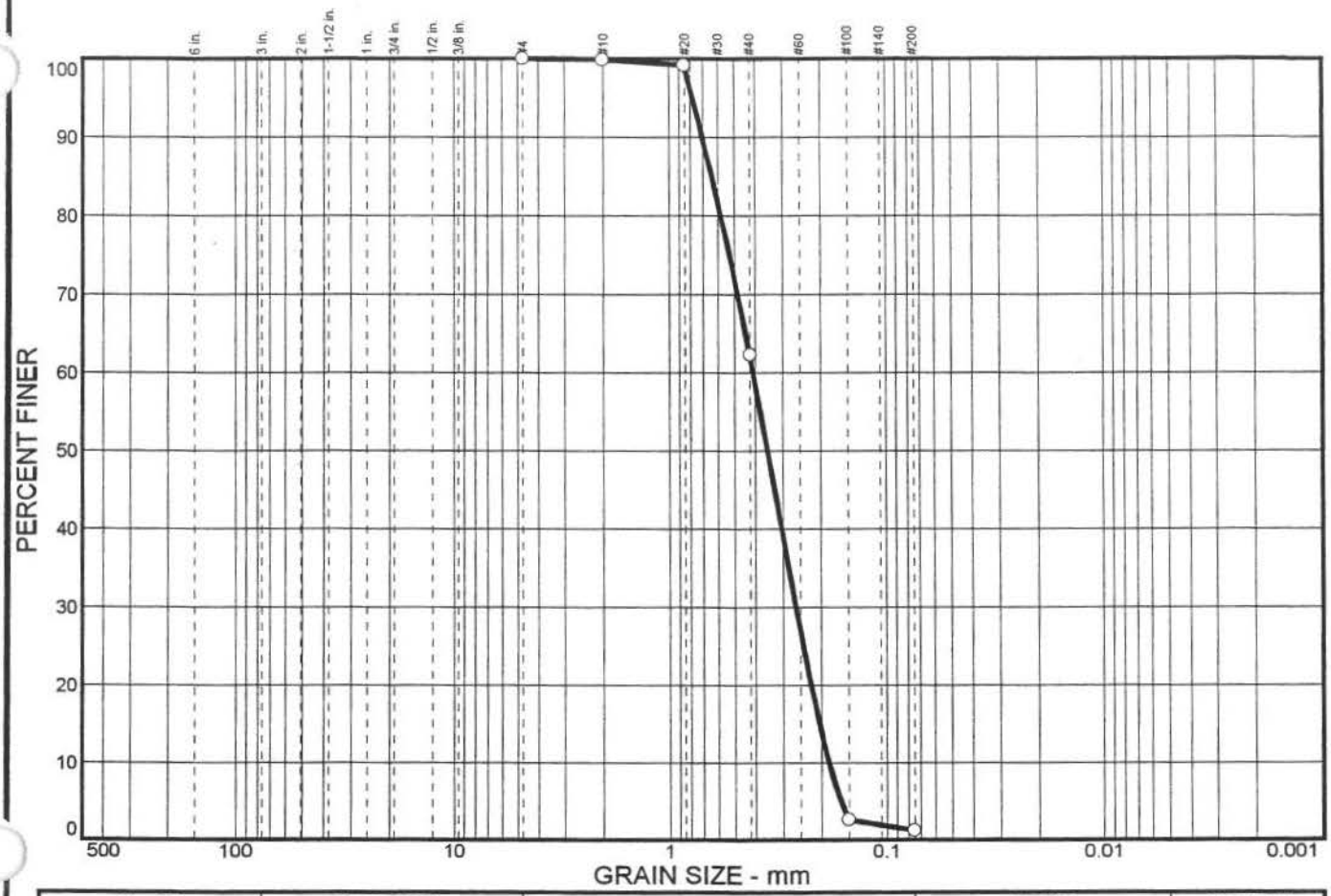
Remarks

Sample No.: 6-A **Source of Sample:** CB-CUL-1 **Date:** 7/13/98
Location: X=248651.1010 Y=212522.8620 **Elev./Depth:** 7.5'@ 9.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	98.8	1.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.2		
#40	62.3		
#100	2.6		
#200	1.2		

* (no specification provided)

Soil Description

SAND, trace silt, brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.638 D_{60}= 0.410 D_{50}= 0.352
D_{30}= 0.261 D_{15}= 0.203 D_{10}= 0.183
C_u= 2.23 C_c= 0.91

Classification

USCS= SP AASHTO=

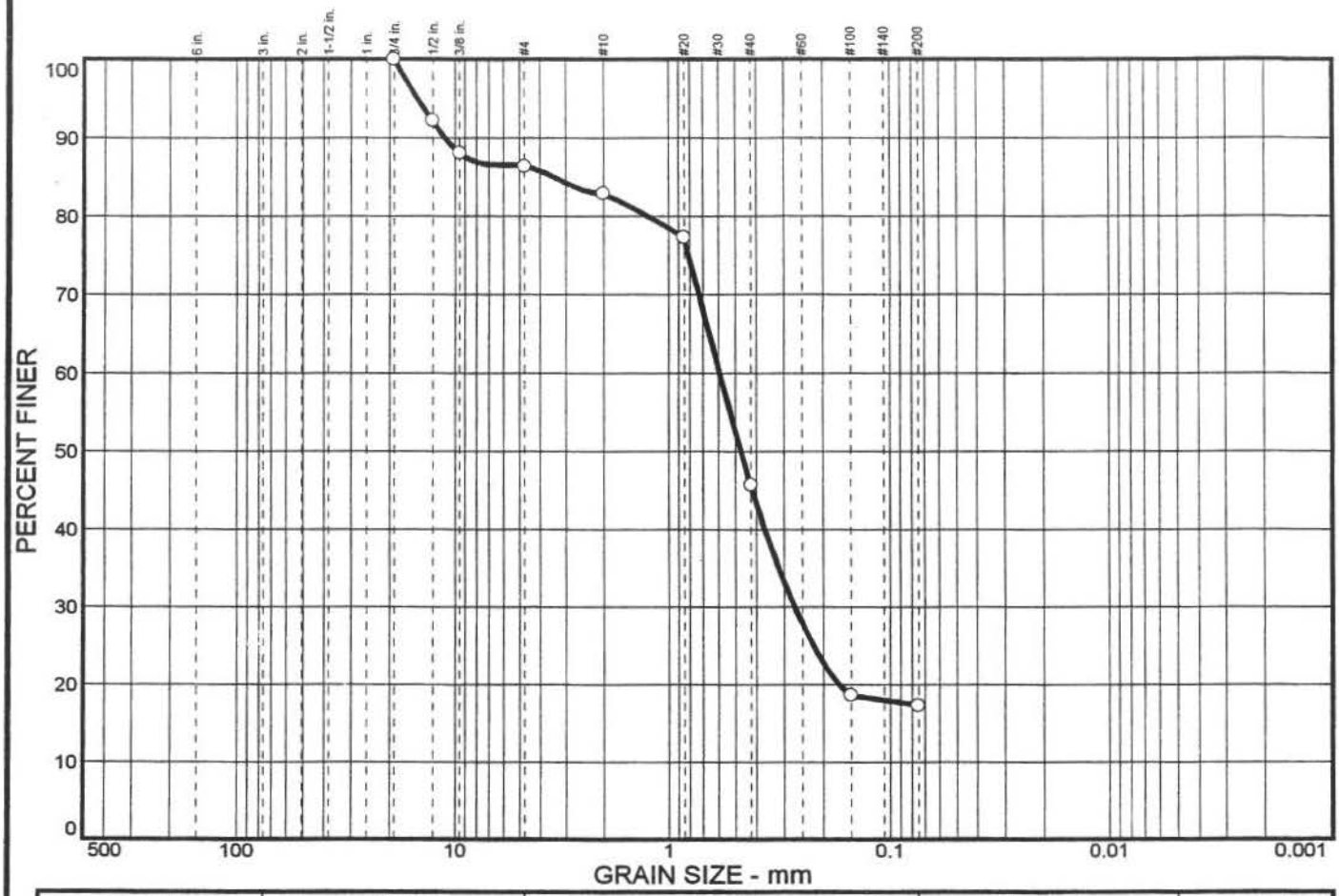
Remarks

Sample No.: 5-A **Source of Sample:** CB-CUL-2 **Date:** 7/13/98
Location: X=248794.8650 Y=211803.9720 **Elev./Depth:** 6.0' @ 7.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	13.6	69.1	17.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	92.2		
.375 in.	88.1		
#4	86.4		
#10	82.9		
#20	77.3		
#40	45.8		
#100	18.6		
#200	17.3		

* (no specification provided)

Soil Description

SAND, little clay, and gravel, dark gray to brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 3.41 D_{60}= 0.589 D_{50}= 0.470
D_{30}= 0.269 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

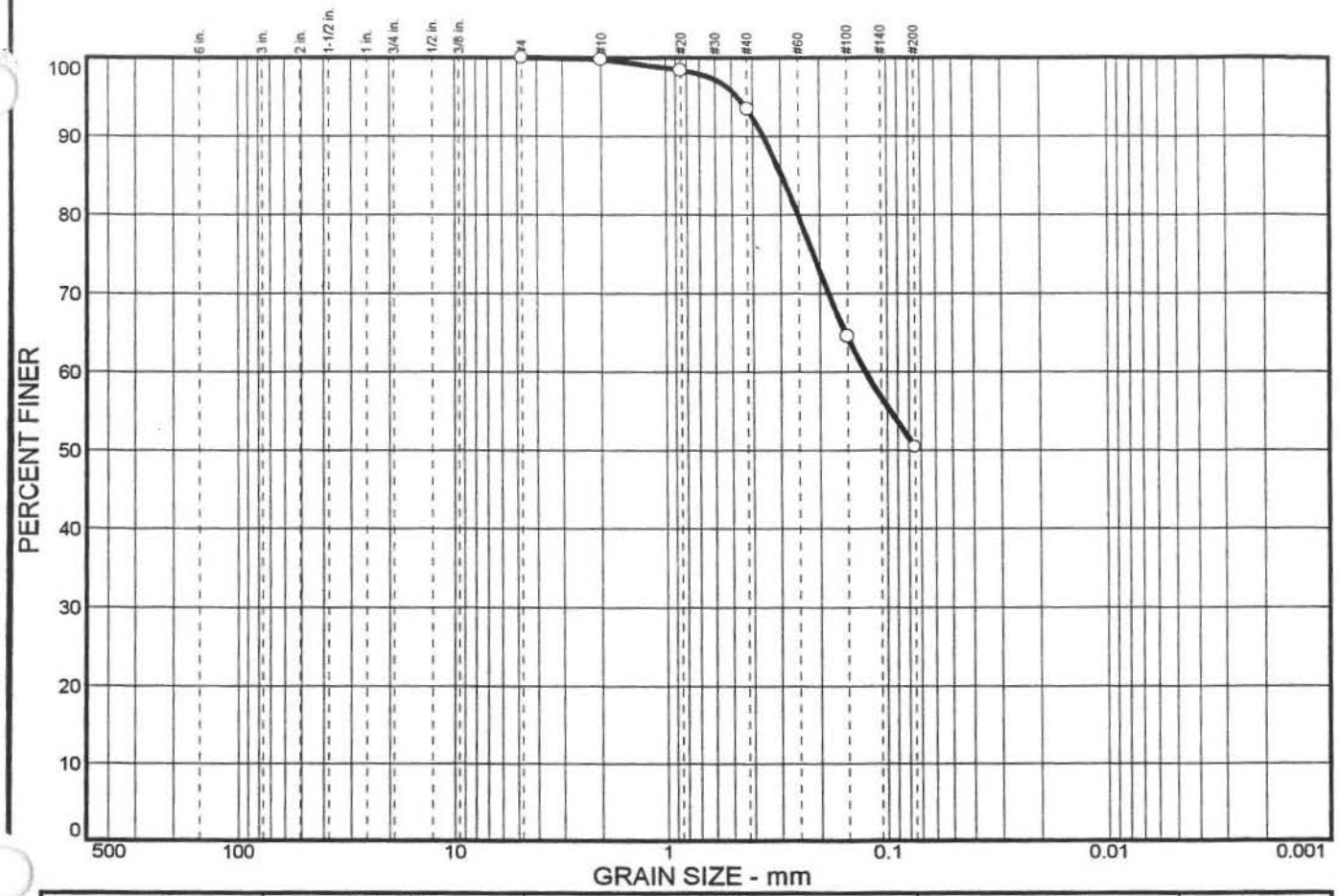
Remarks

Sample No.: 10-A **Source of Sample:** CB-CUL-3 **Date:** 7/13/98
Location: X=248954.5380 Y=211084.4600 **Elev./Depth:** 13.5' @ 15.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	49.5	50.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	98.4		
#40	93.5		
#100	64.6		
#200	50.5		

* (no specification provided)

Soil Description

Sandy CLAY, dark gray to brown.

Atterberg Limits

PL= 22.9 LL= 47.8 PI= 24.9

Coefficients

D_{85}= 0.296 D_{60}= 0.124 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO=

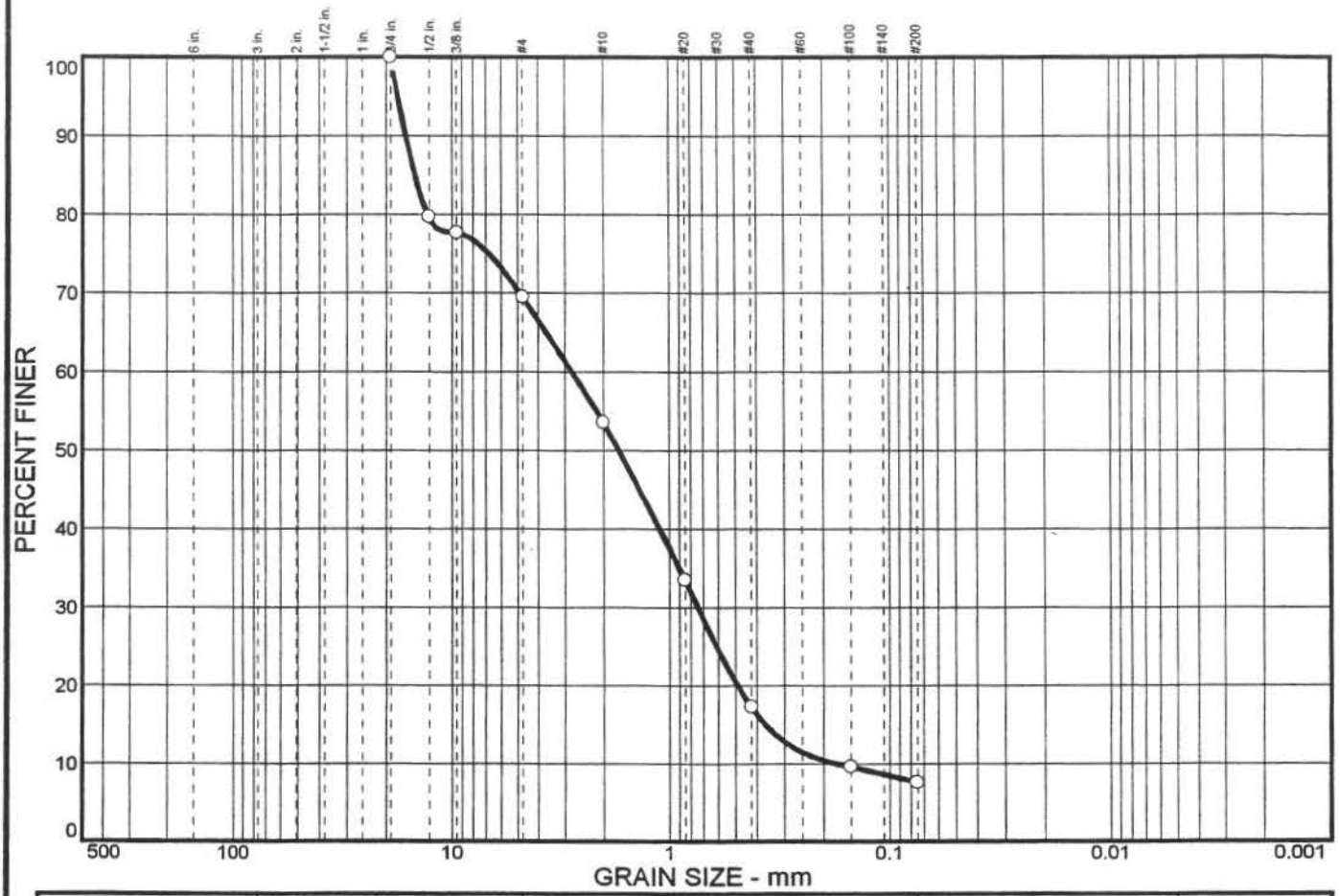
Remarks

Sample No.: 2-A **Source of Sample:** CB-CUL-3 **Date:** 7/13/98
Location: X=248954.5380 Y=211084.4600 **Elev./Depth:** 1.5' @ 3.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	30.5	61.9	7.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	79.7		
.375 in.	77.7		
#4	69.5		
#10	53.6		
#20	33.5		
#40	17.3		
#100	9.6		
#200	7.6		

* (no specification provided)

Soil Description

SAND, some gravel, trace silt, dark gray.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 14.7 D_{60}= 2.77 D_{50}= 1.69
D_{30}= 0.742 D_{15}= 0.365 D_{10}= 0.174
C_u= 15.97 C_c= 1.15

Classification

USCS= SW-SM AASHTO=

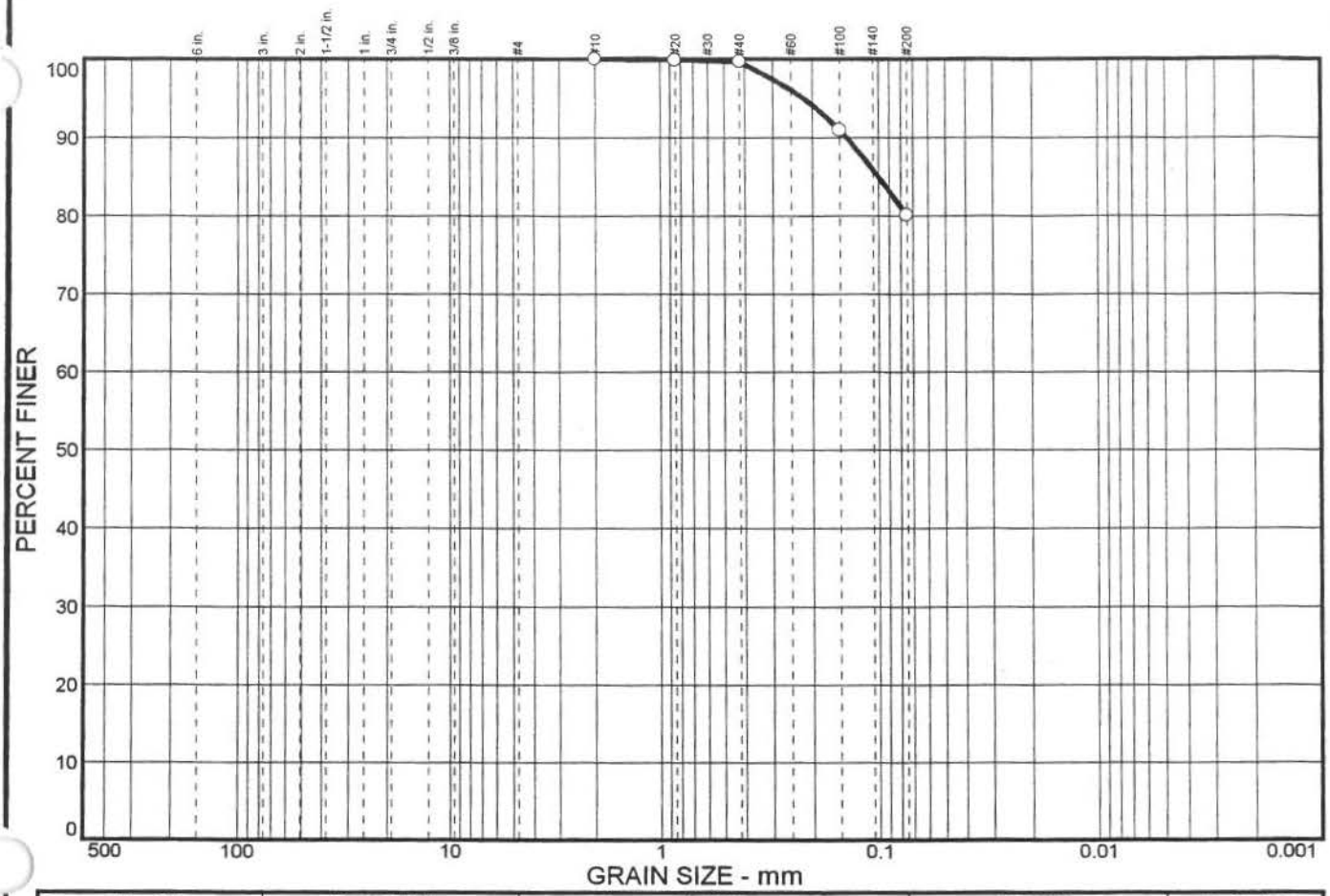
Remarks

Sample No.: 5-A **Source of Sample:** CB-CUL-3 **Date:** 7/13/98
Location: X=248954.5380 Y=211084.4600 **Elev./Depth:** 6.0' @ 7.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	19.9	80.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	99.7		
#100	91.0		
#200	80.1		

* (no specification provided)

Soil Description

SILT, little sand, dark gray.

Atterberg Limits

PL= 40.7 LL= 73.0 PI= 32.3

Coefficients

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

Classification

USCS= MH AASHTO=

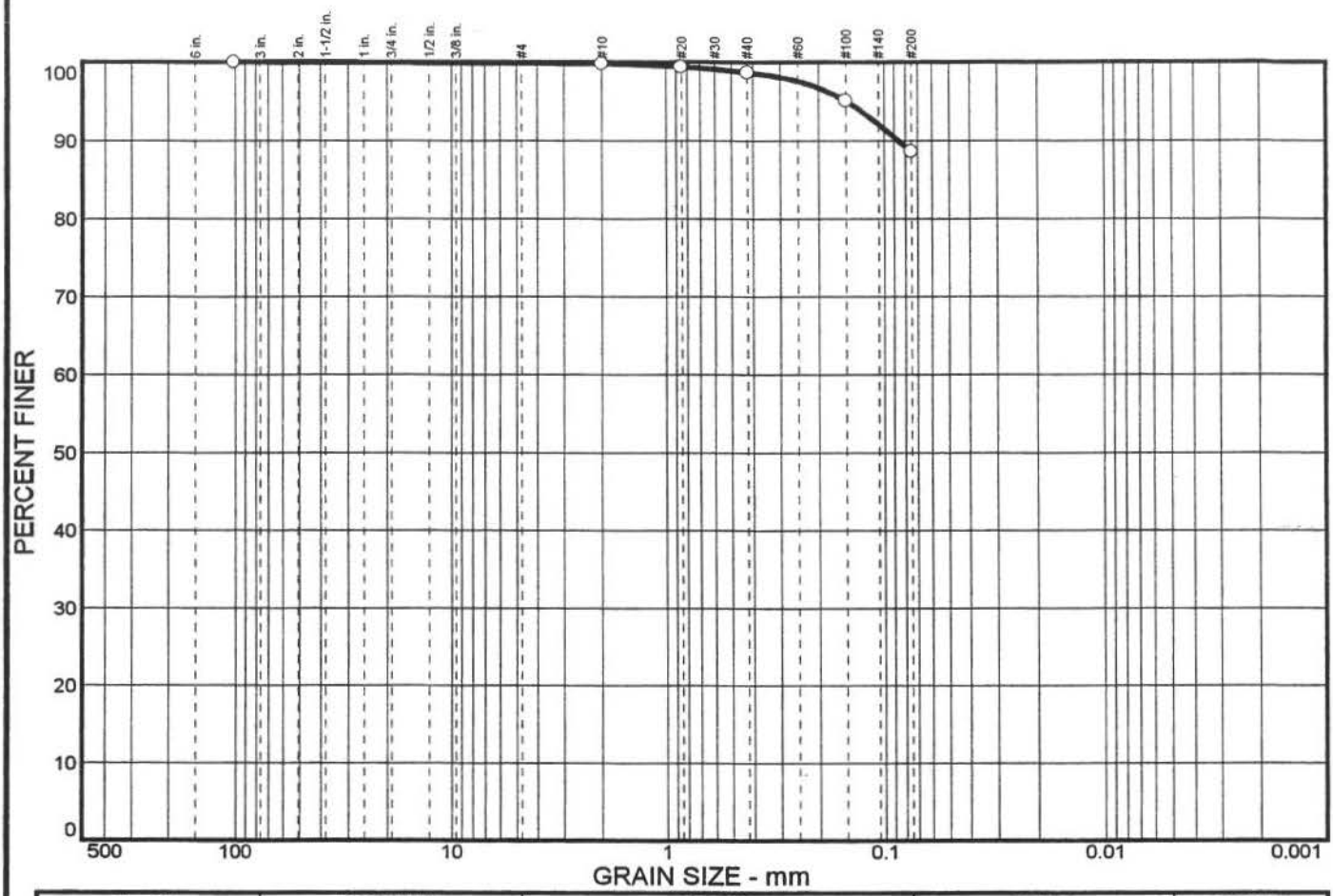
Remarks

Sample No.: 2-A **Source of Sample:** CB-CUL-4 **Date:** 7/13/98
Location: X=248335.6840 Y=210707.2820 **Elev./Depth:** 1.5' @ 3.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.1	11.2	88.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4 in.	100.0		
#10	99.8		
#20	99.4		
#40	98.7		
#100	95.1		
#200	88.6		

* (no specification provided)

Soil Description

SILT, little sand, trace gravel, dark gray.

Atterberg Limits

PL= 44.7 LL= 87.0 PI= 42.3

Coefficients

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

Classification

USCS= MH AASHTO=

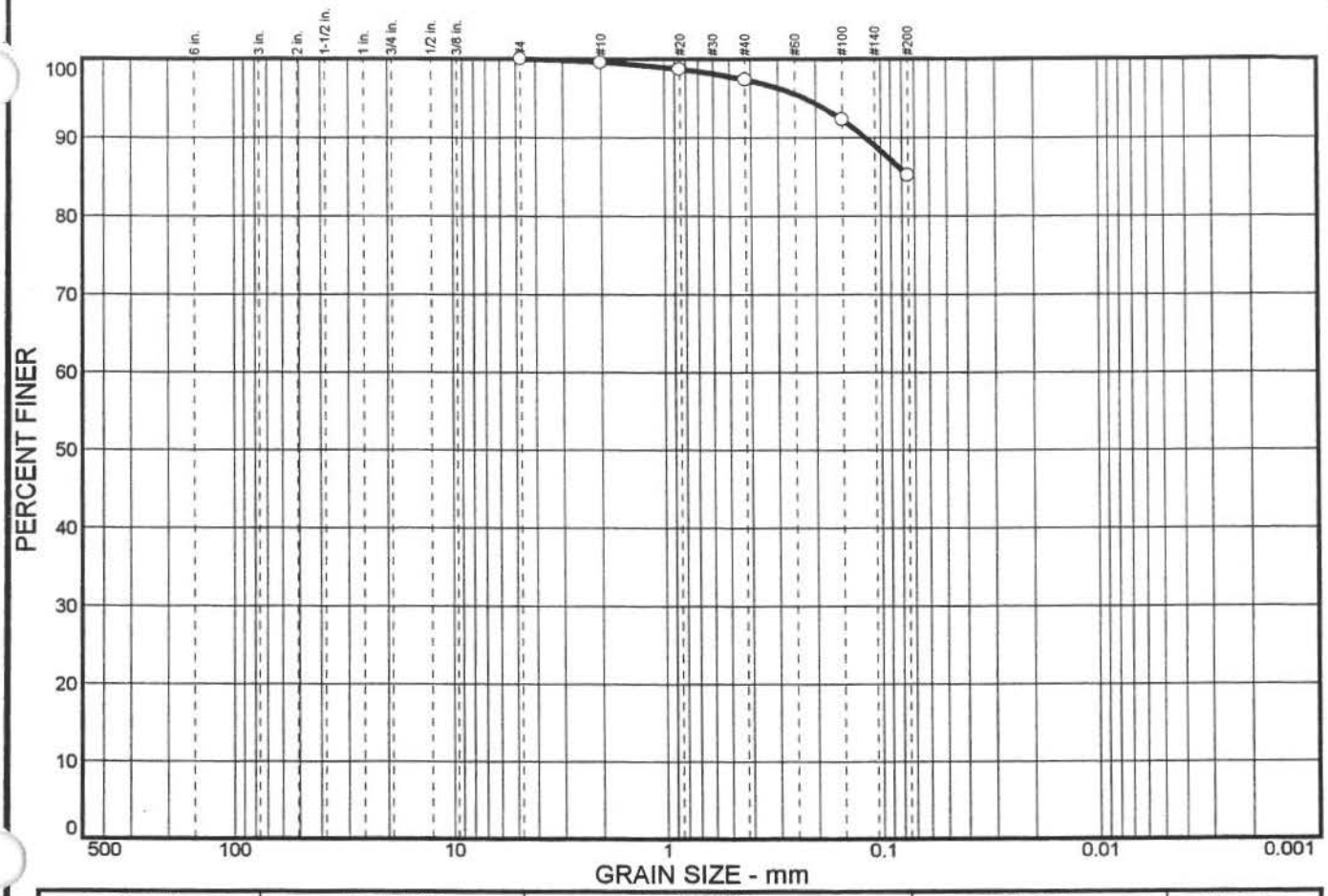
Remarks

Sample No.: 5-A **Source of Sample:** CB-CUL-4 **Date:** 7/13/98
Location: X=248335.6840 Y=210707.2820 **Elev./Depth:** 6.0' @ 7.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	14.8	85.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	98.7		
#40	97.4		
#100	92.3		
#200	85.2		

* (no specification provided)

Soil Description

CLAY, little sand, brown to dark brown.

Atterberg Limits

PL= 34.0 LL= 76.0 PI= 41.9

Coefficients

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

Classification

USCS= CH AASHTO=

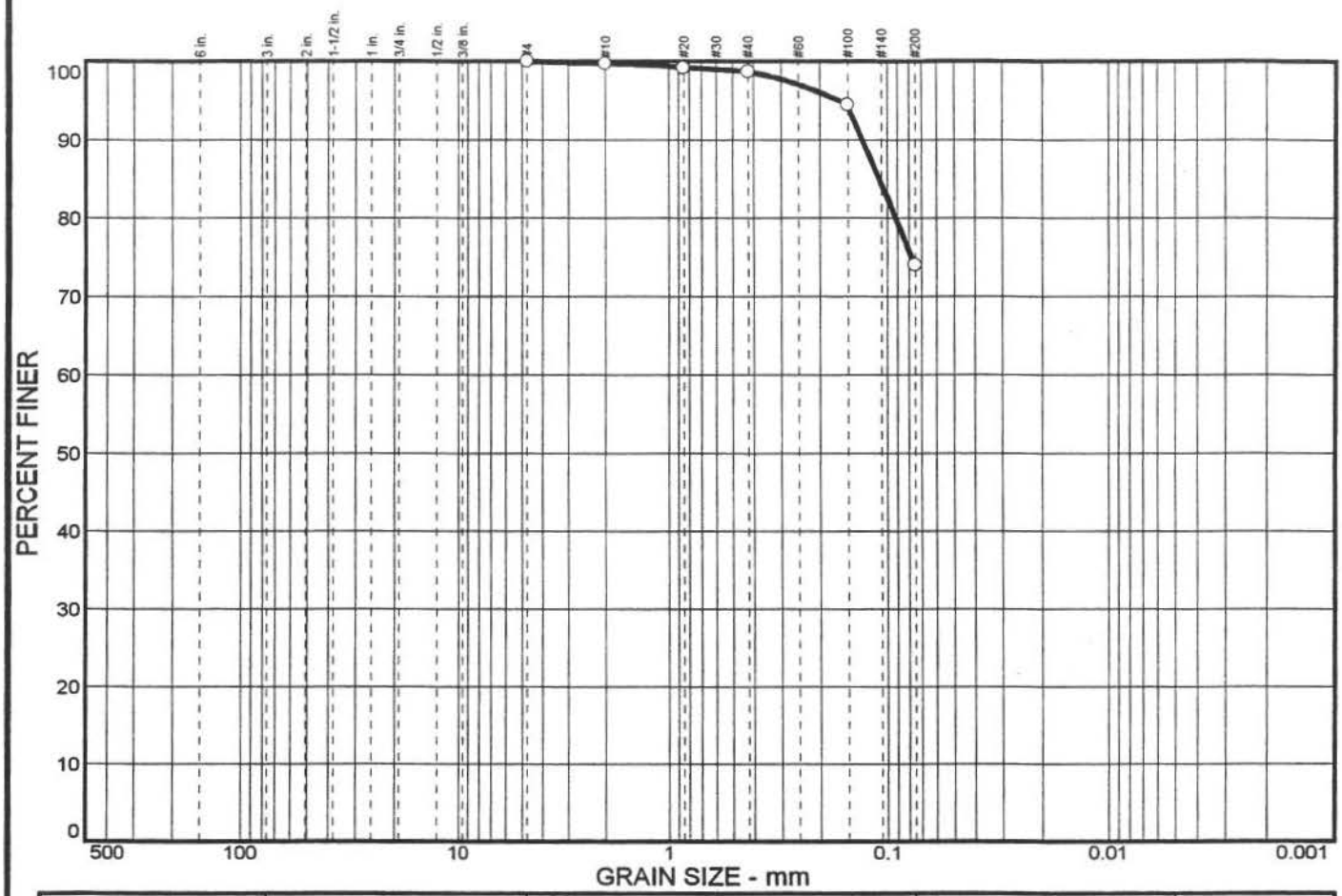
Remarks

Sample No.: 2-A **Source of Sample:** CB-CUL-5 **Date:** 7/9/98
Location: X=249055.4050 Y=210334.2330 **Elev./Depth:** 1.5' @ 3.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	26.0	74.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	99.2		
#40	98.7		
#100	94.5		
#200	74.0		

* (no specification provided)

Soil Description

SILT, some sand, dark gray.

Atterberg Limits

PL= 39.8 LL= 61.6 PI= 21.8

Coefficients

D_{85}= 0.108 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

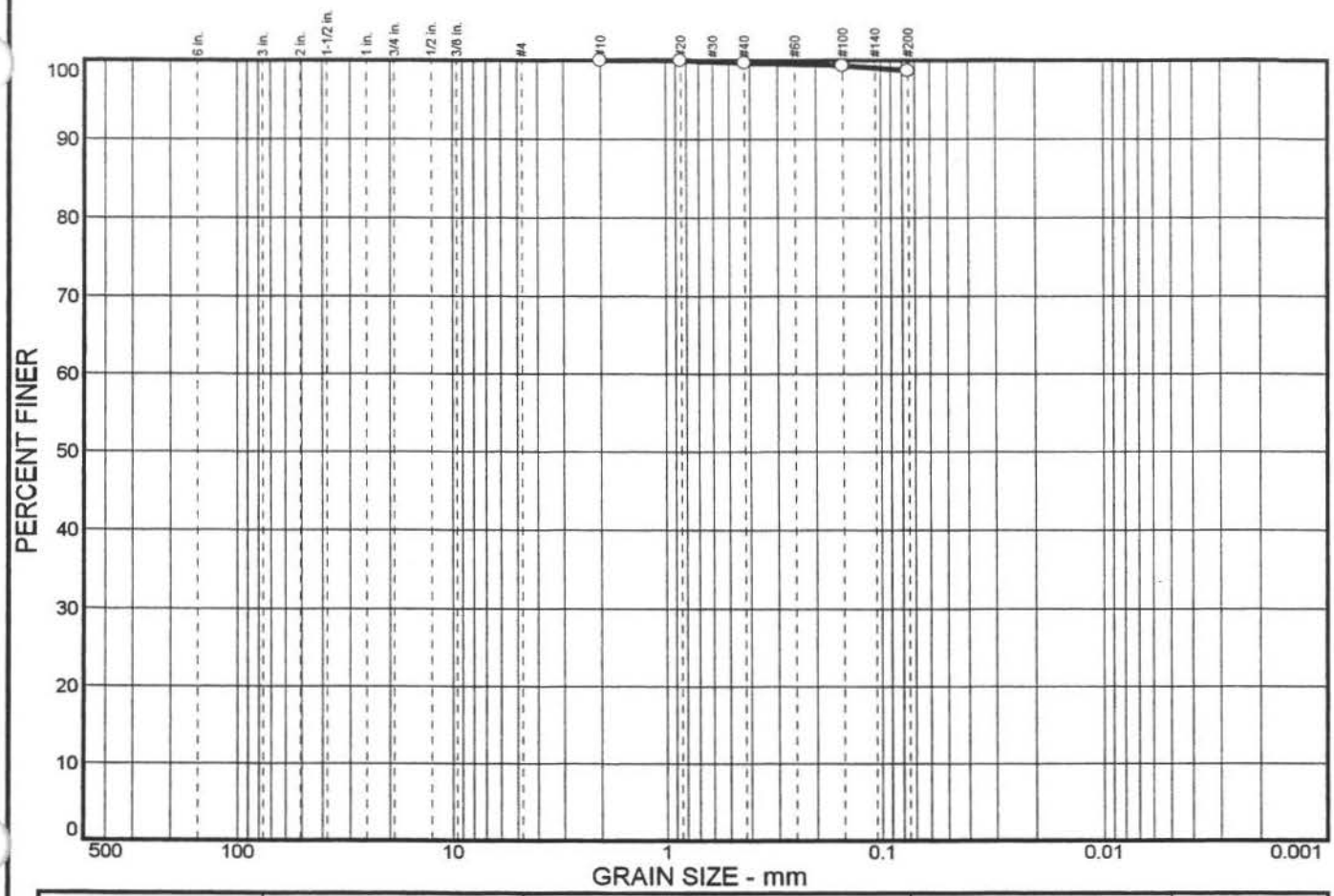
Remarks

Sample No.: 7-A **Source of Sample:** CB-CUL-5 **Date:** 7/9/98
Location: X=249055.4050 Y=210334.2330 **Elev./Depth:** 9.0' @ 10.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	1.3	98.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.7		
#100	99.3		
#200	98.7		

* (no specification provided)

Soil Description

CLAY, trace sand, gray.

Atterberg Limits

PL= 29.9 LL= 92.6 PI= 62.7

Coefficients

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

Classification

USCS= CH AASHTO=

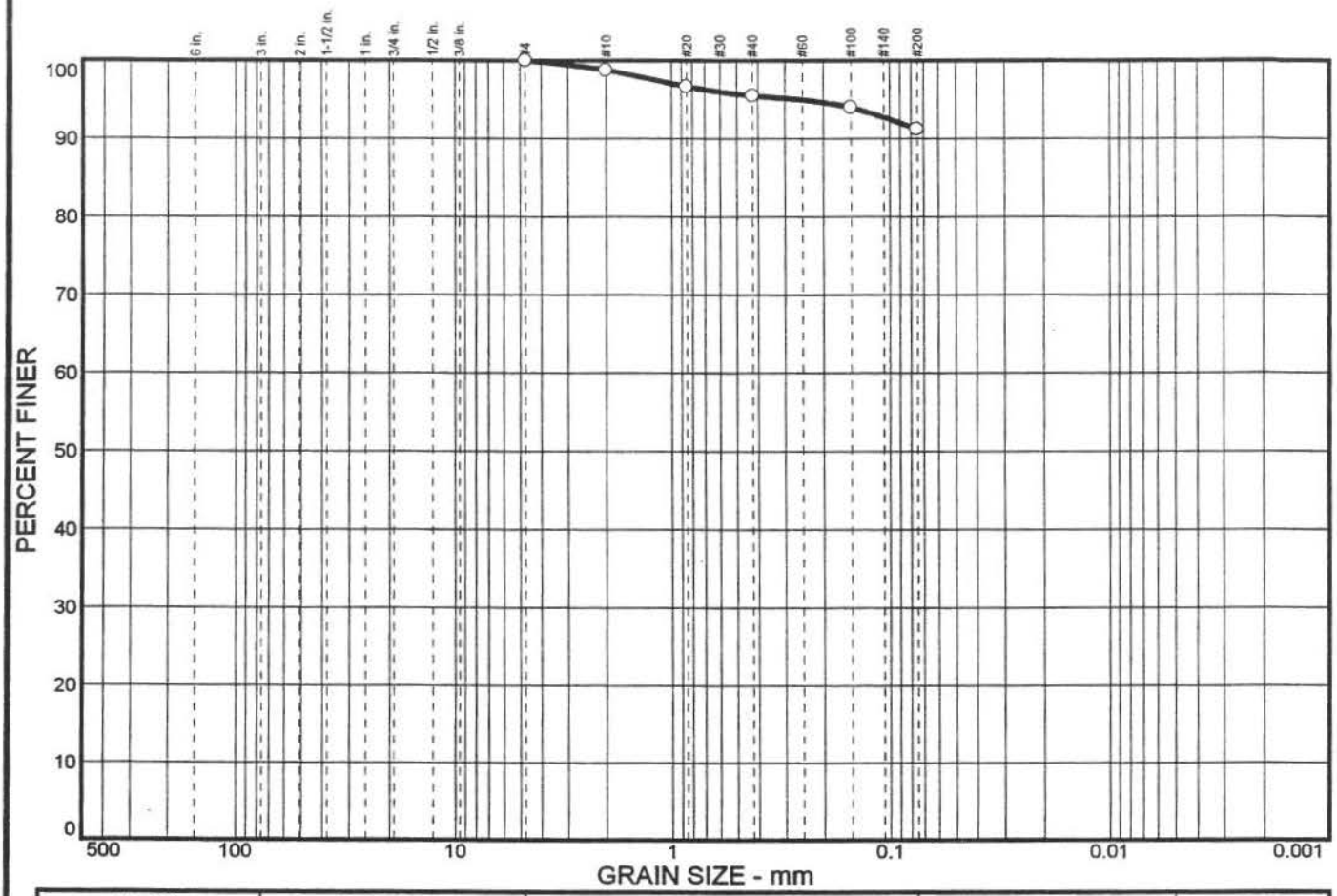
Remarks

Sample No.: 5-A **Source of Sample:** CB-CUL-6 **Date:** 7/9/98
Location: X=249179.6470 Y=209625.8930 **Elev./Depth:** 6.0' @ 7.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	8.8	91.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.8		
#20	96.7		
#40	95.5		
#100	94.0		
#200	91.2		

* (no specification provided)

Soil Description

SILT, trace sand, gray.

Atterberg Limits

PL= 42.7 LL= 73.0 PI= 30.3

Coefficients

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

Classification

USCS= MH AASHTO=

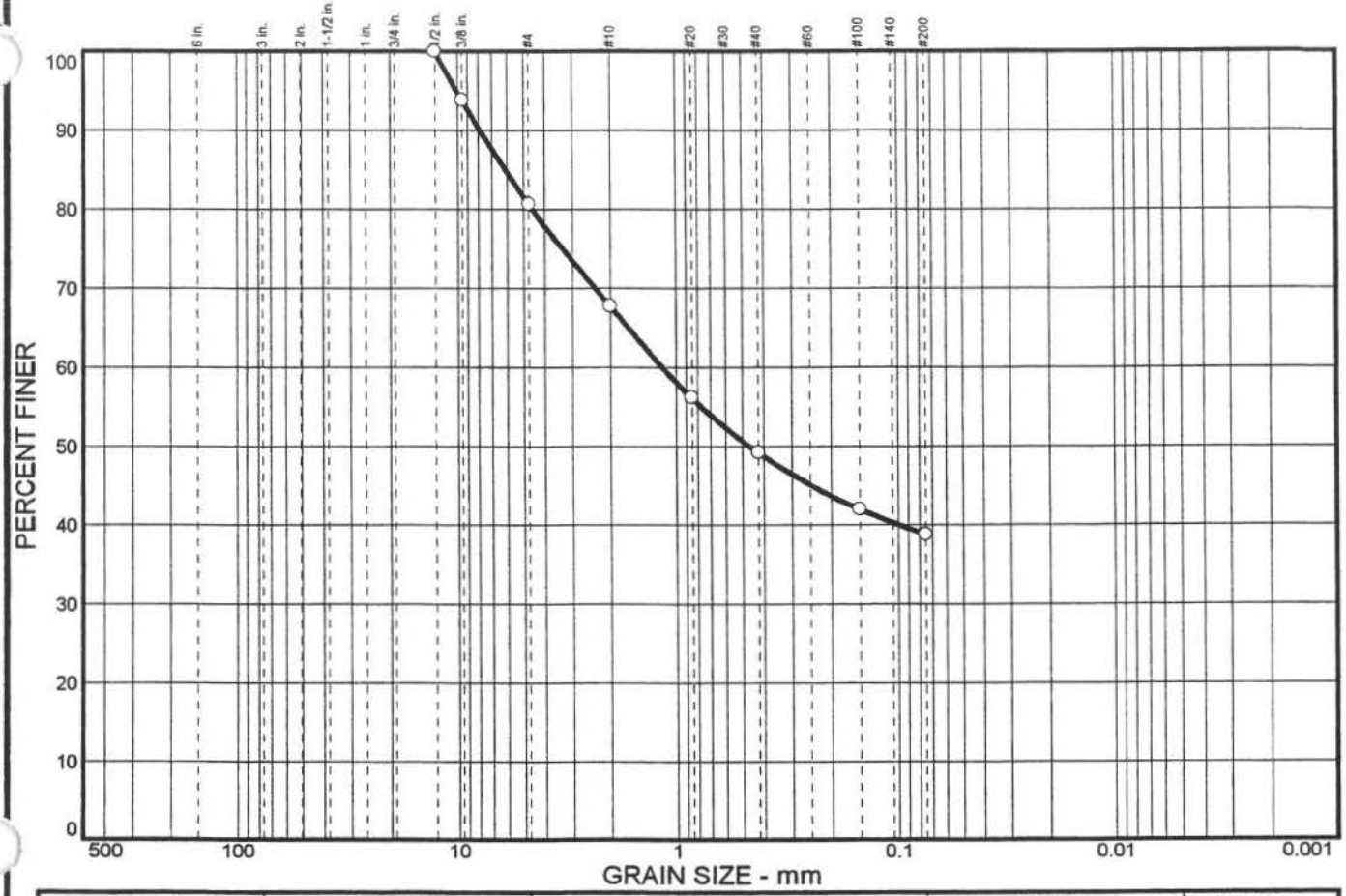
Remarks

Sample No.: 7-A **Source of Sample:** CB-CUL-6 **Date:** 7/9/98
Location: X=249179.6470 Y=209625.8930 **Elev./Depth:** 9.0' @ 10.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	19.3	41.9	38.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
.375 in.	93.9		
#4	80.7		
#10	67.8		
#20	56.2		
#40	49.3		
#100	42.0		
#200	38.8		

* (no specification provided)

Soil Description

Clayey SAND, little gravel,pale brown.

Atterberg Limits

PL= 13.0 LL= 33.8 PI= 20.8

Coefficients

D_{85}= 6.06 D_{60}= 1.15 D_{50}= 0.461
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

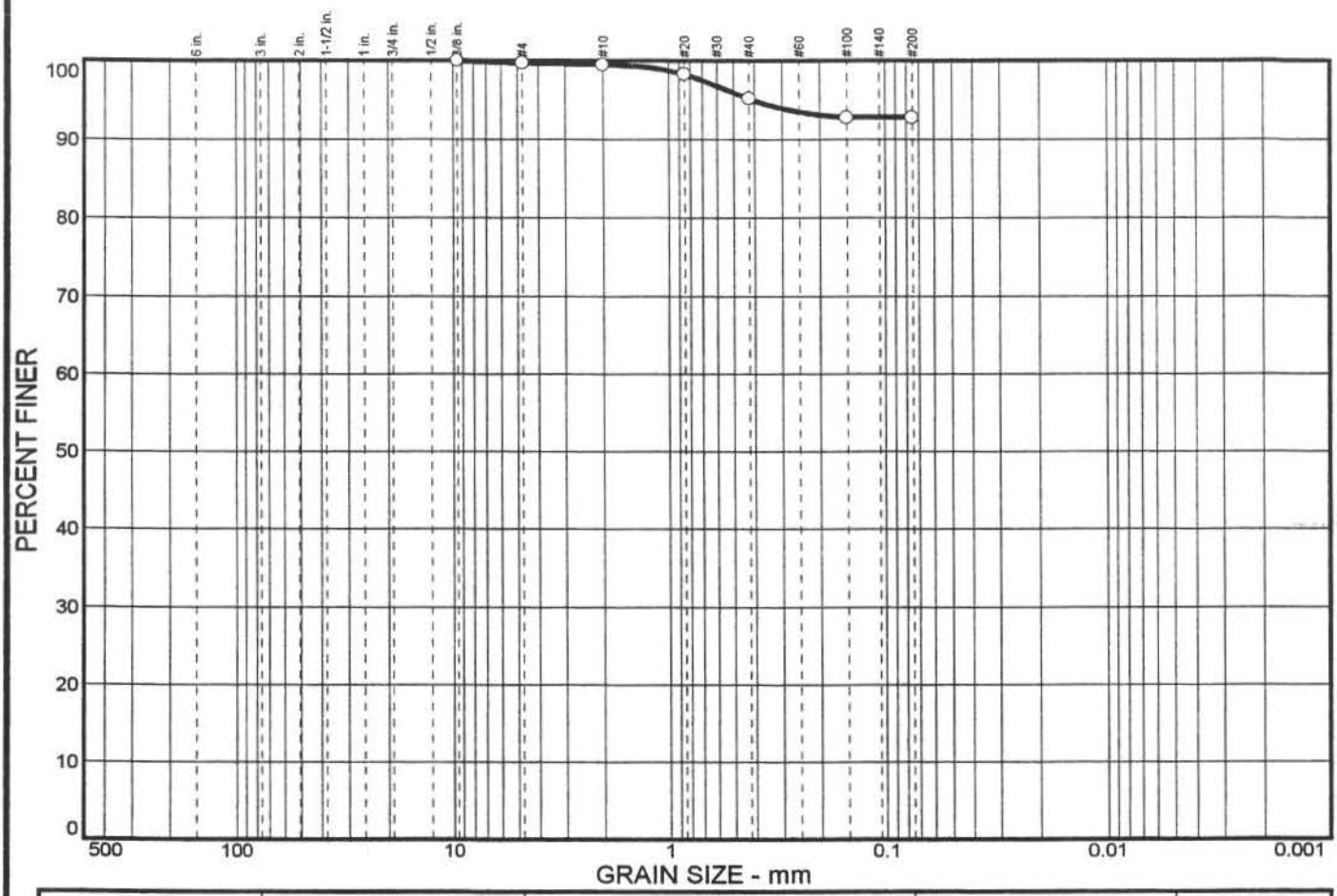
Remarks

Sample No.: 3-A **Source of Sample:** CB-CUL-7 **Date:** 7/16/98
Location: X=249300.8160 Y=208732.9660 **Elev./Depth:** 3.0' @ 4.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.3	6.9	92.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	99.7		
#10	99.5		
#20	98.3		
#40	95.2		
#100	92.8		
#200	92.8		

* (no specification provided)

Soil Description

CLAY, trace sand and gravel, dark brown.

Atterberg Limits

PL= 29.8 LL= 87.0 PI= 57.2

Coefficients

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

Classification

USCS= CH AASHTO=

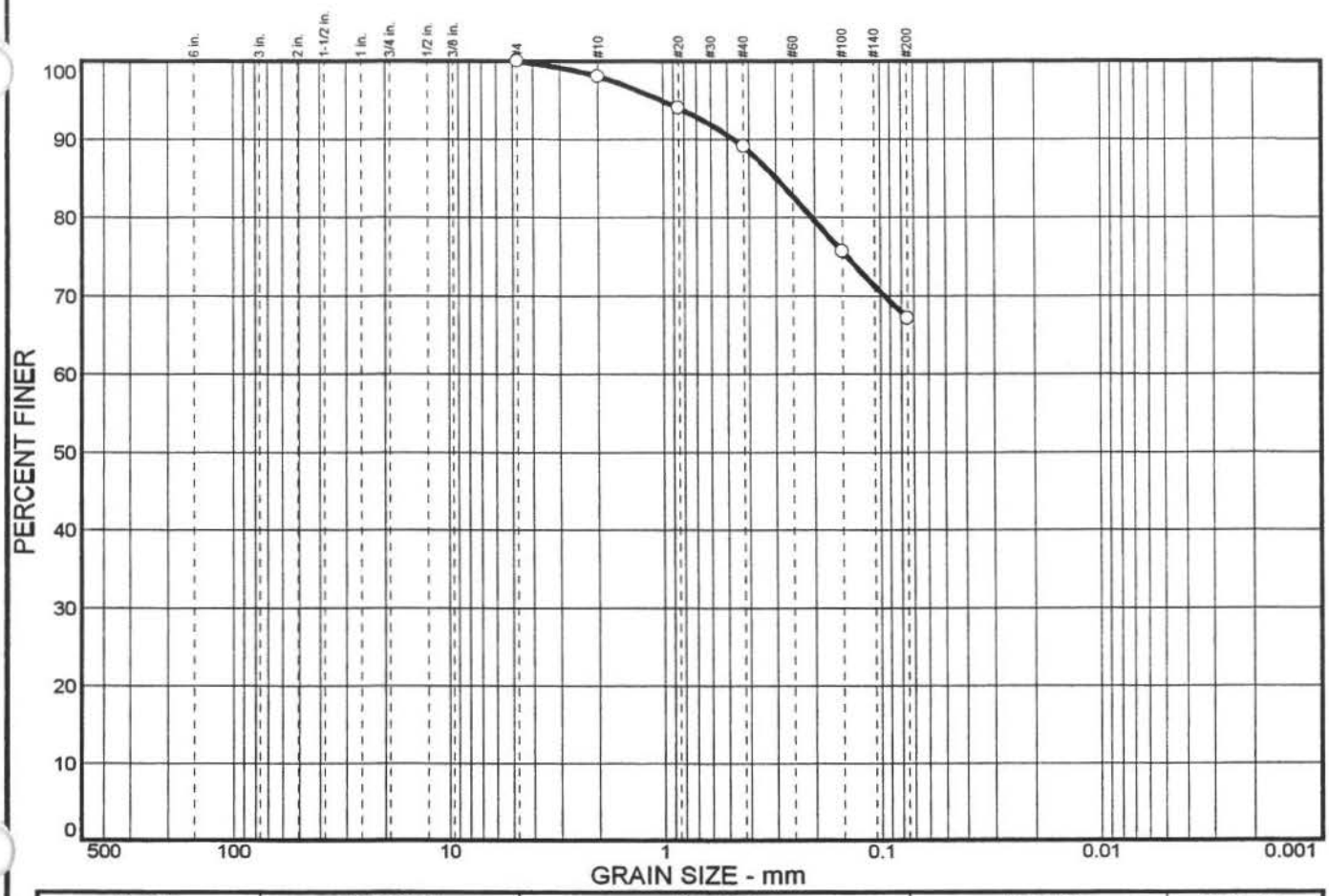
Remarks

Sample No.: 5-A **Source of Sample:** CB-CUL-7 **Date:** 7/13/98
Location: X=249300.8160 Y=208732.9660 **Elev./Depth:** 6.0' @ 7.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	32.8	67.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.1		
#20	94.0		
#40	89.1		
#100	75.7		
#200	67.2		

* (no specification provided)

Soil Description

SILT, some sand, dark gray.

Atterberg Limits

PL= 68.2 LL= 86.0 PI= 17.8

Coefficients

D_{85}= 0.297 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

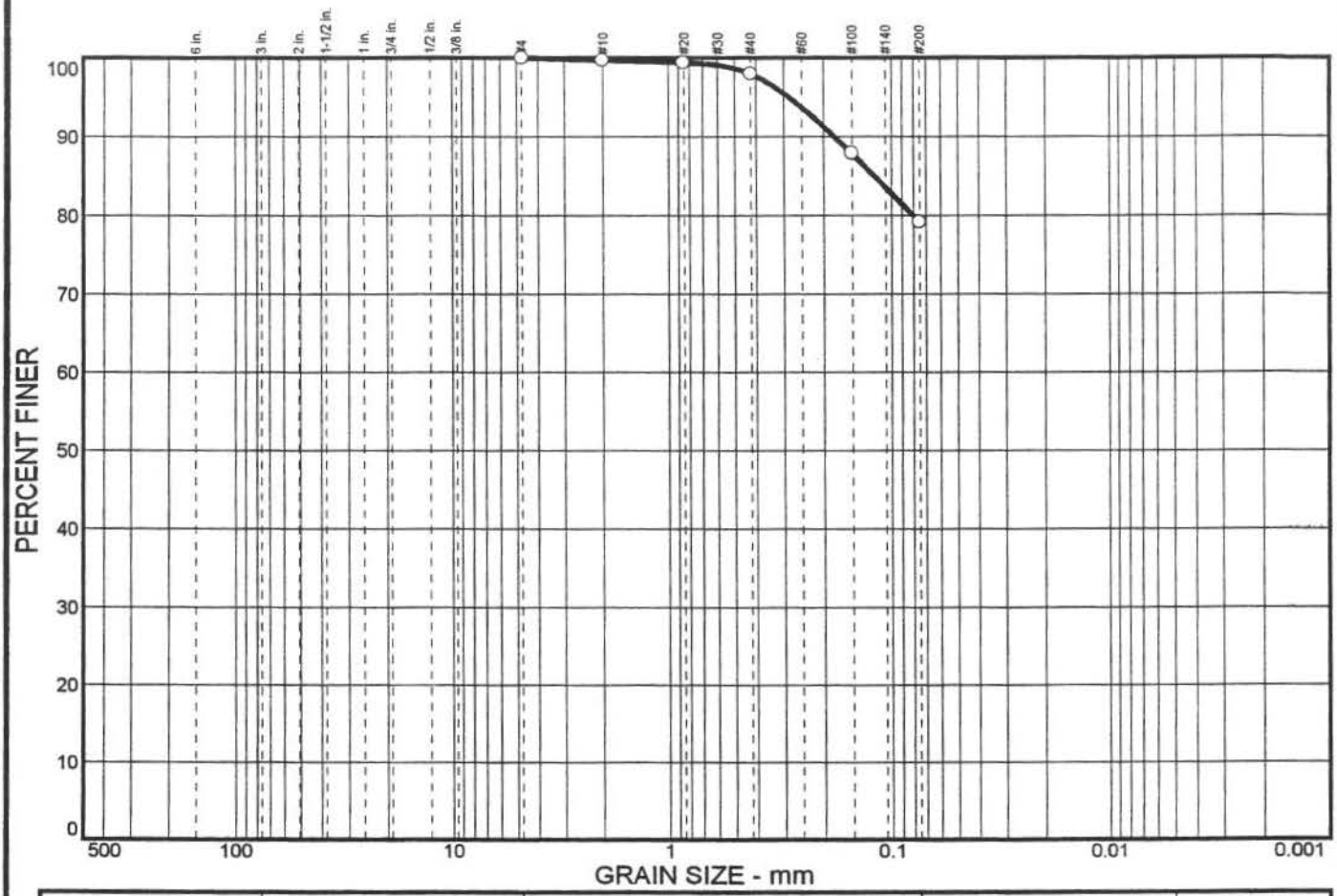
Remarks

Sample No.: 6-A **Source of Sample:** CB-CUL-7 **Date:** 7/13/98
Location: X=249300.8160 Y=208732.9660 **Elev./Depth:** 7.5' @ 9.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	20.8	79.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	99.4		
#40	98.0		
#100	87.9		
#200	79.2		

* (no specification provided)

Soil Description

SILT, some sand, dark gray.

Atterberg Limits

PL= 45.8 LL= 60.0 PI= 14.2

Coefficients

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

Classification

USCS= MH AASHTO=

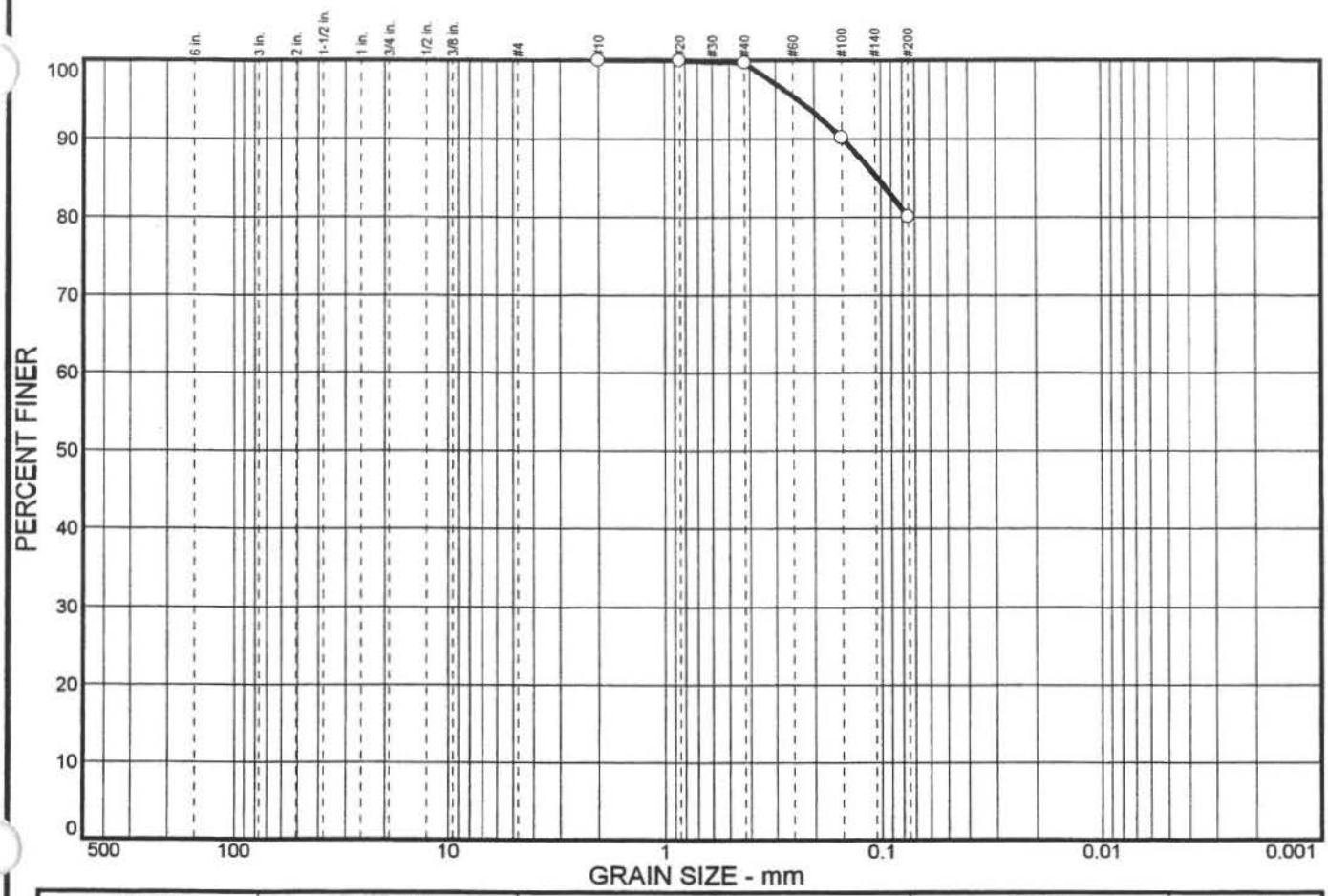
Remarks

Sample No.: 8-A **Source of Sample:** CB-CUL-7 **Date:** 7/14/98
Location: X=249300.8160 Y=208732.9660 **Elev./Depth:** 10.5' @ 12.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	19.9	80.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.7		
#100	90.2		
#200	80.1		

* (no specification provided)

Soil Description

SILT, little sand, dark gray.

Atterberg Limits

PL= 34.5 LL= 62.8 PI= 28.3

Coefficients

D_{85}= 0.103 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

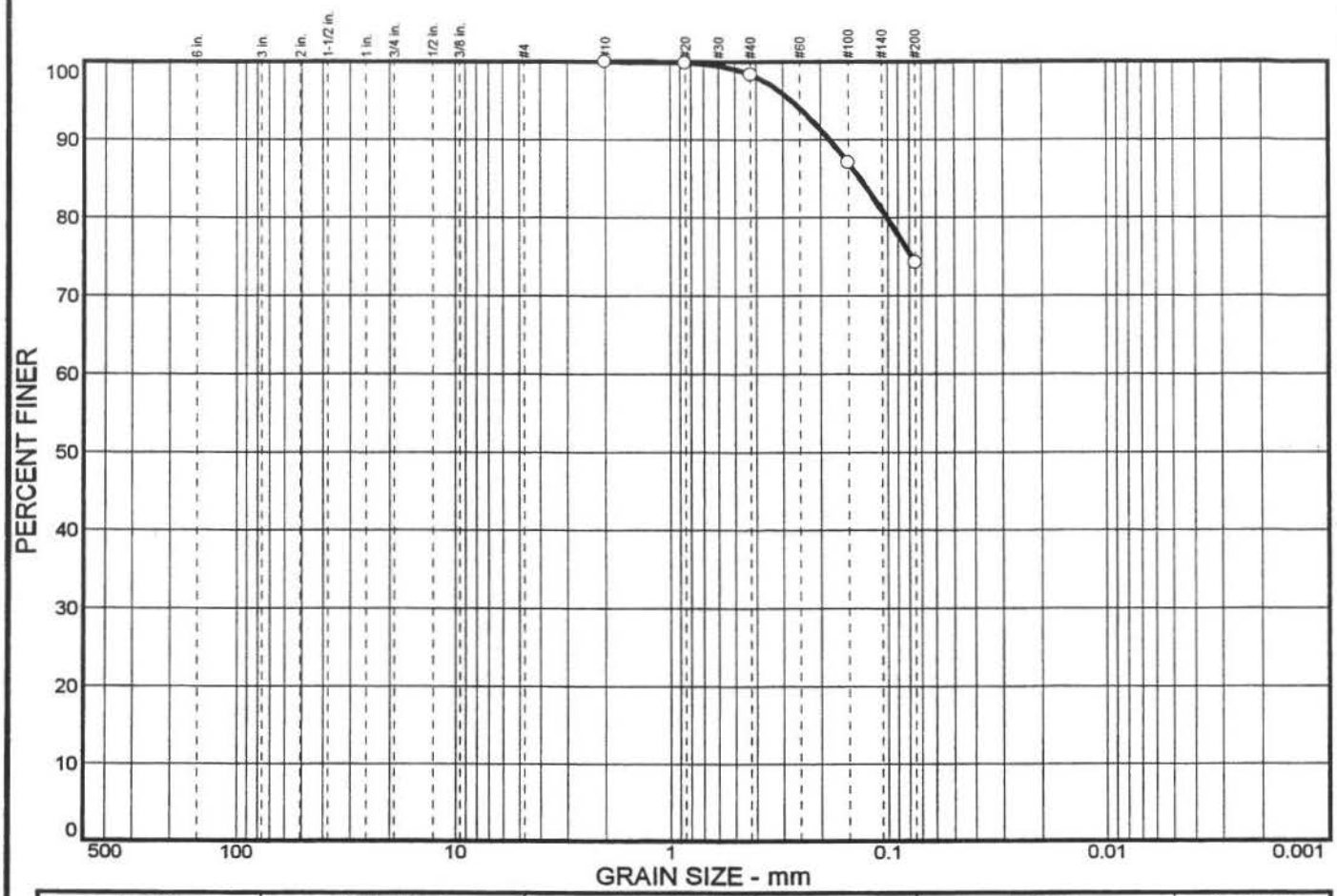
Remarks

Sample No.: 10-A **Source of Sample:** CB-CUL-7 **Date:** 7/13/98
Location: X=249300.8160 Y=208732.9660 **Elev./Depth:** 13.5' @ 14.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	25.7	74.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	98.4		
#100	87.1		
#200	74.3		

* (no specification provided)

Soil Description

CLAY, some sand, dark brown.

Atterberg Limits

PL= 28.4 LL= 61.9 PI= 33.53

Coefficients

D_{85}= 0.132 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO=

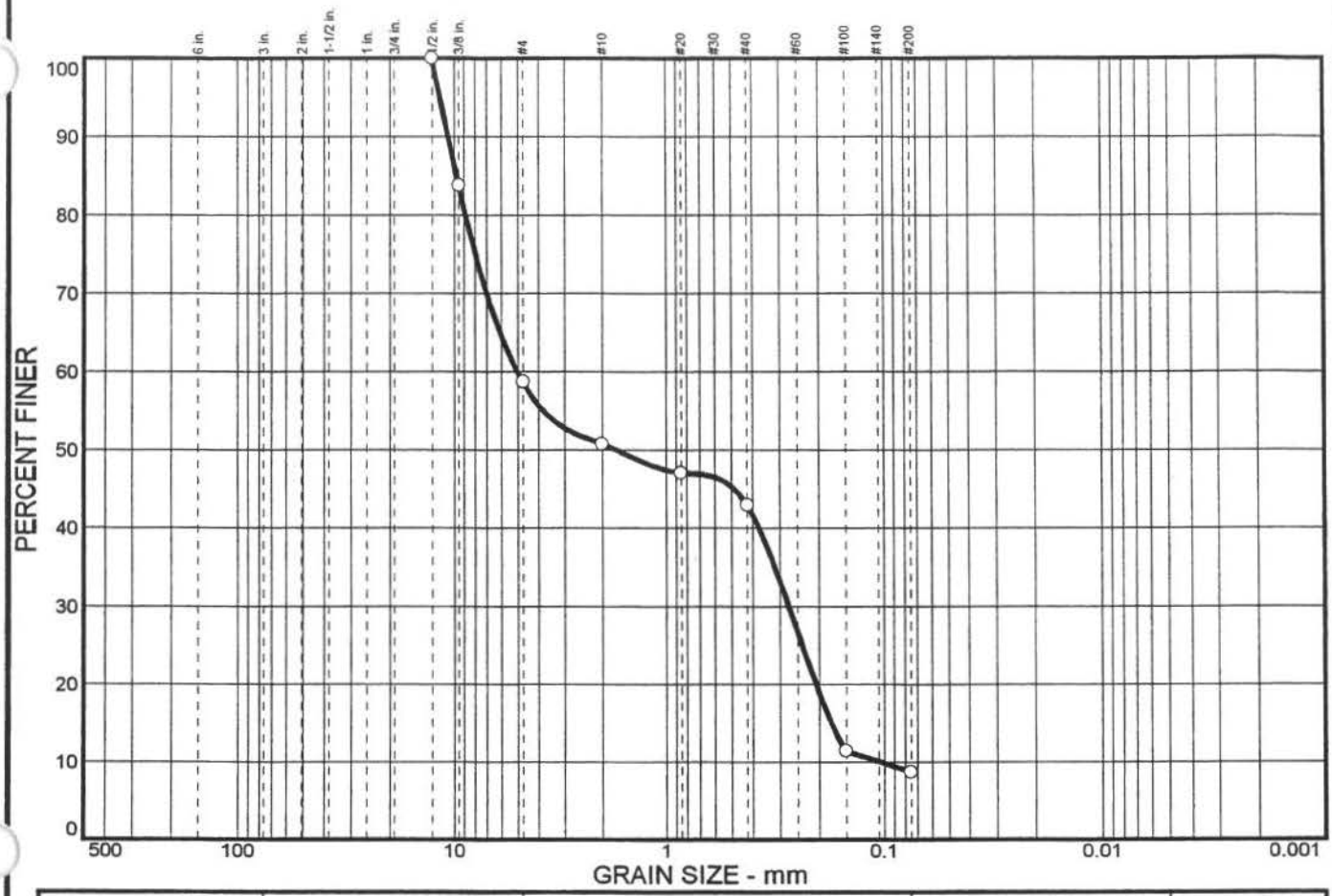
Remarks

Sample No.: 2-A **Source of Sample:** CB-CUL-8 **Date:** 7/13/98
Location: X=249547.2720 Y=207854.5940 **Elev./Depth:** 1.5' @ 3.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	41.3	50.0	8.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
.375 in.	83.8		
#4	58.7		
#10	50.8		
#20	47.1		
#40	43.0		
#100	11.4		
#200	8.7		

* (no specification provided)

Soil Description

Gravelly SAND, trace silt, brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 9.75 D_{60}= 5.04 D_{50}= 1.70
D_{30}= 0.273 D_{15}= 0.175 D_{10}= 0.105
C_u= 48.12 C_c= 0.14

Classification

USCS= SP-SM AASHTO=

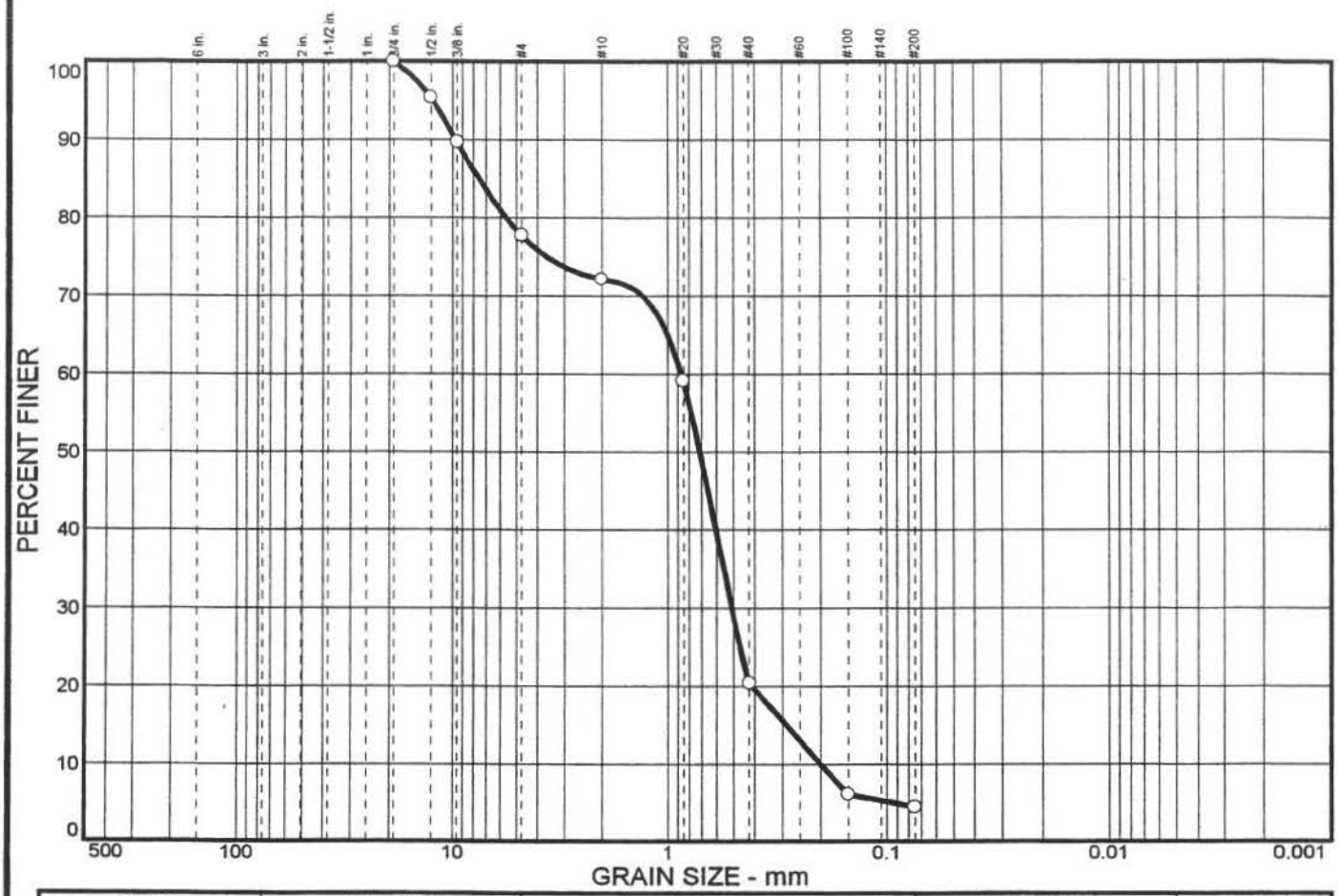
Remarks

Sample No.: 8-A **Source of Sample:** CB-CUL-8 **Date:** 7/13/98
Location: X=249547.2720 Y=207854.5940 **Elev./Depth:** 10.5' @ 12.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	22.2	73.3	4.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	95.4		
.375 in.	89.7		
#4	77.8		
#10	72.2		
#20	59.2		
#40	20.4		
#100	6.1		
#200	4.5		

* (no specification provided)

Soil Description

SAND, some gravel, trace silt, brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 7.52 D_{60}= 0.866 D_{50}= 0.710
D_{30}= 0.510 D_{15}= 0.287 D_{10}= 0.199
C_u= 4.35 C_c= 1.51

Classification

USCS= SP AASHTO=

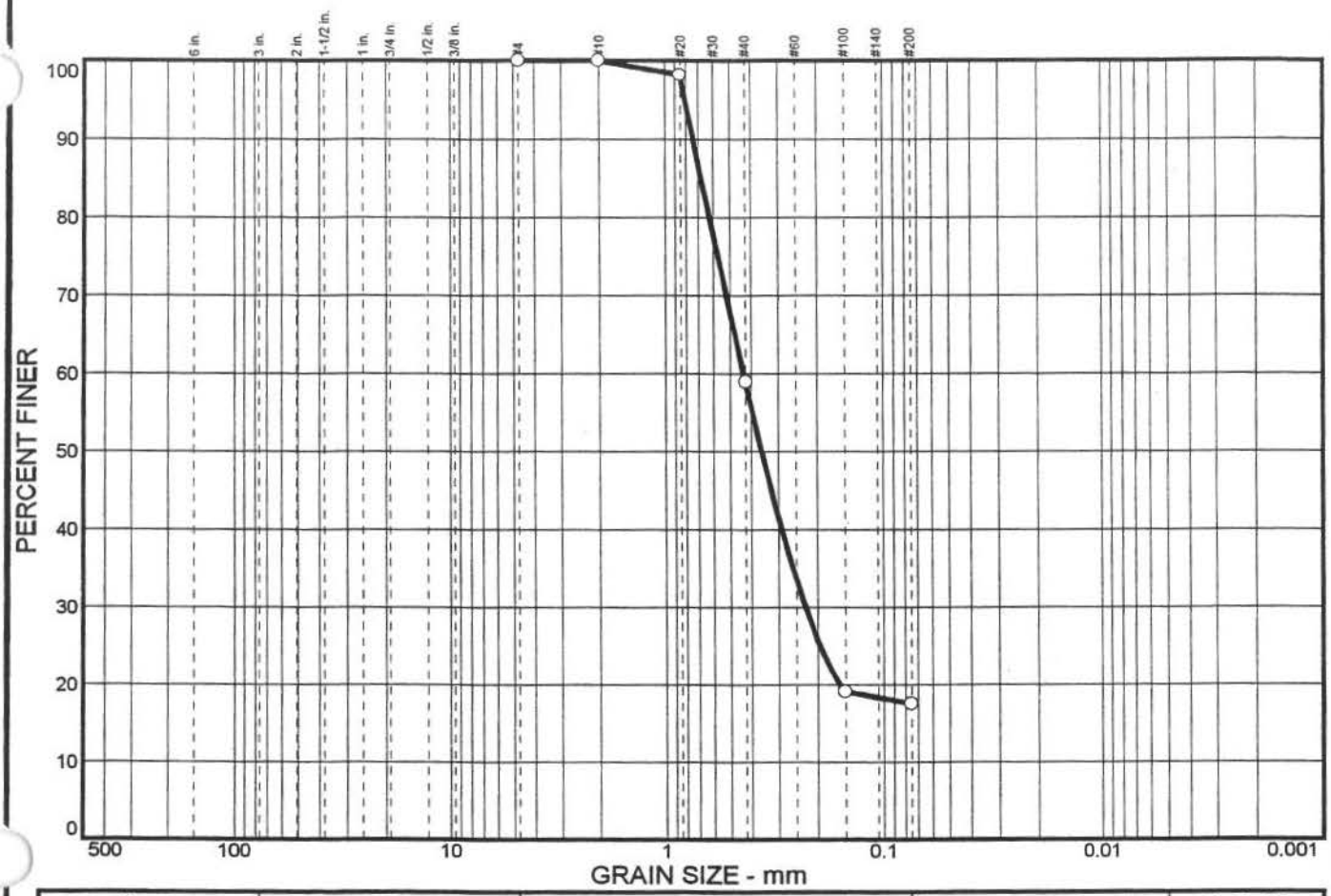
Remarks

Sample No.: 7-A **Source of Sample:** CB-CUL-9 **Date:** 7/13/98
Location: X=246626.7660 Y=207831.6890 **Elev./Depth:** 9.0' @ 10.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	82.5	17.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	98.2		
#40	59.0		
#100	19.1		
#200	17.5		

* (no specification provided)

Soil Description

SAND, little silt, dark brown.

Atterberg Limits

PL= 16.2 LL= 19.1 PI= 2.9

Coefficients

D_{85}= 0.677 D_{60}= 0.433 D_{50}= 0.357
D_{30}= 0.226 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

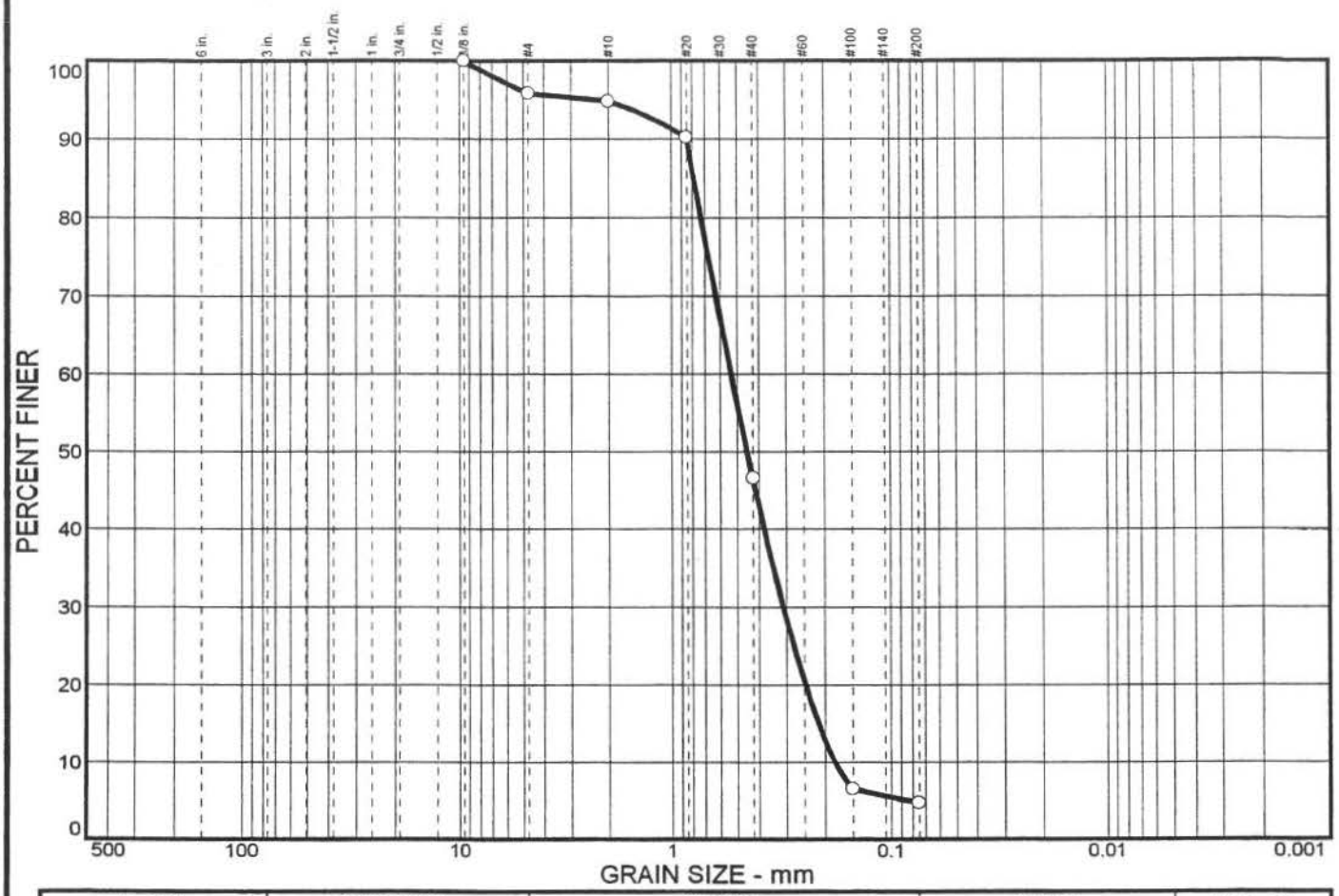
Remarks

Sample No.: 2-A **Source of Sample:** CB-CUL-10 **Date:** 7/13/98
Location: X=247098.7150 Y=207984.1560 **Elev./Depth:** 1.5' @ 3.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	4.2	91.1	4.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	95.8		
#10	94.8		
#20	90.2		
#40	46.6		
#100	6.5		
#200	4.7		

* (no specification provided)

Soil Description

SAND, trace silt and gravel, dark brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.785 D_{60}= 0.532 D_{50}= 0.451
D_{30}= 0.310 D_{15}= 0.214 D_{10}= 0.179
C_u= 2.97 C_c= 1.01

Classification

USCS= SP AASHTO=

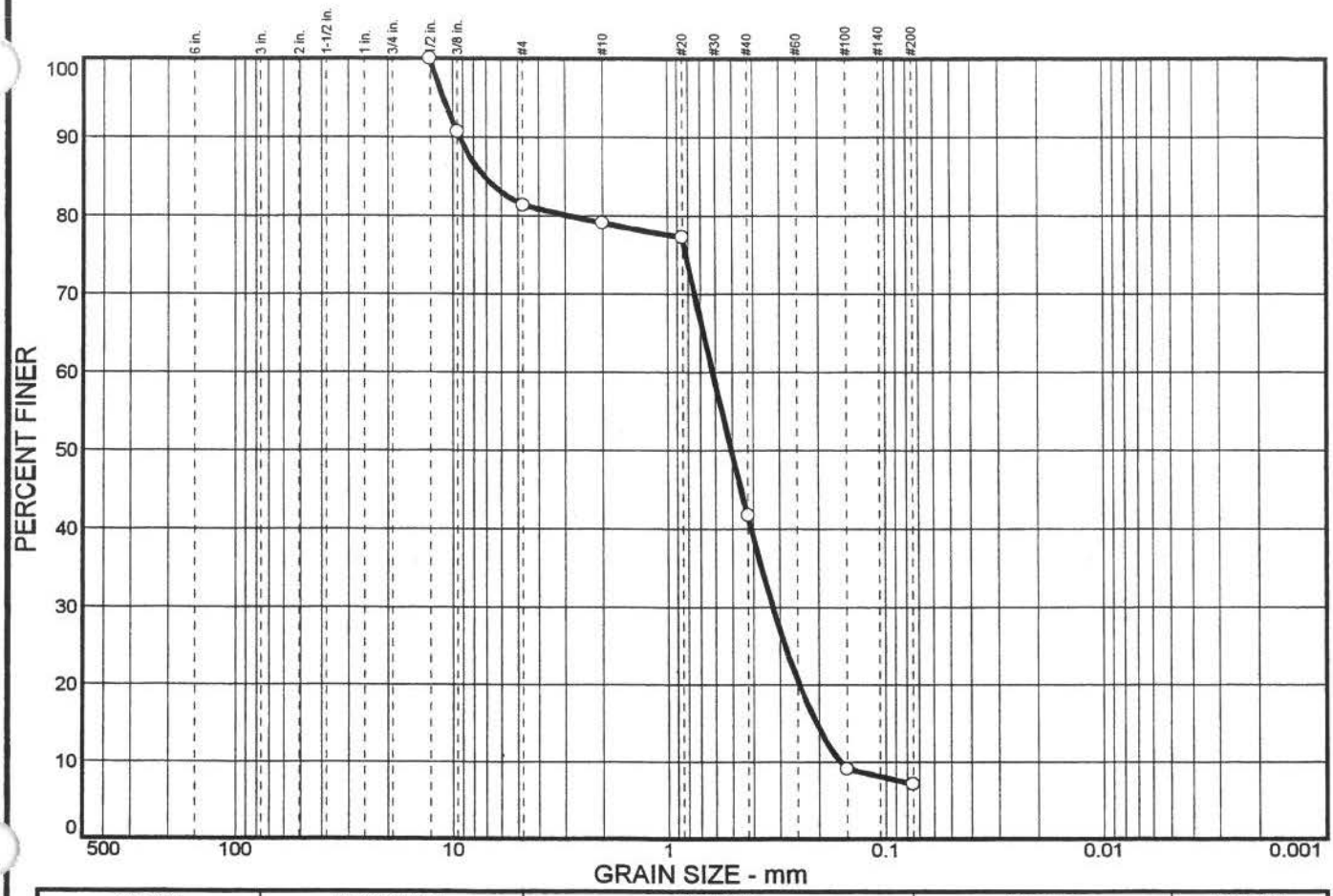
Remarks

Sample No.: 8-A **Source of Sample:** CB-CUL-10 **Date:** 7/13/98
Location: X=247098.7150 Y=207984.1560 **Elev./Depth:** 10.5' @ 12.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	18.6	74.3	7.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
.375 in.	90.7		
#4	81.4		
#10	79.1		
#20	77.3		
#40	41.8		
#100	9.1		
#200	7.1		

* (no specification provided)

Soil Description

SAND, little gravel, trace silt, brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 7.11 D_{60}= 0.614 D_{50}= 0.504
D_{30}= 0.323 D_{15}= 0.204 D_{10}= 0.160
C_u= 3.84 C_c= 1.06

Classification

USCS= SP-SM AASHTO=

Remarks

Sample No.: 8-A **Source of Sample:** CB-CUL-11 **Date:** 7/13/98
Location: X=247804.8820 Y=208505.7240 **Elev./Depth:** 10.5' @ 12.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT

% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	65.4	34.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.2		
#40	75.0		
#100	38.4		
#200	34.6		

* (no specification provided)

Soil Description

Clayey SAND, dark brown.

Atterberg Limits

PL= 16.5 LL= 35.5 PI= 19.7

Coefficients

D_{85}= 0.557 D_{60}= 0.294 D_{50}= 0.226
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

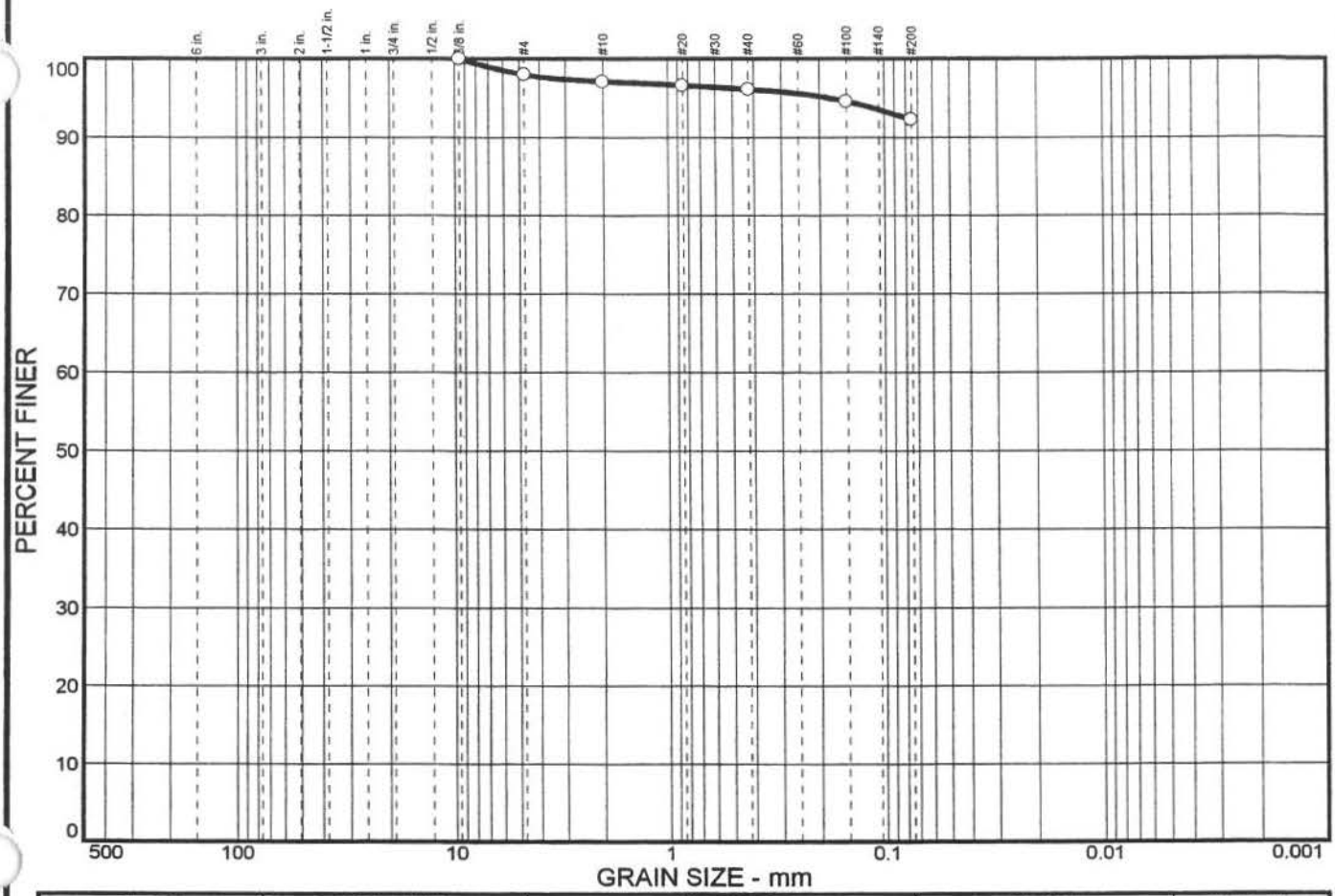
Remarks

Sample No.: 2-A **Source of Sample:** CB-CUL-12 **Date:** 7/14/98
Location: X=247326.1400 Y=209437.8100 **Elev./Depth:** 1.5' @ 3.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	2.0	5.7	92.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	98.0		
#10	97.1		
#20	96.6		
#40	96.1		
#100	94.6		
#200	92.3		

* (no specification provided)

Soil Description

SILT, trace sand and gravel, gray.

Atterberg Limits

PL= 42.7 LL= 90.0 PI= 47.3

Coefficients

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

Classification

USCS= MH AASHTO=

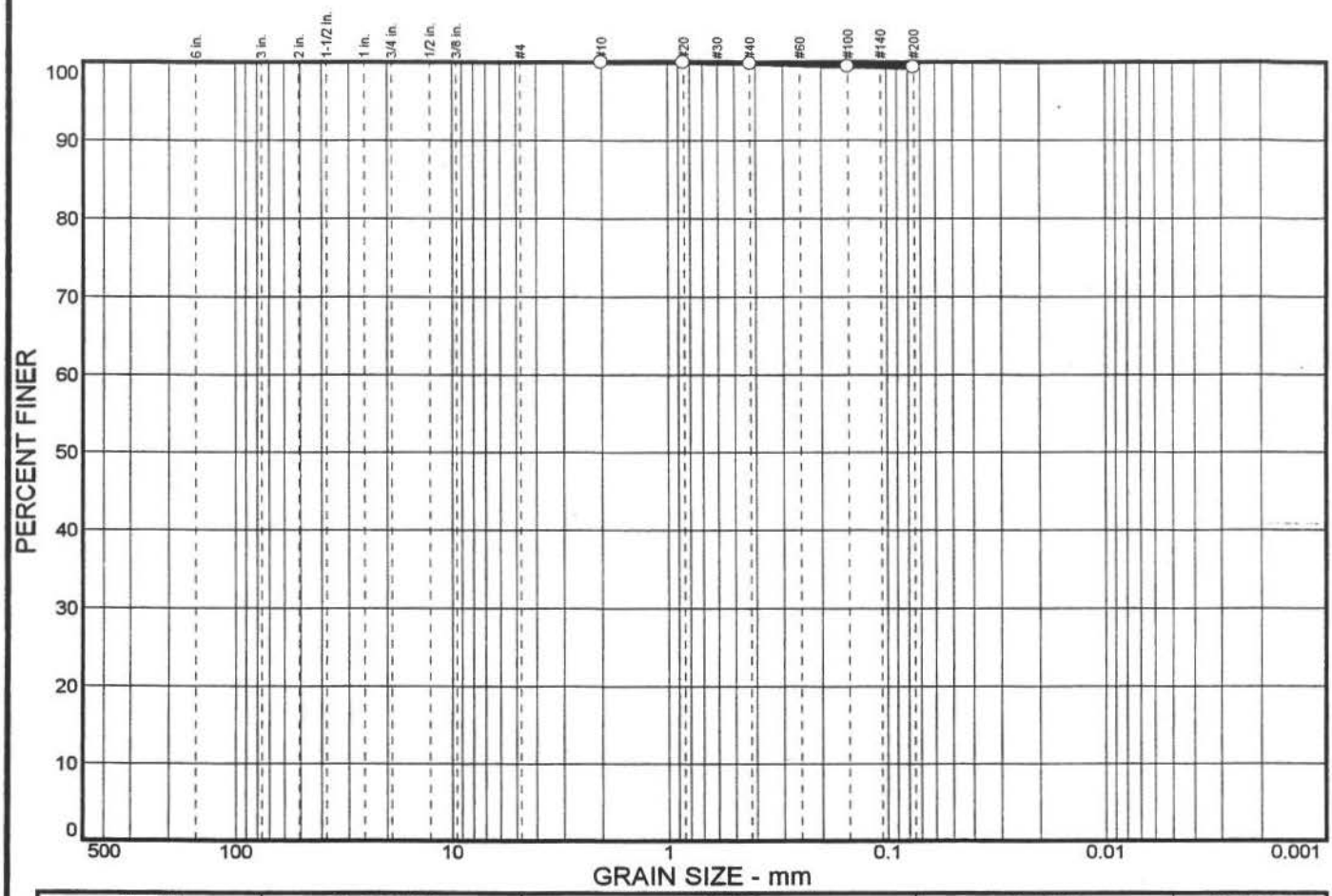
Remarks

Sample No.: 2-A **Source of Sample:** CB-CUL-13 **Date:** 7/8/98
Location: X=247092.2420 Y=210444.4960 **Elev./Depth:** 1.5'-3.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	0.6	99.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.9		
#100	99.5		
#200	99.4		

* (no specification provided)

Soil Description

SILT, trace sand, dark gray.

Atterberg Limits

PL= 48.7 LL= 84.5 PI= 35.8

Coefficients

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

Classification

USCS= MH AASHTO=

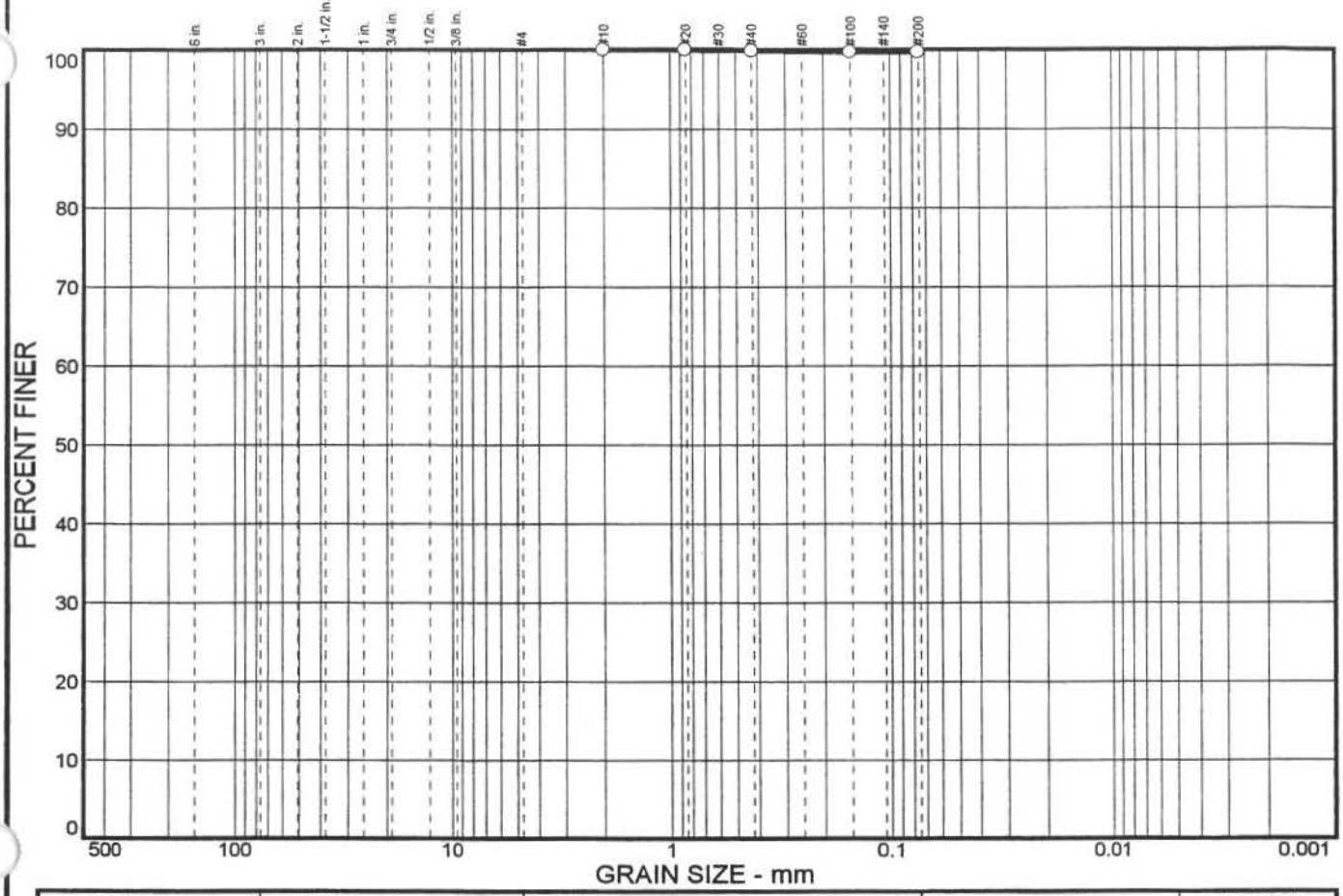
Remarks

Sample No.: 4-A **Source of Sample:** CB-CUL-13 **Date:** 7/8/98
Location: X=247092.2420 Y=210444.4960 **Elev./Depth:** 4.5' - 6.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	0.3	99.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.9		
#100	99.7		
#200	99.7		

* (no specification provided)

Soil Description

SILT, trace sand, dark gray.

Atterberg Limits

PL= 36.9 LL= 71.5 PI= 34.6

Coefficients

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

Classification

USCS= MH AASHTO=

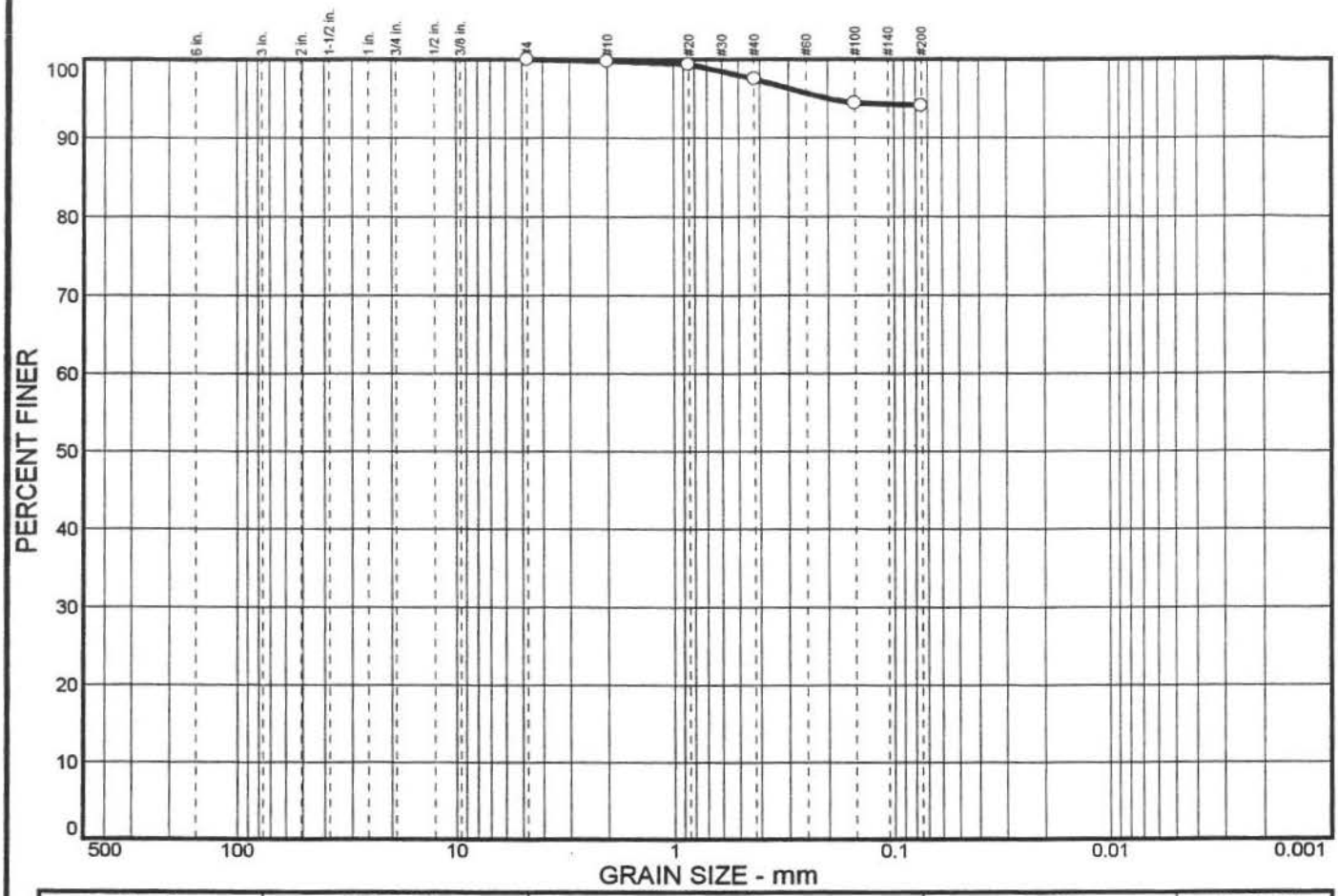
Remarks

Sample No.: 8-A **Source of Sample:** CB-CUL-13 **Date:** 7/8/98
Location: X=247092.2420 Y=210444.4960 **Elev./Depth:** 10.5' - 12.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	5.9	94.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	99.4		
#40	97.5		
#100	94.4		
#200	94.1		

* (no specification provided)

Soil Description

CLAY, trace sand, dark gray.

Atterberg Limits

PL= 42.3 LL= 114.5 PI= 72.21

Coefficients

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

Classification

USCS= CH AASHTO=

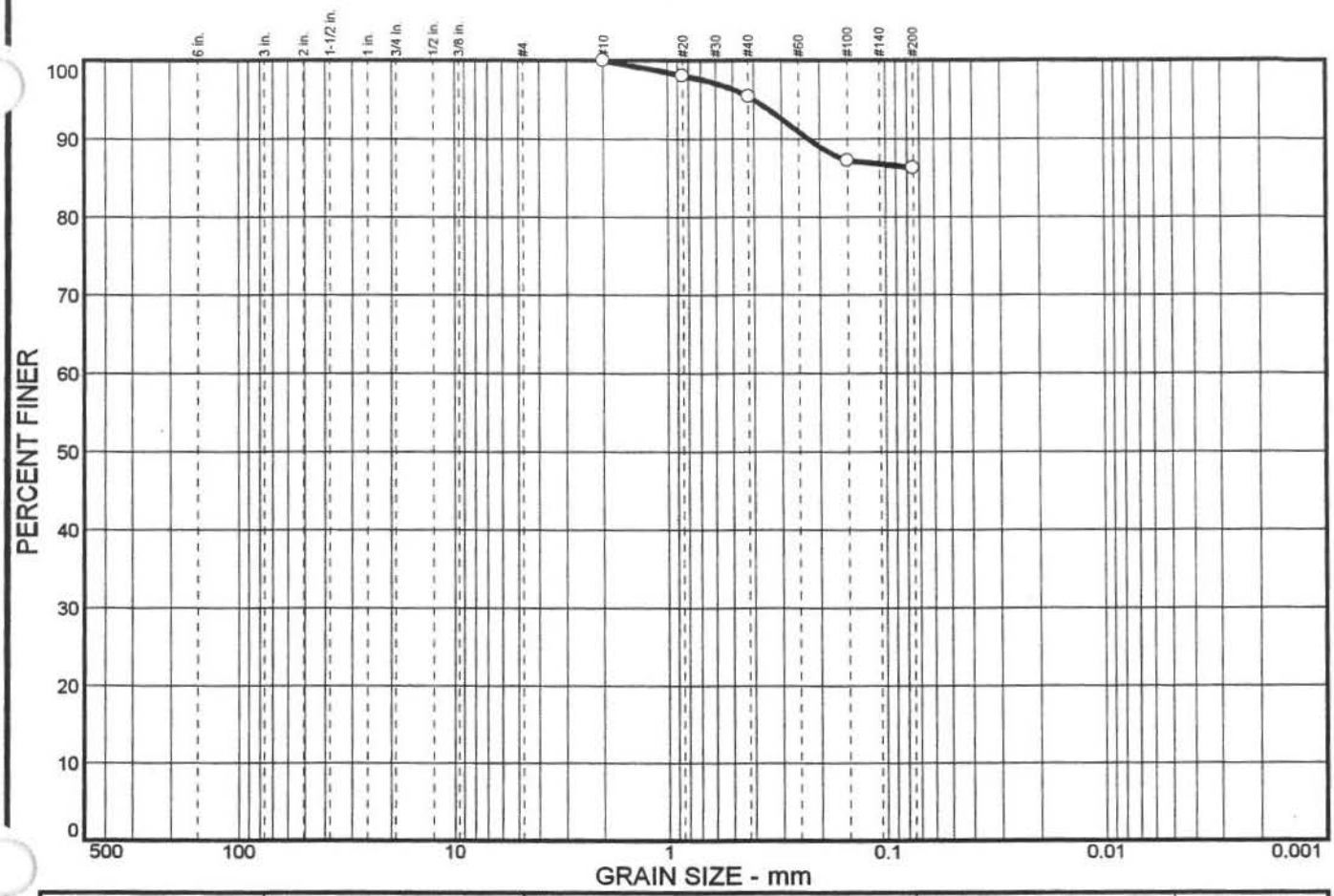
Remarks

Sample No.: 4-A **Source of Sample:** CB-CUL-14 **Date:** 7/8/98
Location: X=246987.9150 Y=211306.2170 **Elev./Depth:** 4.5' - 6.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	13.7	86.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	98.1		
#40	95.4		
#100	87.2		
#200	86.3		

* (no specification provided)

Soil Description

CLAY, little sand, dark gray.

Atterberg Limits

PL= 38.3 LL= 97.9 PI= 59.63

Coefficients

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

Classification

USCS= CH AASHTO=

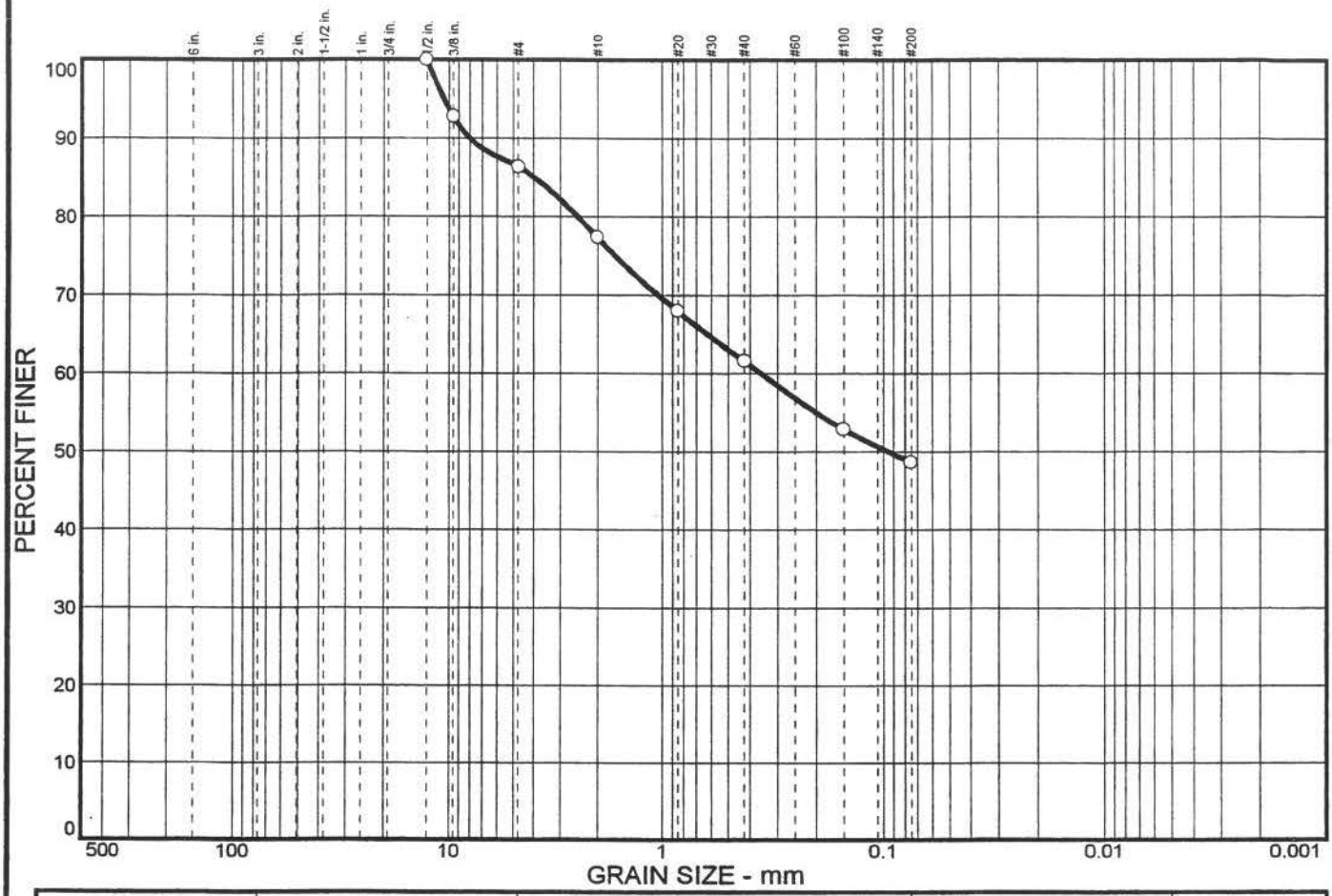
Remarks

Sample No.: 8-A **Source of Sample:** CB-CUL-14 **Date:** 7/8/98
Location: X=246987.9150 Y=211306.2170 **Elev./Depth:** 10.5' - 12.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	13.6	37.7	48.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
.375 in.	92.8		
#4	86.4		
#10	77.4		
#20	68.0		
#40	61.6		
#100	52.9		
#200	48.7		

* (no specification provided)

Soil Description

Sandy CLAY, little gravel, pale brown.

Atterberg Limits

PL= 12.2 LL= 15.5 PI= 3.3

Coefficients

D_{85}= 3.96 D_{60}= 0.356 D_{50}= 0.0944
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC-SM AASHTO=

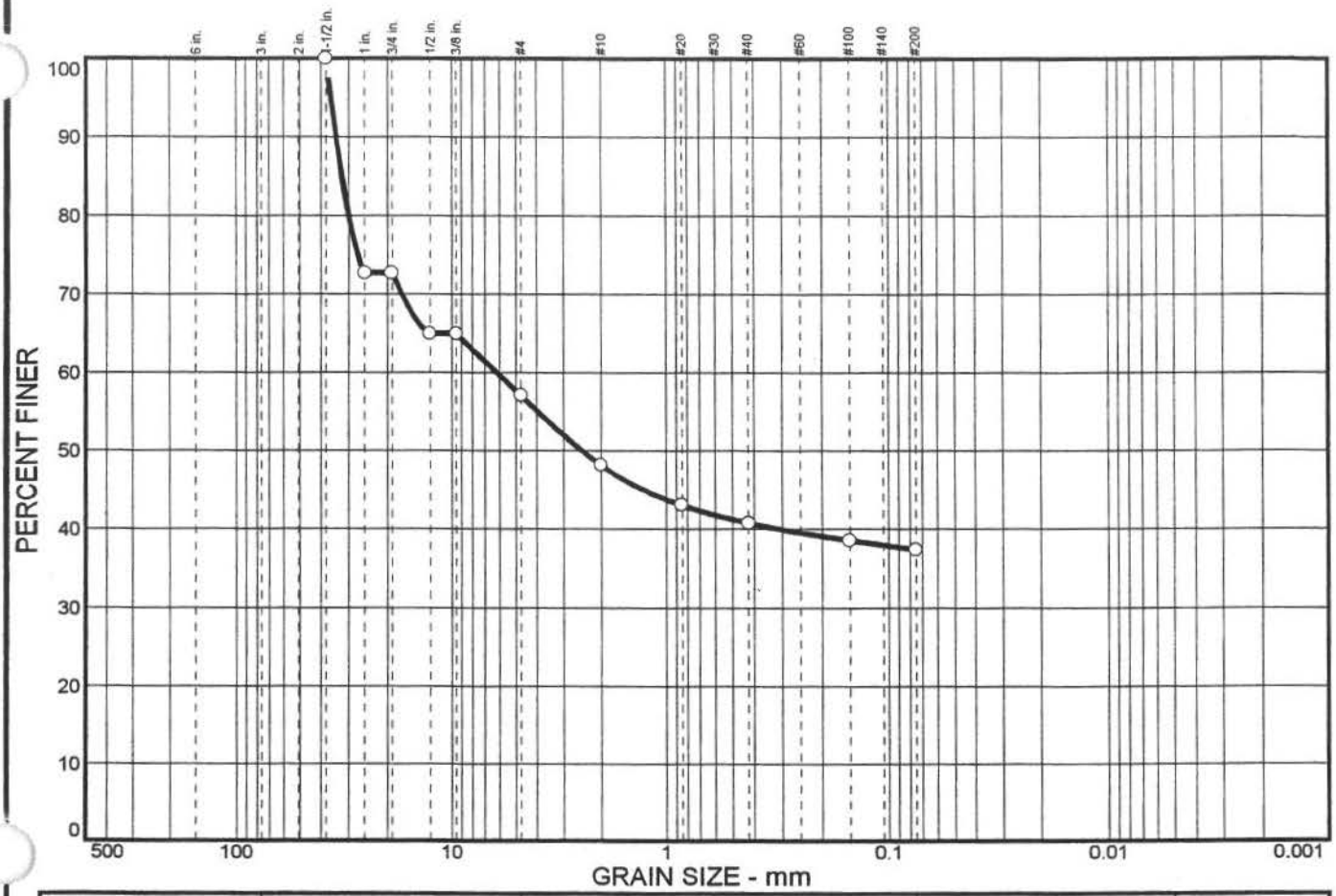
Remarks

Sample No.: 12-A **Source of Sample:** CB-CUL-15 **Date:** 7/16/98
Location: X=243604.9140 Y=204359.9440 **Elev./Depth:** 19.5' @ 21.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	42.9	19.7	37.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	72.7		
.75 in.	72.7		
.5 in.	65.0		
.375 in.	65.0		
#4	57.1		
#10	48.2		
#20	43.1		
#40	40.8		
#100	38.6		
#200	37.4		

* (no specification provided)

Soil Description

Clayey GRAVEL, little sand, brown.

Atterberg Limits

PL= 14.8 LL= 38.7 PI= 23.9

Coefficients

D_{85}= 32.0 D_{60}= 6.14 D_{50}= 2.45
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GC AASHTO=

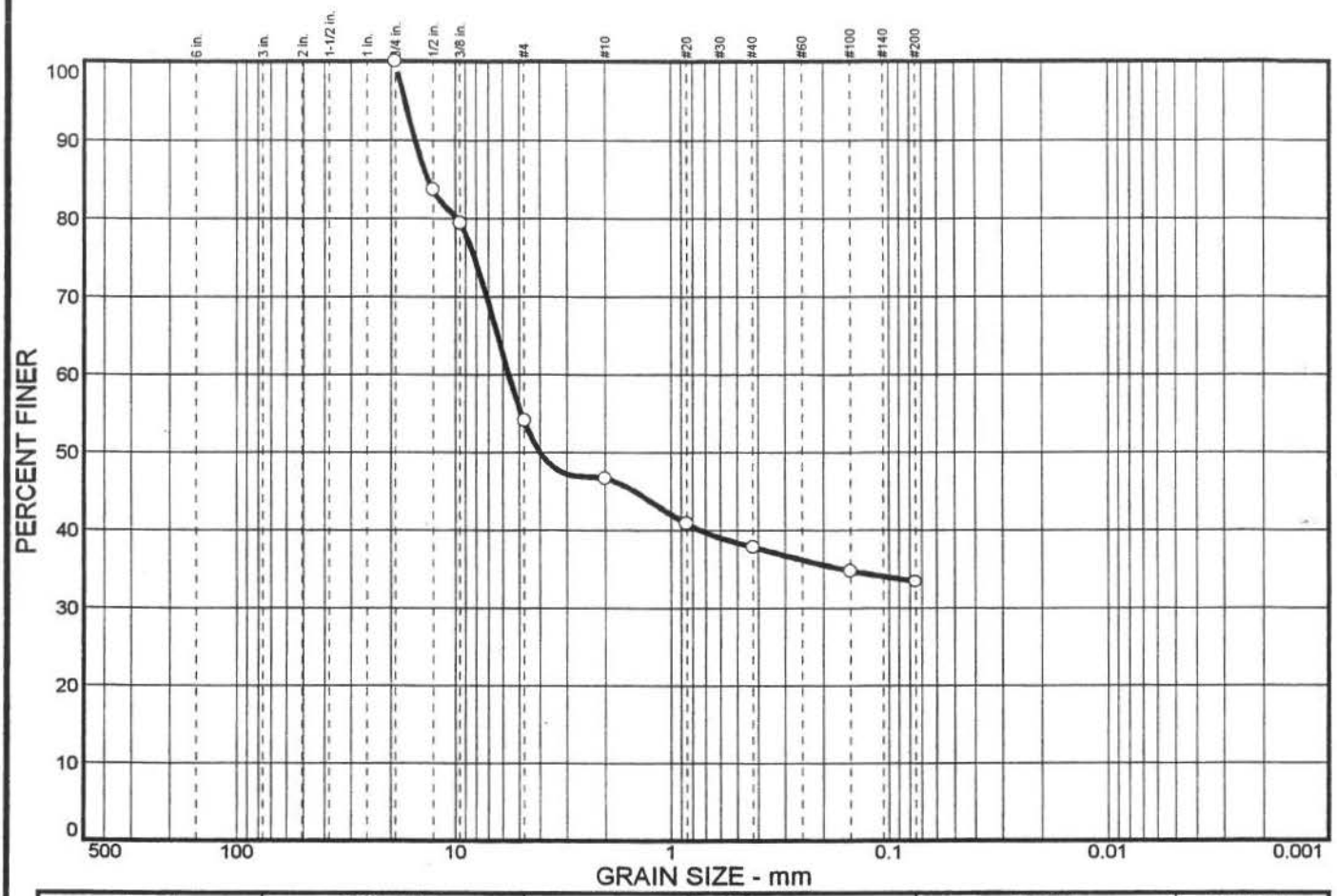
Remarks

Sample No.: 3-A **Source of Sample:** CB-CUL-15 **Date:** 7/16/98
Location: X=243604.9140 Y=204359.9440 **Elev./Depth:** 3.0' @ 4.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	45.9	20.7	33.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	83.7		
.375 in.	79.4		
#4	54.1		
#10	46.7		
#20	40.9		
#40	37.9		
#100	34.8		
#200	33.4		

* (no specification provided)

Soil Description

Silty GRAVEL, some sand, pale brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 13.4 D_{60}= 5.60 D_{50}= 3.98
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GM AASHTO=

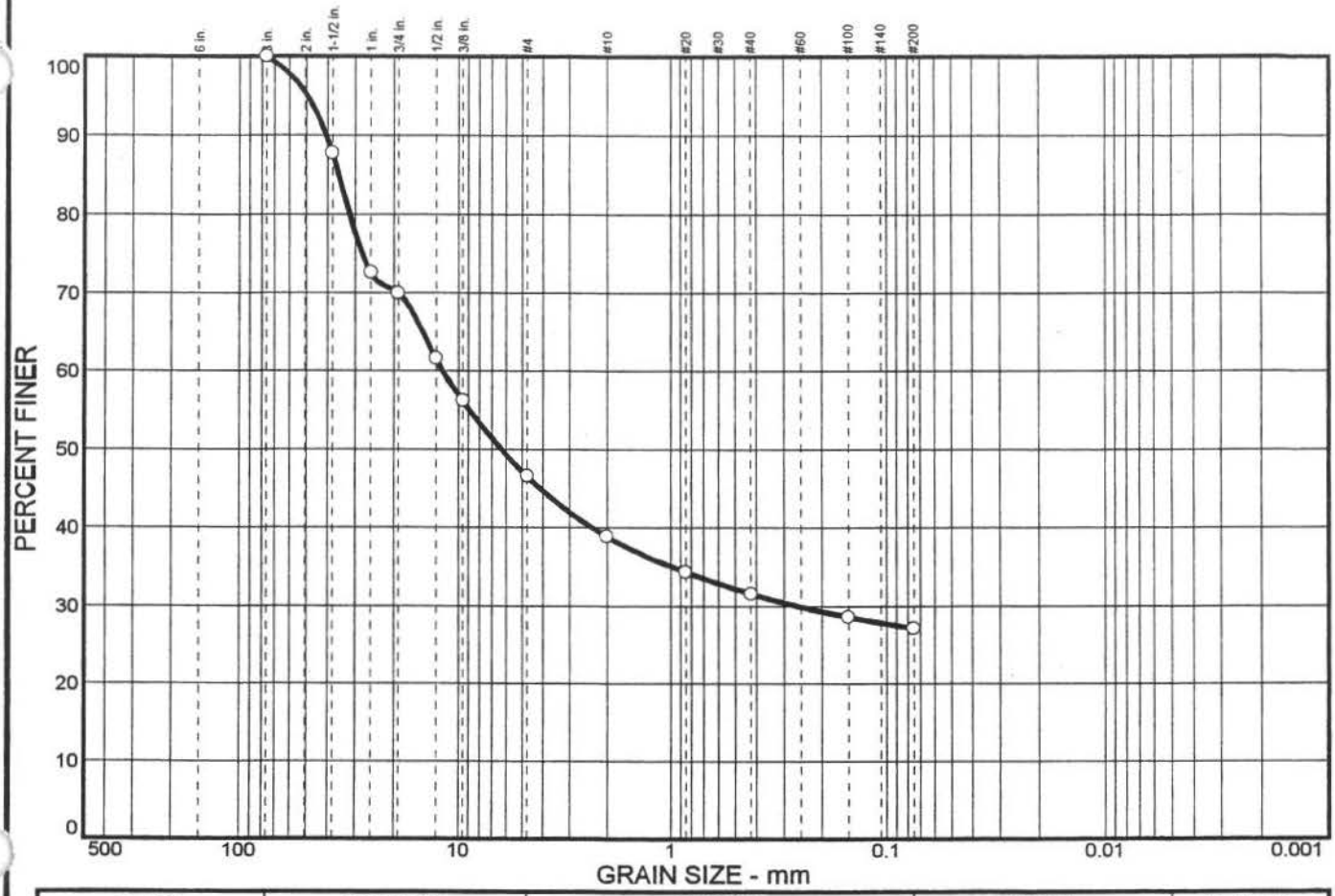
Remarks

Sample No.: 30-A **Source of Sample:** CB-CUL-15 **Date:** 7/16/98
Location: X=243604.9140 Y=204359.9440 **Elev./Depth:** 46.5' @ 48.0'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	53.4	19.5	27.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	87.8		
1 in.	72.6		
.75 in.	70.0		
.5 in.	61.6		
.375 in.	56.2		
#4	46.6		
#10	38.9		
#20	34.4		
#40	31.6		
#100	28.6		
#200	27.1		

* (no specification provided)

Soil Description

GRAVEL, some clay, little sand, brown.

Atterberg Limits

PL= 20.0 LL= 63.6 PI= 43.6

Coefficients

D_{85}= 35.5 D_{60}= 11.8 D_{50}= 6.26
D_{30}= 0.258 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GC AASHTO=

Remarks

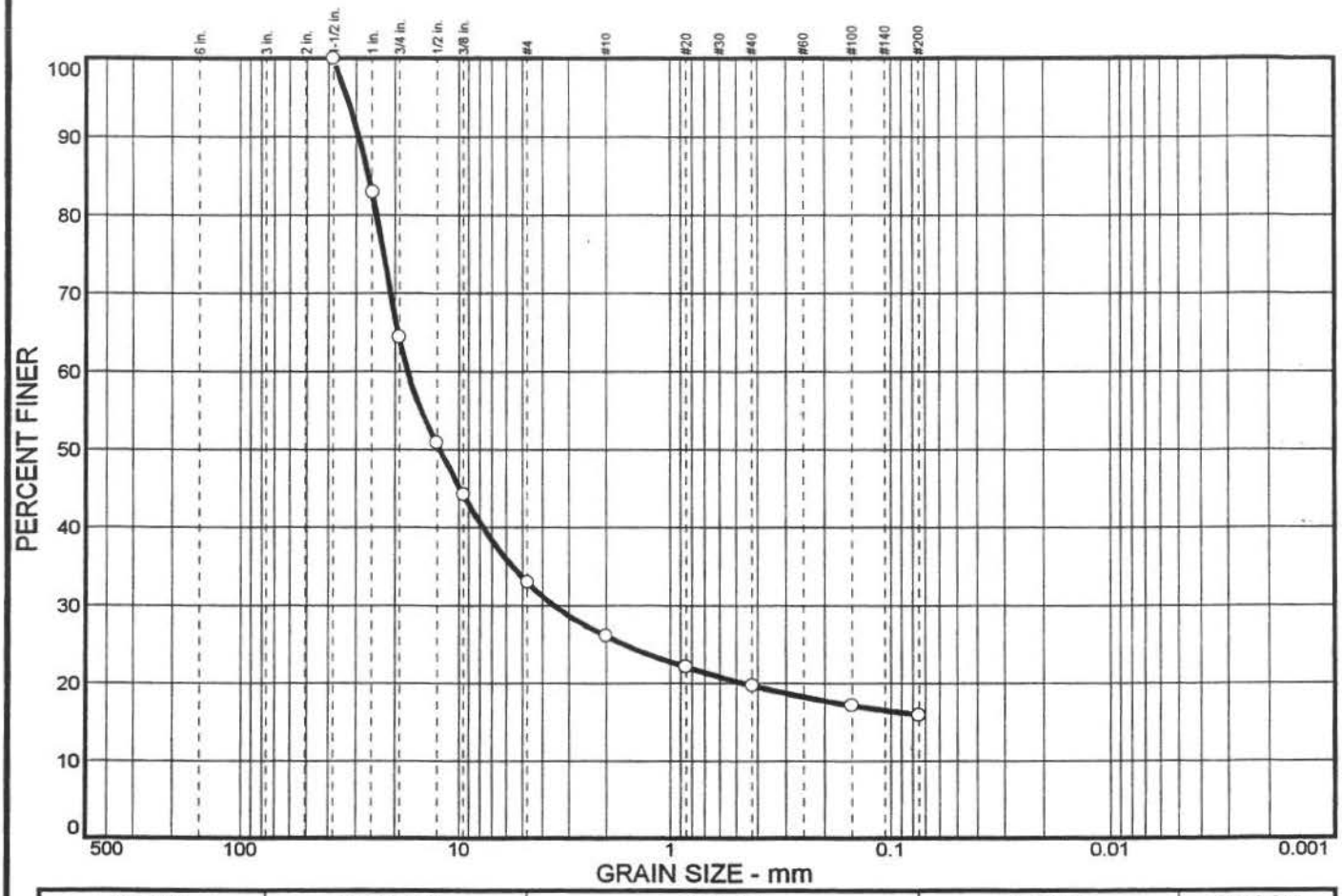
MAx Dry Dens 111.9 pcf @ 15.2% Opt Moisture

Sample No.: 1-A **Source of Sample:** TP-CUL-1 **Date:** 7/16/98
Location: X=243609.0380 Y=204369.8740 **Elev./Depth:** 0.0' @ 4.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	67.0	17.1	15.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	82.9		
.75 in.	64.4		
.5 in.	50.9		
.375 in.	44.3		
#4	33.0		
#10	26.1		
#20	22.1		
#40	19.7		
#100	17.1		
#200	15.9		

* (no specification provided)

Soil Description

GRAVEL, little sand and silt, pale brown.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 26.3 D_{60}= 17.4 D_{50}= 12.2
D_{30}= 3.53 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GM AASHTO=

Remarks

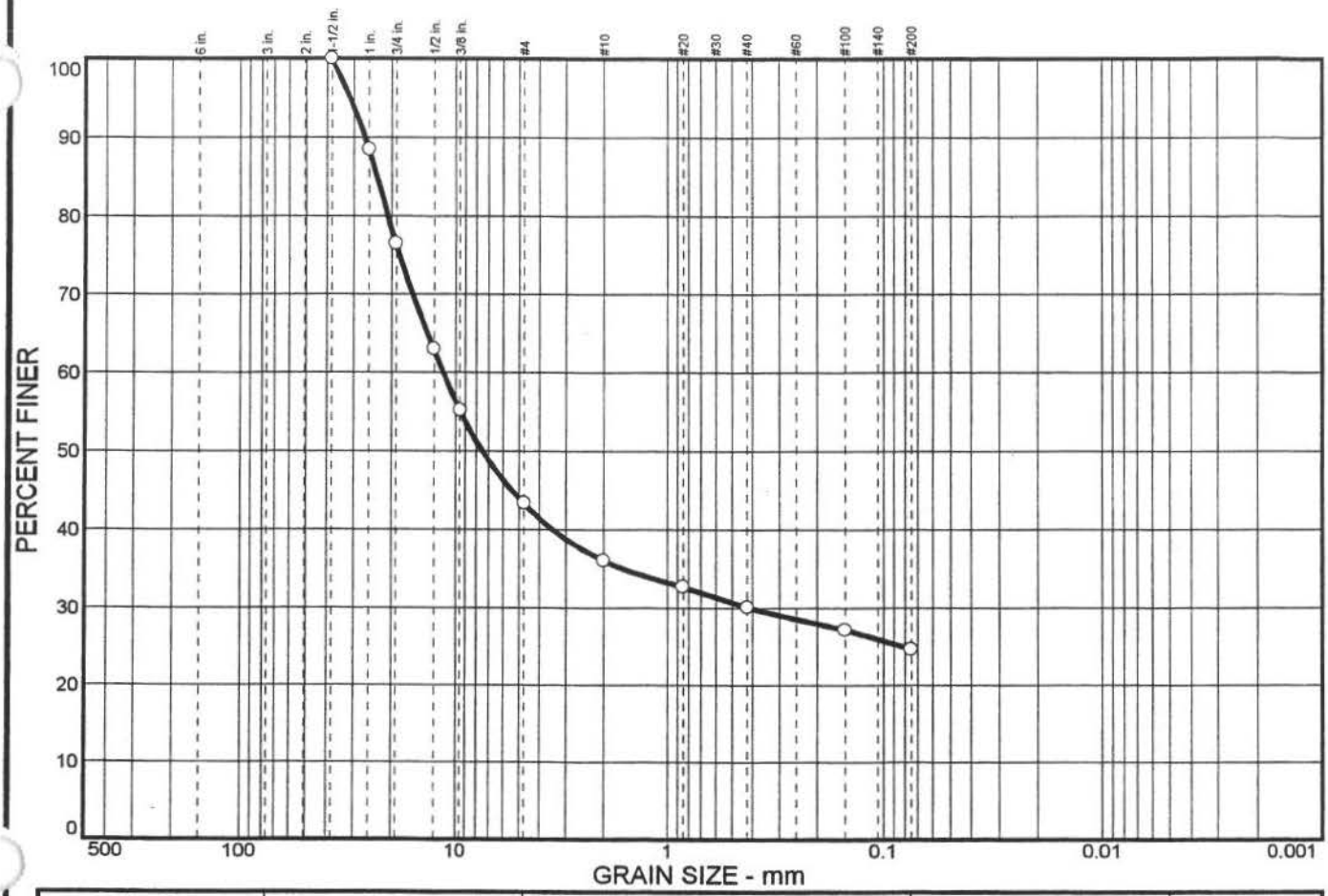
MAx Dry Dens 116.3 pcf @ 11.3% Opt Moisture

Sample No.: 1-A **Source of Sample:** TP-CUL-2 **Date:** 7/16/98
Location: X=243724.1080 Y=204022.1290 **Elev./Depth:** 0.0' @ 4.2'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	56.6	18.8	24.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	88.5		
.75 in.	76.5		
.5 in.	63.0		
.375 in.	55.2		
#4	43.4		
#10	36.1		
#20	32.7		
#40	30.1		
#100	27.1		
#200	24.6		

* (no specification provided)

Soil Description

GRAVEL, some clay, little sand, pale brown.

Atterberg Limits

PL= 14.1 LL= 34.0 PI= 19.9

Coefficients

D_{85}= 23.3 D_{60}= 11.4 D_{50}= 7.45
D_{30}= 0.413 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GC AASHTO=

Remarks

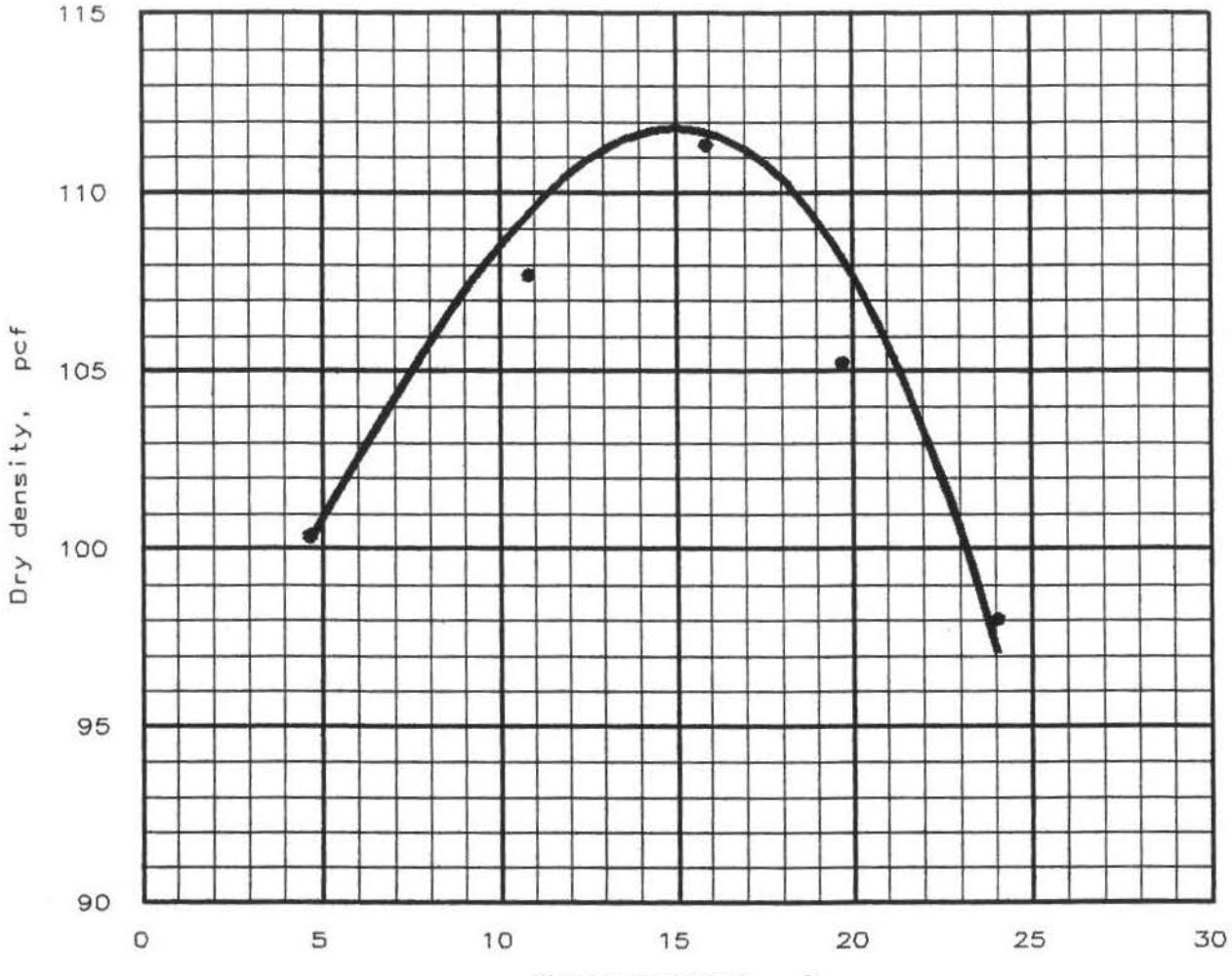
Max Dry Dens 111.7 pcf @ 12.3% Opt Moisture

Sample No.: 2-A **Source of Sample:** TP-CUL-2 **Date:** 7/16/98
Location: X=243724.1080 Y=204022.1290 **Elev./Depth:** 4.5' @ 9.5'

GEO CIM, INC.

Client: Corp of Engineers
Project: Rio Culebrinas Project
Aguadilla, P.R.
Project No: 2174-98 **R. Davila-GCI**

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Procedure C, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in	% < No.200
	USCS	AASHTO						
N/A	GC		17.9 %	2.74	63.6	43.6	30.0 %	27.1 %

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 111.8 pcf Optimum moisture = 15.1 %	GRAVEL, some clay, little sand, brown.

Project No.: 2174-98
Project: Rio Culebrinas Project
Location: Aguadilla, P.R.

Date: July 16, 1998

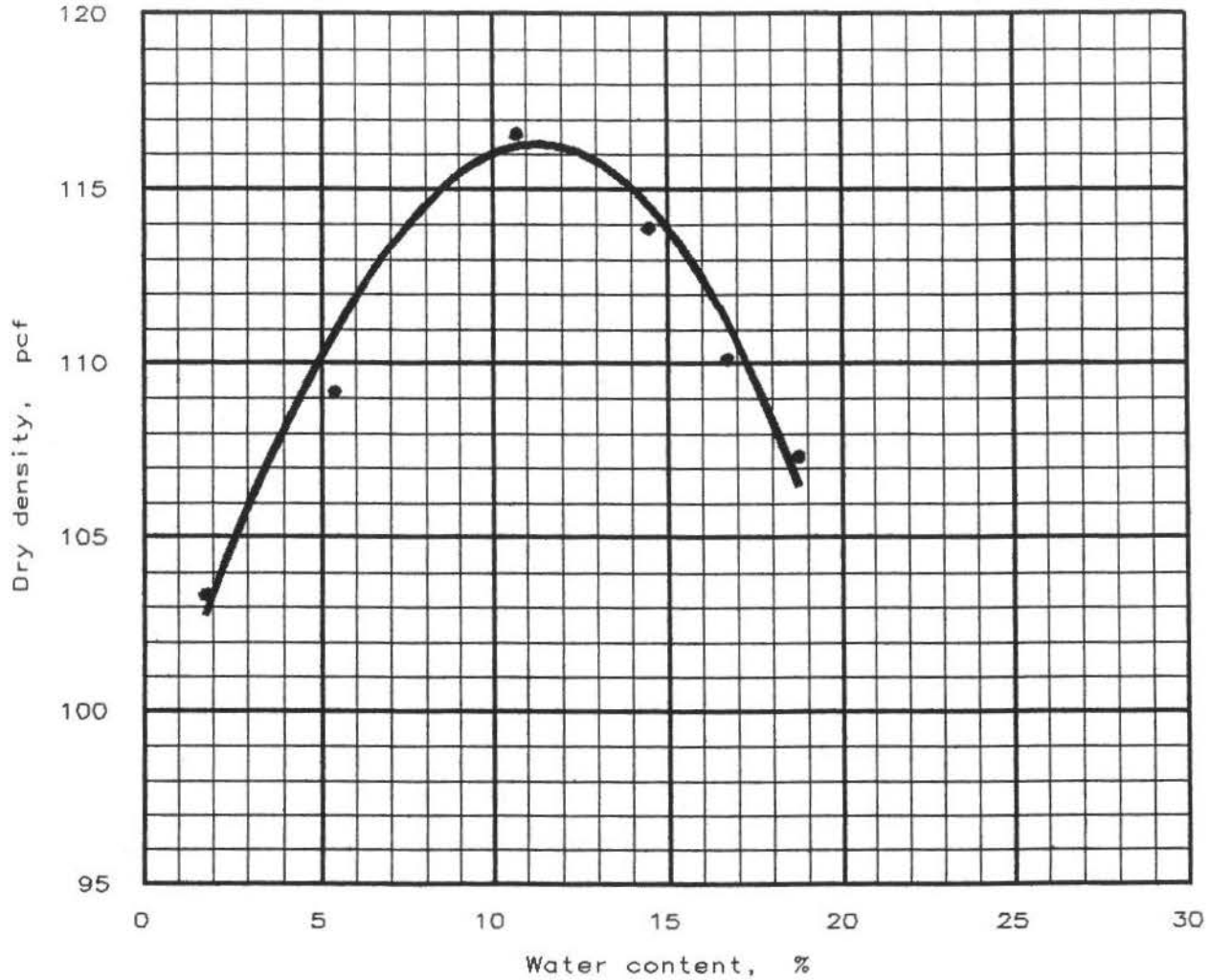
Remarks:
Corp of Engineers
TP-CUL-1 **SAMPLE NO. 1**
X=243609.03 Y=204369.87

MOISTURE-DENSITY RELATIONSHIP TEST

GEO CIM, INC.

Fig. No. 1

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Procedure C, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in	% < No.200
	USCS	AASHTO						
N/A	GM		4.0 %	2.75			35.6 %	15.9 %

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 116.3 pcf Optimum moisture = 11.3 %	GRAVEL, little sand and silt, pale brown to pink

Project No.: 2174-98
Project: Rio Culebrinas Project
Location: Aguadilla, P.R.

Date: July 16, 1998

Remarks:
Corp of Engineers
TP-CUL-2 **SAMPLE NO. 1**
X=243724.10 Y=204022.12

MOISTURE-DENSITY RELATIONSHIP TEST

GEO CIM, INC.

Fig. No. 1

United States Army Corps of Engineers
File Number 98-153
August 27, 1998

Table 1

DESCRIPTIONS OF SHELBY TUBE SOIL SAMPLES

Boring	Depth (feet)	Description	Length (inches)		Classification Tests							Measured w_c (%)	S_u (TV) (lb/ft^2)	Tube Average	
					-200 (%)	LL (%)	PL (%)	PI (%)	OC (%)	G_s	Group† Symbol			w_c (%)	γ_t (lb/ft^3)
CB-CUL-5	13.0 - 15.0	Brown clay	3.5	23.5	--	--	--	--	--	--	--	44.5	--	55.9	100.7
		Gray fat clay with sand and thin seams of fine sand	20.0		78 80 76 73	58	30	28	5.8	2.69	CH	57.6 57.5 54.8 61.7	360 390 360 --		
CB-CUL-13	8.0 - 10.0	Brown clay with organic material	3.0	18.5	--	--	--	--	--	--	--	64.5	--	73.2	96.7
		Gray fat clay with thin seams of fine sand	15.5		97 99 100	74	31	43	--	2.70	CH	73.6 76.5 77.2 72.4	240 260 260 260		
CB-CUL-14	8.0 - 10.0	Gray fat clay to sandy fat clay with thin seams and lenses of fine sand and fine shell fragments and lenses of organic material	15.5	26.5	89 60 81	91	29	62	9.6	2.65	CH	87.1 69.0 82.1 53.1	-- -- 400 --	72.8	100.5
		Gray medium to fine sand with shell framents and occasional lenses of gray clay	11.0		--	--	--	--	--	--	--	40.5	--	40.5	101.9

Where: w_c = Moisture content; γ_t = Total unit weight; -200 = Fines content (i.e., amount of material finer than the U.S. Standard No. 200 sieve); LL = Liquid limit; PL = Plastic limit; PI = Plasticity Index; OC = Organic content (loss on ignition); G_s = Specific gravity; and S_u (TV) = Undrained shear strength measured with a Torvane.

† Group symbols in accordance with ASTM Standard D 2487 "Classification of Soils for Engineering Purposes".

A:\98-153 RC.001.wpd

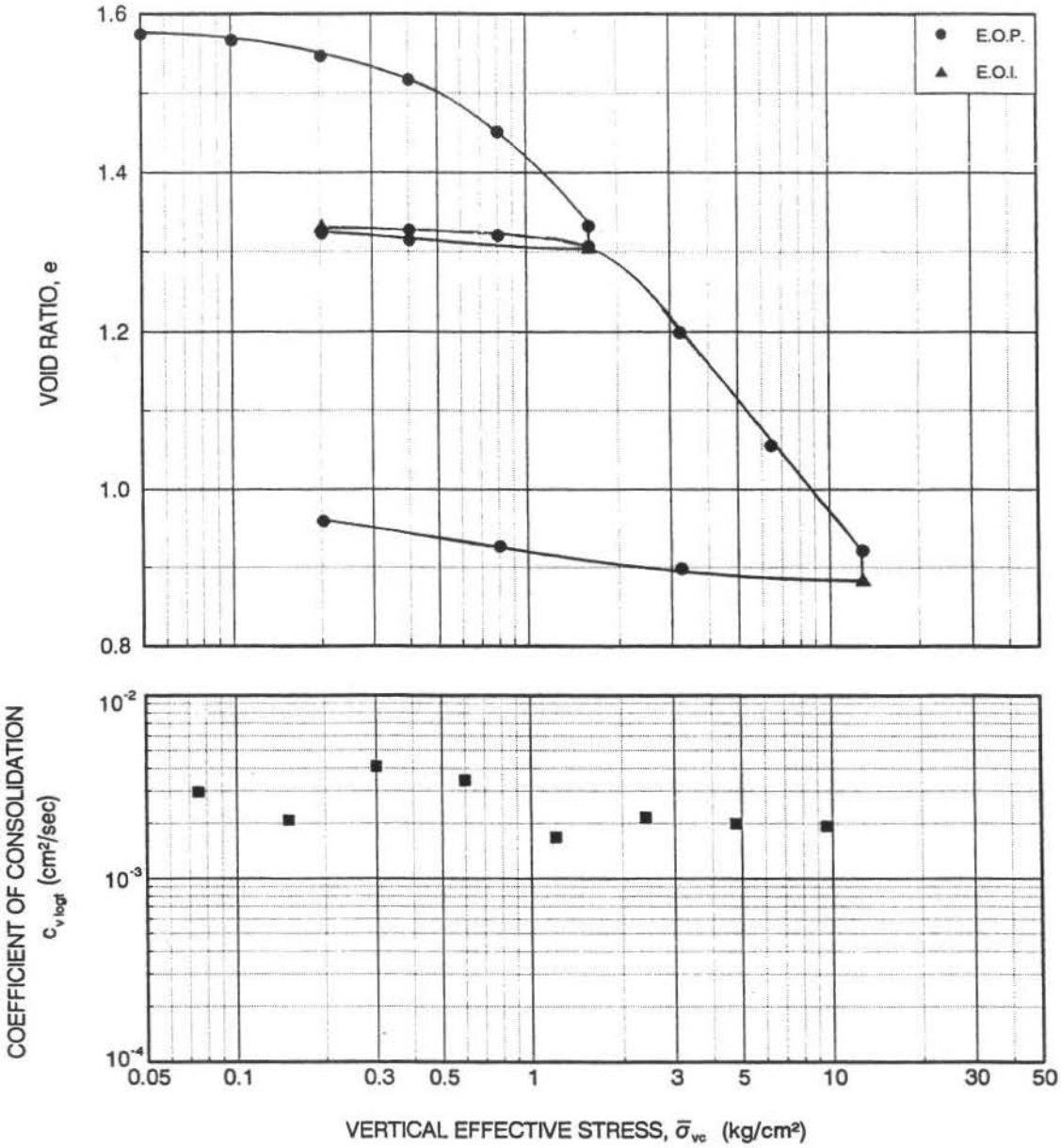
United States Army Corps of Engineers
File Number 98-153
August 27, 1998

Table 2

UNCONSOLIDATED UNDRAINED (UU) TRIAXIAL COMPRESSION TEST RESULTS

Boring	Depth (feet)	Specimen Dimensions			w_c (%)	γ_d (lb/ft^3)	S (%)	-200 (%)	σ_c (kg/cm^2)	$\dot{\varepsilon}$ (cm/min)	at $(\sigma_1-\sigma_3)_{max}$			
		H (cm)	D (cm)	H/D							ε_a (%)	Compressive Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
CB-CUL-13	8.0 - 10.0	7.10	3.48	2.04	73.7	56.3	100	97	1.05	0.066	18.8	0.38	1.43	1.05
		7.08	3.47	2.04	73.6	56.4	100	100	2.10	0.066	18.5	0.33	2.43	2.10
CB-CUL-14	8.0 - 10.0	7.09	3.52	2.01	93.0	47.7	100	89	0.87	0.066	17.8	0.40	1.27	0.87
		7.09	3.52	2.01	75.5	55.1	100	60	1.76	0.066	17.8	0.38	2.14	1.76

Where: H = Specimen height; D = Specimen diameter; w_c = Moisture content; γ_d = Dry density; S = Calculated degree of saturation; -200 = Fines content (i.e., amount of material finer than the U.S. Standard No. 200 sieve); σ_c = Confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress.



SAMPLE DATA

BORING NUMBER:	CB-CUL-5
SAMPLE NUMBER:	--
DEPTH (FEET:	13.0-15.0
DESCRIPTION:	GRAY FAT CLAY WITH SAND AND THIN SEAMS OF FINE SAND

INDEX PROPERTIES

LIQUID LIMIT (%):	58
PLASTIC LIMIT (%):	30
PLASTICITY INDEX (%):	28
% PASSING NO. 200:	78
SPECIFIC GRAVITY:	2.69

SPECIMEN CONDITIONS

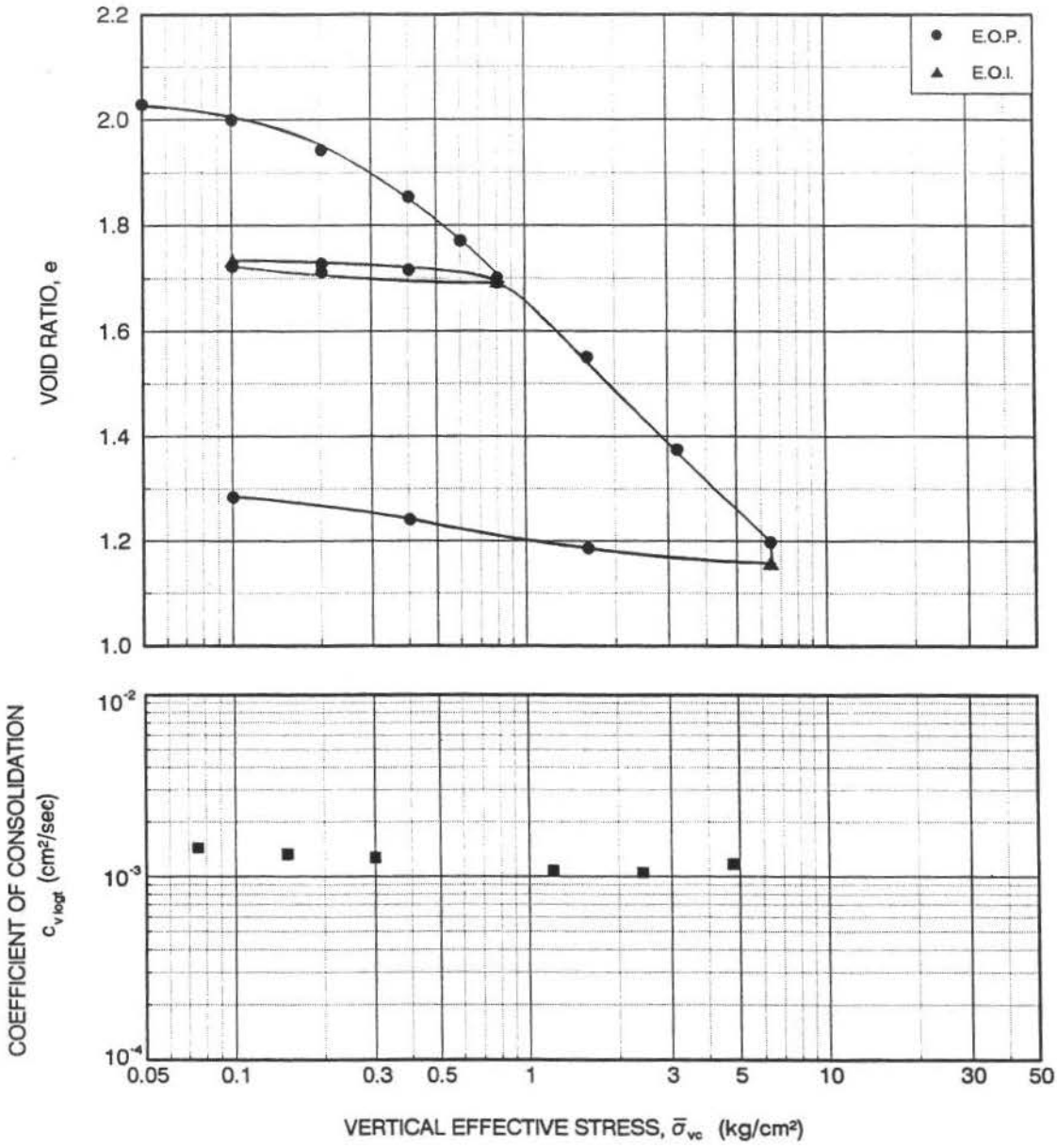
	INITIAL	FINAL
MOISTURE CONTENT (%):	57.4	37.1
DRY DENSITY (lb/ft³):	65.0	83.8
VOID RATIO:	1.58	1.00
SATURATION (%):	98	100

INCREMENTAL LOADING CONSOLIDATION TEST ON SAMPLE CB-CUL-5

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

LABORATORY TESTING
CONTRACT NO. DACW17-98-D-0003
RIO CULEBRINAS PROJECT

DRAWN BY: SA	CHECKED BY: SA	DATE: 08-19-98
FILE NO.: 98-153	APPROVED BY:	FIGURE: 12



SAMPLE DATA

BORING NUMBER:	CB-CUL-13
SAMPLE NUMBER:	--
DEPTH (FEET:	8.0-10.0
DESCRIPTION:	GRAY FAT CLAY WITH THIN SEAMS OF FINE SAND

INDEX PROPERTIES

LIQUID LIMIT (%):	74
PLASTIC LIMIT (%):	37
PLASTICITY INDEX (%):	43
% PASSING NO. 200:	99
SPECIFIC GRAVITY:	2.70

SPECIMEN CONDITIONS

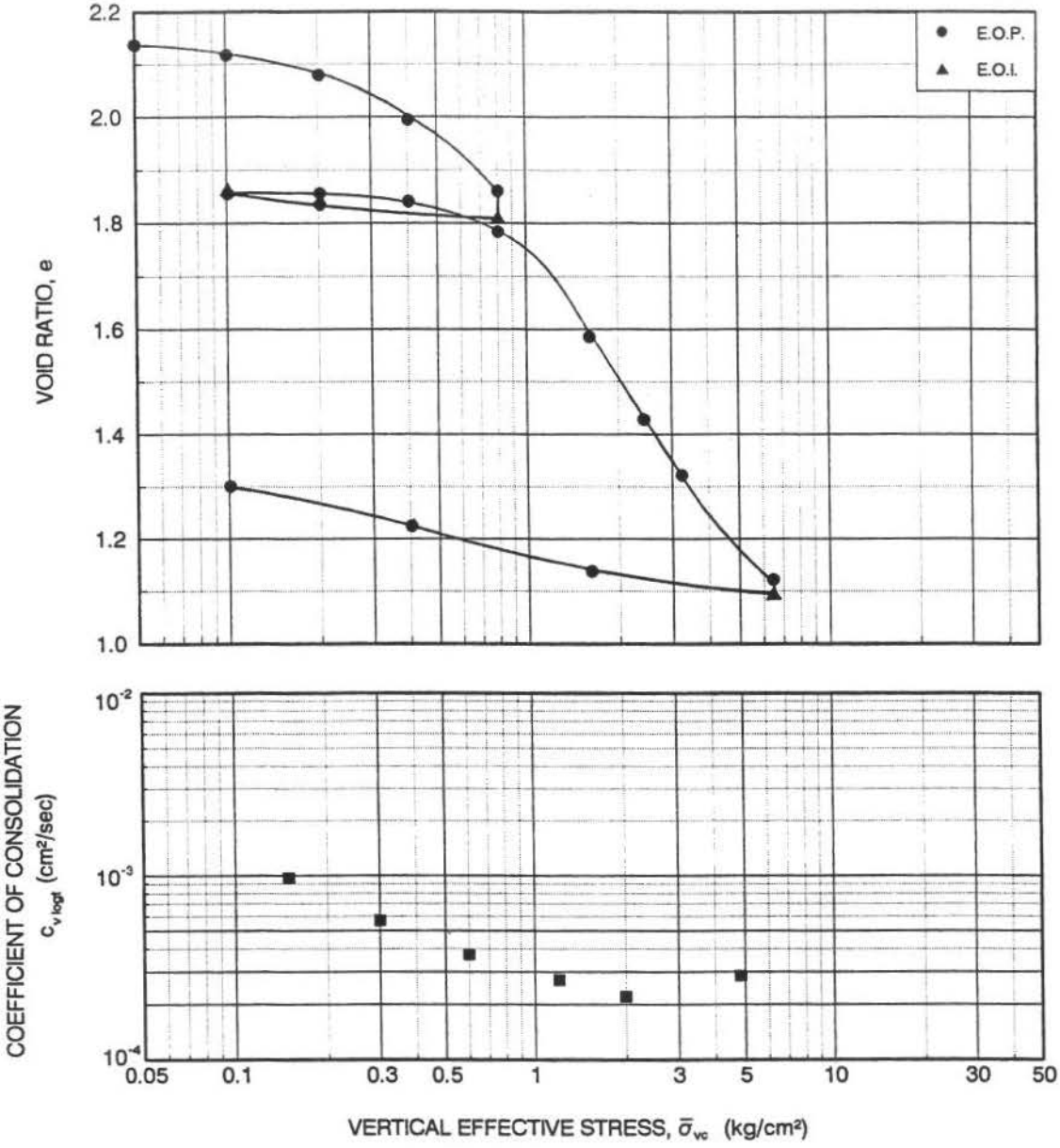
	INITIAL	FINAL
MOISTURE CONTENT (%):	76.3	49.3
DRY DENSITY (lb/ft³):	55.1	72.3
VOID RATIO:	2.06	1.33
SATURATION (%):	100	100

INCREMENTAL LOADING CONSOLIDATION TEST ON SAMPLE CB-CUL-13

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

LABORATORY TESTING
CONTRACT NO. DACW17-98-D-0003
RIO CULEBRINAS PROJECT

DRAWN BY: SA	CHECKED BY: SA	DATE: 08-19-98
FILE NO.: 98-153	APPROVED BY:	FIGURE: 13



SAMPLE DATA	
BORING NUMBER:	CB-CUL-14
SAMPLE NUMBER:	–
DEPTH (FEET:	8.0-10.0
DESCRIPTION:	GRAY FAT CLAY WITH THIN SEAMS OF FINE SAND

INDEX PROPERTIES	
LIQUID LIMIT (%):	91
PLASTIC LIMIT (%):	29
PLASTICITY INDEX (%):	62
% PASSING NO. 200:	81
SPECIFIC GRAVITY:	2.65

SPECIMEN CONDITIONS	INITIAL	FINAL
MOISTURE CONTENT (%):	80.9	51.8
DRY DENSITY (lb/ft³):	52.6	69.7
VOID RATIO:	2.14	1.37
SATURATION (%):	100	100

INCREMENTAL LOADING CONSOLIDATION TEST ON SAMPLE CB-CUL-14

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

LABORATORY TESTING
CONTRACT NO. DACW17-98-D-0003
RIO CULEBRINAS PROJECT

DRAWN BY: SA	CHECKED BY: SA	DATE: 08-19-98
FILE NO.: 98-153	APPROVED BY:	FIGURE: 14

RIO CULEBRINAS AT AGUADILLA AND AGUADA, PUERTO RICO
SECTION 205
FINAL DETAILED PROJECT REPORT
AND ENVIRONMENTAL ASSESSMENT

APPENDIX C
DESIGN AND COST ESTIMATES

RIO CULEBRINAS @ AGUADA/AGUADILLA, PUERTO RICO
DETAILED PROJECT REPORT

Appendix C
Design and Cost Estimates

Table of Contents

Table of Contents (continued)

LIST OF TABLES

LIST OF PLATES