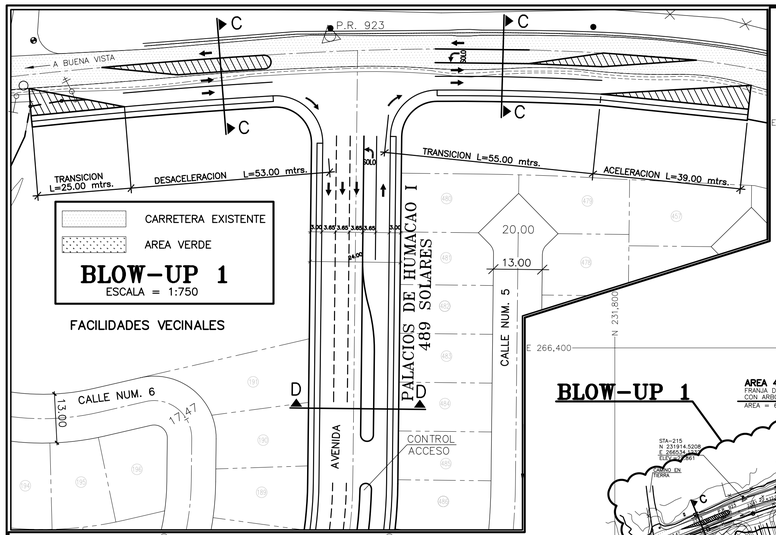
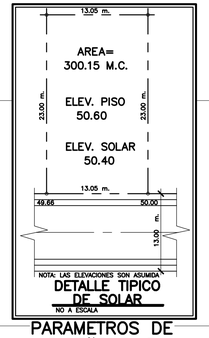
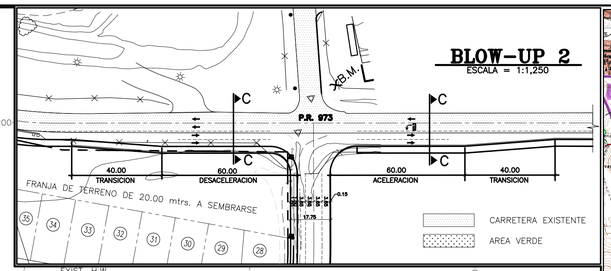
# ANEJOS

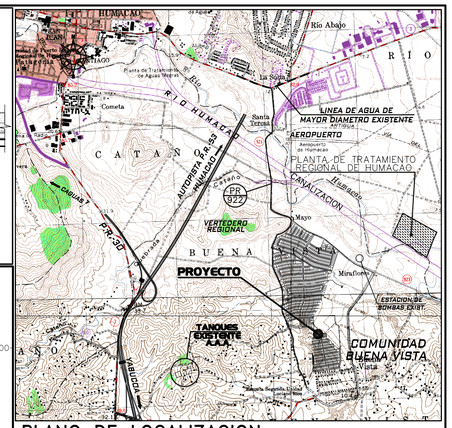
# ANEJO 1




PARAMETROS DE DISEÑO R-3




PLANO DE LOCALIZACION
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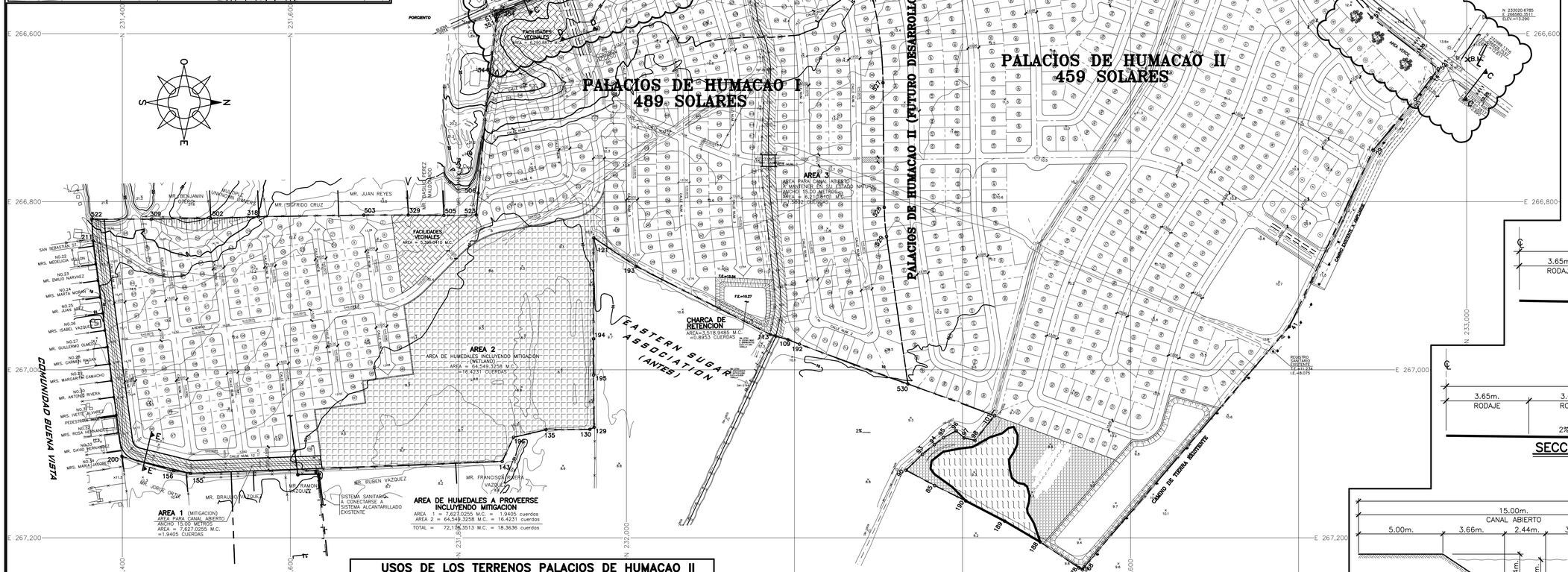
N 232,300 E 266,725




PLANTA
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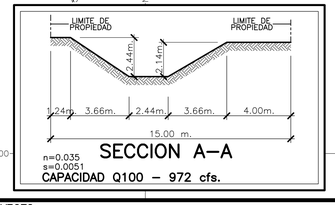


SECCION A–A
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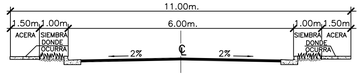


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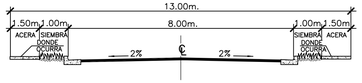


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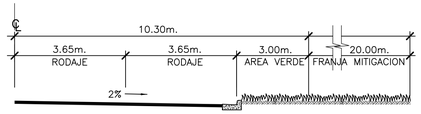


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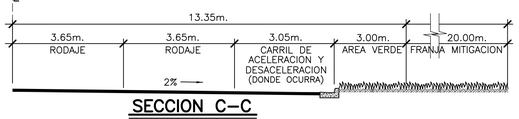


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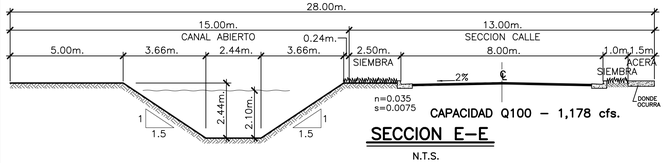
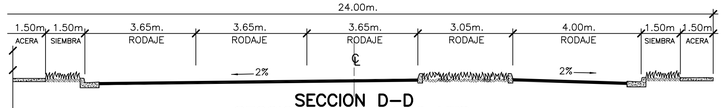



SECCION E–E
N.T.S.




SECCION D–D
SECCION CALLE 24.00 MTS.
N.T.S.

## USOS DE LOS TERRENOS PALACIOS DE HUMACAO I

| USO DE TERRENO | AREA MTS² | AREA CUERDAS | (%) |
|---|---|---|---|
| AREA DE CALLES | 67,698.6533 | 17.2244 | 19.52 |
| AREA DE SOLARES | 178,757.3133 | 45.4808 | 51.55 |
| FACILIDADES VECINALES | 11,685.9283 | 2.9732 | 3.37 |
| AREA 1 (MITIGACION) | 7,627.0255 | 1.9405 | 2.20 |
| AREA 2 (HUMEDAL) | 64,549.3258 | 16.4231 | 18.61 |
| AREA 3 (CANAL ABIERTO) | 6,210.8101 | 1.5802 | 1.79 |
| AREA 4 (AREA VERDE) | 6,726.8171 | 1.7115 | 1.94 |
| CHARCA DE RETENCION | 3,518.9485 | 0.8953 | 1.02 |
| **TOTAL** | **346,774.8219** | **88.2290** | **100.00** |

## USOS DE LOS TERRENOS PALACIOS DE HUMACAO II

| USO DE TERRENO | AREA MTS² | AREA CUERDAS | PORCIENTO (%) |
|---|---|---|---|
| AREA DE CALLES | 62,864.2598 | 15.9944 | 17.135 |
| AREA DE SOLARES | 225,553.4502 | 57.3870 | 61.480 |
| FACILIDADES VECINALES | 18,271.2009 | 4.6487 | 4.980 |
| PLAYLOT (JUEGO DE NIÑOS) | 964.8306 | 0.2455 | 0.263 |
| AREA VERDES (JARDIN) | 603.6430 | 0.1535 | 0.165 |
| AREA VERDE 5 | 16,725.1142 | 4.2553 | 4.559 |
| AREA VERDE 6 (CANAL ABIERTO) | 4,988.6311 | 1.2692 | 1.360 |
| AREA VERDE 7 (CANAL ABIERTO) | 4,888.5790 | 1.2438 | 1.332 |
| AREA DE HUMEDAL (8) | 7,890.8511 | 2.0076 | 2.151 |
| AREA DE MITIGACION (9) | 11,417.1802 | 2.9065 | 3.112 |
| CHARCA DE RETENCION (10) | 12,706.6186 | 3.2329 | 3.463 |
| **TOTAL** | **366,874.3587** | **93.3428** | **100.000** |

| | | |
|---|---|---|
| DIBUJADO POR: R.R.L. | REVISIONES | FECHA |
| CORREGIDO POR: J.A.M. | REVISION GENERAL DE NIVELES | JULIO 2008 |
| APROBADO POR: J.A.M. | | |
| PROYECTO: 0020–H–VRM | | |
| PROYECTO: 1:2,500 | | |

JOSE A. MELENDEZ & ASSOCIATES
ENGINEERING CONSULTANTS
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SAN FRANCISCO DEV.
SAN JUAN, PR 00927
TEL. 787–751–8985
FAX. 787–751–1052
JAMYASSOCC@PRTC.NET

PROYECTO:
**PALACIOS DE HUMACAO (1ra, y 2da FASES)**

DUEÑO:
**EMPRESAS V.R.M.**

TITULO DE HOJA:
# DESARROLLO PRELIMINAR

| | |
|---|---|
| NOMBRE DE DIBUJO: | 0-DESARROLLO PRELIMINAR HUMACAO I Y II – NOV 2008.dwg |
| NUMERO HOJA: | 1 |
| TOTAL DE HOJAS: | 1 |
| FECHA: | NOVIEMBRE DEL 2008 |
| ESCALA: | 1:2.500 |

\\Server\DWGS\04-0020-HUMACAO-VRM\0-DESARROLLO PRELIMINAR HUMACAO I Y II – NOV 2008.dwg 12/2/2008 3:30:02 PM SWST

# ANEJO 2

# REPORT

## ON THE PRELIMINARY GEOTECHNICAL EXPLORATION PERFORMED AT THE SITE OF THE PROPOSED PALACIOS DE HUMACAO, DEVELOPMENT, BUENA VISTA WARD, HUMACAO, PUERTO RICO

SUBMITTED TO:

**Mr. José Valdés**
**President**
**Empresas V.R.M. Inc.**


By:

Rubén Torres, PE

Jaca & Sierra Testing Laboratories Inc.

Soil Consulting Engineers


November 30, 2007

**Job No. 6630**

# REPORT

## ON THE PRELIMINARY GEOTECHNICAL EXPLORATION PERFORMED AT THE SITE OF THE PROPOSED PALACIOS DE HUMACAO, DEVELOPMENT, BUENA VISTA WARD, HUMACAO, PUERTO RICO

## INTRODUCTION:

The present soil report covers the results of the preliminary geotechnical exploration performed at the farm property of Empresas V.R.M. Inc., located at Buena Vista Ward of Humacao, P.R., and which is to be developed with the proposed Palacios de Humacao Development as indicated in the housing project general plan.

The performed subsoil exploration was directed to determine the underground prevailing geologic and general geotechnical subsoil conditions of the farm hillsites and hillsides sections, along the farmsite lower areas toward the existing natural depressions and river valley.

The results of the performed project site subsoil exploration were analyzed and evaluated for the preliminary planning and design concept and the project required earthwork construction recommendations.

The preliminary geotechnical exploration was made following conversations with Mr. José Valdés, president of Empresas V.R.M. Inc., owners of the farm.

**PROJECT SITE PREVAILING GEOLOGIC AND TOPOGRAPHIC CONDITIONS:**

In conformity with the General Geologic Topographic Quadrangle, the housing project construction site falls within a geologic zone defined as KL, which corresponds to granodiorite rocks formation. This formation is found at shallow depths along the higher grounds mainly below 10 ft. as indicated on the test borings. The farmsite lowland area is classified as Qaf according to Geologic Topographic Quadrangle, which corresponds to alluvial and fanglomerate soil deposit. The soil material consists of stratified silty clay, sand, sandy clay and clayey sand with different order of stratification.

Similarly, the Topographic Quadrangle shows that the farmsite natural grounds are found defined by a local hillside section with ground elevations of about 15.0 to 20.0 mts. and which then extend toward the lower natural alluvial terrace areas with their ground elevations gradually descending from 15 to 10 mts. contour elevations toward the river valley and the natural depression areas as referred to the mean sea level elevations.

The housing project construction site development topographic plan, harmonizes with the above described natural ground elevations as obtained from the Humacao Topographic Quadrangle.

**FARMSITE GENERAL PREVAILING UNDERGROUND SUBSOIL CONDITIONS:**

The proposed housing project construction site was explored by the drilling of 31 test borings at various farm site sections of different prevailing

topographic conditions and which discovered by the following project site general soil profile.

1. The farm general grounds are found topped with a topsoil layer basically composed of dark brown and dark gray sandy and silty clays found extending to a depth of about 1.0 to 1.5 ft. beneath existing ground surface at the farmsite higher ground elevations.
2. The subsoil at the farm hillsides and lower terrace areas bordering the hillsides has been found to be basically composed by a thick deposit of light brown silty clay, sandy clay and clayey sand extending depths of 2.0 to 8.0 ft. beneath the existing ground surface.
3. The following soil deposit beneath the above clayey soil materials at the high grounds consists of a weathered granodiorite rock formation, which after excavation breaks into silty sand and rock fragments. The silty sand soil stratum corresponds to the upper horizons of the underneath rock formation according to Humacao Geologic Quadrangle.
4. The soil deposit along the lowland area consists of deep transported deposit composed of organic silt clay, sandy clay and clayey sand with different order of stratification.
5. The natural underground water level is found on the surface along the drainage channels with a water level of about 6 inches above the channel bottom during our field subsoil exploration program.

The remaining project areas show the water level at different depths as indicated on the boring logs.

Please refer to the enclosed boring logs for a more detailed description regarding the soil profile, water level and the corresponding field and laboratory test results.

**PRELIMINARY RESULTS AND RECOMMENDATIONS:**

The results of our preliminary geotechnical exploration indicate that the prevailing subsoil conditions are favorable for the development of the site with the proposed residential structures following the recommendations below:

To facilitate the interpretation of the recommendations, the project area will be divided on Phase I and II.

**Phase I:**

The results of the test made at Phase I indicate surficial unstable soil layers varying from 1 to 4 ft. deep along the higher grounds and lowland areas near the margins of existing drainage channel, except at boring No. 14, where the unstable soil material extends to a depth of about 8.0 ft.

In general, the area involves the removal of the unstable surficial soil layer to a depth of 1 to 4 ft. and backfilling operations with a properly placed and compacted fill material.

The area of boring No. 14 involves a soil removal of about 8.0 ft. or a stabilization program by means of fill surcharge.

On the enclosed plan, we are delimiting the approximated area of the unstable soil material to be removed or stabilized by a fill surcharge.

The horizontal and vertical extension of the soil removal shall be made directly on the field during the progress of the earth work operations; however, for cost estimate purposes on the enclosed plan, we are indicating the depth of the soil material to be removed. The final fill recommendations for the specific area will be submitted once the total area is delimited on the final geotechnical investigation.

Similarly, the project utilities can be safely placed over the existing natural soil or properly compacted fill layer without involving any special subsoil treatment, except the soil removal previously recommended.

The results of the test borings made at the higher grounds or cut areas of the project indicated that the existing soil can be excavated by using the conventional type of earth excavating and hauling equipment.

The hard material was encountered over 10 to 15 ft. deep at borings No. 3, No. 5 and 8, respectively.

Fill and cut slopes shall be designed and constructed for a slope ratio 2:1 (H:V).

The cut material along the project is very susceptible to erosion, and shall be planted within grass to avoid the formation of gullies on the slope faces.

In addition, a swale or drainage ditch shall be constructed at the top of the cut slopes to collect and drain out all waters coming from the high grounds.

**Phase II:**

The phase II of the project corresponds to the lowland areas of the main farm. The test boring made at the lowland area show a deep deposit of stratified transported soil with variable compressive strength and relative densities.

Consequently, the proposed residential area shall be improved by the removal of unstable soil material and backfill operations.

In addition, the lower project area has to be improved by a stabilization program ahead of the house construction.

On the enclosed plan, we are indicating the areas requiring a fill surcharge to stabilized the area ahead of the residential construction; this area has been delimited on preliminary basis, and has to be corroborated with the final geotechnical investigation.

For cost estimate purposes, the fill surcharge shall be estimated of 10 ft. high over the fill grade elevation.

**FILLING OPERATIONS:**

The material shall be placed and compacted following the recommendations below:

1. The topsoil, vegetation or any soft material found at the filling areas shall be removed prior to start with the fill construction. On the enclosed plan we are indicating besides the test borings the depth of the unstable soil material to be removed. Total area shall be delimited on a final geotechnical investigation. In

addition, we are delimiting the approximated areas requiring a stabilization program by means of the fill surcharge.

2. The fill material required to reach the final grade elevation shall be placed in layers not exceeding eight (8) inches, and each layer shall be imparted with a degree of compaction of 95% of maximum dry density as obtained from the soil compaction curve made according to A.S.T.M. D-1557.
3. The cut material of the high grounds can be used for filling purposes at the lower grounds, except the expansive clayey soil material, which can not be used on the last two and a half ft. (2.5 ft.) below final grade.

The last two and a half ft. (2.5 ft.) of fill shall consist of inorganic and non-expansive soil material approved by the soil engineer.

The fill embankment to be constructed resting over the existing natural steep slopes shall be benched or terraced as filling progresses up slope.

Down slope filling operations shall not be permitted.

Once the fill material is placed and compacted in the manner specified above, the proposed residential structures can be safely constructed over the fill layer.

The excavations of the unstable soil material and the expansive soil to be removed shall be made under the direct supervision of a soils laboratory.

**PRELIMINARY HOUSE FOUNDATION DESIGN:**

Once the improvements and general grading are completed following our recommendations, the proposed residential structures can be safely casted over conventional type of foundation.

For preliminary design of the house foundation system, an allowable soil bearing pressure of 2,000 lbs. per sq. ft. can be used.

The bases of the footing shall be located at a minimum depth of 1.5 ft. below final grade elevation for spread footing foundation system or monolithic type of floor and footing system.

**ADDITIONAL COMMENTS:**

The above recommendations were submitted for the general geologic and geotechnical information of the site and for preliminary planning and design of the site facilities.

Each development shall be investigated separately by a detailed geotechnical investigation once the final location, grading and type of structure are established.

**FIELD WORK:**

The field work consisted of drilling twenty-five (25) test borings to the depth of 10.5 to 30.5 ft. with a total footage of 671.0 lin. ft. of borings drilled by the power auger method.

Respectfully submitted,
**JACA & SIERRA TESTING LABORATORIES INC.**

RUBEN TORRES AGUAYO
INGENIERO LICENCIADO
LIC. #5191
PUERTO RICO

RT/jsr
Enclosures
November 30, 2007
Job No. 6630

RUBEN TORRES, P.E.

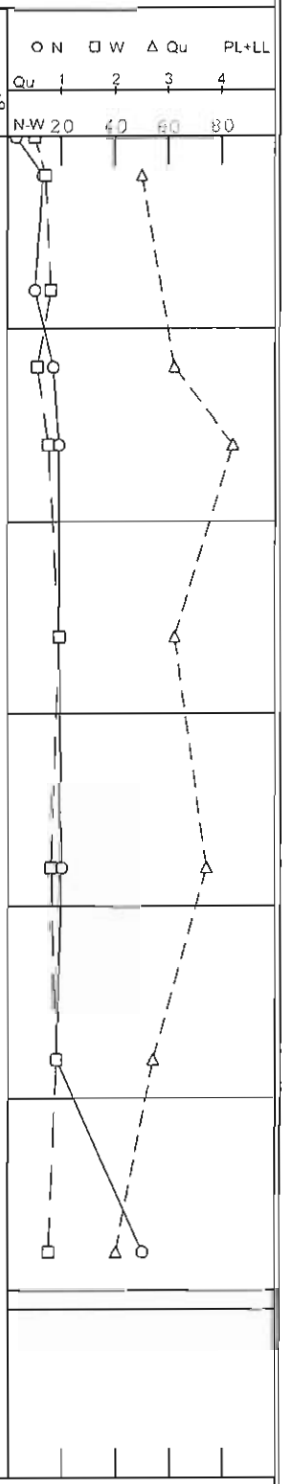
JACA & SIERRA
Testing Laboratories, Inc.
Geotechnical Engineers
P.O. Box 363116, San Juan, Puerto Rico 00936-3116

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 1**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-18-07 | COMPLETED: 10-18-07 |
| GROUNDWATER (ft.) Initial: 15' | Final: 10' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | | | | | | | | | |
| -0.30 | 0 | Brown organic sandy clay (0–1) | | | 1 2 | 3 | 10 | | | |
| | | Light brown stratified sandy clay & clayey sand | | | 1 6 6 7 | 13 | 14 | 2.5 | | |
| | 5 | | | | 6 4 6 | 10 | 16 | | | |
| | | | | | 3 7 10 | 17 | 11 | 3.1 | | |
| -2.44 | | Gray silty clay some sand (7–13) | | | 6 9 10 | 19 | 15 | 4.2 | | |
| | 10 | | | | | | | | | |
| -3.96 | | Light brown sandy clay (13–27) | | | 8 9 10 | 19 | 19 | 3.1 | | |
| | 15 | | | | | | | | | |
| | 20 | | | | 10 8 12 | 20 | 16 | 3.7 | | |
| | 25 | | | | 8 8 10 | 18 | 18 | 2.7 | | |
| -8.23 | | Light brown sandy clay and rock fragments (27–30.5) | | | 14 24 50/5" | 50/5" | 15 | 2.0 | | |
| | 30 | | | | | | | | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
"P" - A "P" in the Unconfined Compressive Strength test indicates the use of the pocket Penetrometer.

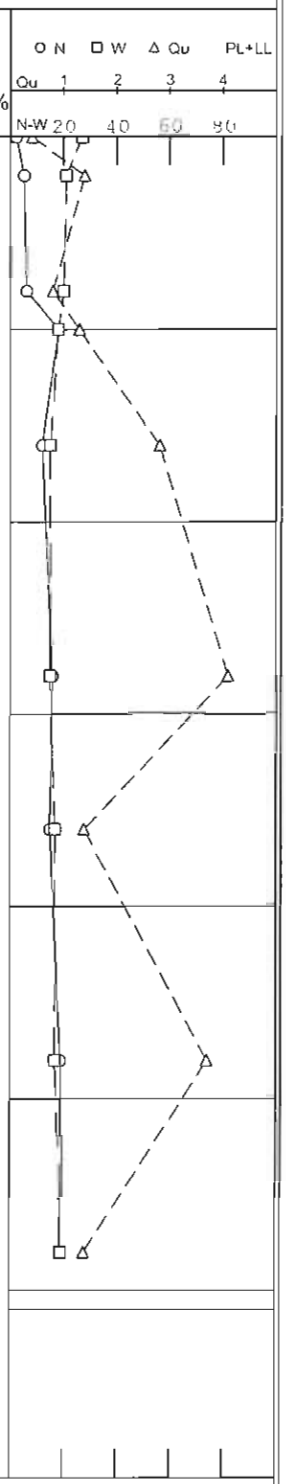
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 2**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-17-07 COMPLETED 10-17-07 |
| GROUNDWATER (ft.) | Initial: 5' Final: 3' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 30.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | | | | | | | | | |
| -0.30 | 0 | Brown organic sandy clay | 0 | | 1 1 1 | 2 | 27 | 0.4 | | |
| | | Dark brown sandy clay | 1 | | 2 2 3 | 5 | 21 | 1.4 | | |
| -1.52 | 5 | Light gray stratified sandy clay & clayey sand | 5 | | 3 3 3 5 7 11 | 6 | 20 | 0.8 | | |
| -2.44 | | Light gray silty sandy clay | 8 | | 5 6 6 | 18 | 18 | 1.3 | | |
| | 10 | | | | | 12 | 15 | 2.8 | | |
| -5.49 | 15 | | 10 | | 5 6 10 | 16 | 15 | 4.1 | | |
| | 20 | Light brown sandy clay | | | 3 7 8 | 15 | 17 | 1.4 | | |
| | 25 | | | | 12 10 9 | 19 | 17 | 3.7 | | |
| | 30 | | | | 10 9 10 | 19 | 19 | 1.4 | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
"P" - A "P" in the Unconfined Compressive Strength test indicates the use of the pocket Penetrometer.

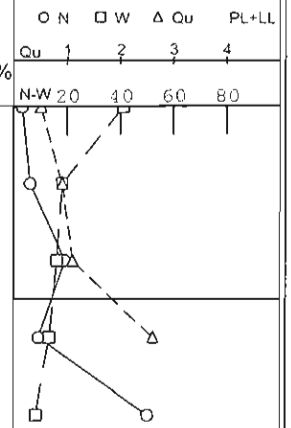
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

BORING NUMBER: 3

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-17-07 COMPLETED 10-17-07 |
| GROUNDWATER (ft.) | Initial: 5' Final: 3' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 10.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown and brown organic sandy clay | | | 2 1 2 | 3 | 41 | 0.5 | | |
| -0.61 | | Light brown sandy clay | | | 4 3 3 | 6 | 18 | 0.9 | | |
| | 5 | | | | 8 9 10 | 19 | 16 | 1.1 | | |
| -2.44 | | | | | 6 4 5 | 9 | 13 | 2.6 | | |
| | | Gray weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) | | | 18 35 50/4" | 50/4" | 8 | | | |
| | 10 | | | | | | | | | |
| | 15 | | | | | | | | | |
| | 20 | | | | | | | | | |
| | 25 | | | | | | | | | |
| | 30 | | | | | | | | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
"P" - A "P" in the Unconfined Compressive Strength test indicates the use of the pocket Penetrometer.

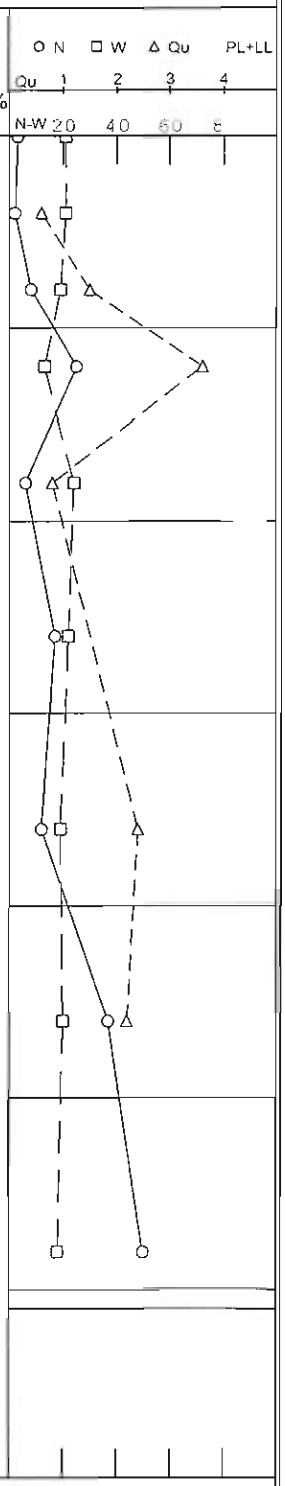
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 4**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-17-07 COMPLETED 10-17-07 |
| GROUNDWATER (ft.) | Initial: 5' Final: 2' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 30.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic sandy clay | | | 1 2 1 | 3 | 21 | | | |
| | | | | | 5 1 1 | 2 | 21 | 0.6 | | |
| -1.22 | 4 | Light gray and brown stiff sandy clay | | | 3 3 5 | 8 | 19 | 1.5 | | |
| | 5 | | | | 8 10 15 | 25 | 13 | 3.6 | | |
| -2.74 | 9 | Light brown medium sandy clay | | | 2 2 4 | 6 | 24 | 0.8 | | |
| | 10 | | | | | | | | | |
| -3.96 | 13 | Light brown clayey sand | | | 5 7 10 | 17 | 22 | | | |
| | 15 | | | | | | | | | |
| -5.49 | 18 | Light gray silty clay some sand | | | 9 6 6 | 12 | 19 | 2.4 | | |
| | 20 | | | | | | | | | |
| -7.01 | 23 | Light brown sandy clay with relic joints (saprolite) | | | 5 10 27 | 37 | 20 | 2.2 | | |
| | 25 | | | | | | | | | |
| -8.23 | 27 | Light brown weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) | | | 50/6" | 50/6" | 18 | | | |
| | 30 | | | | | | | | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
"P" - A "P" in the Unconfined Compressive Strength test indicates the use of the pocket Penetrometer.

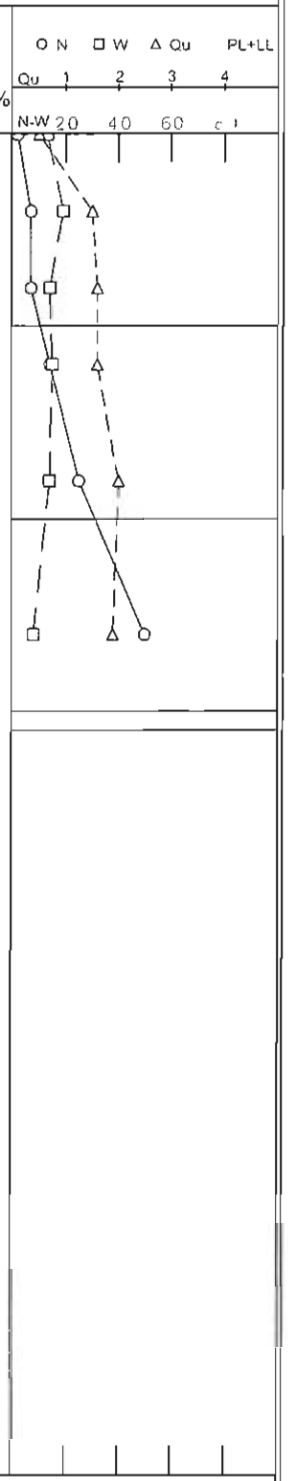
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 5**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-16-07 | COMPLETED: 10-16-07 |
| GROUNDWATER (ft.) Initial: 5' | Final: 3' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 15.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic sandy clay | | | 1 1 1 | 2 | 13 | 0.5 | | |
| -0.61 | | Light gray and light brown silty clay some sand | | | 3 3 4 | 7 | 19 | 1.5 | | |
| | 5 | | | | 3 3 4 | 7 | 14 | 1.6 | | |
| | | | | | 5 6 8 | 14 | 15 | 1.6 | | |
| -2.74 | | Light brown sandy clay | | | 7 10 15 | 25 | 14 | 2.0 | | |
| | 10 | | | | | | | | | |
| -3.96 | | Light brown weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) | | | 26 45 50/4" | 50/4" | 8 | 1.9 | | |
| | 15 | | | | | | | | | |
| | 20 | | | | | | | | | |
| | 25 | | | | | | | | | |
| | 30 | | | | | | | | | |

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"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
"P" - A "P" in the Unconfined Compressive Strength test indicates the use of the pocket Penetrometer.

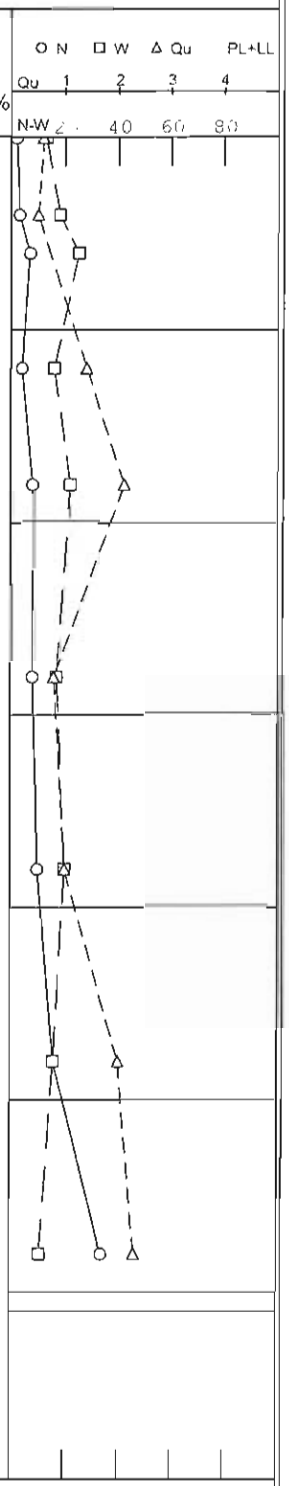
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 6**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-18-07 COMPLETED 10-18-07 |
| GROUNDWATER (ft.) | Initial: 5' Final: 1' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 30.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic sandy clay | 2 1 1 | 2 | 13 | 0.6 | | |
| -0.91 | 3 | Brown sand some gravel | 2 1 2 2 2 5 | 3 | 18 | 0.5 | | |
| -1.83 | 6 | Light brown stratifified sandy clay and clayey silt | 2 1 3 | 7 | 25 | | | |
| | | | 2 2 6 | 4 | 16 | 1.4 | | |
| | | | 2 3 5 | 8 | 22 | 2.1 | | |
| | | | 4 4 6 | 8 | 17 | 0.8 | | |
| -7.32 | 24 | LIght brown sandy clay (saprolite) | 8 7 9 | 10 | 20 | 1.0 | | |
| | | | 8 10 24 | 16 | 16 | 2.0 | | |
| | | | | 34 | 11 | 2.3 | | |

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"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
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Initial G.W. Depth
Final G.W. Depth

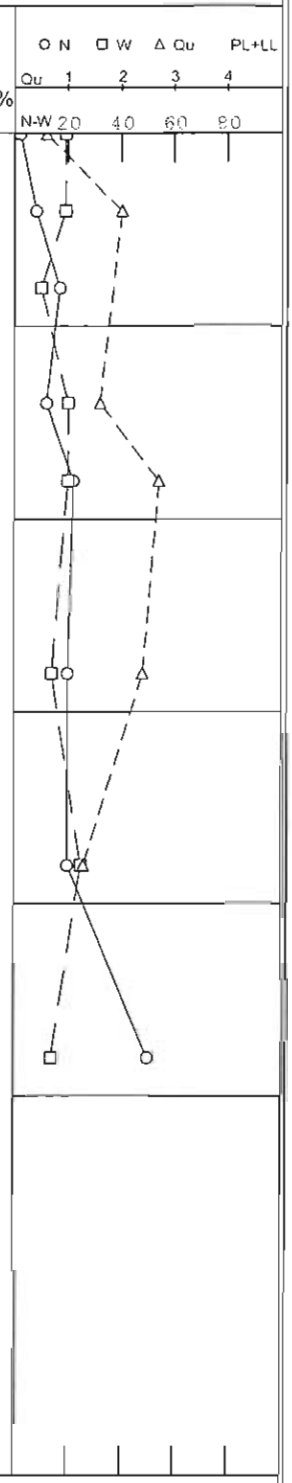
# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 7**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-11-07 COMPLETED 10-11-07 |
| GROUNDWATER (ft.) | Initial: 25' Final: 22' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 25' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | Dark brown organic sandy clay | 0–2 | | 1 1 1 | 2 | 19 | 0.6 | | |
| -0.61 | | Light brown sandy clay | 2–7 | | 5 4 4 | 8 | 19 | 2.0 | | |
| | 5 | | | | 5 8 9 | 17 | 10 | | | |
| -2.13 | | LIght brown very stiff silty clay some sand | 7–22 | | 6 6 6 | 12 | 20 | 1.6 | | |
| | 10 | | | | 7 10 12 | 22 | 20 | 2.7 | | |
| | 15 | | | | 7 9 11 | 20 | 14 | 2.4 | | |
| | 20 | | | | 6 8 12 | 20 | 25 | 1.3 | | |
| -6.71 | | Light brown weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) | 22–25 | | 35 50/5" | 50/5" | 14 | | | |
| | 25 | | | | | | | | | |
| | 30 | | | | | | | | | |

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"Qu" - Unconfined Compressive Strength in tons per square foot.
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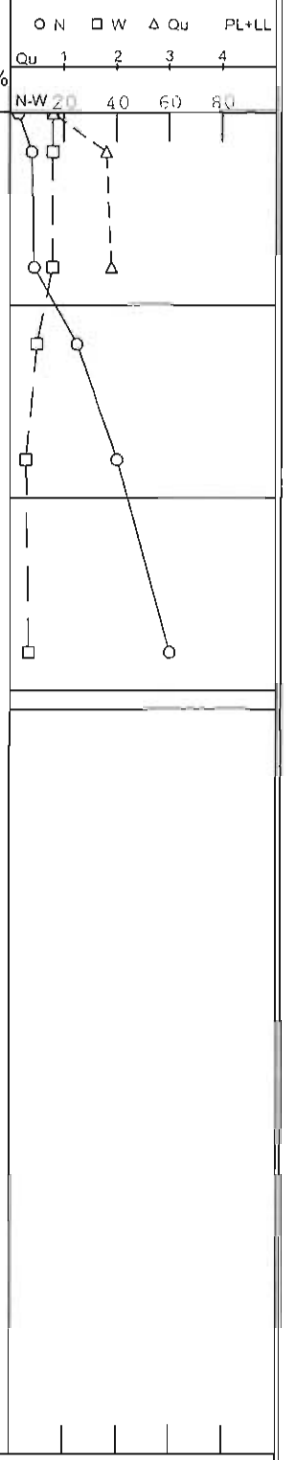
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 8**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-11-07 COMPLETED 10-11-07 |
| GROUNDWATER (ft.) | Initial: 15' Final: 7' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 15' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | | | | | | | | | |
| -0.30 | 0 | Brown organic sandy clay | 0 | | 2 2 | 3 | 16 | 0.8 | | |
| | | Light brown medium to stiff sandy clay | 1 | | 1 3 3 5 | 8 | 16 | 1.8 | | |
| | 5 | | | | 3 4 5 | 9 | 16 | 1.9 | | |
| -1.83 | | | 6 | | | | | | | |
| | | Light brown compact silty sand with relic joints (saprolite) | | | 7 10 15 | 25 | 10 | | | |
| | 10 | | | | 12 19 21 | 40 | 6 | | | |
| -3.96 | | | 13 | | | | | | | |
| | | Light brown weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) | | | 13 35 60/5" | 60/5" | 7 | | | |
| | 15 | | | | | | | | | |
| | 20 | | | | | | | | | |
| | 25 | | | | | | | | | |
| | 30 | | | | | | | | | |

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"Qu" - Unconfined Compressive Strength in tons per square foot.
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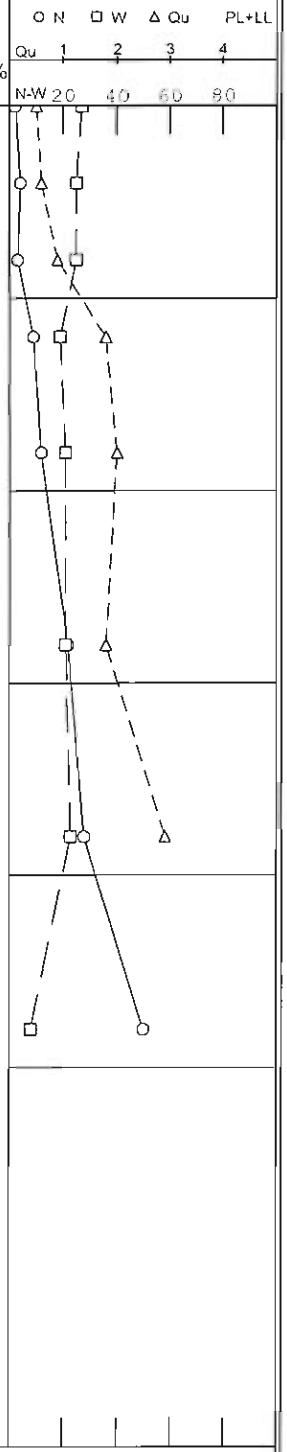
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 9**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-8-07 COMPLETED 10-8-07 |
| GROUNDWATER (ft.) | Initial: 5' Final: 2' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 25' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic sandy clay (0 – 2) | | | 1 1 1 | 2 | 27 | 0.5 | | |
| -0.61 | | Light brown medium sandy clay & clayey sand (2 – 4) | | | 3 1 3 | 4 | 25 | 0.6 | | |
| -1.22 | 5 | Light brown silty clay some sand (4 – 17) | | | WH 1 2 | 3 | 25 | 0.9 | | |
| | | | | | 3 4 5 | 9 | 19 | 1.8 | | |
| | 10 | | | | 3 5 7 | 12 | 21 | 2.0 | | |
| | 15 | | | | 5 8 14 | 22 | 21 | 1.8 | | |
| -5.18 | | Light brown sandy clay (17 – 22) | | | 12 10 18 | 28 | 23 | 2.9 | | |
| -6.71 | 20 | Light brown weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) (22 – 25) | | | 11 26 50/4" | 50/4" | 8 | | | |
| | 25 | | | | | | | | | |
| | 30 | | | | | | | | | |

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"W" - Natural Moisture Content in percentage of dry weight.
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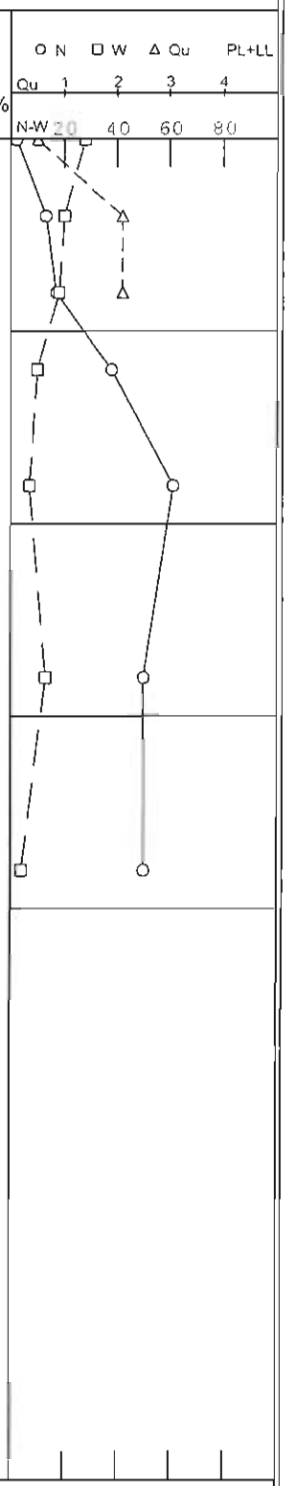
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 10**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-8-07 | COMPLETED: 10-8-07 |
| GROUNDWATER (ft.) Initial: Not Found Final: | | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 20' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Brown organic silty clay | | | 1 1 1 | 2 | 28 | 0.5 | | |
| -0.61 | 2 | Light brown sandy clay | | | 3 6 7 | 13 | 20 | 2.1 | | |
| -1.22 | 4 | Light brown stiff silty clay some sand | | | 6 7 10 | 17 | 18 | 2.1 | | |
| -1.83 | 6 | Light brown weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) | | | 22 22 16 | 38 | 10 | | | |
| | | | | | 26 27 34 | 61 | 7 | | | |
| | | | | | 30 50/6" | 50/6" | 13 | | | |
| | | | | | 50/2" | 50/2" | 4 | | | |

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"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
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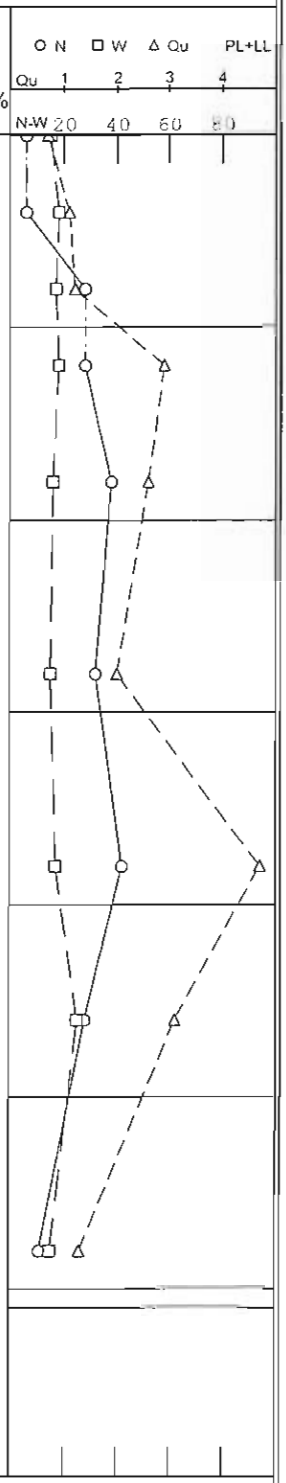
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 11**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-10-07 | COMPLETED: 10-10-07 |
| GROUNDWATER (ft.) Initial: 14' | Final: 10' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | Dark brown organic sandy clay | | | 3 3 3 | 6 | 15 | 0.7 | | |
| -0.61 | | Light brown medium sandy clay | | | 4 3 3 | 6 | 18 | 1.1 | | |
| -1.22 | 5 | Light brown very stiff sandy clay | | | 11 13 15 | 28 | 17 | 1.2 | | |
| | | | | | 11 13 15 | 28 | 18 | 2.9 | | |
| | 10 | | | | 13 19 19 | 38 | 16 | 2.6 | | |
| | 15 | | | | 8 13 19 | 32 | 15 | 2.0 | | |
| | 20 | | | | 13 18 24 | 42 | 17 | 4.7 | | |
| -7.01 | | Light brown silty clay some sand | | | 9 14 14 | 28 | 25 | 3.1 | | |
| | 25 | | | | | | | | | |
| | 30 | | | | 5 5 6 | 11 | 15 | 1.3 | | |

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"W" - Natural Moisture Content in percentage of dry weight.
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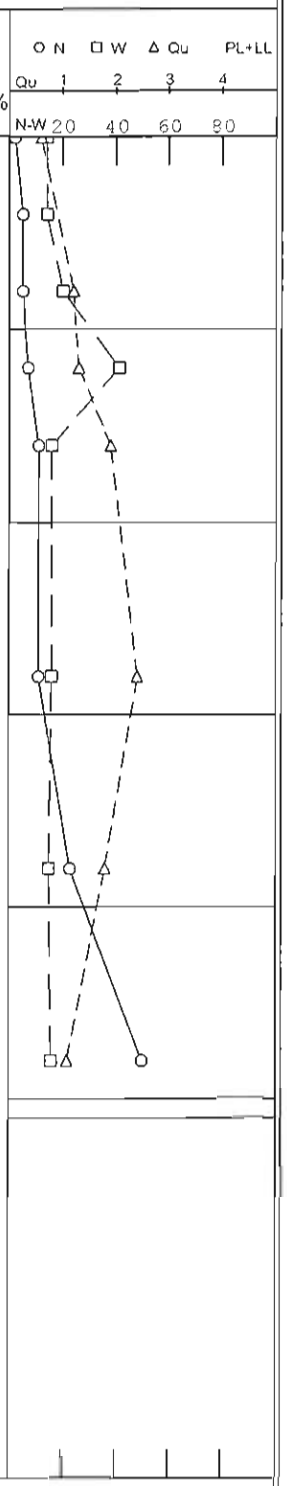
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 12**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-4-07 COMPLETED 10-4-07 |
| GROUNDWATER (ft.) | Initial: 15' Final: 12' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 25.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic sandy clay (0–2) | | | 3 1 1 | 2 | 14 | 0.6 | | |
| -0.61 | | Brown stratified loose silty sand and medium sandy clay (2–6) | | | 4 2 3 | 5 | 14 | | | |
| | | | | | 2 2 3 | 5 | 20 | 1.2 | | |
| -1.83 | | Light brown sandy clay some silt (6–8) | | | 5 4 3 | 7 | 41 | 1.3 | | |
| -2.44 | | Light brown sandy clay (8–21) | | | 2 4 7 | 11 | 16 | 1.9 | | |
| | | | | | 4 4 7 | 11 | 16 | 2.4 | | |
| | | | | | 9 9 14 | 23 | 15 | 1.8 | | |
| -6.40 | | Light brown weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) (21–25.5) | | | 40 50/4" | 50/4" | 16 | 1.1 | | |

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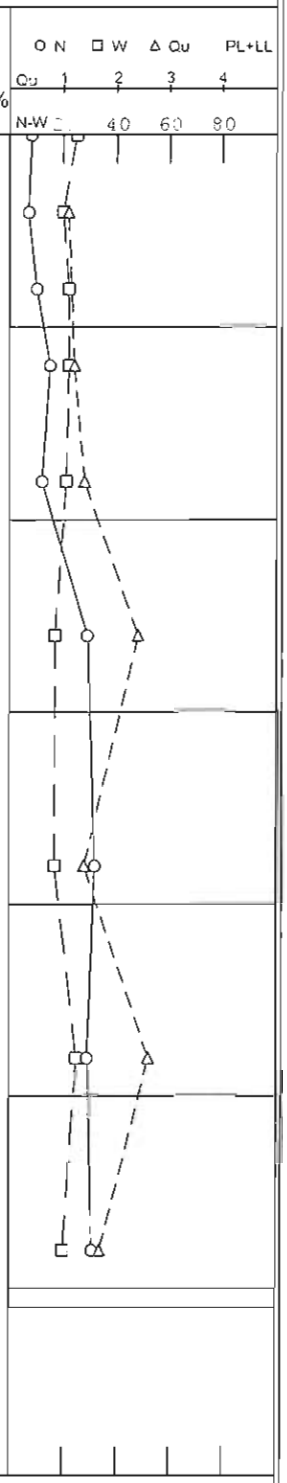
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 13**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-8-07 | COMPLETED: 10-8-07 |
| GROUNDWATER (ft.) Initial: Not Found | Final: | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic sandy clay | | | 1 3 5 | 8 | 25 | | | |
| -0.61 | | Light brown medium to stiff sandy clay | | | 3 3 4 | 7 | 20 | 1.1 | | |
| | 5 | | | | 3 5 5 | 10 | 22 | | | |
| | | | | | 7 7 8 | 15 | 22 | 1.2 | | |
| | 10 | | | | 3 5 7 | 12 | 21 | 1.4 | | |
| -3.96 | | Light brown very stiff sandy clay | | | 8 14 15 | 29 | 17 | 2.4 | | |
| | 15 | | | | | | | | | |
| | 20 | | | | 11 16 16 | 32 | 17 | 1.4 | | |
| -6.71 | 22 | Whitish brown silty clay some sand | | | | | | | | |
| | 25 | | | | 8 13 16 | 29 | 25 | 2.6 | | |
| -8.22 | 27 | Whitish brown sandy clay | | | | | | | | |
| | 30 | | | | 8 12 19 | 31 | 20 | 1.7 | | |

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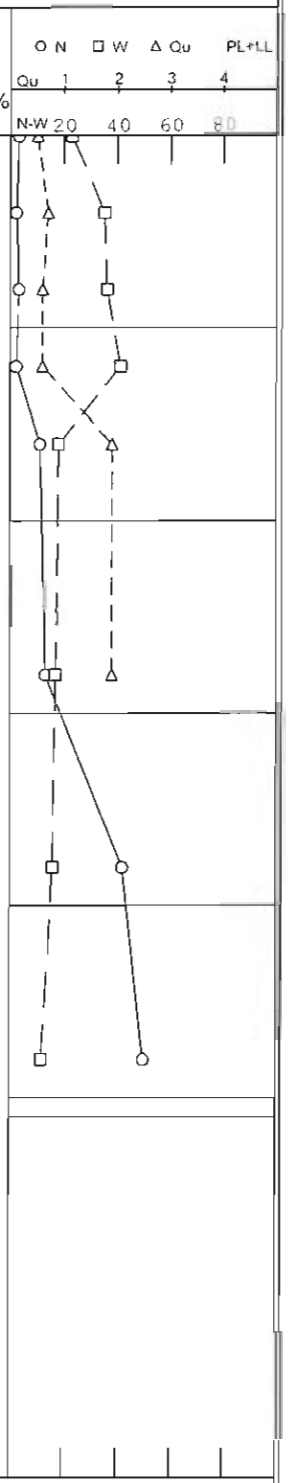
▽ Initial G.W. Depth
▼ Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 14**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-15-07 COMPLETED 10-15-07 |
| GROUNDWATER (ft.) | Initial: 5' Final: 4 | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 25.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic sandy clay | | | 1 2 1 | 3 | 23 | 0.5 | | |
| | | | | | 2 1 1 | 2 | 35 | 0.7 | | |
| -1.22 | 4 | Gray soft silty clay | | | 1 2 1 | 3 | 36 | 0.6 | | |
| | | | | | 2 1 1 | 2 | 41 | 0.6 | | |
| -2.44 | 8 | Light gray silty clay some sand | | | 4 4 7 | 11 | 18 | 1.9 | | |
| | | | | | 5 5 8 | 13 | 17 | 1.9 | | |
| -5.18 | 17 | Light brown weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) | | | 12 17 25 | 42 | 16 | | | |
| | | | | | 35 50/5" | 50/5" | 12 | | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
"P" - A "P" in the Unconfined Compressive Strength test indicates the use of the pocket Penetrometer.

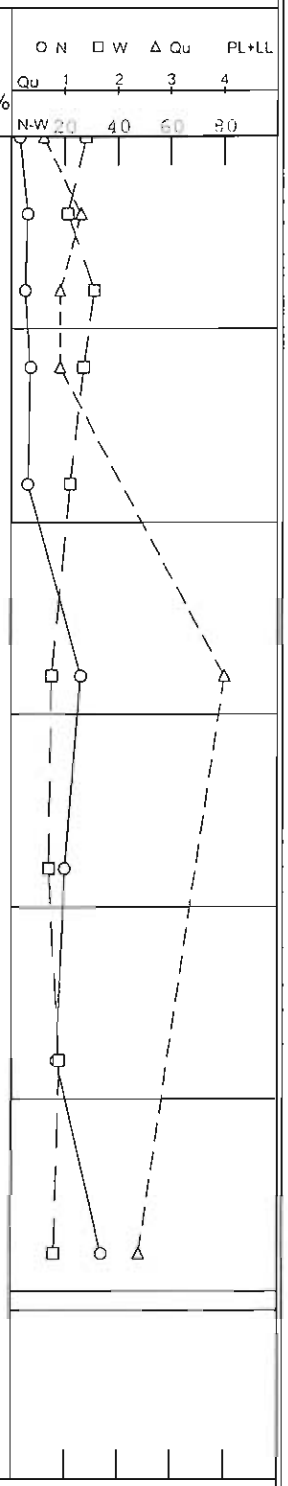
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 15**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-8-07 | COMPLETED: 10-8-07 |
| GROUNDWATER (ft.) Initial: 15' | Final: 11' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Gray organic silty clay trace sand (0–2) | | | 1 2 1 | 3 | 28 | 0.6 | | |
| -0.61 | | Light brown stratified silty clay and sandy clay (2–9) | | | 2 4 2 | 6 | 21 | 1.3 | | |
| | 5 | | | | 2 2 3 | 5 | 31 | 0.9 | | |
| | | | | | 4 4 3 | 7 | 27 | 0.9 | | |
| -2.74 | | Light gray sand trace silt (9–12) | | | 2 3 3 | 6 | 22 | | | |
| | 10 | | | | | | | | | |
| -3.66 | | Light gray very stiff sandy clay (12–30.5) | | | 8 10 16 | 26 | 15 | 4.0 | | |
| | 15 | | | | | | | | | |
| | 20 | | | | 5 8 12 | 20 | 14 | | | |
| | 25 | | | | 6 7 10 | 17 | 18 | | | |
| | 30 | | | | 10 15 19 | 34 | 16 | 2.4 | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
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"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
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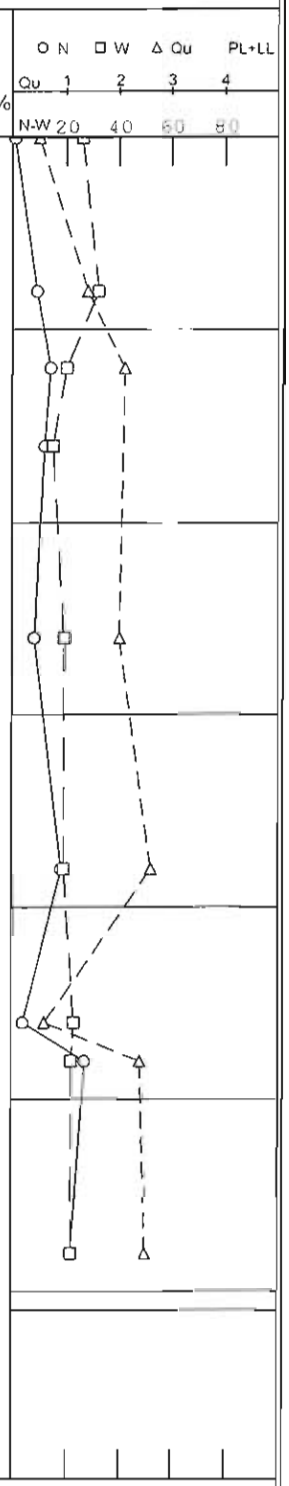
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 16**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-30-07 COMPLETED 10-30-07 |
| GROUNDWATER (ft.) | Initial: 15' Final: 11' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 30.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Gray organic silty clay trace sand | | | Wh WH 1 | 1 | 26 | 0.5 | | |
| | 5 | | | | 3 4 5 | 9 | 32 | 1.4 | | |
| | | | | | 5 6 8 | 14 | 20 | 2.1 | | |
| -2.44 | | Light brown sand some silt | | | 6 6 6 | 12 | 15 | | | |
| | 10 | | | | | | | | | |
| -3.96 | | Light brown silty clay some sand | | | 2 3 5 | 8 | 19 | 2.0 | | |
| | 15 | | | | | | | | | |
| | 20 | | | | 8 7 11 | 18 | 19 | 2.6 | | |
| -6.71 | | Light brown sandy clay | | | | | | | | |
| -7.01 | | Light brown medium to stiff silty clay trace sand | | | 1 2 | 4 | 23 | 0.6 | | |
| | 25 | | | | 2 8 12 15 | 27 | 22 | 2.4 | | |
| | 30 | | | | 7 9 13 | 22 | 22 | 2.5 | | |

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"W" - Natural Moisture Content in percentage of dry weight.
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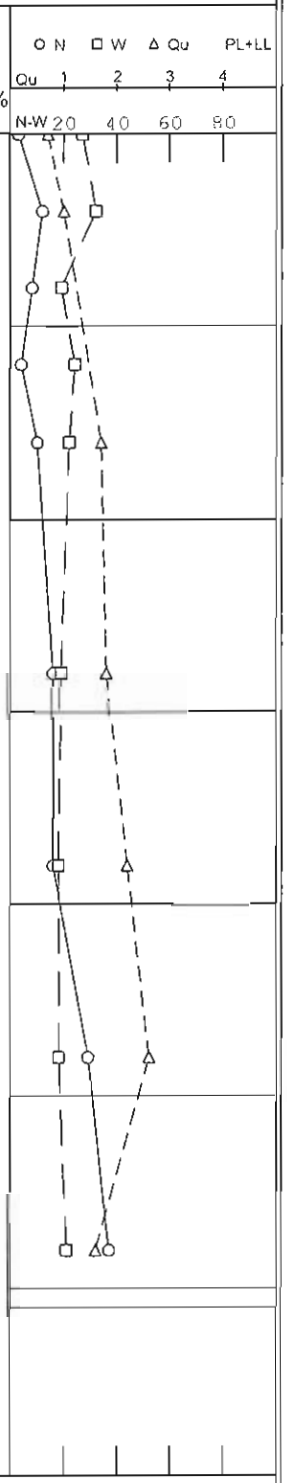
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 17**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-10-07 | COMPLETED: 10-10-07 |
| GROUNDWATER (ft.) Initial: 5' | Final: 2' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic silty clay (0–2) | | | 1 2 1 | 3 | 27 | 0.7 | | |
| -0.61 | | Light gray medium silty clay (2–4) | | | 5 6 6 | 12 | 32 | 1.0 | | |
| -1.22 | 5 | Light brown medium sand (4–8) | | | 4 4 4 | 8 | 19 | | | |
| | | | | | 3 2 2 | 4 | 24 | | | |
| -2.44 | | Light gray and light brown sandy clay (8–22) | | | 2 4 6 | 10 | 22 | 1.7 | | |
| | 10 | | | | | | | | | |
| | 15 | | | | 7 7 9 | 16 | 19 | 1.8 | | |
| | 20 | | | | 6 6 10 | 16 | 18 | 2.2 | | |
| -6.71 | | Light brown silty clay some sand (22–26) | | | | | | | | |
| | 25 | | | | 9 13 16 | 29 | 18 | 2.6 | | |
| -7.93 | | Light brown silty clay (26–30.5) | | | | | | | | |
| | 30 | | | | 14 16 21 | 37 | 21 | 1.6 | | |

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"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
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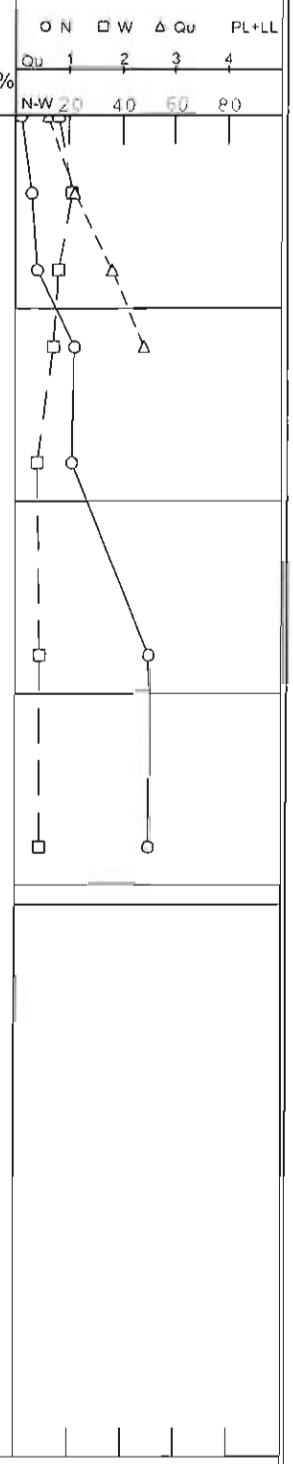
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 18**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-4-07 COMPLETED 10-4-07 |
| GROUNDWATER (ft.) | Initial: 14' Final: 13' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 20.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic silty clay | WH 1 1 | 2 | 16 | 0.6 | | |
| -0.61 | 2 | Light gray stiff silty clay trace sand | 3 3 3 | 6 | 21 | 1.1 | | |
| | 5 | | 3 3 5 | 8 | 16 | 1.8 | | |
| -1.83 | 6 | Light brown heavily weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) | 9 11 11 | 22 | 14 | 2.4 | | |
| | 10 | | 14 14 7 | 21 | 8 | | | |
| -3.66 | 12 | Light brown weathered granodiorite rock (decomposed into very compact sandy silt & rock fragments) | 50/2" | 50/2" | 9 | | | |
| | 15 | | 50/2" | 50/2" | 9 | | | |
| | 20 | | | | | | | |
| | 25 | | | | | | | |
| | 30 | | | | | | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
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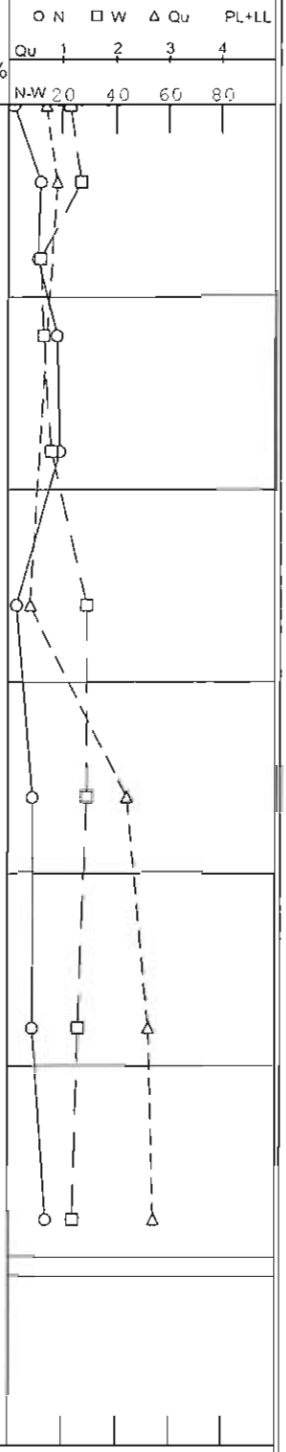
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 19**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-4-07 | COMPLETED: 10-4-07 |
| GROUNDWATER (ft.) Initial: 4' | Final: 1' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | | | | | | | | | |
| -0.30 | 0 | Dark brown organic silty clay some sand | | | 1 1 1 | 2 | 23 | 0.7 | | |
| | | Light brown sandy clay | | | 5 5 7 | 12 | 27 | 0.9 | | |
| -1.22 | 4 | Light brown sand some gravel | | | 5 7 4 | 11 | 12 | | | |
| | 5 | | | | 8 8 10 | 18 | 13 | | | |
| | 10 | | | | 11 10 9 | 19 | 16 | | | |
| -3.96 | 13 | Gray soft to medium silty clay | | | 2 1 2 | 3 | 29 | 0.4 | | |
| | 15 | | | | | | | | | |
| -5.49 | 18 | Light gray silty clay trace sand | | | 4 4 5 | 9 | 29 | 2.2 | | |
| | 20 | | | | | | | | | |
| | 25 | | | | 3 4 5 | 9 | 26 | 2.6 | | |
| | 30 | | | | 5 7 7 | 14 | 24 | 2.7 | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
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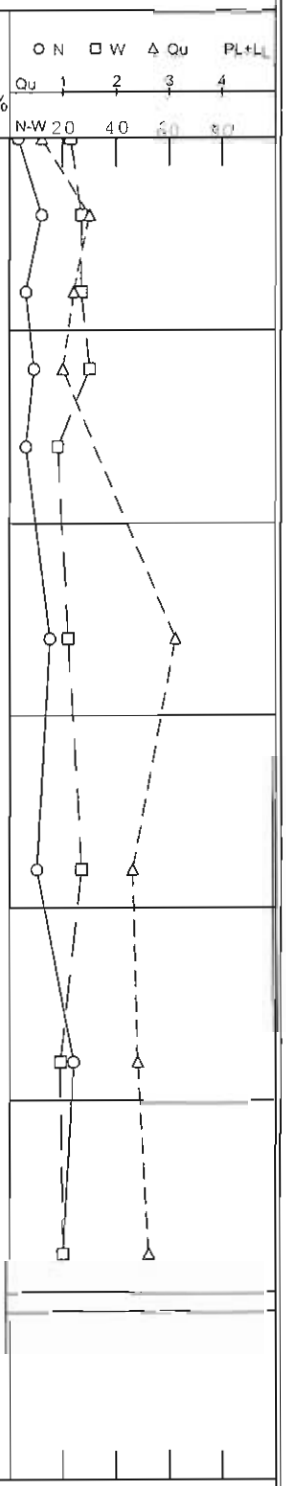
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 20**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-2-07 | COMPLETED: 10-2-07 |
| GROUNDWATER (ft.) Initial: 9' | Final: 4' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | | | | | | | | | |
| -0.30 | 0 | Dark brown organic silty clay | 0–1 | | 2 1 2 | 3 | 23 | 0.6 | | |
| | | Light brown sandy clay | | | 6 5 6 | 12 | 27 | 1.5 | | |
| | 5 | | | | 3 3 3 | 6 | 27 | 1.2 | | |
| | | | | | 5 5 4 | 9 | 30 | 1.0 | | |
| -2.44 | | | 8 | | | | | | | |
| | | Light brown clayey silt | | | 5 4 2 | 6 | 18 | | | |
| | 10 | | | | | | | | | |
| -3.96 | | | 13 | | | | | | | |
| | | Light gray silty clay some sand | | | 4 6 9 | 15 | 22 | 3.1 | | |
| | 15 | | | | | | | | | |
| | 20 | | | | 4 4 6 | 10 | 27 | 2.3 | | |
| | 25 | | | | 8 11 13 | 24 | 19 | 2.4 | | |
| | 30 | | | | 5 8 12 | 20 | 20 | 2.6 | | |

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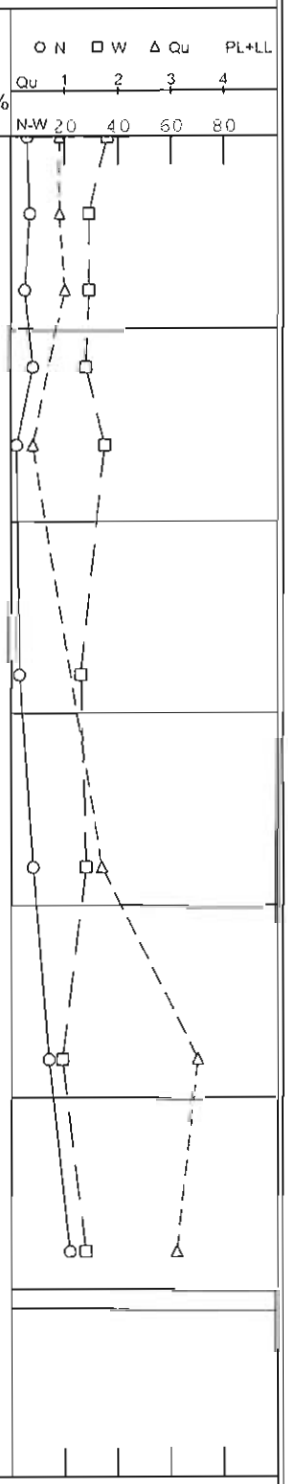
▽ Initial G.W. Depth
▼ Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 21**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-3-07 | COMPLETED: 10-3-07 |
| GROUNDWATER (ft.) Initial: 9' | Final: 3' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | | | | | | | | | |
| -0.30 | 0 | Gray soft organic sand | | | 1 3 3 | 6 | 36 | 0.9 | | |
| | | Light gray medium sandy clay | | | 5 4 3 | 7 | 29 | 0.9 | | |
| | 5 | | | | 2 2 3 | 5 | 29 | 1.0 | | |
| | | | | | 5 4 4 | 8 | 28 | | | |
| -2.44 | | Gray stratified clayey sand and soft sandy clay | | | 1 1 1 | 2 | 35 | 0.4 | | |
| | 10 | | | | | | | | | |
| | 15 | | | | 3 2 1 | 3 | 26 | | | |
| -5.18 | | Light brown silty clay trace sand | | | | | | | | |
| | 20 | | | | 4 4 4 | 8 | 28 | 1.7 | | |
| | 25 | | | | 5 6 8 | 14 | 19 | 3.5 | | |
| | 30 | | | | 5 11 11 | 22 | 28 | 3.1 | | |

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"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
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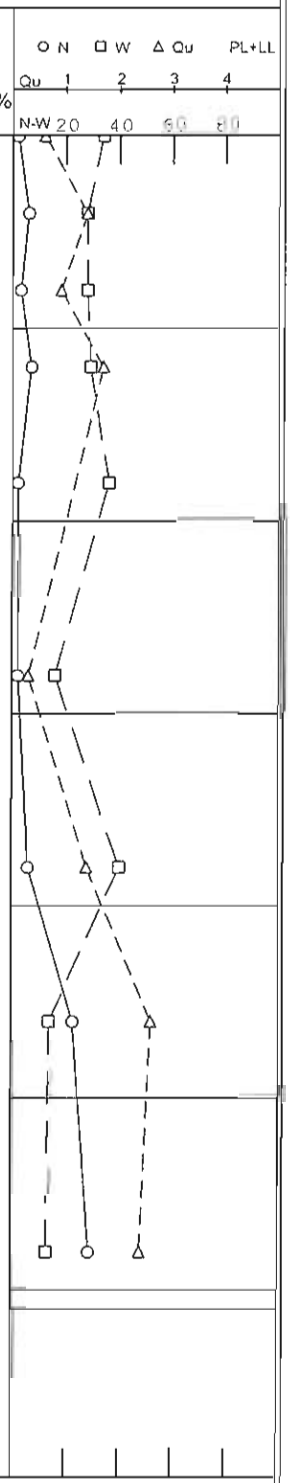
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 22**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-16-07 COMPLETED 10-16-07 |
| GROUNDWATER (ft.) | Initial: 5' Final: 3' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 30.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic silty clay | 1 1 1 | 2 | 34 | 0.6 | | |
| -0.61 | 2 | Light gray stratified silty clay | 4 3 3 | 6 | 28 | 1.4 | | |
| -1.22 | 4 | Dark brown and light brown silty clay some sand | 2 1 2 | 3 | 28 | 0.9 | | |
| | | | 2 3 4 | 7 | 29 | 1.7 | | |
| -2.44 | 8 | Gray and brown sandy clay | 2 1 1 | 2 | 36 | | | |
| | | | 0 1 1 | 2 | 16 | 0.3 | | |
| -5.18 | 17 | Light brown silty clay some sand | 2 3 3 | 6 | 40 | 1.4 | | |
| -7.01 | 23 | Light brown sandy clay | 8 11 12 | 23 | 14 | 2.6 | | |
| | | | 11 13 16 | 29 | 13 | 2.4 | | |

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"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
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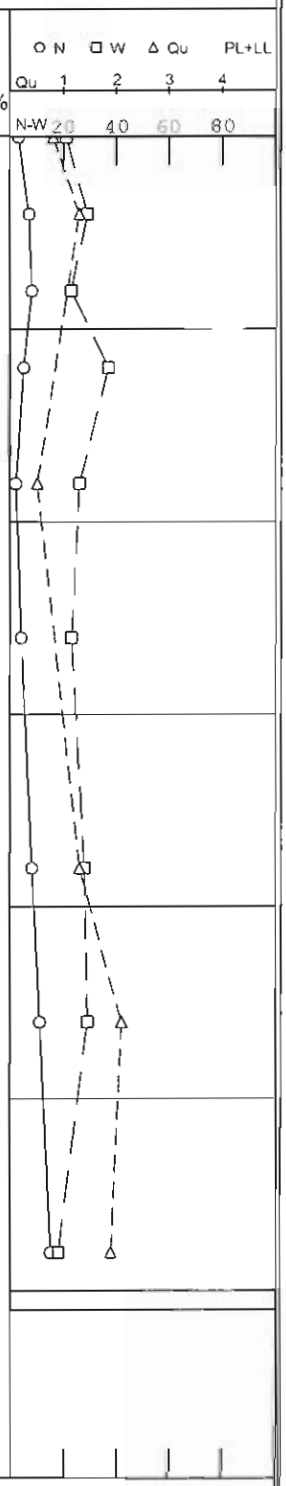
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

BORING NUMBER: 23

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION | HUMACAO, PR | DRILLER/DRILL RIG: | L. SANTOS / B-45 |
| DESCRIPTION BY | R. TORRES | DATE HOLE STARTED | 10-3-07 COMPLETED 10-3-07 |
| GROUNDWATER (ft.) | Initial: 10' Final: 5' | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE | 30.5' | ENGINEER | R. TORRES |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic silty clay trace sand (0–2) | | | 1 2 1 | 3 | 21 | 0.8 | | |
| -0.61 | | Light brown stiff silty clay (2–4) | | | 2 3 4 | 7 | 29 | 1.3 | | |
| -1.22 | | Brown sand (4–6) | | | 3 4 4 | 8 | 23 | | | |
| -1.83 | 5 | Light brown medium sandy clay (6–13) | | | 1 2 3 | 5 | 37 | | | |
| | 10 | | | | 1 1 1 | 2 | 26 | 0.5 | | |
| -3.96 | | Gray clayey sand (13–17) | | | 1 2 2 | 4 | 23 | | | |
| -5.18 | 15 | Light gray silty clay trace sand (17–23) | | | 2 3 5 | 8 | 28 | 1.3 | | |
| -7.01 | 20 | Light brown sandy clay (23–30.5) | | | 4 4 7 | 11 | 29 | 2.1 | | |
| | 25 | | | | 4 7 8 | 15 | 18 | 1.9 | | |
| | 30 | | | | | | | | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
"P" - A "P" in the Unconfined Compressive Strength test indicates the use of the pocket Penetrometer.

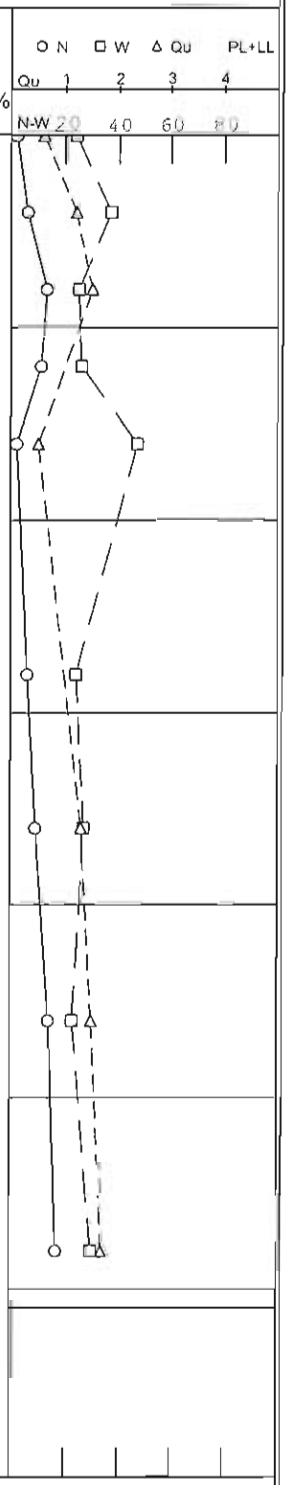
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

**BORING NUMBER: 24**

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-9-07 | COMPLETED: 10-9-07 |
| GROUNDWATER (ft.) Initial: 10' Final: | | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic silty clay (0–2) | 2 1 1 | 2 | 24 | 0.6 | | |
| -0.61 | | Light brown sandy clay (2–5) | 3 3 3 | 6 | 37 | 1.2 | | |
| -1.52 | 5 | Light brown fine sand (5–8) | 4 4 9 | 13 | 25 | 1.5 | | |
| -2.44 | | Gray medium silty clay (8–12) | 4 5 6 | 11 | 26 | | | |
| -3.66 | 10 | Gray sand (12–19) | 3 1 1 | 2 | 47 | 0.5 | | |
| -5.49 | 15 | Light brown medium silty clay some sand (19–23) | 2 3 3 | 6 | 24 | | | |
| -7.01 | 20 | Light brown stiff sandy clay (23–30.5) | 3 4 5 | 9 | 27 | 1.3 | | |
| | 25 | | 4 6 8 | 14 | 23 | 1.5 | | |
| | 30 | | 8 7 10 | 17 | 30 | 1.7 | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
"P" - A "P" in the Unconfined Compressive Strength test indicates the use of the pocket Penetrometer.

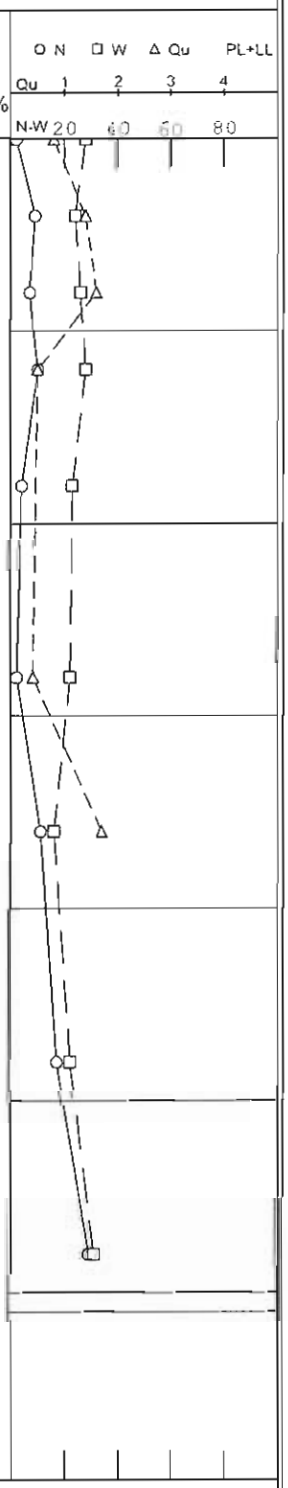
Initial G.W. Depth
Final G.W. Depth

# JACA & SIERRA TESTING LABORATORIES, INC

BORING NUMBER: 25

| DRILLING LOG | PROJECT: PALACIOS DE HUMACAO | JOB: 6630 | SHEET 1 OF 1 |
|---|---|---|---|
| LOCATION: HUMACAO, PR | | DRILLER/DRILL RIG: L. SANTOS / B-45 | |
| DESCRIPTION BY: R. TORRES | | DATE HOLE STARTED: 10-2-07 | COMPLETED: 10-2-07 |
| GROUNDWATER (ft.) Initial: 9' Final: | | ELEVATION TOP OF HOLE (mts): | |
| TOTAL DEPTH OF HOLE: 30.5' | | ENGINEER: R. TORRES | |

| Elev. (mts) | DEPTH (feet) | DESCRIPTION | LEGEND | TYPE | BLOWS | SPT N | W | Qu | RC | RQD% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | Dark brown organic silty clay | 0–2 | | 1 1 1 | 2 | 28 | 0.8 | | |
| -0.61 | | Light brown silty clay | 2–4 | | 4 5 4 | 9 | 24 | 1.4 | | |
| -1.22 | | Light gray silty clay trace sand | 4–7 | | 3 3 4 | 7 | 26 | 1.6 | | |
| -2.13 | 5 | Light brown sand | 7–13 | | 6 5 5 | 10 | 28 | 0.5 | | |
| -3.96 | 10 | Gray soft sandy clay | 13–18 | | 3 3 1 | 4 | 23 | | | |
| -5.49 | 15 | Light gray sandy clay | 18–27 | | WH 1 1 | 2 | 22 | 0.4 | | |
| -8.23 | 20 | Light gray sand | 27–30.5 | | 2 5 6 | 11 | 16 | 1.7 | | |
| | 25 | | | | 7 7 10 | 17 | 22 | | | |
| | 30 | | | | 12 14 15 | 29 | 31 | | | |




"N" - Number of blows required to drive the sampling spoon a distance of 12 in. with a 140 lbs hammer falling 30 in.
"W" - Natural Moisture Content in percentage of dry weight.
"Qu" - Unconfined Compressive Strength in tons per square foot.
"Rc" - Core recovery in percent for each successive run. "Rqd" - Rock quality designation.
"WH" - Sample was recovered by advancing the sampler with the weight of the hammer.
"P" - A "P" in the Unconfined Compressive Strength test indicates the use of the pocket Penetrometer.

Initial G.W. Depth
Final G.W. Depth

# ANEJO 2

## PALACIOS DE HUMACAO

1ra. ETAPA
AREA TOTAL = 49.9121 CUERDAS
NUM. DE UNIDADES = 281
USO DE LOS TERRENOS

| RESUMEN DE AREAS | CUERDAS | % |
|---|---|---|
| AREA SOLARES | - | - |
| FACILIDADES VECINALES | - | - |
| CALLES Y AVENIDAS | - | - |
| CANAL ABIERTO | - | - |
| TOTALES | 49.9121 | 100.00% |

2da. ETAPA
AREA TOTAL = 45.7234 CUERDAS
NUM. DE UNIDADES = 258
USO DE LOS TERRENOS

| RESUMEN DE AREAS | CUERDAS | % |
|---|---|---|
| AREA SOLARES | - | - |
| FACILIDADES VECINALES | - | - |
| CALLES Y AVENIDAS | - | - |
| CANAL ABIERTO | - | - |
| TOTALES | 45.7234 | 100% |

SOLAR TIPICO 15.00 mtrs. x 30.00 mtrs. = 450.000 M.C.
PARAMETROS DE DISEÑO R-4

jcma
JOSE A. MELENDEZ & ASSOCIATES
ENGINEERING CONSULTANTS

PALACIOS DE HUMACAO
(1ra. Y 2da ETAPAS)

EMPRESAS
V.R.M.

ESQUEMA
CONCEPTUAL

# ANEJO 3

# Estudio de Flora y Fauna

Preparado por:
Raúl Pérez
Biólogo- MS, PhDC

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## Introducción

Este estudio de flora y fauna se realizó para una finca localizada en el Barrio Buena Vista del Municipio de Humacao. Ésta tiene una cabida total de 181.6 cuerdas, de las cuales se utilizarán sólo 85.9 cuerdas para la construcción del proyecto residencial de interés social **Villas de Buena Vista** y las restantes 95.7 cuerdas se mantendrán como remanente para futuros proyectos que no han sido definidos.

El propósito de este estudio fue evaluar y describir la flora y la fauna presente en la finca, los recursos naturales y la presencia de especies críticas, vulnerables o en peligro de extinción. De igual manera, recomendar medidas de mitigación que reduzcan los impactos potenciales sobre los recursos naturales y el ambiente general.

El estudio fue llevado a cabo en dos fases, a saber: Fase 1 - Parcela 1 (del 2 al 19 de abril de 2005) y Fase 2 - Parcela 2 (del 10 de abril al 5 de mayo de 2005).

# Fase I

## Parcela 1

La Parcela 1 consiste de cerca de 95.7 cuerdas de terreno (ver Foto 1 y 2). Ésta colinda al este con la carretera PR-923, la que a su vez la separa del Sistema de Relleno Sanitario de Humacao. Al oeste delimita con la finca del doctor Díaz, y al norte y sur limita con varias propiedades privadas.

En esta parcela encontramos dos tipos de hábitat, a saber: un área de tierras altas[1], en la cual aún se encuentra sembrada caña de azúcar, y tres canales del sistema pluvial.

## Método

Previo al comienzo del trabajo, se recorrió la finca y se dividió en dos tipos de hábitat: tierras altas, en las cuales predominan remanentes de la caña de azúcar (*Saccharum officinarum*), y los canales de escorrentía del sistema pluvial. El trabajo de campo se llevó a cabo desde el viernes, 2 de abril hasta el martes 19 de abril de 2005.

Primero, se caminó la periferia de la finca, en la cual encontramos la mayoría de los árboles. Luego, se realizaron transectos lineal de alrededor de 75 metros de largo por 5 metros de ancho. Estos se desplazaban desde el borde del límite de los caminos en la finca hasta el cañaveral. Asimismo, desde el punto más interno en el cañaveral se desplazaba un transecto transversal, el cual tenía las mismas dimensiones antes mencionadas. Al final del transecto transversal se comenzaba otro transecto lineal (perpendicular al transversal), desde el cañaveral hasta el borde del camino. Las entradas y las salidas se identificaron con cinta (flagging) amarilla y blanca. Los transectos (26 en total, longitudinales y transversales) cubrieron la totalidad de la finca. Entendemos que la vegetación encontrada es una muestra amplia y significativa de la flora y fauna presente en la finca.

[1] En la cual se sembró y se cosechó caña de azúcar hasta 1999

La mayoría de la vegetación se identificó en el campo. Las plantas que no se pudieron identificar fueron coleccionadas o fotografiadas (ej. con flores o frutos) para ser identificadas en el laboratorio. Para identificar las plantas se utilizaron los trabajos de: Acevedo Rodríguez (2003), Ashton (1985), Kepler (1975), Liogier (1985-1997); Little y Wadsworth (1964); Little, Woodbury y Wadsworth (1974); Más y García Molinari (1990); Miner-Solá (1999); Vélez (1950); UPR (2001). Para la taxonomía de las plantas se utilizó Liogier y Martorell (2000).

La lista de vertebrados se hizo mediante la observación directa de estos en el campo y por las voces producidas por los anfibios y las aves. Para la clasificación de los anfibios se utilizó a Joglar (1998) y a Rivero (1998); para los reptiles a Schmidt (1928) y Rivero (1998); para las aves a Biaggi (1984) y Oberle (2003). En la lista de aves se incluyeron especies observadas en los alrededores de la propiedad, debido a la similitud de hábitat y la capacidad de desplazamiento de éstas.

Este estudio se llevó a cabo en un período de poca lluvia o sequía, el cual se prolongó a lo largo del mes de marzo. Por tal razón, es posible que hayan pasado desapercibidos especies de aves y anfibios. Durante los períodos de sequía, los coquíes de Puerto Rico (*Eleutherodactylus spp.*) tienden a permanecer silentes, aún durante la noche.

**Cañaveral Abandonado**

Comunidad vegetal es simple en la cual aún predomina la caña de azúcar (ver Foto 3). Sin embargo, entre la caña se puede observar creciendo otras yerbas (ver Foto 4). De igual forma, entre la caña de azúcar ha comenzado a colonizar vegetación arbustiva y arbórea oportunista como la Albicia (*Albizia procera*) (ver Foto 5), la Guayaba (*Psidium guajava*), el Tulipán Africano (*Spathodea campanulata*), el Samán (*Samanea saman*) (ver Foto 6) y la Zarza Barava (*Mimosa pigra*), entre otras (ver Tabla 1).

A pesar de que hay algunos arbustos y árboles dispersos en el cañaveral, la mayoría de los árboles se encuentran en la periferia de la finca, en donde fueron utilizados para construir una verja con alambre estriado (alambre de púas) para delimitarla. Especies

comunes en el perímetro de esta parcela son el Mata Ratón (*Gliricidia sepium)* y la Albicia. El Mata Ratón ha sido utilizado como espeque, lo que propiciando su germinación.

Como es habitual en estos lugares, se encontró una gran variedad de rastreras e hierbas (ver Tabla 2). Sin embargo, no se halló una gran variedad de bejucos y las especies encontradas no son abundantes. Tal vez, la especie dominante es el Bejuco de Caro (*Cissus verticillata*), el cual se encontró creciendo sobre alambre estriado. Otro bejuco común fue el Cundeamor (*Momordica charantia*). Cabe señalar que, el trabajo de campo se llevó a cabo durante un período de sequía extrema; por lo tanto, es posible que afloren más especies de rastreras además de hierbas debido a tono con el período de lluvia de mayo.

**Caño de Escorrentía**

El agua de este caño proviene del Vertedero de Humacao. Por el color del sustrato y el olor que emana del agua, aparenta tratarse de aguas usadas (ver Foto 7). En algunos lugares hay agua apozada, mientras que en otros la cantidad de agua es poca (ver Foto 8). En los lugares en los cuales crece vegetación se han formado bancos de sustrato que aparenta ser arena y en donde crece la Yerba Canga (*Ludwigia octovalvil*) ver Foto 9). El caño que colinda con la Parcela 2 tiene algunas áreas secas debido a la poca actividad de lluvia. En éste hay desperdicios sólidos acumulados. En los caños y sus márgenes existe gran variedad de plantas (ver Tabla 3), de las cuales se destaca la Verdolaga (*Portulaca oleracea*). En los lugares poco profundos, pero con agua fluyendo, predomina el Ombligo de Venus (*Hydrocotyle umbellata*) (ver Foto 10). Existen lugares con agua apozada en los cuales predominan algas verdes, las cuales no fueron identificadas. En estas aguas sólo se observaron renacuajos de Rana Toro (*Rana catesbiana*), además de dos adultos en el caño que colinda con la Parcela 2. La ausencia de peces como el gupie (*Lebistes* (*Poecilia*) *reticulata*) pudiera ser indicio de un cuerpo de agua intermitente, de un lugar contaminado o de ambas cosas.

**Vertebrados**

A pesar de que el muestreo fue realizado bien temprano en la mañana y al caer el sol, se encontraron pocas especies de vertebrados (ver Tabla 4). Entre los anfibios predominó la Ranita de Labio Blanco (*Leptodactylus albilaris*). Se observaron renacuajos y adultos de Rana Toro (*Rana castesbiana*), en la porción del caño ubicada fuera de la finca. La poca cantidad de anfibios escuchados pudiera ser el resultado de la poca lluvia caída en marzo. El martes, 5 de abril de 2005, entrada la noche, se escucharon sólo dos especies de coquíes. Esto fueron la Ranita de Labio Blanco y al Coquí común (*Eleutherodactylus coqui).* Entre los reptiles predominó el Lagartijo de Yerbas (*Anolis pulchellus*), ya que en el predio predominan las gramíneas.

Se observaron pocas especies de aves, lo que es típico en cañaverales abandonados. No obstante, resultó común observar al Gorrión Negro (*Tiaris bicolor*) y, aunque en menor cantidad, al Pitirre (*Tyrannus dominicensis*). A lo largo del caño se observaron tres especies de "playeros", entre estos una Becasina (*Gallinago delicata*). La Becasina es un ave migratoria que por lo general abandona Puerto Rico durante el mes de marzo.

| **Tabla 1: Lista de árboles y arbustos en la Parcela 1** | |
|---|---|
| **Nombre común** | **Nombre científico** |
| Albicia | *Albizia procera* |
| Almendro | *Terminalia cattapa* |
| Bambú | *Bambusa vulgaris* |
| Bayahonda (Ar) | *Prosopis pallida* |
| Berenjena Cimarrona (Ar) | *Solanum torvum* |
| Café Cimarrón (Ar) | *Casearia guianensis* |
| Cafeillo (Ar) | *Casearia silvestris* |
| Dama de Día (Ar) | *Cestrum diurnum* |
| Espino Rubial (Ar) | *Zanthoxylum martinicense* |
| Flamboyán (Ar) | *Delonix regia* |
| Flamboyán Amarillo (Ar) | *Peltophorum pterocarpum* |
| Guayaba (Ar) | *Psidium guajava* |
| Higuereta(Ar) | *Rizinus comunis* |
| Mata Ratón | *Gliricidia sepium* |
| Moca (Ar) | *Andira inermis* |
| Molinillo | *Hura crepitans* |

| Tabla 1: Lista de árboles y arbustos en la Parcela 1 | |
|---|---|
| **Nombre común** | **Nombre científico** |
| **Muñeco** (Ar) | ***Cordia borinquensis*** |
| Papagayo (Ar) | *Sesbania sericea* |
| Péndula | *Citharexylum fruticosum* |
| Roble | *Tabebuia heterophylla* |
| Samán | *Samanea saman* |
| Tamarindillo (Ar) | *Leucaena leucocephala* |
| Tulipán Africano | *Spathodea campanulata* |
| Tua-tua (Ar) | *Adenoropium gossyfolium* |
| Zarza Brava (Ar) | *Mimosa pigra* |
| Ar = arbusto<br>Negritas = especies endémicas | |

| Tabla 2: Lista de rastreras, bejucos e hierbas en la Parcela 1 | |
|---|---|
| **Nombre común** | **Nombre científico** |
| **Rastreras** | |
| Anamú (Rabo de Ratón) | *Achiranthes indica* |
| Batatilla Blanca | *Merremia quinquefolia* |
| Blero | *Amaranthus dubius* |
| Botón Blanco | *Spermacoce verticillata* |
| Cadillo de Perro | *Urena sinuata* |
| Cascabelito | *Crotalaria retusa* |
| Cidrón | *Lippia nodiflora* |
| Cotorrera | *Heliotropium indicum* |
| Escoba | *Sida carpinifolia* |
| Flor de Pito | *Centrosema pubescens* |
| Frijolillo | *Vigna vexilata* |
| Frijolillo | *Vigna hosei* |
| Frijol Silvestre | *Vigna luteola* |
| Jazmín de Río | *Hedychium coronarium* |
| Kudzu | *Pueraria phaseoloides* |
| Lechecilla | *Chamaesise hirta* |
| Lechecilla | *Chamaesise nutans* |
| Leche de Vana | *Poinsetia heterophylla* |
| Malanga Silvestre | *Colocasia esculenta* |
| Malva | *Malachara capitata* |
| Manzanilla | *Bidens pilosa* |
| Matagallina | *Solanum caribaeum* |
| Moriviví | *Mimosa púdica* |
| Moriviví Bobo | *Chamaecrista nictitans* |
| Pringamosa | *Traiga volúbilis* |
| Quino de Pobres | *Philanthus niruri* |

| Tabla 2: Lista de rastreras, bejucos e hierbas en la Parcela 1 | |
|---|---|
| **Nombre común** | **Nombre científico** |
| Verdolaga | *Portulaca oleracea* |
| Yerba de Clavo | *Ludwigia octovalvis* |
| Yerba Socialista | *Emilia coccinea* |
| Zarza | *Mimosa casta* |
| **Bejucos** | |
| Bejuco de Caro | *Cissus verticillata* |
| Bejuco de Puerco | *Ipomea tiliacea* |
| Bejuquillo de Puerco | *Ipomea triloha* |
| Coralina | *Antigonon leptopus* |
| Cundeamor | *Momordica charantia* |
| Pepinito Cimarrón | *Melothria pendula* |
| Tagua-Tagua | *Pasiflora foetida* |
| **Hierbas** | |
| Arrocillo | *Equinochloa colonum* |
| Bahía | *Paspallum notatum* |
| Caña | *Saccharum officinarum* |
| Cohitre | *Commelina difusa* |
| Coquí | *Cyperus rotundus* |
| Horquetilla Blanca | *Paspalum conjugatum* |
| Malojillo | *Brachiaria mutica* |
| Paja Brava | *Paspallum millegrana* |
| Paraguita Morada | *Chloris inflata* |
| Pendejuelo | *Digitaria sanguinalis* |
| Yerba de Egipto | *Dactylectenium aegyptium* |
| Yerba Estrella Morada | *Cynodon niemfuensis* |
| Pata de Gallina | *Eleusine indica* |
| Yerba de Guinea | *Panicum maximum* |
| Yerba Jonson | *Sorghum halapense* |
| Yerba de Zorra | *Trichachne insularis* |

| Tabla 3: Lista de la vegetación observada dentro y en las márgenes inmediatas del caño que cruza la Parcela 1 | |
|---|---|
| **Nombre común** | **Nombre científico** |
| **Rastreras** | |
| Rabano Cimarrón | *Dieffenbachia seguine* |
| Jazmín de Río | *Cleome spinosa* |
| Habichuela Parada | *Macroptilium lathyoides* |
| Leche Vana | *Poinsetia heterophylla* |
| Malanga Cimarrona | *Colocasia esculenta* |
| Papagayo | *Sesbania sericea* |
| Quino de Pobre | *Philanthus niruri* |

| | |
|---|---|
| Verdolaga | *Portulaca oleracea* |
| Yerba de Clavo | *Ludwigia octovalvis* |
| **Hierbas** | |
| Arrocillo | *Echinochloa colonum* |
| Malojilla | *Eriochloa polystachya* |
| Malojillo | *Brachiaria mutica* |
| Trompetilla | *Hymenachne amplexicaulis* |
| Junco | *Cyperus odoratus* |
| Junco de Agua | *Cyperus ligularis* |
| Junco | *Cyperus polystachyos* |
| Yerba Coquí | *Cyperus rotundus* |
| **Plantas Acuáticas** | |
| Ombligo de Venus | *Hydrocotyle umbellata* |

| **Tabla 4: Vertebrados encontrados en la Parcela 1** | |
|---|---|
| **Nombre común** | **Nombre científico** |
| **Anfibios** | |
| **Coquí Común** | ***Eleutherodactylus coqui*** |
| **Ranita de Labio Blanco** | ***Leptodactylus albilabris*** |
| Rana Toro | *Rana catesbiana* |
| Sapo de Surinam | *Bufo marinus* |
| **Reptiles** | |
| **Lagartijo Común** | ***Anolis cristatelus*** |
| **Lagartijo de Yerbas** | ***Anolis pulchellus*** |
| **Siguana** | ***Ameiva exul*** |
| Salamanquesa | *Hemidactylus mabouia* |
| **Aves** | |
| Becasina | *Gallinago delicata* |
| Diablito | *Lonchura cucullata* |
| Garza Ganadera | *Bubulcus ibis* |
| Gaviota Gallega | *Larus atricilla* |
| Garza Real | *Ardea alba* |
| Gorrión Negro | *Tiaris bicolor* |
| Guaraguao | *Buteo jamaicensis* |
| Judío | *Crotophaga ani* |
| Martinete | *Butorides striatus* |
| Mozambique | *Quiscalus niger* |
| Pitirre | *Tyrannus dominicensis* |
| Pizpita de Río | *Seiurus motacilla* |
| Playero Guineilla Menor | *Tringa flavipes* |
| Playero Sabanero | *Charadrius vociferus* |
| Reinita | *Coereba flaveola* |
| Rolita | *Columbina passerina* |

| Tabla 4: Vertebrados encontrados en la Parcela 1 | |
|---|---|
| **Nombre común** | **Nombre científico** |
| Ruiseñor | *Mimus polyglottos* |
| Tórtola Cardosantera | *Zenaida aurita* |
| Veterano | *Estrilda melpoda* |
| Negritas = especies endémicas | |

## Fase II

### Parcela 2

La Parcela 2 consiste de unas 85.9 cuerdas de terreno (ver Fotos 1 y 2), las cuales colindan al este con la finca del doctor Díaz y al norte-noroeste con la Parcela 1 y la Carretera PR-923. En el sur limita con las parcelas Buena Vista.

En esta parcela encontramos dos tipos de hábitat, a saber: un área de tierras altas[2], la cual en la actualidad presenta un pastizal en proceso de sucesión (ver Foto 1), y cuerpos de agua formados por una quebrada (ver Foto 3) y una serie de canales que recogen agua de escorrentía.

### Método

Previo al comienzo del trabajo de campo, se recorrió la finca y se dividió en los dos tipos de hábitat mencionados. El trabajo de campo se realizó desde el domingo, 10 de abril hasta el jueves, 5 de mayo de 2005.

Primero, se caminó la periferia de la finca, en la cual encontramos la mayoría de los árboles. Luego, se realizaron transectos lineales de unos 25 a 75 metros de largo por 5 metros de ancho. Estos se desplazaban desde el borde del límite de los caminos en la finca hasta el cañaveral. Asimismo, desde el punto más interno en el cañaveral se hizo un transecto transversal, con las mismas dimensiones mencionadas. Al final del transecto transversal se comenzó otro transecto lineal (perpendicular al transversal), desde el cañaveral hasta el borde del camino. Los puntos de partida cerca de los postes de las verjas se identificaron con cinta (flagging) amarilla, blanca y roja. Los transectos (26 en

[2] En la cual se sembró y cosechó caña de azúcar hasta 1999.

total, longitudinales y transversales) cubrieron la totalidad de la finca. Entendemos que la vegetación encontrada es una muestra amplia y significativa de la flora y fauna presente en la finca.

La mayoría de la vegetación se identificó en el campo. Las plantas que no se pudieron identificar fueron recopiladas o fotografiadas (las que tenían flores) para ser identificadas en el laboratorio. Para identificar las plantas se utilizaron los trabajos de: Acevedo Rodríguez (2003), Ashton (1985), Kepler (1975), Liogier (1985-1997); Little y Wadsworth (1964); Little, Woodbury y Wadsworth (1974); Más y García Molinari (1990); Miner-Solá (1999); Vélez (1950); UPR (2001). Para la taxonomía de las plantas se utilizó Liogier y Martorell (2000).

La lista de invertebrados se construyó mediante la observación directa de estos en el campo y por las voces producidas por los anfibios y los reptiles. Para la clasificación de los anfibios se utilizó a Joglar (1998) y a Rivero (1998); para los reptiles a Schmidt (1928) y Rivero (1998); y para las aves a Biaggi (1984) y Oberle (2003). En la lista de aves se incluyeron especies observadas en los alrededores de la propiedad, debido a la similitud de hábitat y la capacidad de desplazamiento de éstas.

Casi todo el estudio se llevó a cabo durante un período de poca lluvia, el cual se prolongó hasta la tercera semana del mes de abril (a pesar de que en la última semana de trabajo llovió). Por tal razón, es posible que hayan pasado desapercibidos especies de aves y anfibios. Durante los períodos de poca lluvia, los coquíes de Puerto Rico (*Eleutherodactylus spp.*) tienden a permanecer silentes, aún durante la noche. Las dos veces que permanecimos hasta entrada la noche en la finca, no se escucharon nuevas especies de anfibios distintas a las encontradas de manera previa en el estudio de la Parcela 1.

**Pastizal**

La comunidad vegetal encontrada es simple, en la cual la caña de azúcar ha sido reemplazada por otras yerbas (ver Fotos 1 y 2) como por ejmplo la Yerba Guinea

(*Panicum maximum*) en las partes más secas, el Malojillo (*Brachiaria mutica*) en las partes más bajas y húmedas y la Enea (*Typha dominguensis*) en lugares anegados. La cantidad y la densidad del hierbazal variaron dentro del predio. Existen áreas en las cuales el ganado vacuno y caballar han reducido la cubierta vegetal (ver Fotos 4 y 5).

Al presente, vegetación arbustiva tipica de lugares anegados, como la Yerba Canga (*Ludwigia octovalvis*) (ver Foto 4) ha comenzado a invadir el hierbazal en los lugares más húmedos. También se encontró vegetación arbórea en la parcela, aunque muy poca y dispersa (alrededor de 25 árboles). Entre las especies observamos la Albicia (*Albizia procera*), el Tulipán Africano (*Spathodea campanulata*), el Almendro (*Terminalia catappa*) y el Coco (*Cocos nucifera*) (ver Foto 6), entre otras.

La mayoría de los árboles se encontraron en la periferia de la finca, en la cual se han utilizado como postes para construir una verja con alambre estriado (alambre de púas) para delimitar la finca (ver Foto 1). La Tabla 5 muestra las especies de árboles y arbustos identificados en esta parcela. Las especies más comunes en la periferia lo son el Mata Ratón (*Gliricidia sepium*), la Albicia y la Moca (*Andira inermes*). Las ramas del Mata Ratón y la Moca, utilizadas como espeques, en su mayoría han germinado. Asimismo, en la periferia también se encontraron individuos de Espino Blanco (*Zanthxylum monoplyllum*) (ver Foto 7), el cual es una especie poco común para el área (aunque no se encuentra en la lista de especies en peligro de extinción).

Como es usual para estos lugares, se encontró una gran variedad de rastreras, de las cuales se destacan el llamativo Botón de Cadete (*Leonotis nepetaefolia*) (ver Foto 8) y las hierbas (ver Tabla 6). No se encontró una gran variedad de bejucos y las especies presentes no resultaron abundantes. Las especies de bejucos dominantes son el Caro (*Cissus verticillata*), el cual se encontró creciendo sobre el alambre estriado, y el Bejuco de Puerco (*Ipomoea tiliacea*), el cual ha comenzado a crecer sobre las hierbas en el pastizal. Otro bejuco común encontrado a lo largo de la verja fue el Cundeamor (*Mormodica charantia*).

Una gran variedad de hierbas se encontraron, en particular a lo largo de los caminos que fueron limpiados para la topografía y mensura (ver Tabla 6). Se encontró en las partes más secas del pastizal Yerba de Guinea, la cual ha sustituido a la caña de azúcar. En la porción más húmeda de la parcela se halló, junto a la Yerba de Canga y al Malojillo crecimiento de Eneas (ver Fotos 9 y 10) lo que sugiere que el lugar en particular es anegado (ver Fotos 10 y 11). Asimismo, se encontró crecimiento de Caña de Castilla (*Arundo donax*). Cabe señalar que, gran parte del trabajo se realizó en un período de muy poca lluvia, por lo cual es posible que con las lluvias de mayo afloren más rastreras y otras especies de hierbas. A tono con los cambios, en la visita de 5 de mayo de 2005 observamos mayor cantidad de Yerba Johnson (*Sorghum halapense*), que la observada en visitas previas. Sin embargo, se observó en menor cantidad la yerba Paraguita Morada (*Chloris inflata*). Por otro lado, hay que señalar que el ganado vacuno y el caballar han afectado y seguirá afectando la composición vegetal en el lugar.

**Quebrada y Caños de Escorrentía**

En la propiedad encontramos una quebrada (ver Fotos 3, 11 y 12), la cual se origina al sur de la parcela. Asimismo, encontramos una serie de caños de escorrentía, los cuales se originan en la parcela. Los caños se encuentran secos en algunas áreas aunque en otras tienen agua, en su mayoría apozada.

La quebrada aparenta tener agua todo el tiempo, ya que a pesar de tener algunos sectores secos (ver Foto 13) se observaron gupies (*Lebister* (*Poecilia*) *reticulata*). En los bancos o las márgenes de la quebrada se encontró Rabano Cimarrón (*Dieffenbachia seguine*) (ver Foto 13), Cohitre (*Commelina difusa*), Malojillo, Malojilla (*Eriochloa polystachya*), Yerba de Canga y Malanga Silvestre (*Colocasia esculenta*) (ver Fotos 13 y 14 y la Tabla 7), entre otras. Asimismo, observamos creciendo tanto en las márgenes como en algunos de los caños Verdolaga (*Portulaca oleracea*).

En los lugares poco profundos, con agua fluyendo, encontramos Ombligo de Venus (*Hydrocotyle umbellata*). Existen lugares abiertos con agua apozada, en los cuales predominan algas verdes (las cuales no fueron identificadas). En estos lugares sólo se

observaron renacuajos de Rana Toro (*Rana catesbiana*), aunque se observaron dos adultos en el caño que colinda con la Parcela 1. La ausencia de peces, tales como los gupies , en los caños sugiere que estos son cuerpos de agua intermitente. La vegetación observada en estos caños fue similar a la encontrada a lo largo de la quebrada; excepto en uno, en el cual se encontró Eneas (ver Tabla 7). La composición de la vegetación en los cuerpos de agua puede cambiar debido a la lluvia y al ganado.

**Vertebrados**

En la parcela se encontraron pocas especies de vertebrados (Tabla 8). Entre los anfibios tiende a predominar la Ranita de Labio Blanco (*Leptodactylus albilabris*). Observamos en uno de los caños renacuajos de Rana Toro. El 19 de abril y el 5 de mayo de 2005 entrada la noche escuchamos a la Ranita de Labio Blanco y al Coquí Común. La poca cantidad de anfibios escuchados pudo deberse a la poca lluvia caída en marzo y la primera mitad de abril.

Entre los reptiles predominó el Lagartijo de Yerbas (*Anolis pulchellus*), ya que en el predio predominan las gramíneas.

Se observaron pocas aves, lo que es típico de cañaverales abandonados. Sin embargo, fue común observar al Gorrión Negro (*Tiaris bicolor*) y al Pitirre (*Tyrannus dominicensis*). De igual manera, se observó, en todos los muestreos, a lo largo de los caminos limpios a la Rolita (*Columbina passerina*). Asimismo, a lo largo de los caños y la quebrada se observaron tres especies de playeros, de los cuales uno (Playero Solitario, *Tringa solitaria*) no se observó en la Parcela 1. Además, en esta parcela se encontró lo que parece ser un gato cimarrón. En la colindancia noreste de la finca se encontró un nido de Guaraguao (*Buteo jamaicensis*) en un árbol de Almendro (ver Fotos 15 y 16).

Es menester mencionar que ambas fincas están siendo utilizadas como vertederos clandestinos (ver Fotos 17 y 18).

En ninguna de las dos parcelas estudiadas se observaron plantas ni animales considerados en peligro de extinción por el Departamento de Recursos Naturales y Ambientales y el Servicio de Pesca y Vida Silvestre.

| **Tabla 5: Lista de árboles y arbustos en la Parcela 2** | |
|---|---|
| **Nombre común** | **Nombre científico** |
| Albicia | *Albizia procera* |
| Almendro | *Terminalia catappa* |
| Bambú | *Bambusa vulgaris* |
| Bayahonda(Ar) | *Prosopis juliflora* |
| Berenjena Cimarrona (Ar) | *Solanum torvum* |
| Café Cimarrón (Ar) | *Casearia guianensis* |
| Coco | *Cocos nucifera* |
| Tostado | *Casearia decandra* |
| Corcho Bobo | *Pisonea albida* |
| Espino Blanco | *Zanthoxylum monophyllum* |
| Espino Rubial | *Zanthoxylum martinicense* |
| Flamboyán Amarillo | *Peltophorum pterocarpum* |
| Jobo | *Spodias mombin* |
| Guayaba (Ar) | *Psidium guajava* |
| Higuereta (Ar) | *Ricinus communis* |
| Hoja Menuda o Cieneguillo | *Myrcia deflexa* |
| Mata Ratón | *Gliricidia sepium* |
| Moca (Ar) | *Andira inermis* |
| Molinillo | *Hura crepitans* |
| **Muñeco (Ar)** | ***Cordia borinquensis*** |
| Perico | *Cordia polycephala* |
| Papagayo (Ar) | *Sesbania sericea* |
| Péndula | *Citharexylum fruticosum* |
| Quenepa | *Melicoccus bijugatus* |
| Reina de las Flores (Ar) | *Lagerstroemia speciosa* |
| Roble | *Tabebuia heterophylla* |
| Samán | *Samanea saman* |
| Tamarindillo (Ar) | *Leucaena leucocephala* |
| Terocarpus | *Pterocarpus indicus* |
| Tulipán Aficano | *Spathodea campanulata* |
| Tua-tua (Ar) | *Adenoropium gossyfolium* |
| Yagrumo Hembra | *Cecropia schreberiana* |
| Zarcilla | *Leucaena glabra* |
| Ar = arbusto<br>Negritas = especies endémicas | |

| Tabla 6: Lista de rastreras, bejucos e hierbas en la Parcela 2 | |
|---|---|
| **Nombre científico** | **Nombre común** |
| **Rastreras** | |
| Anamú (Rabo de Ratón) | *Achiranthes indica* |
| Batatilla Blanca | *Merremia quinquefolia* |
| Blero | *Amaranthus dubius* |
| Botón Blanco | *Spermacoce verticillata* |
| Botón de Cadete | *Leonotis nepetaefolia* |
| Bretonica Piramidal | *Melochia pyramidata* |
| Cadillo de Perro | *Urena sinuata* |
| Cascabelito | *Crotalaria retusa* |
| Cascabelito | *Crotalaria striata* |
| Cariaquillo | *Lantana camara* |
| Cidrón | *Lippia nodiflora* |
| Dragón | *Senna alata* |
| Escoba | *Sida carpinifolia* |
| Frijol | *Phaseolus vulgaris* |
| Frijolillo | *Vigna vexilata* |
| Frijolillo | *Vigna hosei* |
| Habichuela Parada | *Macroptilium lathyroides* |
| Jazmín de Río | *Hedychium coronarium* |
| Kudzu | *Pueraria phaseoloides* |
| Lechecilla | *Chamaesise hirta* |
| Lechecilla | *Chamaesise nutans* |
| Leche Vana | *Poinsetia heterophylla* |
| Malanga Silvestre | *Colocasia esculenta* |
| Malva | *Malachra capitata* |
| Manzanilla | *Bidens pilosa* |
| Moriviví | *Mimosa pudica* |
| Moriviví Bobo | *Chamaecrista nictitans* |
| Orosne | *Polygala paniculata* |
| Pequeque | *Desmodium tortuosum* |
| Pica-Pica | *Stizolobium pruriens* |
| Quinino del Pobre | *Philanthus niruri* |
| Verdolaga | *Portulaca oleracea* |
| Yerba de Clavo | *Ludwigia octovalvis* |
| Yerba Socialista | *Vernonia cinerea* |
| Zarza | *Mimosa casta* |
| Zarza Brava | *Mimosa pigra* |
| **Bejucos** | |
| Bejuco de Caro | *Cissus verticillata* |
| Bejuco de Puerco | *Ipomoea tiliacea* |
| Bejuquillo de Puerco | *Ipomoea triloba* |
| Cundeamor | *Momordica charantia* |

| Tabla 6: Lista de rastreras, bejucos e hierbas en la Parcela 2 | |
|---|---|
| **Nombre científico** | **Nombre común** |
| Gloria de la Mañana | *Ipomoea setifera* |
| Malanga Trepadora | *Syngonium podophyllum* |
| **Hierbas** | |
| Arrocillo | *Equinochloa colonum* |
| Bahía | *Paspallum notatum* |
| Caña de Azúcar | *Saccharum officinarum* |
| Caña de Castilla | *Arundo donax* |
| Cohitre | *Commelina difusa* |
| Horquetilla Blanca | *Paspalum conjugatum* |
| Junco | *Cyperus odoratus* |
| Junco | *Cyperus polystachyos* |
| Malojilla | *Eriochloa polystachya* |
| Malojillo | *Brachiaria mutica* |
| Paja Brava | *Paspallum millegrana* |
| Paraguita Morada | *Chloris inflata* |
| Yerba Estrella Morada | *Cynodon niemfuensis* |
| Yerba de Egipto | *Dactylocterium aegyptium* |
| Yerba de Guinea | *Panicum maximum* |
| Yerba Jonson | *Sorghum halapense* |
| Yerba de Zorra | *Trichachne insularis* |

| Tabla 7: Lista de vegetación observada dentro y en las márgenes inmediatas a la quebrada y los caños de la Parcela 2 | |
|---|---|
| **Nombre común** | **Nombre científico** |
| **Rastreras** | |
| Almendro (A) | *Terminalia catappa* |
| Bambú | *Bambusa vulgaris* |
| Cascabelito | *Crotalaria striata* |
| Coco (A) | *Cocos nucifera* |
| Dormidera | *Senna obtusifolia* |
| Guaraguao (Ar) | *Guarea guidonia* |
| Jazmín de Río | *Cleome spinosa* |
| Kudzu | *Pueraria phaseoloides* |
| Habichuela Parada | *Macroptilium lathyroides* |
| Higuereta | *Ricinus communis* |
| Leche Vana | *Poinsetia heterophylla* |
| Malanga Cimarrona | *Colocasia esculenta* |
| Moca (Ar) | *Andira inermis* |
| Moriviví | *Mimosa pudica* |
| Moriviví Bobo | *Chamaecrista nictitans* |
| Papagayo | *Sesbasnia sericea* |

| Tabla 7: Lista de vegetación observada dentro y en las márgenes inmediatas a la quebrada y los caños de la Parcela 2 | |
|---|---|
| **Nombre común** | **Nombre científico** |
| Rabano Cimarrón | *Dieffenbachia seguine* |
| Quino de Pobre | *Philanthus niruri* |
| Verdolaga | *Portulaca oleracea* |
| Yerba de Clavo | *Ludwigia octovalvis* |
| Zarza | *Mimosa casta* |
| **Hierbas** | |
| Arrocillo | *Echinochloa colonum* |
| Enea | *Typha dominguensis* |
| Malojilla | *Eriochloa polystachya* |
| Malojillo | *Brachiaria mutica* |
| Junco | *Cyperus odoratus* |
| Junco de Agua | *Cyperus ligularis* |
| Junco | *Cyperus polystachyos* |
| Junco | *Cyperus imbricatus* |
| Trompetilla | *Hymenachne amplexicaulis* |
| Yerba de Coquí | *Cyperus rotundus* |
| **Bejucos** | |
| Bejuco de Puerco | *Ipomoea tiliacea* |
| Cundeamor | *Momordica charantia* |
| Pepinito Cimarrón | *Melothria pendula* |
| **Plantas Acuáticas** | |
| Ombligo de Venus | *Hydrocotyle umbellata* |
| A = árbol<br>Ar = arbusto | |

| Tabla 8: Vertebrados encontrados en la Parcela 2 | |
|---|---|
| **Nombre común** | **Nombre científico** |
| **Anfibios** | |
| **Coquí Común** | ***Eleutherodactylus coqui*** |
| **Rana de Labio Blanco** | ***Leptodactylus albilabris*** |
| Rana Toro | *Rana catesbiana* |
| Sapo de Surinam | *Bufo marinus* |
| **Reptiles** | |
| **Lagartijo Común** | ***Anolis cristatelus*** |
| **Lagartijo de Yerbas** | ***Anolis pulchellus*** |
| **Siguana** | ***Ameiva exul*** |
| **Aves** | |
| Diablito | *Lonchura cucullata* |
| Garza Ganadera | *Bubulcus ibis* |
| Gaviota Gallega | *Larus atricilla* |

| Tabla 8: Vertebrados encontrados en la Parcela 2 | |
|---|---|
| **Nombre común** | **Nombre científico** |
| Garza Real | *Ardea alba* |
| Gorrión Barba-Amarilla | *Tiaris olivacea* |
| Gorrión Negro | *Tiaris bicolor* |
| Guaraguao | *Buteo jamaicensis* |
| Judío | *Crotophaga ani* |
| Martinete | *Butorides striatus* |
| Mozambique | *Quiscalus niger* |
| Pinzón Pico Plateado | *Lonchura malabarica* |
| Pitirre | *Tyrannus dominicensis* |
| Playero Guineilla Menor | *Tringa flavipes* |
| Playero Sabanero | *Charadrius vociferus* |
| Playero Solitario | *Tringa solitaria* |
| Reinita | *Coereba flaveola* |
| Rolita | *Columbina passerina* |
| Ruiseñor | *Mimus polyglottos* |
| Tórtola Aliblanca | *Zenaida asiatica* |
| Tórtola Cardosantera | *Zenaida aurita* |
| Veterano | *Estrilda melpoda* |
| Negritas = especies endémicas | |

**Recomendaciones**

Las parcelas están formadas por pastizal que ha sustituido a la caña de azúcar, que había sido sembrada en éstas. La mayoría de los árboles se encuentran en la periferia de la finca. Se recomienda que se conserve la mayoría de estos árboles, en particular los individuos de Espino Blanco (*Zanthoxylum monophyllum*) (ver Foto 7), los cuales fueron marcados con cinta plástica roja, y el Almendro, árbol solitario en la colindancia oeste (ver Foto 15), en el cual una pareja de Guaraguaos han construido un nido.

Como medida de mitigación por los árboles que se eliminarán en la fase de construcción, se recomienda sembrar vegetación arbórea a lo largo de la quebrada.

Aunque no se encontró especies en peligro de extinción o vulnerables, si durante las obras de construcción se encuentra la presencia de estas especies, se puntualiza que el proponente debe cumplir con el protocolo establecido por el Departamento de Recursos Naturales y Ambientales y con los requisitos de la Nueva Ley de Vida Silvestre (Ley

Número 241 del 15 de agosto de 1999) y el Reglamento para Regir el Manejo de las Especies Vulnerables y en Peligro de Extinción del Estado Libre Asociado de Puerto Rico (Reglamento Número 3250).

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**Certificación**

Yo, Raúl A. Pérez Rivera, funcionario responsable designado por Servicios Científicos y Técnicos he evaluado, revisado y aceptado la información del Estudio de Flora y Fauna para el proyecto Villas de Buena Vista, localizado en el Barrio Buena Vista del Municipio de Humacao, Puerto Rico.

En relación con el proyecto antes mencionado y al estudio de Flora y Fauna, **CERTIFICO QUE**:

a. Toda la información vertida en el Estudio de Flora y Fauna es **CIERTA**, **CORRECTA** y **COMPLETA** a mi mejor saber y entender.
b. **AFIRMO** y **RECONOZCO** las consecuencias de incluir y someter información incompleta, inconclusa o falsa en dicho documento.

Y para que conste, firmo la presente certificación en Caguas, Puerto Rico, hoy 21 de junio de 2005.

Raúl A. Pérez Rivera
Biólogo- MS, PhDC

# Anejos

# Anejo I

Parcela 1
Parcela 2

# Anejo II

# Fase I

# Fotos

Foto 1: Vista panorámica de la Parcela 1, Bo. Buena Vista de Humacao

Foto 2: Vista del cañaveral abandonado, en el cual aún se puede observar plantas de caña

Foto 3: Tallos secos de caña de azúcar creciendo en la Parcela 1

Foto 4: Hierbas, en las cuales se encuentra el Malojillo (*Brachiaria mutica*) creciendo entre la caña de azúcar en la Parcela 1

Foto 5: Individuos de Albicia (*Albizia procera*) creciendo entre las cañas en la Parcela 1

Foto 6: Individuo de Samán (*Samanea saman*) creciendo entre las cañas en la Parcela 1

Foto 7: Vista del caño formado por las aguas que se originan en el Vertedero de Humacao, las cuales corren a lo largo de la Parcela 1

Foto 8: Vista de la parte del caño que pasa a través de la Parcela 1. Nótese la veta de agua y las pisadas de ganado vacuno

Foto 9: Hierba de Canga (*Ludwigia octovalvis*) creciendo en la Parcela 1

Foto 10: Ombligo de Venus (*Hydrocotyle umbellata*) creciendo en el caño de la Parcela 1

# Fase II

# Fotos

Foto 1: Vista panorámica de la Parcela 2, en la cual se puede observar vegetación arbórea en la periferia y las rastreras e hierbas que cubren casi toda la finca

Foto 2: Vista panorámica de la finca, en la cual se puede observar árboles de la periferia e hierbas de diferentes alturas como resultado del pastoreo

Foto 3: Entrada de la quebrada a la Parcela 2. Nótese a la extrema derecha la verja de alambre estriado que marca la colindancia de la propiedad.

Foto 4: Efecto del pastoreo en las hierbas de la Parcela 2. En la parte posterior se observan arbustos de Yerba Canga (*Ludwigia octovalvis*), los cuales son color rojizo. Al fondo se observa un árbol de Almendro (*Terminalia catappa*).

Foto 5: Efecto del pastoreo por ganado caballar. En la parte intermedia y posterior del caballo se observa caña que aún permanece en la Parcela 2.

Foto 6: Un Almendro (*Terminalia catappa*) y una Palma de Cocos (*Cocos nucifera*) creciendo en la margen superior de la quebrada

Foto 7: Árbol de Espino (*Zanthoxylum monophyllum*) en la colindancia de la Parcela 2. Foto colocada horizontalmente para que se puedan observar los detalles de las hojas

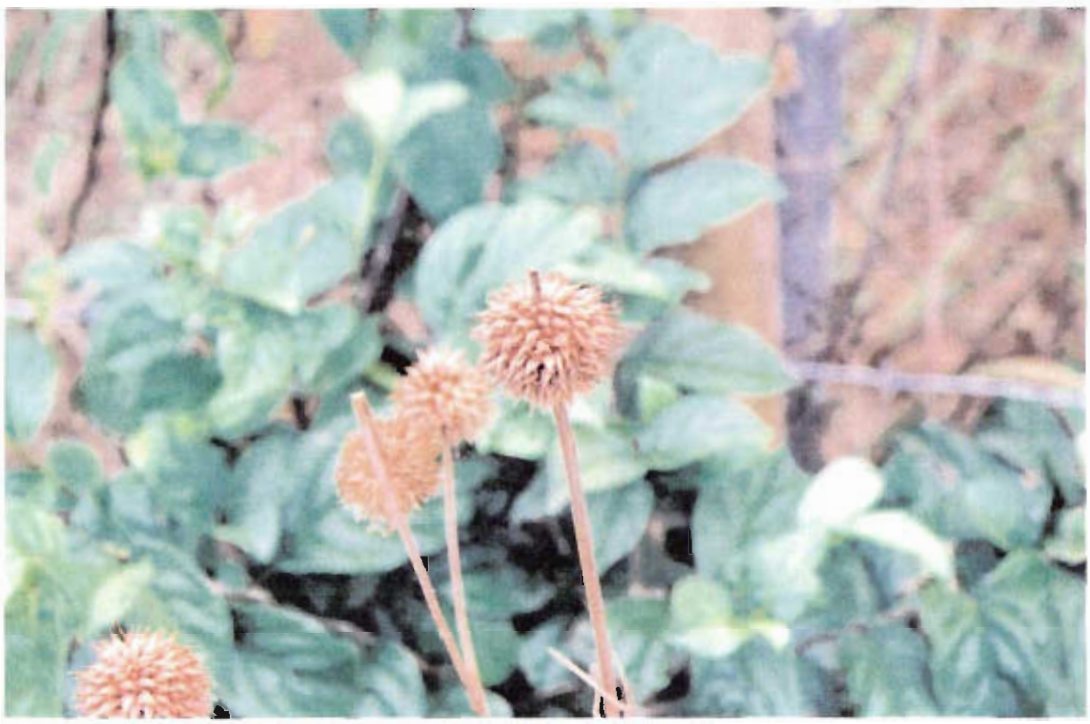

Foto 8: Individuo de Botón de Cadete (*Leonotis nepataefolia*), una de las plantas más llamativas encontrada en la Parcela 2

Foto 9: Eneas (*Typha dominguensis*) comenzando a invadir una de las partes más húmedas de la propiedad. A la derecha se observa Zarza (*Mimosa casta*), otro colonizador

Foto 10: Crecimiento de Eneas en una de las partes más anegadas de la Parcela 2

Foto 11: Márgenes de la quebrada en los cuales crece Malojillo, Malojilla y Malanga Cimarrona

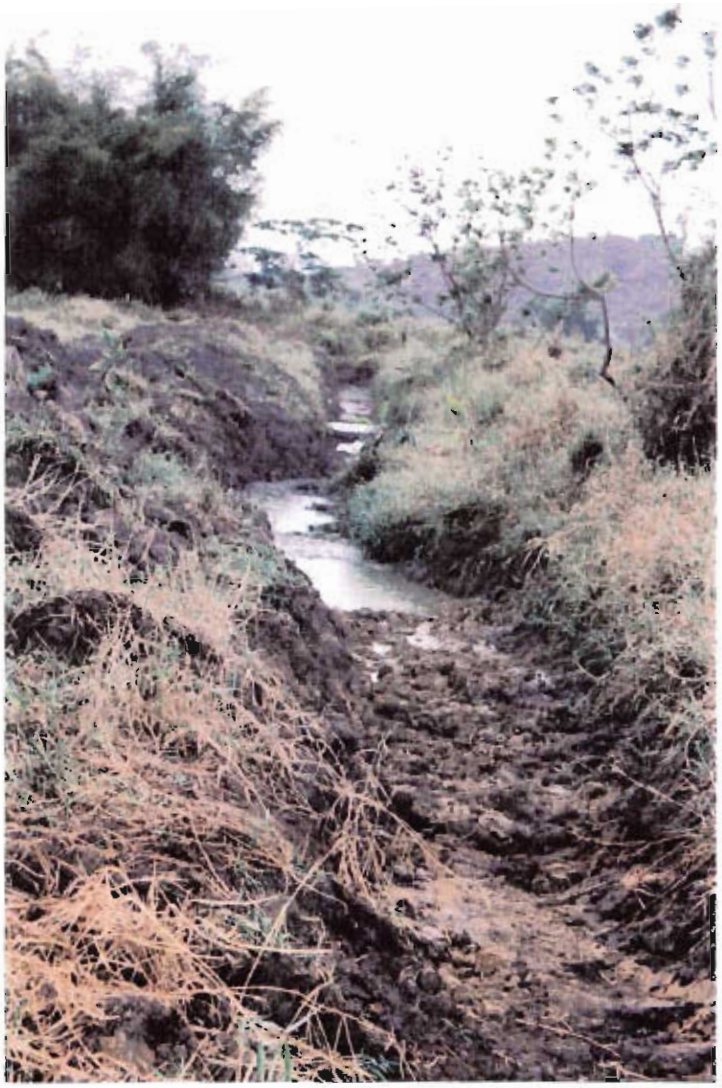

Foto 12: Vegetación creciendo en las márgenes de la quebrada. En la foto se observa vegetación seca y al fondo crecimiento de Bambú

Foto 13: Plantas de Rábano Cimarrón (*Dieffenbachia seguine*)

Foto 14: Otra de las partes húmedas del predio en la cual se puede observar Yerba de Canga (al frente) y Malanga Cimarrona (*Colocasia esculenta*)

Foto 15: Árbol de Almendro (*Terminalia catappa*) enorme, en el cual se encontró anidado una pareja de Guaraguos (*Buteo jamaicensis*)

Foto 16: Nido de Guaraguao (*Buteo jamaicensis*). Nótese las ramitas que sobresalen en el centro de la fotografía

Foto 17: Vertedero clandestino en la Parcela 1

Foto 18: Vertedero clandestino en la colindancia de la Parcela 2