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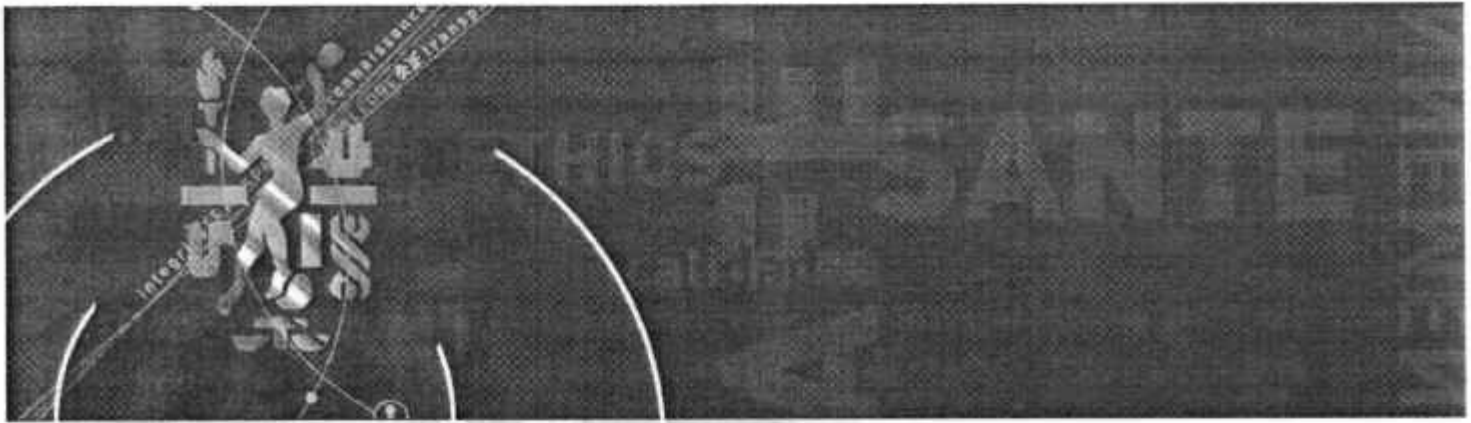
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REPORT ON
GEOTECHNICAL INVESTIGATION FOR THE PLAN SHOWING THE PROPOSED CONSTRUCTION OF NON HIGH RISE GROUP DEVELOPMENT CONSISTS OF 28 BLOCKS, BLOCK 1 TO 27: GROUND FLOOR + FIRST FLOOR, TOTALLY 221 D/U, CLUBHOUSE BLOCK-28 : GROUND FLOOR + FIRST FLOOR + SECOND FLOOR WITH SWIMMING POOL ON THE GROUND FLOOR, COMPRISED IN S.NOS. 267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 OF SATHANKUPPAM VILLAGE (HAMLET OF PUDHUPAKKAM), VANDALUR TALUK, CHENGALPET DISTRICT.

Report for

CASAGRANT
building aspirations

M/s. Casagrand Zest Private Limited
New No.111, Old No.59,
NPL Devi, LB Road, Thiruvannmiyur
Chennai – 600 041



BUREAU VERITAS INDIA PVT LTD

DP-102, Nallakinaru Street, Mangalapuram, SIDCO Industrial Estate,
Ambattur Industrial Estate, Chennai-600 098.

Report on : Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool on the ground floor, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Report for : M/s. Casagrande Zest Private Limited
New No.111, Old No.59,
NPL Devi, LB Road, Thiruvannamiyur
Chennai – 600 041

Reference : IND.C.7.23.062, dated 30.03.2023
WO: Casagrande LOI dated 04.04.2023

Report No : BV/GT/Casagrande-18661799/01

Field investigation by : Mr. Immanuel Jabasingh
Site Engineer

Bureau Veritas (India) Pvt. Ltd.,
Chennai

Approved by : Mr. Ravi N
Manager - Geotech, South.

Bureau Veritas (India) Pvt. Ltd.
Bangalore.

Prepared by : Ms. Sathya G
Geotechnical Engineer

Bureau Veritas (India) Private Limited,
Bangalore

Date of submission of a report : 13.06.2023

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LOCATION: Kelambakkam

1. INTRODUCTION:

The client **M/s. Casagrand Zest Pvt Ltd.**, Chennai, commissioned **M/s Bureau Veritas India Pvt. Ltd.** for carrying out geotechnical investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool on the ground floor, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpet district. The Purpose of the investigation is to evaluate the subsurface stratification and to suggest suitable foundation system.

The scope of work are as follows:

- Drilling Twenty-Five (25) number boreholes for a maximum depth 5.0m to 10.0m from the existing ground level through a rotary core-drilling machine.
- Collection of disturbed and undisturbed sample collection at regular intervals or whenever change in strata.
- Testing of the samples in laboratory for classification and engineering properties of samples.
- Examination, and interpretation of the data thus collected, along with an assessment of the soil type, its bearing capacity, its physical behavior, etc. and guidelines regarding the suitable foundation system.

2. FIELDWORK:

The field investigations comprised of a visual examination of the ground surface condition, the sinking of Twenty-Five (25) boreholes namely BH-1 to BH-25. Borehole's locations were



identified on the ground and shown to us by the client. The details of borehole locations provided in **Annexure I**.

Exploration carried out by drilling with in-situ standard penetration tests, bore logging and sample collection from the boreholes.

2.1 Location Details

A list of exploration location completed as on date; details are presented in the below table:

Table 1: Location Details of exploration location

Structure*	BH No	Co-ordinates*		Reduced Level*	Termination depth from EGL (m)	Layer at termination depth	Ground water level from EGL (m)
		X	Y				
Villa	BH-1	2712.7721	466.8553	8.37	5.0	CWR	2.4
Apartment	BH-2	2739.3350	506.1429	8.43	10.0	HWR	2.4
Villa	BH-3	2788.3870	516.3552	8.57	5.0	CWR	2.4
Apartment	BH-4	2799.6632	553.8444	8.80	10.0	HWR	2.4
	BH-5	2750.0076	554.1235	8.72	10.0	CWR	2.2
Villa	BH-6	2687.5304	521.8322	8.58	5.0	CWR	1.7
	BH-7	2705.6694	564.7270	8.76	5.0	CWR	2.2
	BH-8	2780.2831	593.9799	8.85	5.0	CWR	2.2
	BH-9	2779.0593	637.2574	9.03	10.0	CWR	2.3
	BH-10	2703.7755	611.0151	8.74	5.0	CWR	1.9
	BH-11	2652.9889	583.5081	8.49	10.0	HWR	1.8
Apartment	BH-12	2656.9659	624.7835	8.67	10.0	CWR	1.9
	BH-13	2727.8954	651.8786	8.83	5.0	CWR	2.0
	BH-14	2744.1564	696.9080	8.75	10.0	HWR	2.2
	BH-15	2691.4434	715.3818	8.72	10.0	HWR	1.5
Villa	BH-16	2682.2262	670.4906	8.89	6.0	CWR	1.6
Apartment	BH-17	2618.9452	649.9257	8.81	7.5	CWR	1.6
Villa	BH-18	2642.2949	697.0681	8.81	5.0	CWR	1.6
	BH-19	2593.7431	687.5334	8.84	6.0	CWR	1.6
Apartment	BH-20	2604.6081	726.5551	8.97	10.0	HWR	1.5
Villa	BH-21	2654.1820	754.2151	9.00	5.0	CWR	1.5
	BH-22	2706.1155	758.5825	9.06	6.5	CWR	1.5
	BH-23	2752.3820	739.4100	9.22	5.0	CWR	1.6

Structure*	BH No	Co-ordinates*		Reduced Level*	Termination depth from EGL (m)	Layer at termination depth	Ground water level from EGL (m)
		X	Y				
Apartment	BH-24	2741.1387	786.7397	9.34	10.0	CWR	1.7
Villa	BH-25	2768.0724	816.9866	9.41	5.0	CWR	1.6

*-Details Provided by client

HWR-Highly Weathered Rock; CWR-Completely Weathered Rock.

Drilling:

Drilling of 150mm diameter boreholes was carried out by employing a rotary core drilling technique using a Rotary rig supported by a mud pump for Bentonite circulation and temporary steel casings were utilized to stabilize the sides of the borehole wherever required. The boreholes were drilled in soil, disintegrated rock, weathered & Hard rock from the existing ground level.

2.1.1 Drilling in Soil:

Drilling in soil was carried out by conducting Standard penetration tests in the boreholes at 1.5m intervals up to the termination depth as per the client's requirement as presented in **Table 1**.

Standard Penetration Test:

This is a field test to determine the penetration resistance of the stratum at the test depth. As per procedures described in IS: 2131. In this test, the driving bit was replaced by a split spoon sampler (50.8 mm OD and 35 mm ID). A sampler of length 60 cm was then driven by dropping 63.5 kg hammer on top of the driving collar with a free fall of 75 cm. The sampler was first driven through 15 cm as a seating drive. It was further driven through 30 cm. The number of blows required to drive the sampler for 30 cm beyond the seating drive was termed as Penetration Resistance, "N". Where full penetration of 30 cm was impossible (refusal conditions) blows, and corresponding penetration was recorded. Each sample retrieved from SPT spoon are disturbed and is inspected for visual identification of the strata. These samples are preserved and tested in the laboratory. The record of boreholes with SPTs results are given in **Annexure-II**.



2.1.2 Drilling in Rock:

Once the hard stratum or rock surface is met the size of the borehole is reduced to NX size (76mm). The hard stratum or top of the rock surface is conformed, either by the refusal from standard penetration test N value or due to resistance during the drilling operation. In this hard stratum using NX core drilling with TC/Diamond studded bits carries out further work. The maximum length of the drill (run) maintained is 1.50m. At the end of each run the drill rod string with core barrel is extracted from the borehole and core is recovered from the core barrel. The core samples were extracted from the core barrels in a manner to prevent disturbances to the core. The cores are carefully transferred to the core boxes and preserved. The core recovery percentage is recorded and also the core pieces transferred to the core box are numbered and labelled properly Rock Quality Designation (RQD) is also recorded. The selected core samples are sent to the laboratory for conducting physical tests.

Core recovery and Rock Quality Designation is calculated for extracted rock core pieces from the core barrel using below formulae:

$$CR\% = \frac{\text{Length of core}}{\text{Length of run}} \times 100$$

$$RQD\% = \frac{\text{Length of core pieces} \geq 10\text{cm}}{\text{Length of run}} \times 100$$

After completion of the drilling, the borehole was flushed with clean water to clear Bentonite mud and kept under observation for groundwater monitoring for 24 hours.

3. LABORATORY TESTING:

3.1 Test on Soil Samples

The following tests were conducted on soil samples for their Physical and Engineering properties conforming to IS 2720 (relevant parts) as under

1. Sieve analysis
2. Liquid Limit (LL), Plastic Limit (PL)
3. Natural Moisture Content and Sieve Analysis

3.2. Tests on Rock Samples

The following tests will be conducted on rock samples

1. Water absorption (IS 13030)
2. Density (IS 13030)
3. Specific Gravity (13030)

3.2. Chemical test on soil and water sample

1. pH
2. Chloride
3. Sulphate

The laboratory test results are presented in **Annexure III**.

4. SITE CONDITIONS:

4.1 Surface Condition:

The proposed construction site is situated in Kelambakkam, Chennai. The site ground surface was even during the time of investigation.

4.2 Sub-Surface Condition:

Based on the field investigation data and laboratory test results the summary of the subsurface stratigraphy at the site is as below

Layer I: Soil Layer

The subsurface profile and lithology encountered in the boreholes is summarized in the below table. For a detailed description of the sub-strata encountered is given in the bore logs in **Annexure-II**.

Table 2: Sub Soil Stratification

BH No.	Depth (m)	Description of Strata	SPT N Value
BH-1	0.0-1.5	Brownish Clayey SAND	-
	1.5-4.0	Grayish Dense to Very Dense Clayey SAND	32-52
	4.0-5.0	Brownish Grayish Very Dense Clayey SAND	>100
	Below 5.0	Brownish Grayish Very Dense Silty SAND (CWR)	>100
BH-2	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Brownish Dense Clayey SAND	41

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BH No.	Depth (m)	Description of Strata	SPT N Value
BH-2	3.0-4.5	Grayish Very Dense Silty SAND	>100
	4.5-7.5	Brownish Very Dense Silty SAND (CWR)	>100
BH-3	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Brownish Grayish Hard Intermediate Compressible Sandy CLAY	32
	3.0-5.0	Greenish Grayish Brownish Very Dense Clayey SAND/ Silty SAND	>100
	Below 5.0	Brownish Very Dense Silty SAND (CWR)	>100
BH-4	0.0-1.5	Brownish Silty SAND	-
	1.5-4.0	Grayish Yellowish Very Dense Clayey SAND	>100
BH-5	0.0-1.5	Brownish Silty SAND	-
	1.5-3.0	Grayish Dense Clayey SAND	44
	3.0-4.5	Grayish Very Dense Clayey SAND	>100
	4.5-5.0	Grayish Very Dense Silty SAND (CWR)	>100
BH-6	0.0-1.5	Brownish Silty SAND	-
	1.5-3.0	Brownish Grayish Dense Silty SAND	45
	3.0-5.0	Brownish Grayish Very Dense Silty SAND/ Clayey SAND	>100
	Below 5.0	Brownish Grayish Very Dense Silty SAND (CWR)	>100
BH-7	0.0-1.5	Brownish Silty SAND	-
	1.5-3.0	Grayish Dense Clayey SAND	37
	3.0-5.0	Greenish Grayish Very Dense Silty SAND	>100
	Below 5.0	Greenish Grayish Very Dense Silty SAND (CWR)	>100
BH-8	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Grayish Dense Clayey SAND	30
	3.0-5.0	Grayish Yellowish Very Dense Clayey SAND	>100
	Below 5.0	Yellowish Grayish Very Dense Silty SAND (CWR)	>100
BH-9	0.0-1.5	Brownish Clayey SAND	-
	1.5-4.5	Grayish Dense Clayey SAND	39-42
	4.5-6.0	Grayish Very Dense Silty SAND	>100
BH-10	0.0-1.5	Brownish Clayey SAND	-



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BH No.	Depth (m)	Description of Strata	SPT N Value
BH-10	1.5-3.0	Grayish Very Dense Clayey SAND	59
	3.0-4.0	Brownish Grayish Very Dense Clayey SAND	>100
	4.0-5.0	Greenish Very Dense Silty SAND	>100
	Below 5.0	Brownish Grayish Very Dense Silty SAND (CWR)	>100
BH-11	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Blackish Dense Silty SAND	58
	3.0-4.0	Blackish Very Dense Silty SAND (CWR)	>100
BH-11	4.0-6.0	Blackish Very Dense Silty SAND (CWR)	>100
BH-12	0.0-1.5	Brownish Silty SAND	-
	1.5-3.0	Grayish Brownish Very Dense Clayey SAND	76
	3.0-4.5	Brownish Very Dense Clayey SAND	>100
	4.5-5.0	Brownish Very Dense Silty SAND (CWR)	>100
BH-13	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Blackish Very Dense Clayey SAND	>100
	3.0-5.0	Blackish Very Dense Silty SAND	>100
	Below 5.0	Blackish Very Dense Silty SAND (CWR)	>100
BH-14	0.0-1.5	Brownish Clayey SAND	-
	1.5-4.5	Grayish Greenish Dense Clayey SAND	32-49
	4.5-6.0	Brownish Very Dense Silty SAND	>100
	6.0-7.0	Brownish Very Dense Silty SAND (CWR)	>100
BH-15	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Grayish Dense Clayey SAND	32
	3.0-4.5	Greenish Grayish Very Dense Clayey SAND	>100
	4.5-5.0	Greenish Grayish Very Dense Clayey SAND (CWR)	>100
BH-16	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Blackish Brownish Very Dense Silty SAND	>100
	3.0-4.5	Blackish Brownish Very Dense Silty SAND (CWR)	>100



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BH No.	Depth (m)	Description of Strata	SPT N Value
BH-17	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Grayish Brownish Very Dense Clayey SAND	>100
	3.0-4.5	Brownish Very Dense Silty SAND	>100
	4.5-6.0	Brownish Very Dense Silty SAND (CWR)	>100
BH-18	0.0-1.5	Brownish Clayey SAND	-
	1.5-4.5	Brownish Grayish Very Dense Clayey SAND	>100
	4.5-5.0	Brownish Grayish Very Dense Silty SAND (CWR)	>100
BH-19	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Grayish Brownish Very Dense Clayey SAND	>100
	3.0-6.0	Grayish Brownish Very Dense Silty SAND (CWR)	>100
BH-20	0.0-1.5	Brownish Clayey SAND	-
	1.5-6.0	Grayish Brownish Very Dense Clayey SAND	>100
	6.0-7.0	Grayish Brownish Very Dense Silty SAND (CWR)	>100
BH-21	0.0-1.5	Brownish Clayey SAND	-
	1.5-4.0	Grayish Dense to Very Dense Clayey SAND	43-52
	4.0-5.0	Brownish Grayish Very Dense Clayey SAND	>100
	Below 5.0	Brownish Grayish Very Dense Clayey SAND (CWR)	>100
BH-22	0.0-1.5	Brownish Clayey SAND	-
	1.5-4.0	Grayish Dense Clayey SAND/ Silty SAND	34-42
	4.0-5.0	Grayish Greenish Very Dense Silty SAND	>100
	5.0-6.5	Greenish Very Dense Silty SAND (CWR)	>100
BH-23	0.0-1.5	Brownish Clayey SAND	-
	1.5-3.0	Grayish Dense Clayey SAND	35
	3.0-5.0	Grayish Blackish Very Dense Silty SAND	>100
	Below 5.0	Blackish Very Dense Silty SAND (CWR)	>100
BH-24	0.0-1.5	Brownish Clayey SAND	-
	1.5-2.5	Brownish Grayish Dense Clayey SAND	34



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BH No.	Depth (m)	Description of Strata	SPT N Value
BH-24	2.5-3.0	Brownish Grayish Silty SAND	-
	3.0-4.5	Grayish Very Dense Clayey SAND	63
	4.5-6.5	Brownish Very Dense Silty SAND (CWR)	>100

Layer II: Rock Layer

Below the soil layer, Whitish Blackish Brownish Completely to Highly Weathered Rock with extremely close spaced fractures is observed up to the termination depth.

Diamond bits were used to drill through this stratum. Visual examinations of cores recovered indicate evidence of discoloration. Rock is weak but not friable and rock fragments cannot be broken by hand. Relevant details describing the layer characteristics are tabulated below. The thickness of this layer and recorded Core Recovery (CR) and RQD are as under:

Table 3: Rock Layer Details

BH No.	Occurrence below EGL(m)	Layer Thickness# (m)	Range of CR (%)	Range of RQD (%)	RQD Based classification of intact rock (IS:13365:Part 1)
BH-2	7.5	2.5	Nil-2	Nil	Very Poor
BH-4	4.0	6.0	Nil-10	Nil	Very Poor
BH-5	5.0	10.0	Nil	Nil	Very Poor
BH-9	6.0	4.0	Nil-2	Nil	Very Poor
BH-11	6.0	4.0	3-40	Nil-30	Very Poor-Poor
BH-12	5.0	10.0	Nil	Nil	Very Poor
BH-14	7.0	10.0	Nil-8	Nil	Very Poor
BH-15	5.0	5.0	Nil-29	Nil-29	Very Poor-Poor
BH-16	4.5	1.5	Nil	Nil	Very Poor
BH-17	6.0	1.5	Nil	Nil	Very Poor
BH-19	4.5	1.5	Nil	Nil	Very Poor
BH-20	7.0	3.0	4-30	Nil-8	Very Poor
BH-24	6.5	3.5	Nil	Nil	Very Poor

Up to explored depth.



4.2 Groundwater condition:

Groundwater was encountered in all the boreholes at the time of field investigation.

No long-term monitoring of groundwater was specified. Thus, the groundwater conditions established are applicable for the time of investigation only. The groundwater condition is subjected to climatic changes and any changes in the surrounding area. Reconfirmation of groundwater level is proposed before any work relating to the groundwater regime.

5. DISCUSSION ON FOUNDATION DESIGN DETAILS

Suitable foundation for any structure must satisfy two basic independent criteria with respect to the underlying foundation soils. First, the foundation must have an adequate factor of safety against exceeding the bearing capacity of the foundation soils. Second, the vertical movements of the foundation due to settlement or swelling of the foundation soils must be within tolerable limits for the structure. In view of this, all the types of considered and foundation recommended in this report will satisfy the above criteria.

Generally, homogeneous two-layer sub soil profile has been noticed in the boreholes. Based on the sub-soil profile noticed and the proposed structures, shallow foundations can be considered at depths of 1.5m and 2.0m depth below EGL.

Calculations of Safe Bearing capacity for the foundations supported in soil layers are recommended based on following approach

- Shear Criteria recommended by IS: 6403
- Settlement Criteria by IS-8009 (Part I),

Consistent with standard Geotechnical Practices, the lower of values worked out from shear as well as settlement approach is recommended for design.

5.1.1 Net SBC Computations from Shear Criteria

The calculations are based on equation recommended by Code IS: 6403 which takes care of L/B ratio (shape), foundation depth etc., along with other parameters based on general shear failure. The equation used to calculate net ultimate bearing capacity (UBC) is as under.

$$\text{Net UBC} = c N_c S_c d_c i_c + \gamma D (N_q - 1) S_q d_q i_q + 0.5 \gamma B N_\gamma S_\gamma d_\gamma i_\gamma$$

Where,

c = Cohesion of founding strata in t/m^2

ϕ = Angle of internal friction of founding strata

S_c , S_q and S_γ = Shape factors referred from IS: 6403 for square foundation = 1.3, 1.2 and 0.8 respectively

N_c , N_q and N_γ = Bearing capacity factors referred from IS: 6403

d_c , d_q and d_γ = Depth factors referred from IS:6403

$\sqrt{N\phi} = \tan^2(45 + \phi/2)$

$d_c = 1 + 0.2(D/B) \sqrt{N\phi}$

d_q and $d_\gamma = 1 + 0.1(\Delta/B) \sqrt{N\phi}$

i_c , i_q and i_γ = Inclination factors, all three factors are equal to 1

D = Depth of foundation below existing ground level

B = Width of foundation

γ = Bulk unit weight of founding strata

5.1.2 Net Allowable Bearing Pressure Computations from Settlement Criteria

As per IS-8009 (Part I), considering sub-soil stratum encountered at the founding depth, settlements have been computed. Calculations are presented in **Annexure IV**.

The calculated allowable bearing pressure values are tabulated in **Table.5**.

Table 4: Shallow foundation: Isolated Footing

Sl. No	BH No.	Depth of Foundation	Size of footing (m)	Allowable Bearing pressure (t/m2)	Permissible Settlements (mm)
1	BH-1, 2, 3, 5, 6, 7, 8, 9, 14, 15, 21, 22, 23 & 24	1.5	2.0 x 2.0	35	<50
		2.0		40#	
		2.5		40#	
2		1.5	3.0 x 3.0	20	
		2.0		22	
		2.5		25	

Sl. No	BH No.	Depth of Foundation	Size of footing (m)	Allowable Bearing pressure (t/m2)	Permissible Settlements (mm)	
3	BH-10, 11 & 12	1.5	2.0 x 2.0	40		
		2.0		40#		
		2.5		40#		
4		1.5	3.0 x 3.0	25		
		2.0		28		
		2.5		30		
5	BH-4, 13, 16, 17, 18, 19 & 20	1.5	2.0 x 2.0	40#		<50
		2.0		40#		
		2.5		40#		
6		1.5	3.0 x 3.0	40		
		2.0		40#		
		2.5		40#		
7	BH-25	2.0	2.0 x 2.0	20		
		2.5		25		
8		2.0	3.0 x 3.0	17		
		2.5		20		

#- Limited value

The details of calculations are presented in the **Annexure IV**.

Note:

1. Once founding levels are reached, thorough inspection of the surface shall be done by the geotechnical engineer.
2. Wherever soil strata is loose/ soft and seepage water is encountered, provide minimum 230mm thick dry rubble (soling) packing for foundation with approved hard stone set in regular lines, hand packed, filling the interstices with small stone chips and sand,

ramming, watering and compacting. There after a levelling course of lean concrete should be laid and construction of foundation can be taken up subsequently.

3. Any localized soft soil, erratic soil-rock interfaces, outcrops, if found shall be removed and foundations shall be placed on level and uniform strata.
4. Over excavation and loosening in founding strata shall be avoided. Same, if done shall be refilled with lean concrete.
5. Foundations resting on sloping ground shall comply to IS: 1904/ IS 13063 regulations. When the ground surface slopes downward adjacent to a footing, the sloping surface shall not intersect the frustum of bearing material under the footing having sides which make an angle of 30° with the horizontal for soil and horizontal distance from the lower edge of the footing to the sloping surface shall be at least 60cm for rock and 90cm for soil.

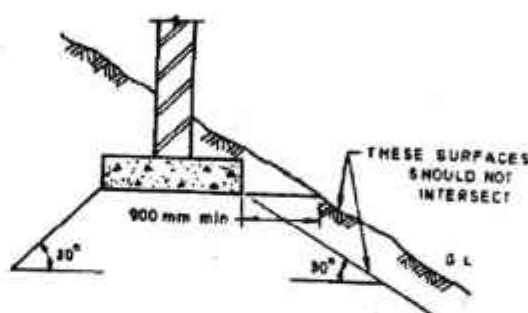


Fig.1 Footing in sloping ground

5.2. Retaining Wall

The proposed construction involving deep excavations and underground infrastructure has great influence on the adjacent existing structures. Stress release caused by these deep excavations may lead to excessive lateral ground movements. The interaction of these lateral ground movements with nearby existing foundations causes the distress in the sub soil beneath the foundation and they should be taken into account to ensure the integrity of the foundations as well as the structures supported by them.

The potential failure surface up on deep excavation due to the ground induced movements as shown in fig. below

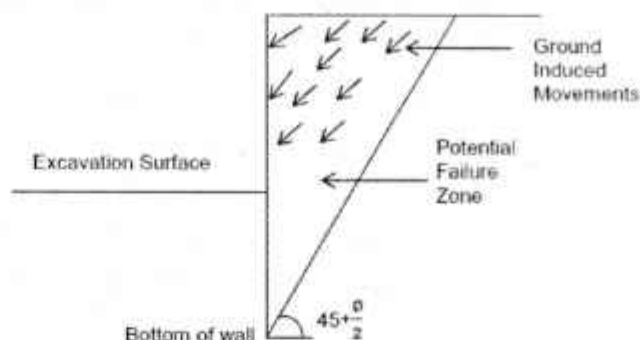


Fig.2 Potential failure surfaces in excavations

We evaluated values of K_a , K_p and K_o for various friction angles. The evaluated values are tabulated below:

Table.5- Lateral Earth Pressure Coefficients

Angle of Internal Friction	Active Earth Pressure Coefficient, K_a	Passive Earth Pressure Coefficient, K_p	At-Rest Earth Pressure Coefficient, K_o
29	0.35	2.88	0.52
30	0.33	3.00	0.50
31	0.32	3.12	0.49
32	0.31	3.25	0.47
33	0.30	3.39	0.46
34	0.28	3.53	0.44
35	0.27	3.69	0.43
36	0.26	3.85	0.41
37	0.25	4.02	0.40
38	0.24	4.20	0.38
39	0.23	4.39	0.37
40	0.23	4.60	0.36
41	0.21	4.81	0.34

The proper drainage system shall be designed along retaining wall such as weep holes in order to dissipate the development pore water pressure within the soil mass retained by the retaining wall.

5.2. Site preparation and Earthwork

We understand that cut and fill operations may be required at the site to achieve the desired grades for various construction activities related to the project. In general, fill placement and compaction should be in accordance with Project specifications.

Suitable approved sandy soil or silty/ clayey soil with liquid limit not exceeding 50%, plasticity index not exceeding 25% and differential free swell index less than 50% as per IS 1498 shall be used for backfill purposes in and around the site.

Based on laboratory test results of soil, available topsoil consists of clayey soil with liquid limit less than 50% and plasticity index less than 25%, hence these soil can be used as backfill material.

5.3. Site Preparation

The construction site must be suitably prepared. All undesirable materials such as roots, trash or other foreign materials shall be removed to about 250mm. And the foundation shall be prepared for its required depth. the exposed subgrade should be proof rolled and inspected to check for soft spots and loose zones. If any soft spots or loose zones are observed during proof rolling, they should be compacted in place or excavated till the firm soil/rock and replaced with structural fill material.

Surficial deleterious material including any loose soil pockets and vegetation should be removed from areas to receive fill. We suggest to removing any surficial loose soil pockets and then backfill with compacted fill material. Prior to fill placement the surficial soils should be scarified to a depth of at least 150 mm, moisture conditioned and then compacted to the required percentage compact. The backfilled soils should then be tested and prepared prior to fill placement to ensure that they meet the project specification requirements. Field density tests should be performed to evaluate the requirement for compaction of the surficial soils. For contract purposes, we recommend to consider grubbing at least 0.3-m thick top soil. However, the construction contractor should be responsible for grubbing of the top soil based on the results of field density test. If the field density test indicates loose soil condition, grubbing should be continued until medium to well compacted soils are encountered.

The excavated materials having clayey soil available shall be used as backfill material for building, site filling and pavement formation. However the above shall be cross checked by the client in accordance project specifications or IRC 78 back fill specifications.

5.4. Excavation

For purpose of excavations, in standard Indian Practice, there is no explicit definition such as Soft rock. Method to be adopted are based on degree of weathering as stated below

- Soil – Manual excavation or mechanical if found to be hard/dense
- Complete to Highly weathered rock – Mechanical excavation (Rock < Soil)
- Fractured /hard rock – Considering the presence of nearby structures, blasting is not recommended. Excavations may require adopting suitable alternate techniques approved in construction tender specifications

5.5. Safe Slope for excavations

Safe slope of excavations up to 10m is as under (Reference is IS:10386, Part 8)

Strata	Safe slope
Soil overburden and boulder strata	2H:1V to 1H:1V
Soft /weathered rock	0.5H:1V
Hard rock	0.25H:1V

5.6. Uplift

Deep seated Structures such as basements must be checked for uplift considering water table as per client /construction specifications. Uplift must be counteracted either by self-weight of structure (gravity) or by any other method such as piles/passive anchors. Decision on method to be adopted shall be based on techno-economic consideration and comply with construction tender specifications.

5.7. Foundation Protection Consideration

Chemical analysis on soil and water sample indicated that the site falls under Class I for Sulphates and chlorides (as per IS 456:2000). Hence, following precautions shall be taken to protect concrete and reinforcement in foundations (as per IS 456 Clauses 8.2.2.4 and 9.1.2).

- a) Type of cement OPC or PPC
- b) Minimum Cement Content 280kg/m³
- c) Maximum Water Cement Ratio 0.55

Results of the chemical tests on selected soil samples are presented on **Annexure III**.

6. CONCLUSIONS:

- Based on field investigation and laboratory test results the subsurface stratigraphy in general consists of Blackish Grayish Brownish Dense to Very Dense Silty SAND/ Clayey SAND followed by Whitish Brownish Blackish highly weathered rock with extremely close spaced fractures is observed up to the termination depth.
- Ground water was encountered in all the boreholes during the time of investigation.
- Care should be taken to ensure that the foundation soil is not disturbed during excavation. No loose portion may be left on the excavated floor at the founding depth. The excavated floor may not be left open to nature for long and it may be well compacted before the foundation concrete is laid.
- Good site drainage must be provided to reduce the risk of sub surface materials from becoming saturated, the risk of differential settlement and to prevent scouring and erosion of the surface material.
- Landscaping, if planned, should be at least 3.0m away from the structure perimeters. A 2.0m wide concrete or asphalt apron should be constructed adjacent to structures around the perimeters to protect the foundation soils from surface water. The apron should be sloped away from the structures to facilitate drainage. Water lines should, if possible, be kept away from the foundation.

- Suitable approved sandy soil or Silty/Clayey soil with liquid limit not exceeding 50%, plasticity index not exceeding 25% and differential free swell index less than 50% shall be used for backfilling purposes in and around the site.

Based on laboratory test results, the available top soil consist of clayey SAND with liquid limit less than 50% and plasticity index less than 25%. Hence these soil can be used as backfill material. In case of borrowed soil is used as the backfill material, the same has to be reconfirmed with laboratory test results and requirement as stated above before using it for backfilling purpose as per IS 1498.

DISCLAIMER:

The geotechnical investigation is based on data obtained from test location. If any stratification at this location which is, different from that met during soil investigation is encountered, the same shall be brought to the notice of the Consultants / Engineer-in-Charge for taking appropriate action, if necessary.

For: Bureau Veritas India Pvt. Ltd.



Ravi N,

Manager-GTD South, B & I Service line



Gurukumar V P,

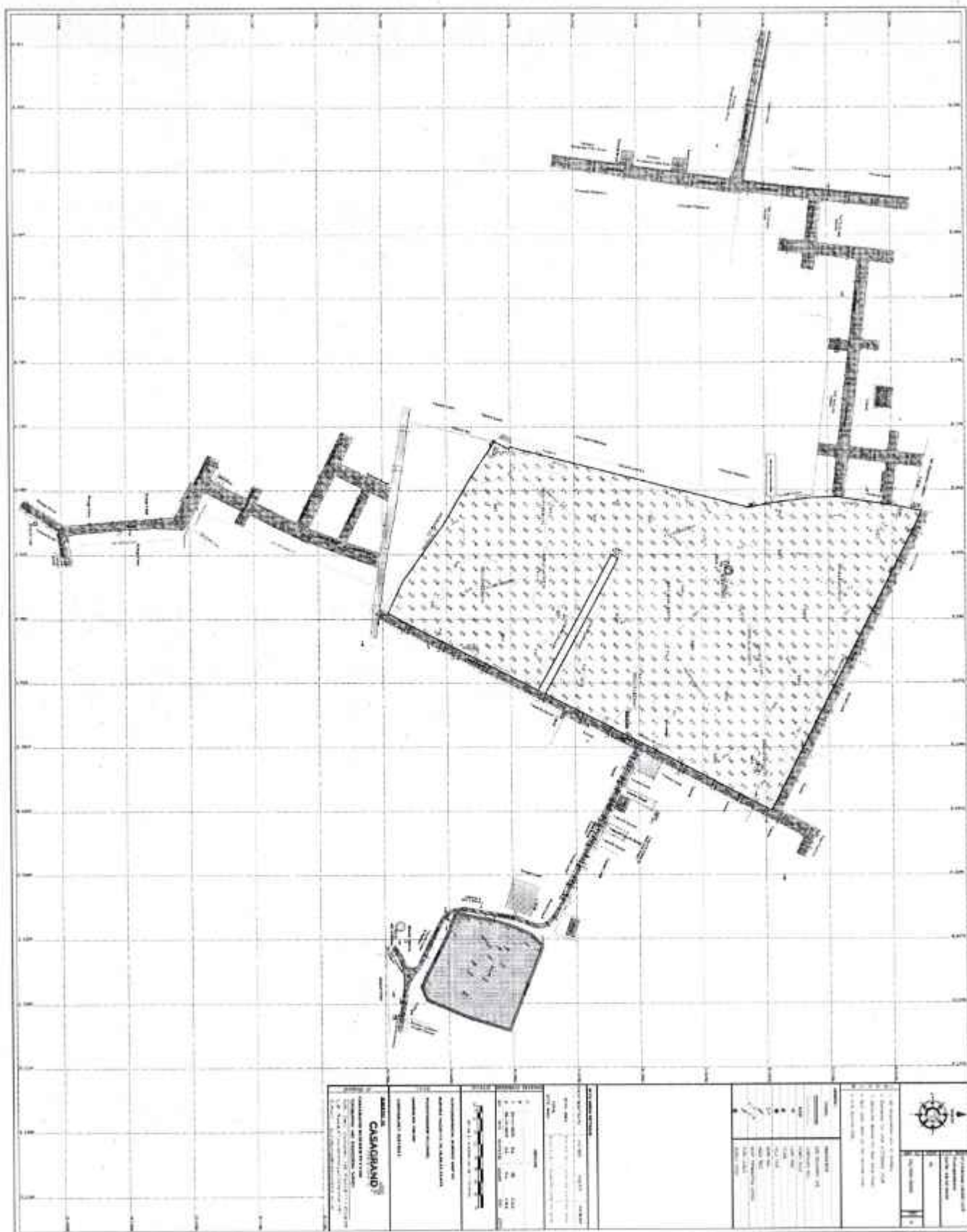
Manager –B & I Service line, Chennai





ANNEXURE I **PLAN OF BOREHOLE** **LOCATION**





Scale: 1:1000 North Arrow	Legend 1. Building 2. Road 3. Boundary 4. Plot No. 10 5. Plot No. 11 6. Plot No. 12	Area Plot No. 10: 1000 sq. m. Plot No. 11: 500 sq. m. Plot No. 12: 200 sq. m.	Volume Plot No. 10: 1000 cu. m. Plot No. 11: 500 cu. m. Plot No. 12: 200 cu. m.	Weight Plot No. 10: 1000 kg. Plot No. 11: 500 kg. Plot No. 12: 200 kg.	Remarks 1. Building 2. Road 3. Boundary 4. Plot No. 10 5. Plot No. 11 6. Plot No. 12
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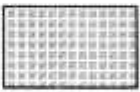




ANNEXURE II **BORELOGS**



LEGENDS

	Clayey SAND		Low compressible Sandy CLAY
	Silty Sand		Intermediate compressible Sandy CLAY
	Low Compressible Sandy SILT		High compressible Sandy CLAY
	Intermediate compressible Sandy SILT		Filled Up Soil
	High compressible Sandy SILT		Sand with less fines
	Weathered Rock / Boulder		Hard / Fresh Rock





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

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Date of commencement : 07.04.2023

Date of Completion : 07.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.4m

BH No : 1

Reduced level : 8.37

Location: Kelambakkam

X- coordinate: 2712.7721

Y-Coordinate: 466.8553

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	10/12/20 N=32				
2.0	Grayish Dense Clayey SAND	1.5								
3.0				SPT	3.0	15/20/32 N=52				
4.0	Grayish Very Dense Clayey SAND	1.0		SPT	4.0	50R For 12cm Penetration				
5.0	Brownish Grayish Very Dense Clayey SAND	1.0		SPT	5.0	100R For 4cm Penetration				
	Brownish Grayish Very Dense Silty SAND (Completely Weathered Rock)									Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





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Date of commencement : 12.04.2023

Date of Completion : 13.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.4m

BH No : 2

Reduced level : 8.43

Location: Kelambakkam

X- coordinate: 2739.335

Y-Coordinate: 506.1429

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	12/16/25 N=41				
2.0	Brownish Dense Clayey SAND	1.5				20/50R For 9cm Penetration				
3.0				SPT	3.0					
4.0	Grayish Very Dense Silty SAND	1.5				50R For 11cm Penetration				
5.0				SPT	4.5					
6.0	Brownish Very Dense Silty SAND (Completely Weathered Rock)	3.0				50R For 11cm Penetration				
7.0				SPT	6.0					
8.0	Blackish Brownish Completely Weathered Rock	2.5				100R For 3cm Penetration				
9.0				SPT	7.5					
10.0				C	9.0		Nil	Nil		
				C	10.0		2	Nil		

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





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Date of commencement : 06.04.2023

Date of Completion : 06.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.4m

BH No : 3

Reduced level : 8.57

Location: Kelambakkam

X- coordinate: 2788.387

Y-Coordinate: 516.3552

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	10/12/20 N=32				
2.0	Brownish Grayish Hard Intermediate Compressible Sandy CLAY	1.5				11/50R For 13cm Penetration				
3.0				SPT	3.0					
4.0	Greenish Grayish Very Dense Clayey SAND	1.0		SPT	4.0	50R For 10cm Penetration				
5.0	Brownish Very Dense Silty SAND	1.0		SPT	5.0	100R For 4cm Penetration				
	Brownish Very Dense Silty SAND (Completely Weathered Rock)									Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





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Date of commencement : 10.04.2023

Date of Completion : 10.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.4m

BH No : 4

Reduced level : 8.80

Location: Kelambakkam

X- coordinate: 2799.6632

Y-Coordinate: 553.8444

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Silty SAND	1.5		DS	0.5					
1.0				SPT	1.5	27/50R For 7cm Penetration				
2.0	Grayish Very Dense Clayey SAND	1.5				50R For 8cm Penetration				
3.0				SPT	3.0					
4.0	Yellowish Grayish Very Dense Clayey SAND	1.0		SPT	4.0	100R For 3cm Penetration				
5.0	Blackish Brownish Completely Weathered Rock	4.5								Wash Sample
6.0				C	5.5		Nil	Nil		
7.0				C	7.0		1	Nil		
8.0	Blackish Highly Weathered Rock	1.5		C	8.5		6	Nil		
9.0										
10.0				C	10.0		10	Nil		

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





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Date of commencement : 10.04.2023

Date of Completion : 12.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.2m

BH No : 5

Reduced level : 8.72

Location: Kelambakkam

X- coordinate: 2750.0076

Y-Coordinate: 554.1235

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Silty SAND	1.5		DS	0.5					
1.0				SPT	1.5	15/16/23 N=44				
2.0	Grayish Dense Clayey SAND	1.5				17/50R For 7cm Penetration				
3.0				SPT	3.0					
4.0	Grayish Very Dense Clayey SAND	1.5				50R For 3cm Penetration				
5.0				SPT	4.5					
	Grayish Very Dense Silty SAND (Completely Weathered Rock)	0.5		SPT	5.0	100R For 4cm Penetration				
6.0	Grayish Completely Weathered Rock									Wash Sample
7.0				C	6.5		Nil	Nil		
8.0				C	8.0		Nil	Nil		
9.0				C	9.0		Nil	Nil		
10.0				C	10.0		Nil	Nil		

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





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Date of commencement : 07.04.2023

Date of Completion : 07.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.7m

BH No : 6

Reduced level : 8.58

Location: Kelambakkam

X- coordinate: 2687.5304

Y-Coordinate: 521.8322

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Silty SAND	1.5		DS	0.5					
1.0				SPT	1.5	10/15/30 N=45				
2.0	Brownish Grayish Dense Silty SAND	1.5								
3.0				SPT	3.0	19/50R For 11cm Penetration				
4.0	Brownish Grayish Very Dense Silty SAND	1.0		SPT	4.0	50R For 10cm Penetration				
5.0	Brownish Grayish Very Dense Clayey SAND	1.0		SPT	5.0	100R For 3cm Penetration				
	Brownish Grayish Very Dense Silty SAND (Completely Weathered Rock)									Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

R - Rebound

C - Core

UDS - Undisturbed sample

* - Sample not retrieved

Site Engineer: Mr. Immanuel Jabasingh

CR - Core Recovery

RQD - Rock Quality Designation





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Date of commencement : 06.04.2023

Date of Completion : 06.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.2m

BH No : 7

Reduced level : 8.76

Location: Kelambakkam

X- coordinate: 2705.6694

Y-Coordinate: 564.7279

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Silty SAND	1.5		DS	0.5					
1.0				SPT	1.5	10/12/25 N=37				
2.0	Grayish Dense Clayey SAND	1.5				23/50R for 12cm Penetration				
3.0				SPT	3.0					
4.0	Greenish Grayish Very Dense Silty SAND	2.0		SPT	4.0	50R For 13cm Penetration				
5.0				SPT	5.0	100R For 3cm Penetration				
	Greenish Grayish Very Dense Silty SAND (Completely Weathered Rock)									Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





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Date of commencement : 08.04.2023

Date of Completion : 08.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.2m

BH No : 8

Reduced level : 8.85

Location: Kelambakkam

X- coordinate: 2780.2831

Y-Coordinate: 593.9799

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	9/11/19 N=30				
2.0	Grayish Dense Clayey SAND	1.5		SPT	3.0	13/50R For 12cm Penetration				
3.0				SPT	4.0	39/50R For 6cm Penetration				
4.0	Grayish Very Dense Clayey SAND	1.0		SPT	5.0	100R For 4cm Penetration				
5.0	Yellowish Grayish Very Dense Clayey SAND	1.0		SPT						
	Yellowish Grayish Very Dense Silty SAND (Completely Weathered Rock)									Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





BUREAU VERITAS (INDIA) PVT. LTD. **BORE LOG**

Project: Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 09.04.2023

Date of Completion : 09.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.3m

BH No : 9

Reduced level : 9.03

Location: Kelambakkam

X- coordinate: 2779.0593

Y-Coordinate: 637.2574

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	8/10/29 N=39				
2.0	Grayish Dense Clayey SAND	3.0		SPT	3.0	12/13/29 N=42				
3.0				SPT	4.5	50R For 12cm Penetration				
4.0	Grayish Very Dense Silty SAND	1.5		SPT	6.0	100R For 4cm Penetration				
5.0				SPT	6.0	100R For 4cm Penetration				
6.0	Brownish Whitish Completely Weathered Rock	4.0		C	7.5		Nil	Nil		Wash Sample
7.0				C	9.0		2	Nil		
8.0				C	10.0		Nil	Nil		Wash Sample
9.0				C	10.0		Nil	Nil		
10.0										

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





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BORE LOG

Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.no.s.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 04.04.2023

Date of Completion : 04.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.9m

BH No : 10

Reduced level : 8.74

Location: Kelambakkam

X- coordinate: 2703.7755

Y-Coordinate: 611.0151

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	12/23/36 N=59				
2.0	Grayish Very Dense Clayey SAND	1.5								
3.0				SPT	3.0	32/50R For 11cm Penetration				
4.0	Brownish Grayish Very Dense Clayey SAND	1.0		SPT	4.0	50R For 12cm Penetration				
5.0	Greenish Very Dense Silty SAND	1.0		SPT	5.0	100R For 3cm Penetration				
	Brownish Grayish Very Dense Silty SAND (Completely Weathered Rock)									Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh



**BUREAU VERITAS (INDIA) PVT. LTD.****BORE LOG**

Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, Project: totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Puthupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 05.04.2023

Date of Completion : 05.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.8m

BH No : 11

Reduced level : 8.49

Location: Kelambakkam

X- coordinate: 2652.9889

Y-Coordinate: 583.5081

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	12/22/36 N=58				
2.0	Blackish Dense Silty SAND	1.5				50R For 8cm Penetration				
3.0				SPT	3.0					
4.0	Blackish Very Dense Silty SAND	1.0		SPT	4.0	50R For 2cm Penetration				
5.0	Blackish Very Dense Silty SAND (Completely Weathered Rock)	2.0		SPT	5.0	100R For 3cm Penetration				Wash Sample
6.0				SPT	6.0	100R For 3cm Penetration				
7.0	Blackish Brownish Whitish Completely Weathered Rock	3.0		C	7.5		3	Nil		
8.0										
9.0	Blackish Highly Weathered Rock	1.0		C	9.0		8	Nil		
10.0				C	10.0		40	30		

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Project: Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 12.04.2023

Date of Completion : 13.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.9m

BH No : 12

Reduced level : 8.67

Location: Kelambakkam

X- coordinate: 2656.9659

Y-Coordinate: 624.7835

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Silty SAND	1.5		DS	0.5					
1.0				SPT	1.5	20/38/38 N=76				
2.0	Grayish Brownish Very Dense Clayey SAND	1.5				50R For 11cm Penetration				
3.0				SPT	3.0					
4.0	Brownish Very Dense Clayey SAND	1.5				50R For 3cm Penetration				
5.0				SPT	4.5					
5.0	Brownish Very Dense Silty SAND (Completely Weathered Rock)	0.5		SPT	5.0	100R For 3cm Penetration				
6.0	Brownish Completely Weathered Rock									Wash Sample
7.0				C	6.5		Nil	Nil		
8.0				C	8.0		Nil	Nil		
9.0				C	9.0		Nil	Nil		
10.0				C	10.0		Nil	Nil		

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh



**BUREAU VERITAS (INDIA) PVT. LTD.****BORE LOG**

Project:

Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 04.04.2023

Date of Completion : 04.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.0m

BH No : 13

Reduced level : 8.83

Location: Kelambakkam

X- coordinate: 2727.8954

Y-Coordinate: 651.8786

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	9/13/50R For 12cm Penetration				
2.0	Blackish Very Dense Clayey SAND	1.5				50R For 8cm Penetration				
3.0				SPT	3.0					
4.0	Blackish Very Dense Silty SAND	2.0		SPT	4.0	50R For 3cm Penetration				
5.0				SPT	5.0	100R For 4cm Penetration				
	Blackish Very Dense Silty SAND (Completely Weathered Rock)									Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Project: Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 08.04.2023

Date of Completion : 08.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 2.2m

BH No : 14

Reduced level : 8.75

Location: Kelambakkam

X- coordinate: 2744.1564

Y-Coordinate: 696.9080

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	8/12/20 N=32				
2.0	Grayish Greenish Dense Clayey SAND	1.5								
3.0				SPT	3.0	11/19/30 N=49				
4.0	Grayish Dense Clayey SAND	1.5								
5.0				SPT	4.5	50R For 10cm Penetration				
6.0	Brownish Very Dense Clayey SAND	1.5								
7.0				SPT	6.0	50R For 3cm Penetration				
8.0	Brownish Very Dense Silty SAND (Completely Weathered Rock)	1.0								
9.0				SPT	7.0	100R For 3cm Penetration				
10.0	Brownish Blackish Completely Weathered Rock	3.0								
				C*	8.5		Nil	Nil		
				C	10.0		8	Nil		

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

R - Rebound

C - Core

UDS - Undisturbed sample

* - Sample not retrieved

Site Engineer: Mr. Immanuel Jabasingh

CR - Core Recovery

RQD - Rock Quality Designation





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, Project: totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 07.04.2023

Date of Completion : 07.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.5m

BH No : 15

Reduced level : 8.71

Location: Kelambakkam

X- coordinate: 2691.4434

Y-Coordinate: 715.3818

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	8/12/20 N=32				
2.0	Grayish Dense Clayey SAND	1.5				21/50R For 12cm Penetration				
3.0				SPT	3.0					
4.0	Greenish Grayish Very Dense Clayey SAND	1.5				50R For 12cm Penetration				
5.0				SPT	4.5					
5.0	Greenish Grayish Very Dense Clayey SAND (Completely Weathered Rock)	0.5		SPT	5.0	100R For 3cm Penetration				
6.0	Brownish Blackish Completely Weathered Rock	1.5								Wash Sample
7.0				C*	6.5		Nil	Nil		
8.0	Brownish Blackish Highly Weathered Rock	1.5		C	8.0		3	Nil		
9.0				C	9.0		18	13		
10.0	Brownish Blackish Whitish Highly Weathered Rock	2.0		C	10.0		29	29		

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





BUREAU VERITAS (INDIA) PVT. LTD. **BORE LOG**

Project: Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 03.04.2023

Date of Completion : 03.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.6m

BH No : 16

Reduced level : 8.89

Location: Kelambakkam

X- coordinate: 2682.2262

Y-Coordinate: 678.4986

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	50R For 12cm Penetration				
2.0	Blackish Brownish Very Dense Silty SAND	1.5				50R For 3cm Penetration				
3.0				SPT	3.0					
4.0	Blackish Brownish Very Dense Silty SAND (Completely Weathered Rock)	1.5		SPT	4.5	100R For 3cm Penetration				Wash Sample
5.0	Blackish Brownish Completely Weathered Rock									
6.0		1.5		C*	6.0		Nil	Nil		

BH terminated at 6.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Project: Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 02.04.2023

Date of Completion : 03.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.6m

BH No : 17

Reduced level : 8.81

Location: Kelambakkam

X- coordinate: 2618.9452

Y-Coordinate: 649.9257

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	17/50R For 12cm Penetration				
2.0	Grayish Brownish Very Dense Clayey SAND	1.5								
3.0				SPT	3.0	50R For 10cm Penetration				
4.0	Brownish Very Dense Silty SAND	1.5								
5.0				SPT	4.5	50R For 3cm Penetration				
6.0	Brownish Very Dense Silty SAND (Completely Weathered Rock)	1.5								Wash Sample
7.0				SPT	6.0	100R For 4cm Penetration				
	Brownish Completely Weathered Rock	1.5		C	7.5		Nil	Nil		

BH terminated at 7.5 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, Project: totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Puthupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 02.04.2023

Date of Completion : 02.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.6m

BH No : 18

Reduced level : 8.81

Location: Kelambakkam

X- coordinate: 2642.2949

Y-Coordinate: 697.6681

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	7/16/50R For 12cm Penetration				
2.0	Brownish Grayish Very Dense Clayey SAND	3.0		SPT	3.0	13/32/50R For 9cm Penetration				
3.0				SPT	4.5	100R For 3cm Penetration				
4.0	Brownish Grayish Very Dense Silty SAND (Completely Weathered Rock)	0.5								
5.0										Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, Project: totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 03.04.2023

Date of Completion : 03.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.6m

BH No : 19

Reduced level : 8.84

Location: Kelambakkam

X- coordinate: 2593.7431

Y-Coordinate: 687.5334

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	22/50R For 2cm Penetration				
2.0	Grayish Brownish Very Dense Clayey SAND	1.5				50R For 3cm Penetration				
3.0				SPT*	3.0					
4.0	Grayish Brownish Very Dense Silty SAND (Completely Weathered Rock)	1.5				100R For 3cm Penetration				Wash Sample
5.0				SPT*	4.5					
6.0	Grayish Brownish Completely Weathered Rock	1.5		C*	6.0		Nil	Nil		

BH terminated at 6.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, Project: totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 05.04.2023

Date of Completion : 05.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.6m

BH No : 20

Reduced level : 8.97

Location: Kelambakkam

X- coordinate: 2604.6081

Y-Coordinate: 726.5551

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	22/50R For 12cm Penetration				
2.0	Grayish Brownish Very Dense Clayey SAND	4.5				39/50R For 11cm Penetration				
3.0				SPT	3.0					
4.0				SPT	4.5	50R For 10cm Penetration				
5.0	Grayish Brownish Very Dense Silty SAND (Completely Weathered Rock)	1.0				50R For 2cm Penetration				
6.0				SPT	6.0	100R For 2cm Penetration				Wash Sample
7.0	Blackish Brownish Whitish Highly Weathered Rock	3.0								
8.0				C	8.5		4	Nil		
9.0										
10.0				C	10.0		30	8		

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh



**BUREAU VERITAS (INDIA) PVT. LTD.****BORE LOG**

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Date of commencement : 06.04.2023

Date of Completion : 06.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.5m

BH No : 21

Reduced level : 9.0

Location: Kelambakkam

X- coordinate: 2654.1820

Y-Coordinate: 754.2151

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	11/17/26 N=43				
2.0	Grayish Dense Clayey SAND	1.5								
3.0				SPT	3.0	9/25/27 N=52				
4.0	Grayish Very Dense Clayey SAND	1.0		SPT	4.0	50R For 12cm Penetration				
5.0	Brownish Grayish Very Dense Clayey SAND	1.0		SPT	5.0	100R For 8cm Penetration				Wash Sample
	Brownish Grayish Very Dense Clayey SAND (Completely Weathered Rock)									

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

R - Rebound

C - Core

UDS - Undisturbed sample

* - Sample not retrieved

Site Engineer: Mr. Immanuel Jabasingh

CR - Core Recovery

RQD - Rock Quality Designation





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Project: Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 09.04.2023

Date of Completion : 09.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.5m

BH No : 22

Reduced level : 9.86

Location: Kelambakkam

X- coordinate: 2706.1155

Y-Coordinate: 758.5815

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	9/12/22 N=34				
2.0	Grayish Dense Clayey SAND	1.5								
3.0				SPT	3.0	11/14/28 N=42				
4.0	Grayish Dense Silty SAND	1.0		SPT	4.0	29/50R For 9cm Penetration				
5.0	Grayish Greenish Very Dense Silty SAND	1.0		SPT	5.0	100R For 8cm Penetration				
6.0	Greenish Very Dense Silty SAND (Completely Weathered Rock)	1.5		SPT	6.5	100R For 3cm Penetration				

BH terminated at 6.5 m depth from existing ground level

Note:

SPT - Standard penetration test

R - Rebound

C - Core

UDS - Undisturbed sample

* - Sample not retrieved

Site Engineer: Mr. Immanuel Jabasingh

CR - Core Recovery

RQD - Rock Quality Designation





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Geotechnical investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 du, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 10.04.2023

Date of Completion : 10.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.6m

BH No : 23

Reduced level : 9.12

Location: Kelambakkam

X- coordinate: 2752.382

Y-Coordinate: 739.4100

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	10/13/22 N=35				
2.0	Grayish Dense Clayey SAND	1.5								
3.0				SPT	3.0	19/50R For 8cm Penetration				
4.0	Grayish Blackish Very Dense Silty SAND	1.0		SPT	4.0	50R For 9cm Penetration				
5.0	Blackish Very Dense Silty SAND	1.0		SPT	5.0	100R For 3cm Penetration				
	Blackish Very Dense Silty SAND (Completely Weathered Rock)									Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





BUREAU VERITAS (INDIA) PVT. LTD. **BORE LOG**

Project: Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Puthupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 11.04.2023

Date of Completion : 12.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.7m

BH No : 24

Reduced level : 9.34

Location: Kelambakkam

X- coordinate: 2741.1387

Y-Coordinate: 786.7397

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	15/16/18 N=34				
2.0	Brownish Grayish Dense Clayey SAND	1.0		UDS	2.5					
3.0	Brownish Grayish Silty SAND	0.5		SPT	3.0	30/30/33 N=63				
4.0	Grayish Very Dense Clayey SAND	1.5		SPT	4.5	50R For 13cm Penetration				
5.0	Brownish Very Dense Silty SAND (Completely Weathered Rock)	2.0		SPT	6.0	50R For 3cm Penetration				
6.0				SPT	6.5	100R For 4cm Penetration				
7.0	Brownish Completely Weathered Rock	3.5		C	7.5		Nil	Nil		Wash Sample
8.0										
9.0				C	9.0		Nil	Nil		
10.0				C	10.0		Nil	Nil		

BH terminated at 10.0 m depth from existing ground level

Note:

SPT - Standard penetration test

R - Rebound

C - Core

UDS - Undisturbed sample

* - Sample not retrieved

Site Engineer: Mr. Immanuel Jabasingh

CR - Core Recovery

RQD - Rock Quality Designation





BUREAU VERITAS (INDIA) PVT. LTD.
BORE LOG

Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Date of commencement : 10.04.2023

Date of Completion : 10.04.2023

Client : M/s. Casagrand builders Pvt Ltd.

Ground water level: 1.6m

BH No : 25

Reduced level : 9.41

Location: Kelambakkam

X- coordinate: 2768.0724

Y-Coordinate: 816.9866

Method: Rotary Drilling

Depth	Description of Strata	Thickness of Strata (m)	Legend	Details of sampling		SPT N Value	CR (%)	RQD (%)	Running Time (min)	Remarks
				Type	Depth (m)					
0.0	Brownish Clayey SAND	1.5		DS	0.5					
1.0				SPT	1.5	4/5/5 N=10				
2.0	Grayish Yellowish Medium Dense Clayey SAND	1.5		UDS	2.5					
3.0				SPT	3.0	32/50R For 13cm Penetration				
4.0	Brownish Very Dense Silty SAND	2.0		SPT	4.0	50R For 12cm Penetration				
5.0				SPT	5.0	100R For 4cm Penetration				
	Brownish Very Dense Silty SAND (Completely Weathered Rock)									Wash Sample

BH terminated at 5.0 m depth from existing ground level

Note:

SPT - Standard penetration test

UDS - Undisturbed sample

CR - Core Recovery

R - Rebound

* - Sample not retrieved

RQD - Rock Quality Designation

C - Core

Site Engineer: Mr. Immanuel Jabasingh





ANNEXURE III **LABORATORY** **RESULTS**





**BUREAU
VERITAS**

Project: Geotechnical Investigation for the plan showing the proposed construction of non-high rise group development consists of 28 blocks, block 1 to 27 : ground floor + first floor, totally 221 d/u, clubhouse block-28 : ground floor + first floor + second floor with swimming pool, comprised in s.nos.267/17, 267/18, 267/19, 267/20, 267/21, & 267/22 of Sathankuppam village (hamlet of Pudhupakkam), Vandalur taluk, Chengalpattu district.

Client: M/s. Casagrand Builder Private Limited

Location: Kelambakkam

TABLE - 1
Laboratory Test Results on Soil Samples

BH No.	Sample type	Depth (m)	Grain Size Distribution (%)					Atterberg Limits (%)			Bulk Density (g/cc)	Direct Shear Test		Moisture content (%)	IS Classification
			Gravel	Sand Coarse	Sand Med	Sand Fine	Silt & Clay	Liquid Limit	Plastic Limit	Plasticity Index		C (kg/cm ²)	Ø (deg)		
BH-1	DS	0.5	4	3	32	30	31	28	15	14	-	-	-	21.3	SC
	SPT	1.5	3	3	23	21	50	37	18	19	-	-	-	-	SC
	SPT	3.0	1	3	25	29	51	39	18	21	-	-	-	-	SC
	SPT	4.0	1	4	34	19	42	33	16	17	-	-	-	-	SC
	SPT	5.0	1	32	58	6	3	Non-Plastic			-	-	-	-	SP
BH-2	DS	0.5	3	3	30	25	39	34	15	19	-	-	-	-	SC
	SPT	3.0	12	15	41	20	12	Non-Plastic			-	-	-	-	SM
	SPT	6.0	33	6	18	17	26				-	-	-	-	SM
BH-3	DS	0.5	0	2	42	29	27	29	13	16	-	-	-	-	SC
	SPT	1.5	3	3	11	9	74	49	23	26	-	-	-	-	CI
	SPT	3.0	3	6	27	24	40	37	16	21	-	-	-	-	SC
	SPT	4.0	10	24	37	17	12	Non-Plastic			-	-	-	-	SP-SM
BH-4	DS	0.5	9	6	47	25	13	Non-Plastic			-	-	-	-	SM





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BH No.	Sample type	Depth (m)	Grain Size Distribution (%)					Atterberg Limits (%)			Bulk Density (g/cc)	Direct Shear Test		Moisture content (%)	IS Classification
			Gravel	Sand			Silt & Clay	Liquid Limit	Plastic Limit	Plasticity Index		C (kg/cm ²)	Ø (deg)		
BH-4	SPT	1.5	9	5	25	24	37	34	16	18	-	-	-	-	SC
	SPT	3.0	1	6	30	25	38	35	16	19	-	-	-	-	SC
	SPT	4.0	32	55	7	0	6	Non-Plastic			-	-	-	-	SP-SM
BH-5	DS	0.5	3	4	36	30	27	Non-Plastic			-	-	-	-	SM
	SPT	1.5	5	4	24	24	43	42	24	18	-	-	-	-	SC
	SPT	3.0	2	5	21	29	43	44	24	20	-	-	-	-	SC
	SPT	4.5	18	31	42	1	8	Non-Plastic			-	-	-	-	SP-SM
BH-6	DS	0.5	0	3	45	35	17	Non-Plastic			-	-	-	14.6	SM
	SPT	1.5	20	18	34	13	15				-	-	-	-	SM
	SPT	3.0	8	7	42	28	15				-	-	-	-	SM
	SPT	4.0	0	8	43	21	28	23	12	11	-	-	-	-	SC
	SPT	5.0	31	46	21	1	1	Non-Plastic			-	-	-	-	SP
BH-7	DS	0.5	3	4	40	37	16	Non-Plastic			-	-	-	13.0	SM
	SPT	1.5	12	11	23	18	36	27	12	15	-	-	-	-	SC
	SPT	3.0	16	16	44	12	12	Non-Plastic			-	-	-	-	SP-SM
	SPT	5.0	43	29	26	1	1				-	-	-	-	SW
BH-8	DS	0.5	0	2	32	42	24	28	13	15	-	-	-	-	SC
	SPT	1.5	11	8	19	19	43	39	19	17	-	-	-	-	SC





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BH No.	Sample type	Depth (m)	Grain Size Distribution (%)					Atterberg Limits (%)			Bulk Density (g/cc)	Direct Shear Test		Moisture content (%)	IS Classification
			Gravel	Coarse Sand	Med Sand	Fine Sand	Silt & Clay	Liquid Limit	Plastic Limit	Plasticity Index		C (kg/cm ²)	Ø (deg)		
BH-8	SPT	3.0	4	7	18	22	49	41	20	21	-	-	-	-	SC
BH-9	DS	0.5	1	4	26	38	31	30	17	13	-	-	-	18.5	SC
	SPT	1.5	17	4	22	23	34	33	18	15	-	-	-	-	SC
	SPT	3.0	1	3	30	24	42	39	20	19	-	-	-	-	SC
	SPT	6.0	21	31	35	3	9	Non-Plastic			-	-	-	-	SP-SM
	SPT	6.0	21	31	35	3	9	Non-Plastic			-	-	-	-	SP-SM
BH-10	DS	0.5	5	6	23	20	46	38	20	19	-	-	-	21.0	SC
	SPT	1.5	0	2	37	32	29	25	12	13	-	-	-	-	SC
	SPT	3.0	2	5	30	23	40	32	16	16	-	-	-	-	SC
	SPT	4.0	10	14	38	18	20	Non-Plastic			-	-	-	-	SM
	SPT	5.0	51	31	9	1	8				-	-	-	-	SW-SM
BH-11	DS	0.5	0	2	24	39	35	30	16	14	-	-	-	16.5	SC
	SPT	1.5	0	39	44	14	3	Non-Plastic			-	-	-	-	SW
	SPT	3.0	1	5	57	20	17				-	-	-	-	SM
	SPT	4.0	0	6	79	11	4				-	-	-	-	SP
	SPT	5.0	0	7	83	7	3				-	-	-	-	SP
	SPT	6.0	3	31	55	5	6				-	-	-	-	SW-SM
BH-12	DS	0.5	1	3	35	36	25	Non-Plastic			-	-	-	-	SM
	SPT	1.5	9	5	26	23	37	33	16	17	-	-	-	-	SC
	SPT	3.0	1	4	28	26	41	39	18	18	-	-	-	-	SC





BUREAU
VERITAS

BH No.	Sample type	Depth (m)	Grain Size Distribution (%)					Atterberg Limits (%)			Bulk Density (g/cc)	Direct Shear Test		Moisture content (%)	IS Classification
			Gravel	Sand			Silt & Clay	Liquid Limit	Plastic Limit	Plasticity Index		C (kg/cm ²)	Ø (deg)		
BH-12	SPT	5.0	6	39	50	3	2	Non-Plastic			-	-	-	-	SP
BH-13	DS	0.5	0	2	35	32	31	28	15	13	-	-	-	16.8	SC
	SPT	1.5	3	2	23	23	49	39	17	22	-	-	-	-	SC
	SPT	3.0	0	13	51	17	19	Non-Plastic			-	-	-	-	SM
	SPT	4.0	0	8	80	7	5				-	-	-	-	SP-SM
	SPT	5.0	0	10	65	13	12				-	-	-	-	SP-SM
BH-14	DS	0.5	2	2	35	33	28	29	13	16	-	-	-	-	SC
	SPT	1.5	11	2	26	25	36	34	18	16	-	-	-	-	SC
	SPT	3.0	12	10	22	27	29	31	16	15	-	-	-	-	SC
	SPT	4.5	13	7	18	19	43	42	22	20	-	-	-	-	SC
BH-15	DS	0.5	2	2	34	36	26	24	13	11	-	-	-	-	SC
	SPT	1.5	14	5	24	18	39	34	16	18	-	-	-	-	SC
	SPT	3.0	14	6	31	21	28	25	13	12	-	-	-	-	SC
	SPT	4.5	15	8	20	16	41	38	19	19	-	-	-	-	SC
BH-15	SPT	6.0	67	20	11	1	1	Non-Plastic			-	-	-	-	SW
	SPT	7.5	60	16	17	4	3				-	-	-	-	SW
BH-16	DS	0.5	0	0	26	32	42	38	18	20	-	-	-	-	SC
	SPT	1.5	2	6	51	22	19	Non-Plastic			-	-	-	-	SM
	SPT	3.0	0	5	84	8	3				-	-	-	-	SP





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VERITAS

BH No.	Sample type	Depth (m)	Grain Size Distribution (%)					Atterberg Limits (%)			Bulk Density (g/cc)	Direct Shear Test		Moisture content (%)	IS Classification
			Gravel	Coarse	Med	Fine	Silt & Clay	Liquid Limit	Plastic Limit	Plasticity Index		C (kg/cm ²)	Ø (deg)		
BH-16	SPT	4.5	0	23	59	9	9	Non-Plastic			-	-	-	-	SP-SM
	SPT	6.0	0	20	53	9	18				-	-	-	-	SM
BH-17	DS	0.5	5	7	29	31	28	25	14	11	-	-	-	18.4	SC
	SPT	1.5	21	10	23	18	28	25	13	12	-	-	-	-	SC
	SPT	3.0	5	16	42	21	16	Non-Plastic			-	-	-	-	SM
	SPT	4.5	0	26	57	3	14				-	-	-	-	SM
	SPT	6.0	5	30	61	2	2				-	-	-	-	SP
	SPT	7.5	2	39	32	2	25				-	-	-	-	SM
BH-18	DS	0.5	1	2	34	33	30	20	7	13	-	-	-	-	SC
	SPT	1.5	9	6	24	25	36	31	16	15	-	-	-	-	SC
	SPT	3.0	5	10	39	21	25	22	12	10	-	-	-	-	SC
	SPT	4.5	18	39	39	3	1	Non-Plastic			-	-	-	-	SP
	SPT	5.0	8	36	48	2	6				-	-	-	-	SP-SM
BH-19	DS	0.5	18	6	30	21	25	22	12	10	-	-	-	-	SC
	SPT	1.5	1	12	33	26	27	25	13	12	-	-	-	-	SC
	SPT	3.0	12	53	32	1	2	Non-Plastic			-	-	-	-	SP
	SPT	4.5	35	32	29	3	1				-	-	-	-	SW
	SPT	6.0	57	20	11	1	11				-	-	-	-	SP-SW
BH-20	DS	0.5	0	3	40	31	26	20	11	9	-	-	-	-	SC





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BH No.	Sample type	Depth (m)	Grain Size Distribution (%)					Atterberg Limits (%)			Bulk Density (g/cc)	Direct Shear Test		Moisture content (%)	IS Classification
			Gravel	Sand			Silt & Clay	Liquid Limit	Plastic Limit	Plasticity Index		C (kg/cm ²)	Ø (deg)		
BH-20	SPT	1.5	2	1	26	32	39	30	14	16	-	-	-	-	SC
	SPT	3.0	2	4	36	24	34	28	12	15	-	-	-	-	SC
	SPT	4.5	3	3	28	34	32	28	11	17	-	-	-	-	SC
	SPT	6.0	31	48	19	1	1	Non-Plastic			-	-	-	-	SP
	SPT	7.0	53	35	10	1	1				-	-	-	-	SW
BH-21	DS	0.5	5	9	35	28	23	22	11	11	-	-	-	-	SC
	SPT	1.5	9	9	30	19	33	34	15	19	-	-	-	-	SC
	SPT	3.0	15	4	23	21	37	33	14	19	-	-	-	-	SC
	SPT	4.0	25	5	21	29	20	18	10	8	-	-	-	-	SC
	SPT	5.0	37	8	9	12	34	29	14	15	-	-	-	-	SC
BH-22	DS	0.5	1	1	31	33	34	31	16	15	-	-	-	-	SC
	SPT	1.5	6	11	35	18	30	29	13	16	-	-	-	-	SC
	SPT	3.0	20	11	29	16	24	Non-Plastic			-	-	-	-	SM
	SPT	4.0	7	15	42	19	17				-	-	-	-	SM
BH-23	DS	0.5	0	0	22	29	49	39	16	23	-	-	-	-	SC
	SPT	1.5	0	4	29	24	43	41	22	19	-	-	-	-	SC
	SPT	3.0	3	5	52	20	20	Non-Plastic			-	-	-	-	SM
	SPT	5.0	0	12	74	3	11				-	-	-	-	SP-SM
BH-24	DS	0.5	3	3	43	25	26	27	12	15	-	-	-	15.6	SC





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BH No.	Sample type	Depth (m)	Grain Size Distribution (%)					Atterberg Limits (%)			Bulk Density (g/cc)	Direct Shear Test		Moisture content (%)	IS Classification
			Gravel	Sand			Silt & Clay	Liquid Limit	Plastic Limit	Plasticity Index		C (kg/cm2)	Ø (deg)		
				Coarse	Med	Fine									
BH-24	SPT	1.5	2	2	23	24	49	42	22	20	-	-	-	-	SC
	SPT	2.5	14	10	34	26	16	Non-Plastic			1.90	0.07	28	10.9	SM
	SPT	3.0	9	6	22	28	35	34	18	16	-	-	-	-	SC
	SPT	4.5	11	23	46	11	9	Non-Plastic			-	-	-	-	SP-SM
BH-25	DS	0.5	0	1	23	43	33	31	14	17	-	-	-	-	SC
	SPT	1.5	3	11	34	21	31	29	15	14	-	-	-	-	SC
	SPT	2.5	5	4	25	27	39	35	21	14	1.97	0.15	26	-	SC
	SPT	3.0	19	17	30	15	19	Non-Plastic			-	-	-	-	SM

*SM- Silty SAND; SC- Clayey SAND; SW- Well Graded SAND; SP- Poorly Graded SAND

TABLE - 2
Laboratory Test Results on Rock Samples

BH No.	Depth (m)	Specific gravity (G)	Water Absorption (%)	Density (g/cc)
BH-11	9.0-10.0	2.71	0.93	2.80
BH-15	9.0-10.0	2.74	0.80	2.70
BH-20	9.0-10.0	2.80	0.57	-



BH No.	Depth (m)	Specific gravity (G)	Water Absorption (%)	Density (g/cc)
BH-25	9.0-10.0	2.78	0.59	-

TABLE – 3
Chemical Test Results on Soil Sample

BH No.	Depth (m)	pH	Sulphate as SO ₄ (% by mass)	Organic Matter (% by Mass)
BH-1	1.5	8.5	0.033	0.21
BH-3	1.5	7.66	0.026	0.18
BH-10	1.5	6.49	0.031	0.67
BH-21	1.5	8.56	0.030	0.11
BH-22	1.5	8.66	0.033	0.14
BH-25	3.0	7.88	0.033	0.18

Chemical analysis on soil sample indicated that the site falls under Class I for Sulphates and chlorides (as per IS 456:2000).

TABLE – 4
Chemical Test Results on Water Samples

BH No	Chloride as Cl (mg/l)	Sulphate as SO ₄ (mg/l)	pH
BH-1	252.96	172.97	7.89
BH-3	229.97	173.49	7.80
BH-20	177.28	153.75	7.91
BH-25	219.97	159.41	7.99
Well Water	34.00	14.93	8.15
Stipulations of IS 456:2000	500 mg/l max. for RCC 2000 mg/l max. for PCC	400 mg/l max.	Shall not be less than 6



ANNEXURE IV **SAMPLE CALCULATIONS**



ANNEXURE-IV

Sample Calculations:

Shallow foundation: Isolated Footing on soil

For BH-18

Shear Criteria: (as per IS: 6403)

B= 2m; L=2m; Df=1.5m; Density of Soil= 1.8g/cc; C=0.00kg/cm²; Ø=35 (Based on SPT N Value as per IS 6403); water table Correction Wg=0.5

Bearing factors: Nc=46.03; Nq=33.21; Ng=47.88

Shape factors: Sc=1.3; Sq=1.2; Sg=0.8 (Square)

Depth factors: Dc=1.28; Dq=Dg=1.14(Ø>10)

Inclination factors: Ic=Iq=Ig=1

Qu= C Nc Sc Dc Ic +q (Nq-1) Sq Dq iq + 0.5 g B Ng DgSg Ig Wg

FOS=3.0

Shear criteria SBC **Qa = 67.26t/m² corrected to 60t/m²**

Settlement Criteria:

From 1.5 to 4.5m

N values – 100

$$S_e = \Delta\sigma(\alpha B') \frac{1 - \mu_s^2}{E_s} I_s I_f$$

Breadth of footing – 2.0m Length of footing= 2.0m

Df= Depth of foundation= 1.5m

H= thickness of layer = 3.0m

B' = B/2= centre of foundation -1.0m

μ =Poisons ratio of soil – 0.3

Es= Modulus of elasticity of the soil under the foundation = 300 (N+ 6)/100 = 318kg/cm²

Is= Shape factor- 0.391

δσ= foundation pressure= 4kg/cm²

m'= L/B=1

n'= H/(B/2)=3



α = factor that depends on the location of the foundation where settlement is being calculated = 4

If- depth factor = 0.7

Total Immediate settlement in soil $S_i = 12.516\text{mm} < 25\text{mm}$

Therefore, Safe allowable bearing pressure is considered as 40t/m², and the settlement found to be within permissible limit of 25mm.





ANNEXURE V **PHOTOGRAPHS**



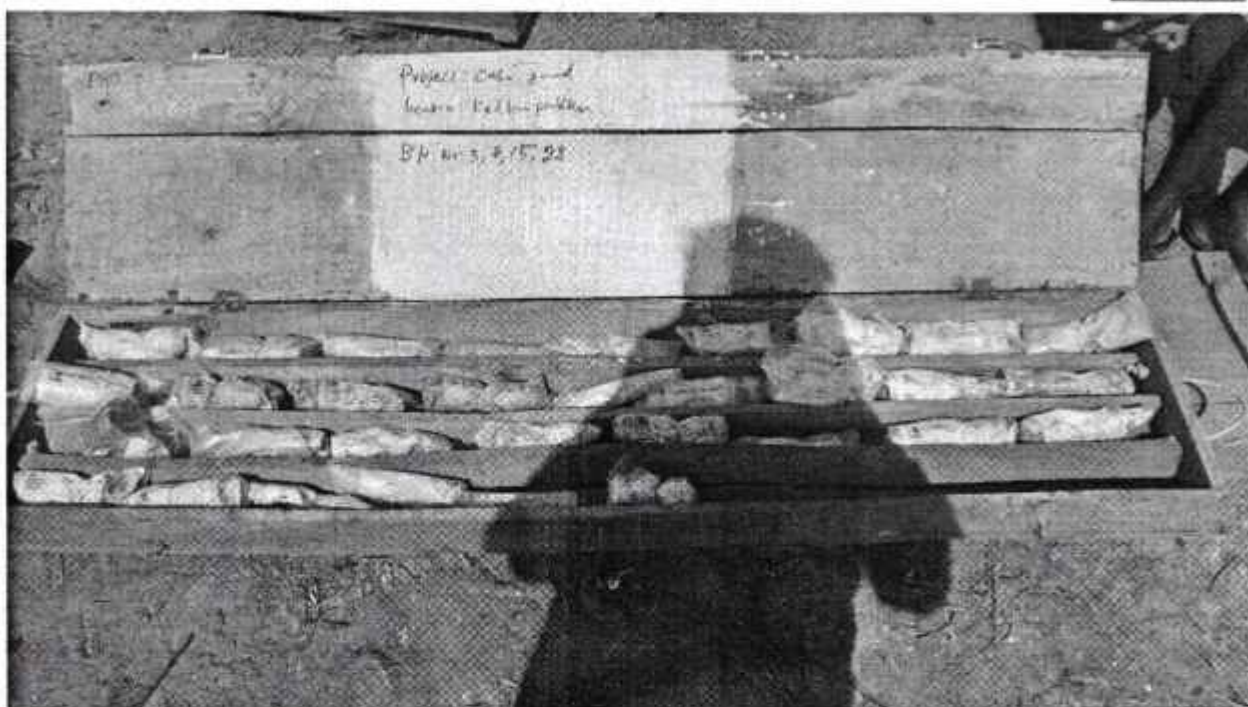
ANNEXURE V

CORE BOX PHOTOS OF COLLECTED SAMPLES





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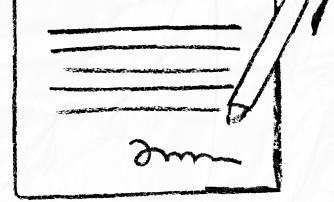
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ANNEXURE I **PLAN OF BOREHOLE** **LOCATION**





our services doesn't just end there



Buying & Selling Services

Property Buying Assistance, Property Selling Support, Market Price Analysis, Owner Outreach and Negotiation.



Legal & Documentation Services

Certified EC, Patta, legal opinions, property verification, due diligence, litigation solutions, and legal heir certificates.



Property Development & Approvals

Building plan approvals, construction, layout and sub-division approvals, zone conversion, and occupancy certification.



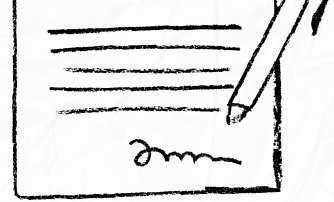
NRI & Investment Services

Escrow Services, Rentals, Litigation Solutions, Property Valuation and Property Management



Compliance & Special Services

Demolition, Vaasthu checks, regularization of unauthorized buildings, and office space solutions.



 **empowering your real estate decisions
with smart tools**



Property Valuation & Cost Estimation

Guideline Value, Apartment Composite Value, Stamp Duty & Registration Fees Calculator, Building Value Calculator, Capital Gains Calculator, Area Unit Converter, Length Unit Converter



Ownership, Compliance & Legal Verification

Encumbrance Certificate (EC) Search, Find Your SRO, Temple Property Check, WAQF Property Check, View Patta/Chitta, View FMB, Patta Analyzer, EC Analyzer



Zoning & Land Use Analysis

Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator



Property Documentation & Workflow Tools

Forms & Templates, Document Generator, Document Translation, Dictionary



Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management



We're honored to be part of your
real estate journey

3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai, India

hello@verified.realestate
[+91 9996 12 9996](tel:+919996129996)
www.verified.realestate