GORE ENGINEERING, INC.

SOIL AND FOUNDATION INVESTIGATIONS

LAWRENCE W. GILBERT, D. ENGR.
REG. C.E.

BORINGS
ANALYSES

TESTING
REPORTS

3613 HESSMER AVENUE
P. O. BOX 8867
METAIRIE, LOUISIANA 70011

JAMES R. GORE
(1962 - 1991)

(504) 888-6690
FAX: (504) 888-6827

31 July 2007

Southern Yacht Club
c/o Schrenk & Peterson
4141 Bienville Avenue
New Orleans, Louisiana 70119

Subsoil Investigation
Proposed New Building
Southern Yacht Club
New Orleans, Louisiana
Our Project No. 9412

Gentlemen:

Herein is our report on the results a subsoil foundation investigation made for the subject project.

Yours very truly,

GORE ENGINEERING, INC.

Lawrence W. Gilbert

LWG:jrt

SUBSOIL INVESTIGATION

PROPOSED NEW BUILDING

SOUTHERN YACHT CLUB

NEW ORLEANS, LOUISIANA

PROJECT NO. 9412

FOR
SOUTHERN YACHT CLUB
NEW ORLEANS, LOUISIANA

ANTHONY F. BULTMAN
PROJECT COORDINATOR
COVINGTON, LOUISIANA

WAGGONNER & BALL ARCHITECTS
ARCHITECTS
NEW ORLEANS, LOUISIANA

SCHRENK & PETERSON
CONSULTING ENGINEERS, INC.
NEW ORLEANS, LOUISIANA

GORE ENGINEERING, INC.
SOIL AND FOUNDATION INVESTIGATIONS
METAIRIE, LOUISIANA

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SOUTHERN YACHT CLUB
NEW ORLEANS, LOUISIANA

INTRODUCTION

1. This report contains the results of a subsoil foundation investigation made at the subject site. Instructions to proceed with the investigation were received on June 18, 2007 from the Southern Yacht Club. Waggonner and Ball Architects are the Architects for the project. Schrenk and Peterson Consulting Engineers, Inc. are the Consulting Engineers for the project.

2. The study included the drilling of a soil test boring to determine subsurface conditions and stratification and the performance of soil mechanics laboratory tests on samples obtained from the boring to evaluate their physical characteristics. Engineering analyses were made, based on the boring and test data to develop criteria to be used in foundation design.

SOIL BORING

Field Exploration

3. One (1) undisturbed sample type soil test boring (B-1) was drilled to a depth of 80 ft. on July 17, 2007. The boring was made with a truck mounted drill rig at a designated location approximately as shown in plan on Figure 1. It should be noted that the boring had to be shifted, since an underground obstruction was encountered at the original

location. Undisturbed sampling was performed continuously in all cohesive or semi-cohesive materials with a three inch diameter thin wall tube sampler. Representative samples were cut from the cores and placed in moisture proof containers for preservation until laboratory testing could be performed. A log of the boring showing the detailed stratification and sample depths is given on Figure 2.

4. When cohesionless material was encountered, which could not be sampled by undisturbed methods, the Standard Penetration Test was performed. This test consists of driving a two inch diameter splitspoon sampler 1 ft. (after first seating it 6 inches) with a 140 lb. hammer falling 30 inches. The number of blows required to drive the sampler gives an indication of the density of the material.

LABORATORY TESTS

5. In order to develop the physical properties of the soils, soil mechanics laboratory tests were performed on samples obtained from the boring. This testing consisted primarily of Natural Moisture Content, Unit Weight and Unconfined Compression. Grain Size (percent passing the No. 200 Sieve) tests were performed on some of the more granular materials and Atterberg Limits were performed on selected cohesive samples. The results of all the laboratory tests are tabulated along side the boring log at the appropriate sample and depth on Figure 2.

6. The Unconfined Compression tests give a measure of "skin friction" values used to estimate pile load capacities. The Atterberg Limits along with the Natural

Moisture Content tests give an indication of the compressibility of the soils and are used empirically to estimate settlements. The Grain Size tests are used to classify the more granular soils.

SUBSOIL CONDITIONS

7. Based on the borings, the subject site could be classified as Site Class E according to the criterion given in Table 1615.1.1 of the International Building Code (IBC).

Subsoil Description

8. Reference to the log of boring B-1 shows that underlying 1 ft. of loose tan fine sand there is medium stiff gray silty clay to the 3½ ft. depth. This is underlain by loose gray sandy silt with shell to the 16½ ft. depth. A slight petroleum odor was detected in some of the samples from this stratum. Below this there is loose to medium dense gray silty fine sand with shell to 23½ ft. This sand stratum is followed by soft gray clay to the 44½ ft. depth and then by loose to medium dense gray silty fine sand to 48 ft. Below this there is soft to medium stiff gray clay to the 68 ft. depth where the geologically identified Pleistocene age soils were first encountered. These Pleistocene age soils generally consist of stiff to very stiff greenish gray and reddish tan or reddish tan and gray sandy clay or silty clay to at least the 80 ft. depth, the maximum depth explored.

9. **Groundwater** At the time of making the boring, groundwater was measured at a depth of 6.5 ft. below the existing ground surface elevation in boring B-1. Groundwater was measured shortly after making the boring and may not have become fully

static at the time of measurement. In any event, groundwater could fluctuate due to seasonal precipitation, drainage, prolonged drought and the water level in Lake Pontchartrain. If groundwater is important to construction, it should be measured at that time.

FOUNDATION ANALYSIS

10. It is understood that the proposed construction will consist of a new Building in the area of boring B-1 and approximately as shown in plan on Figure 1. The Building will consist of two (2) elevated concrete levels and a steel framed roof with mechanical equipment on the roof. Maximum column loads on the order of 320 kips are anticipated. While not known with certainty, it was assumed that less than 2 ft. of fill will be needed to raise the site grade in the area of the proposed structure.

11. The near surface soils at the site are only fair in bearing quality. In view of this and considering the magnitude of the column loads, piles are recommended for support of all structural loads that cannot tolerate settlements including the ground floor slab and any sensitive pavements. Analyses were made in this regard and the results are given in the following section.

Pile Foundations

12. Analyses were made based on boring B-1 to estimate the load carrying capacities of several types and lengths of timber piles (ASTM D-25). These include small timber piles having a 6 inch tip and an 8 inch butt and Class "B" timber piles. The piles will

generally receive their support through "skin friction" along their embedded length, since no stratum was encountered that could be relied on to offer good additional "point" support.

13. **Estimated Pile Load Capacities** The results of analyses to estimate pile load capacities in compression and tension, or uplift, are given in the following table. Pile lengths given are as measured from the existing ground surface elevation at the boring location, but a pile cutoff of up to 5 ft. should be of no consequence.

ESTIMATED SINGLE PILE LOAD CAPACITY IN TONS
FACTOR OF SAFETY = 2.0 IN COMPRESSION
FACTOR OF SAFETY = 3.0 IN TENSION

LENGTH OF PILE IN FEET	Small Timber 6" tip - 8" butt		Class "B" Timber	
	Comp.	Tens.	Comp.	Tens.
40	8	5½	11	7
45	--	--	12	8
50	--	--	14	9½
55	--	--	16	10½
60	--	--	18	12
65	--	--	20	13½
70	--	--	22	14½
75	--	--	24	16

The foregoing estimated pile load capacities contain factors of safety of 2.0 against failure in compression and 3.0 in tension, or uplift, which is recommended for design. They do not consider drag load, group effect or settlements, as will discussed.

14. **Drag Load** When fill is placed on the site, the underlying compressible soils consolidate, resulting in surface settlement. As the compressible soils

consolidate, "negative skin friction" or downdrag may be imparted on piles. This could result in an extraneous load, additive to any structural load, on the piles and could increase settlements of the structure. It is our opinion that drag load is dependent on the thickness of fill, compressibility of the soils, time-rate of consolidation and pile length. If 2 ft. of new fill or less is required, drag load should be unimportant to design. However, it is recommended that this fill be placed as soon as practical prior to construction. If more than 2 ft. of new fill is required, further consideration should be given to the effects of drag load.

15. **Group Effect** The effect of pile grouping on the single pile load capacities is dependent on pile spacing, pile lengths and soil characteristics throughout the pile length and below the pile tips. Assuming a minimum center to center spacing of 3 ft., group effect should be unimportant for pile clusters of less than 6 piles. Group effect could become important for larger clusters and should be evaluated when actual pile layouts are known as outlined in the local building code or in the criteria given in Appendix "A" following the text.

16. **Estimated Settlements** Settlement of pile supported footings using the recommended pile load capacities in single widely spaced rows or in clusters of up to 4 to 6 piles are estimated to be on the order of ¾ to 1 inch. Settlements would increase with the size of the pile cluster and, if larger clusters of closely spaced piles are needed for support, detailed settlement analyses should be made.

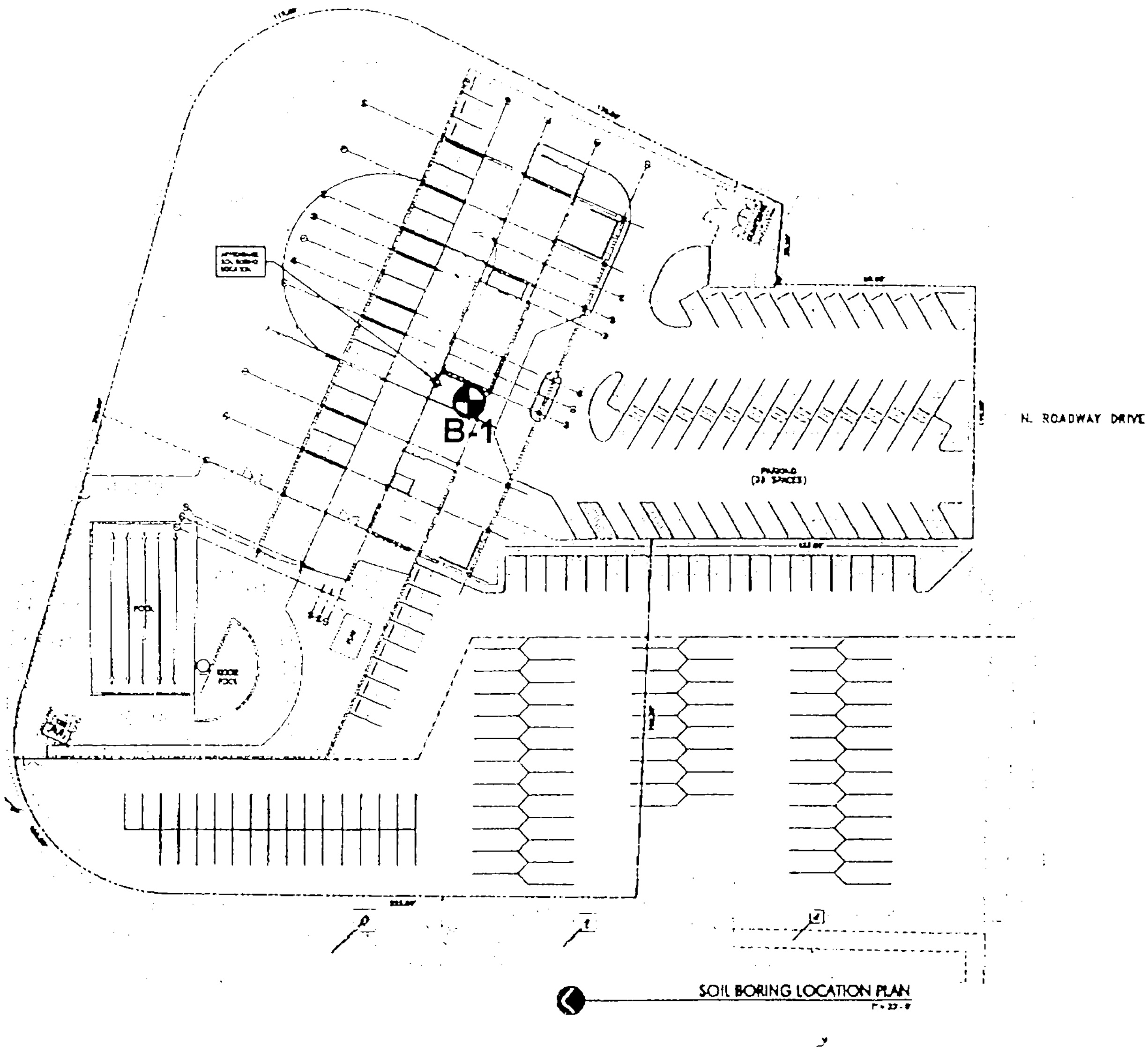
17. **Pile Driving** Some discussion with regard to pile driving appears warranted. In general, driving of small timber piles should be limited to the rate of 10 to 12

blows per foot using a Vulcan No. 2 hammer or a 2000 to 3000 lb. drop hammer falling 5 ft. Driving of Class "B" timber piles should be limited to the rate of 25 blows per foot using a Vulcan No. 1 hammer or equivalent. These recommendations are given in order to minimize possible damage to the piles. Prepunching of the piles may also be needed in view of the possible presence of underground obstructions.

18. Vibrations due to pile driving activities should be expected and they should be monitored during the driving of probe piles and job piles. In general, vibrations should be limited to about 0.25 inch/sec. (peak particle velocity) at all existing nearby sensitive structures. If this value is exceeded, further consideration should be given to the effects of vibrations.

GORE ENGINEERING, INC.

Lawrence W. Gilbert



BORING LOCATION
Not to Scale

SUBSOIL INVESTIGATION
PROPOSED NEW BUILDING
SOUTHERN YACHT CLUB
NEW ORLEANS, LOUISIANA

FOR
SOUTHERN YACHT CLUB
NEW ORLEANS, LOUISIANA

J-9412 Fig. 1

GORE ENGINEERING, INC.
SOIL AND FOUNDATION INVESTIGATIONS

Boring No. B-1

LOG OF BORING AND TEST RESULTS

Date Boring Drilled: 17 July 2007

Project: PROPOSED NEW BUILDING - SOUTHERN YACHT CLUB - NEW ORLEANS, LOUISIAN
FOR: SOUTHERN YACHT CLUB - NEW ORLEANS, LOUISIANA
ANTHONY F. BULTMAN - PROJECT COORDINATOR - COVINGTON, LOUISIANA
WAGGONNER & BALL ARCHITECTS - ARCHITECTS - NEW ORLEANS, LOUISIANA
SCHRENK & PETERSON CONSULTING ENGINEERS, INC. - NEW ORLEANS, LOUISIANA

Recorded By: Mark Albarado

Sample No	Sample Depth in Feet From	Sample Depth in Feet To	Stratum Depth in Feet	Visual Classification	*Blows per Foot	Symbol Log	Scale (feet)	Unconfined Compression (Qu) (lbs/sq.ft.)	Water Content (percent)	Unit Weight Dry (lbs/cu.ft.)	Unit Weight Wet (lbs/cu.ft.)	Atterberg Limits L.L.	P.L.	P.I.
			.0				0							
1	.5	1.0	1.0	LOOSE TAN FINE SAND										
2	2.5	3.0	3.5	MEDIUM STIFF GRAY SILTY CLAY				1485	31.9	86.5	114.1			
3	5.5	6.0		LOOSE GRAY SANDY SILT			5	1550	26.9	94.7	120.2			
4	7.5	8.0		W/ SHELL				1100	28.2	93.1	119.3		(59)	
5	8.5	9.0		(SLIGHT PETROLEUM ODOR)										
6	11.5	12.0					10							
7	14.5	15.0	16.5				15	480	32.4	87.6	116.0			
8	16.5	17.0	17.0	LOOSE GRAY SILTY FINE SAND					30.5					
9	17.0	18.5	23.5	MEDIUM DENSE GRAY SILTY FINE SAND W/ SHELL	19		20							
10	24.5	25.0		SOFT GRAY CLAY W/ SAND LENSES & SILT LENSES			25	695	58.2	66.5	105.2			
11	29.5	30.0					30		51.9			83	28	55
12	34.5	35.0					35	675	61.4	58.7	94.8			
13	39.5	40.0	44.5				40	705	75.1	55.5	97.1			
14	44.5	45.0	45.0	LOOSE GRAY SILTY FINE SAND			45		24.8					
15	45.0	46.5	48.0	MEDIUM DENSE GRAY SILTY FINE SAND	22				23.3				(13)	
16	49.5	50.0		SOFT TO MEDIUM STIFF GRAY CLAY			50	1000	61.3	57.0	91.9			
17	54.5	55.0					55	960	55.3	65.6	101.8	75	22	53
18	59.5	60.0					60	725	53.5	64.2	98.5			
19	64.5	65.0	68.0				65	1075	56.0	65.3	101.9			
20	69.5	70.0	74.5	STIFF GREENISH GRAY & REDDISH TAN SANDY CLAY			70	2245	55.5	64.4	100.1			
21	74.5	75.0	78.5	VERY STIFF REDDISH TAN SILTY CLAY			75	4970	23.6	97.7	120.8			
22	79.5	80.0	80.0	STIFF REDDISH TAN & GRAY SILTY CLAY			80	3115	27.2	97.6	124.2			
							85							
							90							
							95							
							100							

NOTE: VALUES IN PARENTHESES ( ) INDICATE PERCENT PASSING NO. 200 SIEVE.

CLAY SILT SAND ORGANIC
Predominant Type Bold. Modifying Type Light.

*140 lb. hammer dropped 30 inches on 2 inch splitspoon sampler after first being seated 6 inches.

REMARKS: Water Table Depth = 6.5 ft (See Text)
Free Water Depth = 4.0 ft (See Text)

Fig. 2

Minimum Pile Spacing

$$SPAC = 0.05\,L_1 + 0.025\,L_2 + 0.0125\,L_3 \text{ (Min.3.0 ft.)}$$

SPAC = Center to center spacing of piles (ft.)

L_1 = Pile penetration in ft. up to 100 ft.

L_2 = Pile penetration in ft. from 101 to 200 ft.

L_3 = Pile penetration in ft. from 200 to 300 ft.

Allowable Group Capacity*

$$Q_a = \frac{P \times L \times c}{FSF} + \frac{2.6q_u\left(1 + 0.2\,\frac{w}{b}\right)A}{FSB}$$

P = Perimeter distance of pile group (ft.)

L = Length of pile (ft.)

c = Average (weighted) shear strength ($\frac{1}{2}q_u$) of soil throughout pile length (lbs./sq.ft.)

q_u = Unconfined compressive strength of soils below pile tips (lbs./sq.ft.)

w = Width of base of pile group (ft.)

b = Length of base of pile group (ft.)

A = Base area of pile group (sq. ft.)

FSF = Factor of safety for friction area = 2

FSB = Factor of safety for base area = 3

*In no case should the recommended single pile load capacity be exceeded.

Appendix "A"