

ANEJO J

INFORME DE METROPOLITAN SOILS

January 2004



1000 Meters

0

W

Map b

REPORT ON PRELIMINARY GEOTECHNICAL INVESTIGATION
FOR
PROPOSED WIND TURBINES FARM
PUNTA VERRACO-CERRO TORO-PUNTA VENTANA
GUAYANILLA, PUERTO RICO
ANTILLES CEMENT CORPORATION
MR. VICTOR GONZALEZ, PRESIDENT
BY
METROPOLITAN SOILS AND ENGINEERING MATERIALS
LABORATORY, INC.
FEBRUARY 2004

A. **INTRODUCTION:**

This is our report on a **PRELIMINARY GEOTECHNICAL INVESTIGATION** performed at the Punta Verraco-Cerro Toro-Punta Ventana site of Guayanilla, Puerto Rico, proposed for an electricity-generating Wind Turbines Farm.

The site, bounded west by the Guánica State Forest, and protruding out into the mostly shallow waters of Guayanilla Bay, is **in southwest Puerto Rico**, facing the Caribbean Sea. Prevailing winds are from the southeast.

The Guayanilla project shall consist of around 100, 900 to 1,500 KW **wind turbines mounted atop 200+ feet-high steel towers**.

Our proposal of 01/27/03 included the performance of **8 PRELIMINARY soil borings** in the Punta Verraco and Punta Ventana sites. Mr. Víctor González, President of Antilles Cement Corporation, has since extended the original number of borings with **8 additional borings**.

The work performed was authorized by Mr. Víctor González in early February 2004.

B. **FIELD EXPLORATION:**

Field exploration was made by Metropolitan Soils and Engineering Materials Laboratory, Inc.

The method of drilling through overburden was generally by power-advanced continuous-flight augers. [Overburden refers to any unconsolidated soil material lying above bedrock (including both natural soil formations and/or man-made fill) that can be drilled without resorting to rotary drilling with diamond bits.]

The method of drilling through rock, **if performed**, and including rubble, concrete, stones, cobbles, boulders, etc. which could not be broken up nor displaced, was by diamond-bit rotary drilling [rock coring].

The method of sampling overburden was split-spoon drive. The individual samples were obtained by **driving** a 2-in. O.D. special split-barrel sampling spoon into material which has not been disturbed by the immediately preceding drilling operation.

The method of sampling rock [bedrock, detached sections of rock, or large boulders into or through which core boring is necessary], **if performed**, was by continuous core-boring with a diamond core bit and a double-tube core barrel.

The **Standard Penetration Test** was performed in every split spoon sampling incident to **estimate** the in-situ **density** of granular [coarse-grained] soil materials and the **consistency** of fine-grained clayey soils. A 140-pound drop hammer, free-falling 30 inches, is utilized to drive the split-barrel sampler 12 inches and the corresponding number of blows recorded and annotated as the **blow count** or **N-value**.

C. **LABORATORY TESTS:**

Moisture content and unconfined compression routine tests were performed on the recovered split-spoon drive samples whenever possible. Special Atterberg limits, classification, unit weight, specific gravity of solids, unconfined compression [Shelby-tube samples] and grain size and gradation distribution tests **may have been performed** to determine, estimate or correlate pertinent engineering properties to the type of project under consideration.

D. **GROUNDWATER LEVELS:**

The depth to groundwater, if groundwater was indeed observed at the location of the boring, has been shown on the log of the boring. Unless otherwise modified, the noted depth refers to the measured depth **when first observed by the driller/logger while drilling and/or sampling at the particular boring location**. In particularly impermeable strata **more reliable methods** [like observation wells] **should be adopted** to measure the depth to the water level over a considerable length of time. The use of water during drilling, the use of casing, the penetration of strata of vastly different permeability, the occurrence of perched water, **and the limited time available for observation** all contribute to the difficulty of obtaining reliable groundwater data during the time span of the actual field exploration.

E. **GENERAL GEOLOGY:**

The Geologic Map of the Yauco and Punta Verraco Quadrangles, Puerto Rico, by Krushensky and Monroe, 1978, maps the Punta Verraco-Cerro Toro-Punta Ventana site in map unit **Tp, Ponce Limestone**, described briefly as:

"White to dark-yellowish-orange biomicrite in which voids are lined with sparry calcite, and containing, in the lower part, abundant internal molds of mollusks and solitary corals; also shells of echinoids, and tests of Foraminifera; locally contains scattered grains of quartz; near coast contains as much as 7 percent Mg. About 200 m thick."

Two other valuable sources of geologic information on Ponce Limestone were used, (1) "The Karst Landforms of Puerto Rico" (Monroe, 1976, Geological Survey Professional Paper 899), and (2) "Geology of the Middle Tertiary Formations of Puerto Rico" (Monroe, 1980, Geological Survey Professional Paper 953). Important distinguishing features of Ponce Limestone are:

1. The Ponce Limestone, of Miocene age, is exposed continuously [except where covered by alluvium in river valleys] from the valley of the Río Pastillo just west of Ponce to Bahía Montalva 8 Km west of Guánica.
2. The Ponce Limestone rests unconformably on the youngest known rocks of the Juana Díaz Formation (the upper clastic beds of the Juana Díaz) in the quarries of the Puerto Rican Cement Company at the west edge of Ponce and on the western side of the valley of the Río Tallaboa.
3. The best outcrops of Ponce Limestone known are in the cuts of Highway PR-2 between the valleys of the Río Tallaboa and the Río Macaná north of the refinery of the Commonwealth Oil Refining Company. Most parts of the outcrop are very fossiliferous, mostly containing molds of mollusks, but echinoids are common, as are coral and common foraminifers.
4. The **very hard limestone** is relatively pure calcium carbonate, containing only very minor amounts of material insoluble in hydrochloric acid.
5. **The lithologic character of the Ponce Limestone is much the same as observed in plenty of cuts and quarries as far west as the Río Yauco.**

6. The Ponce Limestone is present on the southern slopes of the ridge between Central San Francisco (just 2.3 km north-northwest of Pta. Ventana) and Bahía de Guánica, but much of it has been **recrystallized** to very pale orange and light-gray limestone. Exposures **along the coast** from Punta Ventana west to Bahía de Guánica are all limestone of Miocene age that has been almost completely recrystallized. Outcrops near the sea may have been slightly dolomitized with the magnesium coming originally from sea spray.
7. The outcrops west of Río Tallaboa, north of the at one time CORCO refinery, is known to be cut by several **small** faults.
8. The Ponce Limestone is entirely **an organic reef deposit** characterized by various kinds of corals, algae, and mollusks. It probably formed as a fringing reef, on a reef flat, on the southern coast of Puerto Rico in Miocene time and became thicker as the coastal shelf slowly subsided.
9. The limestone is **recrystallized reef limestone** that **resists erosion**; hence, it gives rise to steep-sided hills that tend to be characterized by a small north-facing cuesta scarp.
10. **Few caves** have been reported in the formation but most are small, little more than rock shelters.
11. The karst landforms of Puerto Rico are controlled primarily by **climatic factors** such as **precipitation** and **wind direction**.

F. **EXISTING GROUND:**

The northeast-oriented Punta Verraco elongated-main-site, topped by a 40 m contour, exhibits **steep northwest and southeast sideslopes**.

At Cerro Toro, the crown contour is 55 m, with steep south-southeast sideslopes.

At Pta. Ventana, the highest site at 100 m crown contour, steep east and north-northeast sideslopes occur.

G. **SOIL CONDITIONS AND PROPERTIES:**

The enclosed Particle Size Distribution Tests kind of summarize the Pta. Verraco-Cerro Toro-Pta. Ventana upper "soils" except for perhaps the topmost 10 to 13 feet of hardened (recrystallized "crust") calcareous materials encountered primarily at Borings "B", "D", "E" & "F" at Punta Verraco, and throughout all of Boring "G" also at Punta Verraco. At Punta Toro Borings "L" and "M" no such "crust" was found, while the Punta Ventana Borings "H", "H-2", "I-1", "I-2", "J-1", "J-2" and "K" were the hardest borings of the 16 borings performed in this preliminary geotechnical investigation for the proposed wind turbines project.

Arbitrarily, 3 sets of tests group the in-situ "soils":

1. **Silty SANDS with varying amounts of weathered limestone fragments/pebbles/stones, and gravelly SANDS with fines.** Percentages finer than the #200 sieve size, 0.075 mm, were roughly 20 or less for this group. USCS classification was SM, silty sands/sand-silt mixtures.
2. **Similar silty SANDS or SAND-SILT mixtures but with a higher percentage of the minus #200 sieve size material, say around 25 percent.**
3. **Fine sandy SILTS and fine-and-medium sandy clayey SILTS, with minus #200 sieve size material percentages roughly 35 or more.** The fine sands-silts had Atterberg limits of typically LL=31, PL = 28, PI = 3 (USCS classification ML), while the clayey silts and sandy clayey silts had Atterberg limits of typically LL=53-61, PL=20-32, PI=21-41 (USCS classification MH and CH).

It is perceived that the slightly plastic (ML) to highly plastic (CH) regions or zones are just that, localized random regions or zones, and thus constitute the exception rather than the rule.

Equally we feel that the predominant soil materials shall result soils 1 and 2 above: SILTY SANDS, SAND-SILT MIXTURES, GRAVELLY LIMESTONE and HARD CALICHE.

Because of uplift, base shear and moment considerations we are assuming that support for the many contemplated wind turbines shall be on individual large, pedestal-like foundations set some 10 or so feet into opened excavations into the predominant site "soils" described above.

For a detailed description and stratigraphy of the soil conditions and properties encountered at the sixteen (16) borings performed refer to the Subsurface Exploration Logs at the Appendix.

H. PRELIMINARY CONCLUSIONS AND/OR RECOMMENDATIONS:

From the soils data obtained in the preliminary geotechnical investigation performed, strengthened by the geologic data cited and summarized previously, we may safely say that bearing capacity shall not be a problem at the Punta Verraco-Cerro Toro-Punta Ventana site proposed for the wind turbines. What shall control the design is the uplift generated by the large overturning moments resulting from extreme wind acting on the individual towers of height each 70 meters. We assume, from the submitted foundation drawings, that the underside of the individual foundation mats would lie close to 10 feet underneath the presently existing grades. The weight of the concrete, plus the weight of the overlying compacted backfill, would counter the overturning moments. At the Appendix find results of classification tests [Atterberg limits for the passing No. 40 sieve-size fraction] and

moisture-density relationship tests [Modified Proctor] performed on laboratory compacted samples of one of the site's soil materials.

At proposed foundation level there is **no groundwater** to deal with.

A nominal (design) soil bearing pressure of 5,000 PSF can be safely relied upon in design.

Bag samples of the predominant foundation level soils [i.e., of silty sands and/or sand-silt mixtures, with varying amounts of weathered limestone fragments/pebbles/stones] have been recovered and await sending to a stateside laboratory for consolidated-drained [direct shear] testing. Meanwhile, the following parameters may be assumed in preliminary designs:

γ_{dry} : 93 to 102 PCF	for a 75% relative density
void ratio, e	0.8 to 0.65
friction angle, ϕ	33 to 35 degrees

A bucket sample of the in-situ soil materials at the Punta Verraco Boring "E", depth > 9ft, was recovered from the material raised to the surface by the rotating augers. A Modified Proctor Test was performed of said material, including classification, and the results were as follows:

Sample description: Tan silty fine to coarse gravelly SAND

Plastic limit: 13.8

Liquid limit: 14.6

Plasticity index: 0.8 (non-plastic)

Classification: USCS **SM**

AASHTO **A-1-b(0)**

γ_{dry} max: 130.5 PCF

Opt. moisture: 8.3%

Compacted backfill constructed over the individual foundation mats concrete shall strive to attain percentages compaction in excess of 124 PCF (95% of dry max).

One important consideration would be **to consider maintaining a prudent and safe horizontal offset distance of the individual mat foundations from the face or side of nearby very steep sideslopes.**



Respectfully submitted,

Heraclio A. Amadeo Lopategui

A large, stylized handwritten signature in black ink, which appears to be "Heraclio A. Amadeo Lopategui". The signature is written over the typed name and extends upwards and to the left.

TABLE I

DESCRIPTIVE TERMINOLOGY

SOIL IDENTIFICATION SYSTEM

COHESIVE SOILS

Descriptive Term

Plasticity Index

SILT, trace clay, or **ORGANIC SILT**, trace clay
Clayey **SILT**, or **ORGANIC** clayey **SILT**
Silty **CLAY**, or **ORGANIC** silty **CLAY**
CLAY or **ORGANIC CLAY**

1 - 5
5 - 20
20 - 40
40 plus

GRANULAR SOILS

Descriptive Term

Per Cent by Wt.

trace
little
some
and

0 - 10
10 - 20
20 - 35
35 - 50

TABLE II
DESCRIPTIVE TERMINOLOGY
CONSISTENCY OF COHESIVE SOILS AND
RELATIVE DENSITY OF GRANULAR SOILS

COHESIVE SOILS

N - Blows / Ft. (*)

**Unconfined Compressive
Strength**

See Terzaghi & Peck

Consistency

-0.25 (T.S.F.)
0.25 - 0.50
0.50 - 1.00
1.00 - 2.00
2.00 - 4.00
+4.00

Less than 2
2 - 4
4 - 8
8 - 15
15 - 30
more than 30

Very soft
soft
medium
stiff
very stiff
hard

GRANULAR

N - Blows / Ft.

Relative Density

0 - 4
4 - 10
10 - 30
30 - 50
Over 50

very loose
loose
medium
dense
very dense

(*) Blows per foot on a 1 - 3/8" I. D. - 2" O. D. split spoon sampler driven by a 140 lbs. hammer with a free fall of 30 in.

APPENDIX

METROPOLITAN SOILS & ENGINEERING MATERIALS LABORATORY, INC.

SUBSURFACE EXPLORATION LOG BORING NO. A

Sheet 1 of 1

JOB NO. 2882 JOB TITLE AEROGENERADORES NEG MICON SITE

LOCATION GUAYANILLA, P.R. DATE 02-04-04 REF. ELEV. ---- DATUM ----

SAMPLE HAMMER: WT. 140 LBS. DROP 30" CASING HAMMER: WT. --- DROP ---

SAMPLER TYPE AND SIZE 2" O.D. SPLIT SPOON CASING SIZE AUGERS

Depth in Feet (Elevation)	Blows on Sampler For 6 inches	Percent Sample Recovery	Sample Number	Description of Material	Blows / Foot on Casing	Penetration Test "N" Value	Unconfined Comp. Strength - T / □'	Percent Moisture Content	
5	7,12,12	89	1	Medium dense to dense silty fine SAND , some very fine sandy silt, trace clayey silt, occa. to some weathered liemstone fragments; beige, brown & cream.		24	-	25.1	
	16,18,18	72	2						
10	16,25,25	67	3	Fine SAND-SILT , little weathered rock; beige very pale yellow-cream & pale greenish cream; hard.		50	-	18.6	
	18,28,30	100	4						
15	36,35,30	100	5	Fine & medium sandy clayey SILT , trace cream silt, stones; yellow, light yellowish green, cream & reddish brown.		65	-	46.2	
	25,27,30	100	6						
25	60/6"	83	7	CRUSHED & FRAGMENTED LIMESTONE ROCK , little sand-silt, little yellow, occa. light greenish gray clayey silt; reddish brown & pale yellow.		60/6"	-	7.3	
	25,50/6"	50	8						
				END OF BORING 29.5'					



METROPOLITAN SOILS & ENGINEERING MATERIALS LABORATORY, INC.

SUBSURFACE EXPLORATION LOG BORING NO. C

Sheet 1 of 1

JOB NO. 2882 PUNTA VERRACO, JOB TITLE AEROGENERADORES NEG MICO SITE
 LOCATION GUAYANILLA, P.R. DATE 02-06-04 REF. ELEV. --- DATUM ---

SAMPLE HAMMER: WT. 140 LBS. DROP 30" CASING HAMMER: WT. ---- DROP -----

SAMPLER TYPE AND SIZE 2" O.D. SPLIT SPOON CASING SIZE AUGERS

Depth in Feet (Elevation)	Blows on Sampler For 6 inches	Percent Sample Recovery	Sample Number	Description of Material	Blows / Foot on Casing	Penetration Test "N" Value	Unconfined Comp. Strength - T/□'	Percent Moisture Content
5	11,13,15	100	1	SILTY fine medium-coarse SAND , tr. clay, some limestone frags.; brown, tan, pale yellow & cream.		28	-	15.2
	7,10,12	89	2			22	-	18.2
	9,11,11	83	3			22	-	16.2
10	19,30,30	100	4	LIMESTONE ROCK crushed & fragmented; some fine sandy clayey silt.		60	-	9.7
15	22,50/6"	50	5	Dense & very dense silty fine SAND & fine SAND-SILT , tr. to little clay; with limestone fragments.		50/6"	-	14.2
20	12,15,17	28	6			32	-	6.6
25	16,18,18	61	7			36	-	4.1
30	11,14,14	100	8	Very stiff fine sandy SILT with WEATHERED LIMESTONE FRAGS. little clay; pale yellow & cream.		28	-	5.1
				END OF BORING 30.0'				

METROPOLITAN SOILS & ENGINEERING MATERIALS LABORATORY, INC.

SUBSURFACE EXPLORATION LOG

BORING NO. E
Sheet 1 of 1

OB NO. 2882 JOB TITLE AEROGENERADORES NEG MICO SITE
 LOCATION PUNTA VERRACO, GUAYANILLA, P.R. DATE 02-16-04 REF. ELEV. ---- DATUM ----
 ANVIL HAMMER: WT. 140 LBS. DROP 30" CASING HAMMER: WT. ---- DROP ----
 ANVIL TYPE AND SIZE 2" O.D. SPLIT SPOON CASING SIZE AUGERS

Depth in Feet (Elevation)	Blows on Sampler For 6 inches	Percent Sample Recovery	Sample Number	Description of Material	Blows / Foot on Casing	Penetration Test "N" Value	Unconfined Comp. Strength - T/□'	Percent Moisture Content		
5	9,12,14	50	1	WEATHERED and CRUSHED & FRAGMENTED LIMESTONE ROCK, tr. to little fine sand, tr. clayey silt; reddish brown & pale yellow.	26	-	7.9			
	50/4"	50	2		50/4"	-	8.2			
	60/3"	67	3		60/3"	-	8.3			
10	16,18,21	89	4		Dense silty SAND with varying amts. of weathered limestone frags.; pale yellow, very pale yellow & cream.	39	-	9.3		
15	14,19,30	100	5			49	-	9.4		
20	17,21,23	56	6			44	-	8.2		
25	20,30,31	100	7			61	-	7.1		
30	26,39,33	44	8		62	-	6.7			
				END OF BORING 30.0'						

METROPOLITAN SOILS & ENGINEERING MATERIALS LABORATORY, INC.

SUBSURFACE EXPLORATION LOG

BORING NO. F
 Sheet 1 of 1

JOB NO. 2882 JOB TITLE AEROGENERADORES NEG MICO SITE
 LOCATION PUNTA VERRACO, GUAYANILLA, P.R. DATE 02-06-04 REF. ELEV. ---- DATUM ---
 SAMPLE HAMMER: WT. 140 LBS. DROP 30" CASING HAMMER: WT. --- DROP ---
 SAMPLER TYPE AND SIZE 2" O.D. SPLIT SPOON CASING SIZE AUGERS

Depth in Feet (Elevation)	Blows on Sampler For 6 inches	Percent Sample Recovery	Sample Number	Description of Material	Blows / Foot on Casing	Penetration Test "N" Value	Unconfined Comp. Strength - T/□'	Percent Moisture Content
5	9,10,13	17	1	Generally dense silty fine & medium-grained SAND with varyin amounts of weathered limestone rock frags.; tan, pale yellow, cream & very pale yellow.		23	-	14.6
	18,60/5"	45	2			60/5"	-	19.9
	50/4"	50	3			50/4"	-	6.3
10	19,21,21	89	4			42	-	17.2
15	17,19,23	89	5			42	-	13.2
20	16,20,26	100	6			46	-	12.7
25	17,19,22	100	7			41	-	13.3
30	30,39,50	100	8		Hard fine sandy SILT , tr. weathered limestone rock; beige-cream.		89	-
				END OF BORING 30.0'				

METROPOLITAN SOILS & ENGINEERING MATERIALS LABORATORY, INC.

SUBSURFACE EXPLORATION LOG

BORING NO. G
Sheet 1 of 1

JOB NO. 2882 JOB TITLE AEROGENERADORES NEG MICON SITE
LOCATION PUNTA VERRACO GUAYANILLA, P.R. DATE 02-09-04 REF. ELEV. --- DATUM ---
SAMPLE HAMMER: WT. 140 LBS. DROP 30" CASING HAMMER: WT. --- DROP ---
AMPLER TYPE AND SIZE 2" O.D. SPLIT SPOON CASING SIZE AUGERS

Depth in feet (Elevation)	Blows on Sampler For 6 inches	Percent Sample Recovery	Sample Number	Description of Material	Blows / Foot on Casing	Penetration Test "N" Value	Unconfined Comp. Strength - T/□	Percent Moisture Content		
5	50/6"	17	1	Generally silty fine, medium & coarse SAND with varying amts. of weathered limestone pebbles/stones; tan & pale yellow.	50/6"	-	8.6			
5	60/5"	11	2		60/5"	-	8.9			
10	50/6"	11	3		50/6"	-	9.0			
10	3,50/6"	33	4		50/6"	-	5.5			
15	60/6"	28	5		60/6"	-	7.1			
20	50/6"	22	6		50/6"	-	8.3			
25	50/4"	17	7		50/4"	-	5.5			
	50/2"	50	8		50/2"	-	7.1			
				END OF BORING 28.7'						

METROPOLITAN SOILS & ENGINEERING MATERIALS LABORATORY, INC.

SUBSURFACE EXPLORATION LOG

BORING NO. H
 Sheet 1 of 1

JOB NO. 2882 JOB TITLE AEROGENERADORES NEG MICON SITE
 LOCATION PUNTA VENTANA GUAYANILLA, P.R. DATE 02-23-04 REF. ELEV. ----- DATUM ---
 SAMPLE HAMMER: WT. 140 LBS. DROP 30" CASING HAMMER: WT. ----- DROP ---
 SAMPLER TYPE AND SIZE 2" O.D. SPLIT SPOON CASING SIZE AUGERS

Depth in Feet (Elevation)	Blows on Sampler For 6 inches	Percent Sample Recovery	Sample Number	Description of Material	Blows / Foot on Casing	Penetration Test "N" Value	Unconfined Comp. Strength - T/□'	Percent Moisture Content
5	10,10,12	83	1	Silty fine SAND/WEATHERED LIMESTONE; pink & pale yellow	22	-	4.9	
	16,16,19	50	2		35	-	4.1	
	60/5"	80	3	WEATHERED PONCE LIMESTONE ROCK with lesser amts. of silty sand; fine sandy clayey bottom sample; tan & brownish red.	60/5"	-	1.9	
10	46,50/4"	30	4		50/4"	-	1.9	
	60/5"	60	5		60/5"	-	4.0	
15								
20	60/4"	50	6		60/4"	-	6.5	
	60/6"	67	7		60/6"	-	6.6	
				END OF BORING 24.0'				

METROPOLITAN SOILS & ENGINEERING MATERIALS LABORATORY, INC.

SUBSURFACE EXPLORATION LOG

BORING NO. H-2

Sheet 1 of 1

JC NO. 2882 JOB TITLE AEROGENERADORES NEG MICON SITE

LOCATION PUNTA VENTANA, GUAYANILLA, P.R. DATE 02-23-04 REF. ELEV. ---- DATUM ---

SAMPLE HAMMER: WT. 140 LBS. DROP 30" CASING HAMMER: WT. --- DROP --

SAMPLER TYPE AND SIZE 2" O.D. SPLIT SPOON CASING SIZE AUGERS

Depth in Feet (Elevation)	Blows on Sampler For 6 inches	Percent Sample Recovery	Sample Number	Description of Material	Blows / Foot on Casing	Penetration Test "N" Value	Unconfined Comp. Strength - T / □'	Percent Moisture Content		
5	7,9,9	56	1	Mostly stiff-very stiff SILT & fine to coarse sandy SILT with trace to little clay & with WEATHERED LIMESTONE FRAGMENTS ; an indurated silt region starting at a depth of +/- 17 feet; hard clayey silt bottom sample; tan, grayish tan, pale yellow & cream.	18	-	15.6			
	11,10,10	50	2		20	-	29.5			
10	12,12,16	61	3		28	-	17.3			
	7,9,10	89	4		19	-	29.3			
15	10,10,10	100	5		20	-	30.7			
	50/6"	50	6		50/6"	-	16.0			
20										
25	48,50/5"	55	7		50/5"	-	14.1			
30	12,14,28	100	8	42	-	18.1				
				END OF BORING 30.0'						

METROPOLITAN SOILS & ENGINEERING MATERIALS LABORATORY, INC.

SUBSURFACE EXPLORATION LOG

BORING NO. I-1

Sheet 1 of 1

JOB NO. 2882 JOB TITLE AEROGENERADORES NEG MICON SITE

LOCATION PUNTA VENTANA GUAYANILLA, P.R. DATE 02-23-04 REF. ELEV. --- DATUM ---

SAMPLE HAMMER: WT. 140 LBS. DROP 30" CASING HAMMER: WT. ---- DROP ---

SAMPLER TYPE AND SIZE 2" O.D. SPLIT SPOON CASING SIZE AUGERS

Depth in Feet (Elevation)	Blows on Sampler For 6 inches	Percent Sample Recovery	Sample Number	Description of Material	Blows / Foot on Casing	Penetration Test "N" Value	Unconfined Comp. Strength - T / □'	Percent Moisture Content		
5	6, 12, 14	56	1	Mostly silty fine SAND with LIMESTONE ROCK FRAGS. - PEBBLES , trace clay.	26	-	30.8			
	50/6"	50	2		50/6"	-	7.3			
	60/6"	33	3		60/6"	-	7.0			
10	50/3"	67	4		50/3"	-	4.4			
15	60/4"	75	5		60/4"	-	10.7			
20	60/3"	100	6	Sandy clayey SILT with WEATHERED LIMESTONE; reddish - tan.	60/3"	-	14.5			
	60/5"	80	7		60/5"	-	13.2			
				END OF BORING 23.9'						