

परियोजना का नाम:-

जनपद देहरादून के अपर गढ़वाली कालोनी पेयजल योजना का सुदृढीकरण कार्य हेतु वन विभाग मसूरी रेंज से 0.075 हैक्टियर वन भूमि का उत्तराखण्ड जल संस्थान रायपुर को हस्तान्तरण।

भू-वैज्ञानिक की आख्या

संलग्न है।



(अधिशाली अभियन्ता
उत्तराखण्ड जल संस्थान
रायपुर, देहरादून
अधिशाली अभियन्ता
उत्तराखण्ड जल संस्थान
रायपुर, देहरादून)

REPORT

ON

SOIL INVESTIGATIONS

FOR

1000 KL CAPACITY O. H. WATER TANK OVER 22.0m STAGING

IN

GARHWALI COLONY, AYUDH VIHAR

UNDER

E.E., UTTARAKHAND JAL SANSTHAN, RAIPUR

IN

Distt .: DEHEADUN (Uttarakhand)

Submitted to :

M/s Himayati Associates,,
24/3, Nehru Colony,,
DEHRADUN (U.K.)

SOILEX – CONSULTANT Pvt. Ltd.,,

(Consulting Engineers & Contractors)

146, Solanipuram, (First Floor),

ROORKEE – 247667.

Phone(s): 01332-273168, 9412071203, 9927990060 - 61

**REPORT
ON
SOIL INVESTIGATIONS
FOR
1000 KL CAPACITY O. H. WATER TANK OVER 22.0m STAGING
IN
GARHWALI COLONY, AYUDH VIHAR
UNDER
E.E., UTTARAKHAND JAL SANSTHAN, RAIPUR
IN
Distt .: DEHEADUN (Uttarakhand)**

Submitted to :

M/s Himayati Associates,,
24/3, Nehru Colony,,
DEHRADUN (U.K.)

**SOILEX – CONSULTANT Pvt. Ltd.,,
(Consulting Engineers & Contractors)
146, Solanipuram, (First Floor),
ROORKEE – 247667.
Phone(s): 01332-273168, 9412071203, 9927990060 - 61**

ACKNOWLEDGEMENT

We are thankful to Shri Gauri Ramola, of M/s Himayati Associates, 24/3, Nehru Colony, DEHRADUN (U.K.) for providing us with this opportunity to carry out these investigations, and also to the concerned J.E. and A.E. of Uttarakhand Jal Sansthan, Dehradun and field staff working at site, for their kind cooperation and facilities provided to us during field work.



for SOILEX-CONSULTANT Pvt. Ltd.,,

A handwritten signature in black ink, appearing to read "N. P. Sankar", written over a horizontal line.

(Director)

I N D E X

S. No.	PARTICULARS	PAGE
1.	INTRODUCTION.	1
2.	FIELD WORK	2
3.	LABORATORY WORK	2
4.	DISCUSSION OF TEST RESULTS	3
5.	COMPUTATION OF SAFE BEARING CAPACITY OF SOIL	3 - 4
6.	RECOMMENDATIONS	4
7.	FIGURES	5 - 9

1.0 INTRODUCTION :

- 1.01 This report presents the results of the Soil Investigations carried out by M/S Soilex Consultant Pvt. Ltd., 146, Solanipuram, Roorkee for Shri Gauri Ramola, of M/s Himayati Associates, 24/3, Nehru Colony, DEHRADUN (U.K.)
- 1.02 The aim of these investigations is to find Safe Bearing Capacity of soil and other parameters to enable to designer to design suitable economical foundation for structures of the proposed 1000 KL CAPACITY O. H. WATER TANK OVER 22.0m STAGING IN GARHWALI COLONY, AYUDH VIHAR, UNDER E.E., UTTARAKHAND JAL SANSTHAN, RAIPUR IN Distt .: DEHEADUN (Uttarakhand)
- 1.03 The instructions to carry out these investigations were given by Shri Gauri Ramola, of M/s Himayati Associates, 24/3, Nehru Colony, DEHRADUN (U.K.) Dehradun on 10.07..2019. The site was shown to the site supervisor of M/S Soilex Consultant Pvt. Ltd., Shri. Ramola, and the locations for different tests were marked by him in consultation with expert of M/S Soilex Consultant Pvt. Ltd., and the field work was done. in the presence of concerned persons on 19th July 2019...

1.04 The scope of the work proposed was:

The scope of the work proposed was:

- (i) Making bore-hole using 300 mm dia spiral earth auger; up to 10.0m depth from G.L., and in this bore-hole, carrying out Standard Penetration Tests at every 1.5m interval (if fine grained soils are met), or carrying out open excavation up to 3.0m depth, if gravel or boulder mixed strata is met. (or up to refusal strata which so ever is met earlier), Disturbed and undisturbed soil samples were to be picked up at 1.5 m interval and also at depth where strata changed, at 1 locations.
- (ii) Carrying out Dynamic Cone Penetration Tests, up to 10.0m depth or refusal strata, which so ever is met earlier, using 65mm dia. cone and without using bentonite slurry at 2 locations.
- (iii) Carrying out Plate Load Test at the proposed depth of foundation using 30cm X 30cm plate up to loading intensity of 60 t/sqm or ultimate failure of soil which so ever is reached earlier at 1 location.
- (iv) Carrying out necessary tests in lab. and submit report based on above tests giving recommendation about type of suitable foundations, Safe Bearing Capacity of Soil and other necessary parameters required for design of such foundations, in 3 copies.

2.0 FIELD WORK :

- 2.01 Two Dynamic Cone Penetration Tests were carried out as per B.I.S. 4968-Part II, using 65 mm base dia. cone, without using bentonite slurry, at locations DCP-1 and DCP-2. The data was recorded and the Dynamic Cone Penetration Resistance Curves have been drawn as Fig. 1 and Fig.2 for locations DCP-1 and DCP-2 respectively.
- 2.02 As soil strata consisted of sand mixed with small gravels was met with from 1.0m depth, bore hole could not be carried out. JCB was used to excavate the strata up to a possible 3.0m depth from N.G.L. at location B.H.-1. Representative disturbed samples of soil were taken at every metre. The data was recorded and soil samples were sealed numbered and sent to our laboratory at Roorkee for analysis.
- 2.03 Plate Load Test was conducted at location PLT-1, 2.0m depth from N.G.L. at site. The test was conducted as per standard practice, using 25.0 capacity Hydraulic Jack with a least count of 0.20 tonnes, and the settlement was measured with the help of 3 dial gauges, having 0.01mm least count & a travel of 40mm. The loading was done on the plate up to a loading intensity on the plate of 57.0 t /sq.m. ultimate failure of soil was observed at this loading intensity.

3.0 LABORATORY WORK :

- 3.01 Following tests were conducted on soil samples collected from bore-holes and excavated pits:
- (i) Natural Moisture Content
 - (ii) Bulk Density.
 - (iii) Atterberg's Limits of matrix material and
 - (iv) Grain Size Analysis,

The results have been tabulated in Fig.4 for Bore-Hole B.H.-1.

4.0 DISCUSSION OF TEST RESULTS :

The site is located in arhwali Colony, Ayudh Vihar, Raipur, Dehradun.. The Relative positions of different tests have been marked in Fig.5.

4.01 DYNAMIC CONEPENETRATION TESTS :

Both the Dynamic Cone Penetration Resistance Curves Fig. 1 and Fig.2, for locations DCP-1 and DCP-2 uniformly indicate good strata from 1.80m depth up to 4.50m depth, refusal was met at this depth..

4.02 PLATE LOAD TEST :

Load-Settlement Curve has been drawn from Plate Load Test Data, as Fig. 3 for location PLT-1, conducted at 2.0m depth from N.G.L., the loading was done on the plate up to a loading intensity on the plate of 57.0 t/sq.m., ultimate failure of soil has been indicated at this loading intensity.

4.03 The strata up to 3.0m depth consists of rock flour, followed by very hard strata of soil.

4.04 Water table was not met at 4.50 m depth from G.L., and has been reported to be very deep.

5.0 COMPUTATION OF SAFE BEARING CAPACITY OF SOIL:

5.01 As good strata is uniform strata is observed from 2.0m depth. And is uniform all over the site, it is recommended that the foundation may be laid at 2.0m depth (or more depths if structurally required so), as it is of the category of ROCK FLOUR, it is dealt like Non-Plastic Silt or sand, and so model calculations have been done below for computation of safe bearing capacity of soil at 2.0m depth from N.G.L. accordingly.

ASSUMPTIONS : (for Calculation purposes)

Depth of foundation $D_f = 2.0$ m

Width of foundation $B_f = 2.0$ m

$\gamma = 1.70$ t/sqm, $C = 0$ t/sqm, $\phi = 38^\circ$, giving $N_c = 63$, $N_q = 52$, $N_\gamma = 86$

A. From Soil Properties – (General shear failure criteria) : q_a (Nett) is given by the relation

$$\begin{aligned} q_a &= 1/3 [C N_c + 0.5 \gamma B_f N_\gamma + \gamma D_f (N_q - 1)] \\ &= 1/3 [0 \times 63 + 0.4 \times 1.70 \times 2.0 \times 86 + 1.7 \times 2.0 \times (52 - 1)] = 92.0 \text{ t/sqm.} \end{aligned}$$

B. From 'Nc' values – (Settlement Criteria):

$$N_c(\text{corrected}) = 18, \quad q_a = 1.1 \times N_c = 1.1 \times 18 = 19.80 \text{ t/sqm.}$$

C. From Plate Load Test (Ultimate Failure Criteria)

Load Settlement Curve (Fig.3), indicate ultimate failure of soil at a loading intensity of 57.0 t/sq.m, by adopting a factor of safety of 3 over this, we get, Safe Bearing Capacity of soil as $57.0/3 = 19.0$ t/sqm. Adopt lowest of above three i.e. say 19.0 t/sq.m.

Load Settlement indicates a settlement of 4.33mm of plate at this loading intensity (Safe)

Correction for Water Table :

Though, the water table was not present up to a depth of 3.0m from G.L. in July, 2019, and has been reported to be beyond a depth more than 6.0m, but this being a foundation of water tank, there are always chances of water leaking through joints, so as to account for this adopting a correction factor of 0.75, the safe bearing capacity is $q_a = 0.75 \times 19 = 14.0 \text{ t/sqm.}$

Adopt 14.0 t/sq.m. as Allowable Bearing Pressure on Soil at 2.0m or more depths.

6.00 RECOMMENDATIONS :

- 6.01 Dynamic Cone Penetration Resistance Curves Fig. 1 and Fig.2, for locations DCP-1 and DCP-2 uniformly indicate good strata from 1.80m depth up to 4.50m depth, refusal was met at this depth..
- 6.02 Load Settlement Curve has been drawn from Plate Load Test data (Fig.3) indicates ultimate failure of Soil at a loading intensity of 50.50 t / sq.m.
- 6.03 Soil properties at location BH-1 has been mentioned in Fig.4.
- 6.04 Water table was not met up to 4.50 m depth..
- 6.05 Strata being good and uniform from 2.0m depth, from N.G.L., the foundation should be laid at a depth of 2.0m from N.G.L. (or more depths if structurally required so), and the recommended value for Allowable Bearing Pressure on soil Nett), at 2.0m and more depths is 14.00 t/sq.m.
- 6.06 Foundation should be laid on VIRGIN STRATA ONLY.
- 6.07 Good drainage all around the building is essential. A concrete apron 1.50 m wide & 75 mm thick all around the building should be provided. A minimum of 100 mm thick heavily compacted lean concrete (1:5:10) blanket below the foundation should also be provided..
- 6.08 The above value of Safe Bearing Capacity of Soil has been arrived at on the basis of the soil strata observed during the field exploration. However, during the actual construction if soil strata met with is found to be different, a competent Geotechnical engineer should be consulted.
- 6.09 This report is meant only for technical purposes, and is not to be referred for legal purposes.

HH

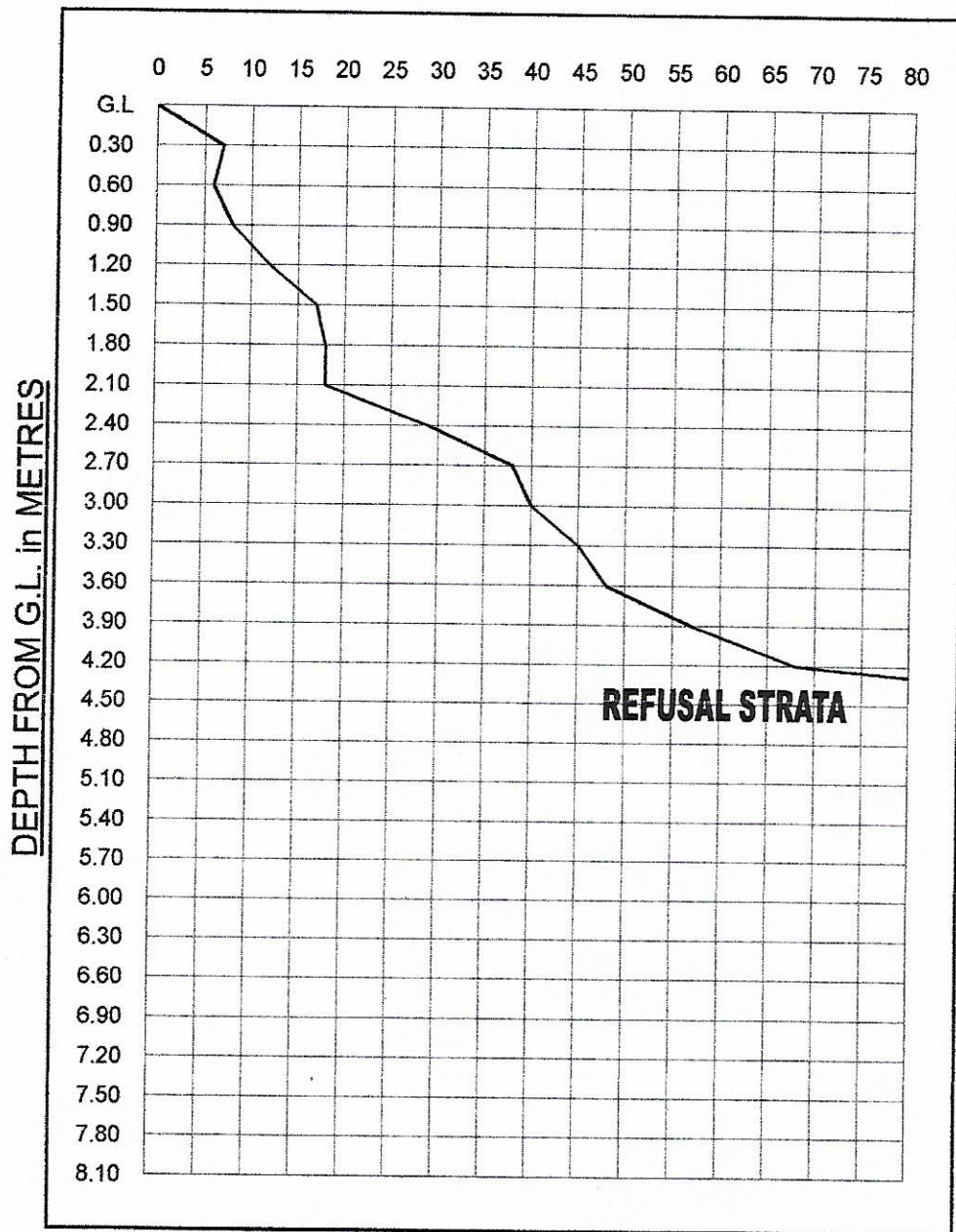


For **SOILEX-CONSULTANT Pvt. Ltd.,**

N. P. Shankar

(Director)

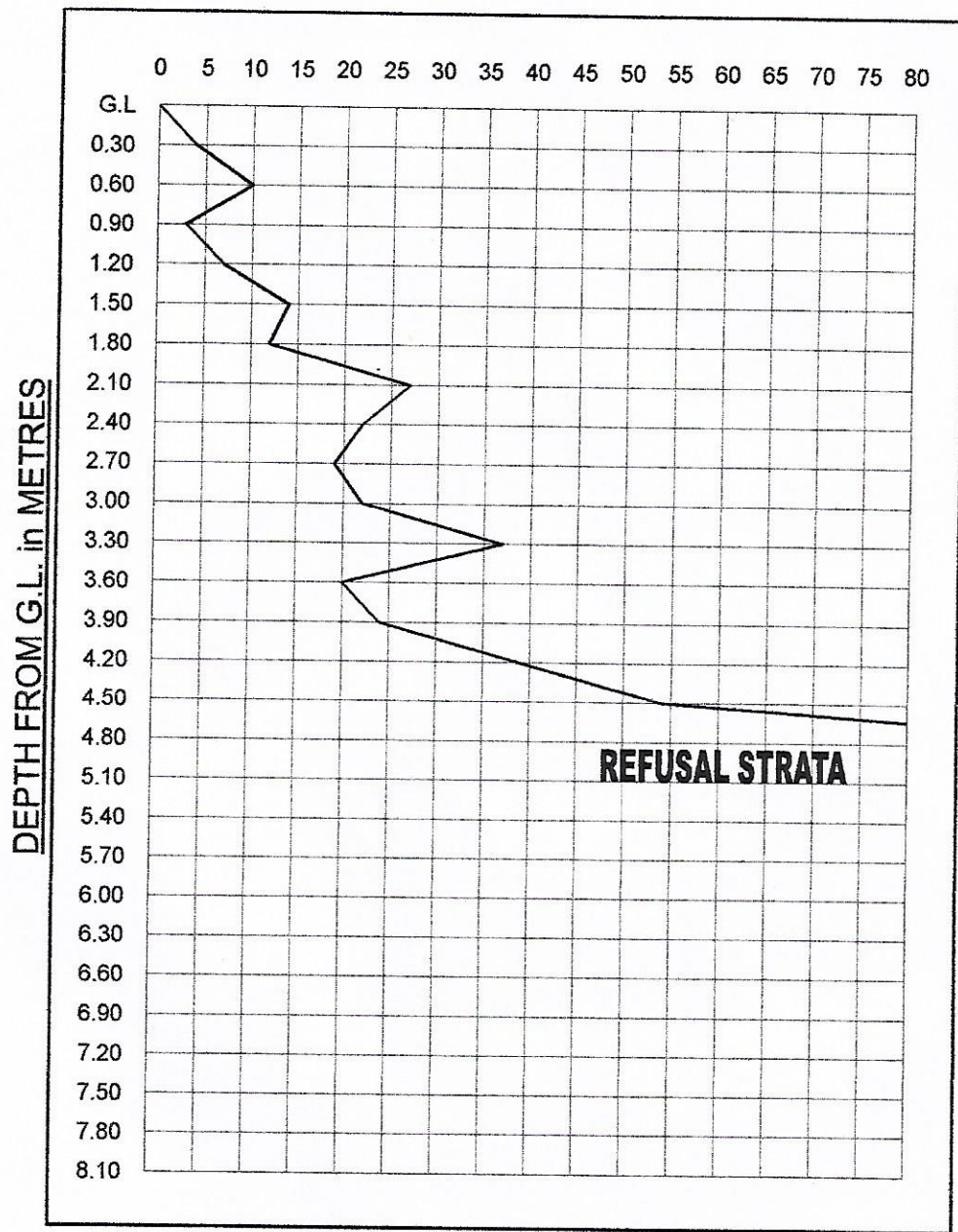
NUMBER OF BLOWS "N"



Site for 1000 KL CAPACITY O.H. Tank IN Garhwali Colony, Ayudh Vihar, Raipur, D, Dur
DYNAMIC CONE PENETRATION RESISTANCE CURVE FOR LOCATION No. 1.

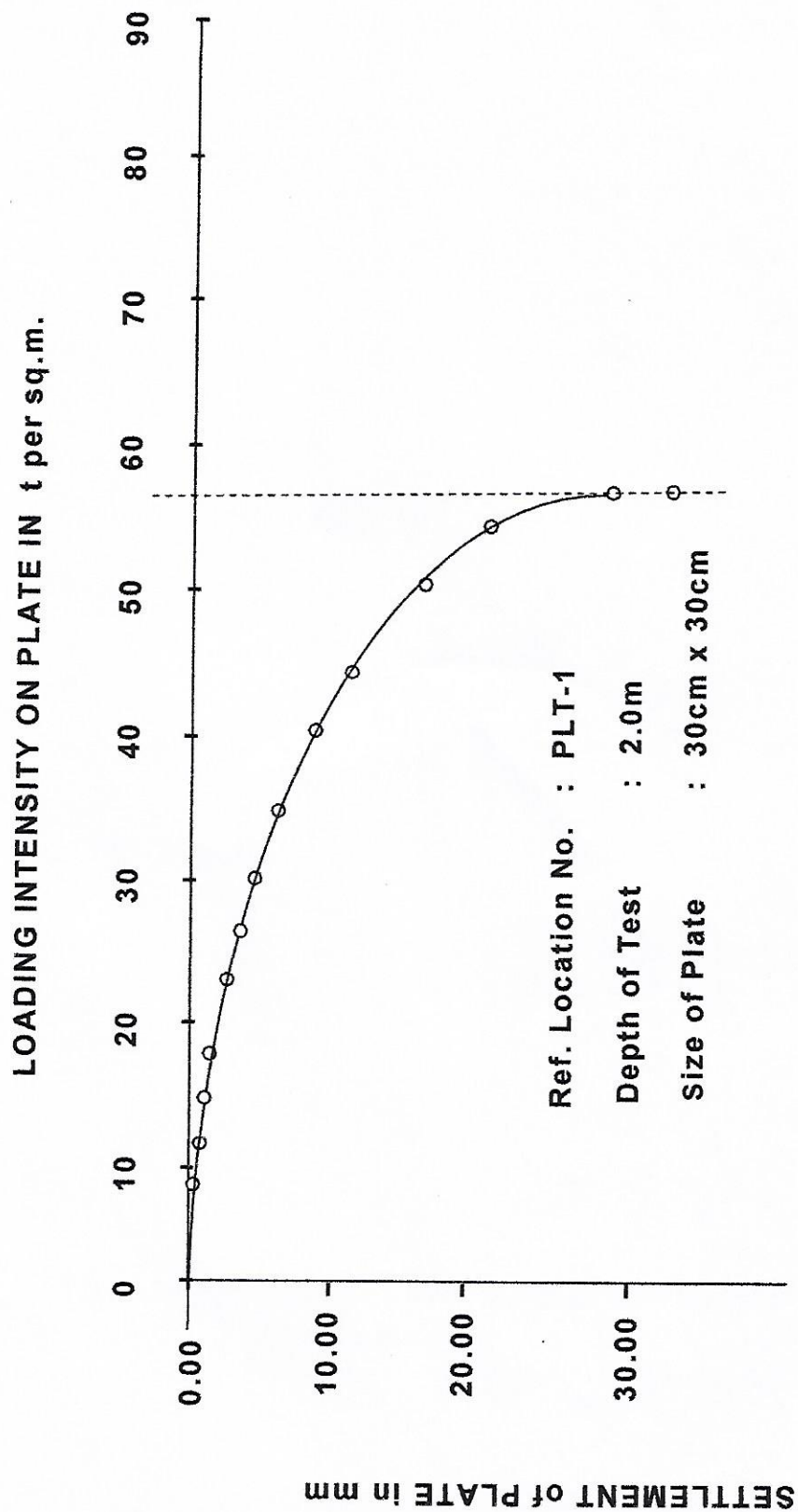
FIG. No.1

NUMBER OF BLOWS "N"



Site for 1000 KL CAPACITY O.H. Tank IN Garhwali Colony, Ayudh Vihar, Raipur, D, Dur
DYNAMIC CONE PENETRATION RESISTANCE CURVE FOR LOCATION No. 2

FIG. No.2



LOAD - SETTLEMENT CURVE FROM PLATE LOAD TEST

AT SITE FOR 1000 KL CAPACITY O.H. WATER TANK IN GARHWALI COLONY, AYUDH VIHAR
RAIPUR, Distt.: DEHRADUN (Uttarakhand)

FIG. 3

Depth Bore Log (m)	IS Classification	S.P.T. No. of Blows 'N'			N.M.C. %	Grain Size Analysis %			Atterberg's Limits/			Bulk Density g/c.c			Shear Parameters		
		15cm	30cm	45cm		Gravel	Sand	Fines	L.L.	P.L.	P.I.	1.5	2.0	2.5	C	φ	Degrees
G.L.																	
0.5	SM																
1	Rock Flour	3	4	4	8	0	75	25	-	NP	-						
1.5	Rock Flour	4	4	5	9	0	88	12	-	NP	-						
2	Rock Flour	8	8	10	18	0	90	10	-	NP	-				0	32	
2.5	Rock Flour								-	NP	-				0	38	
3	Rock Flour	25	25	R	R	0	92	8	-	NP	-						
3.5	Rock Flour								-	NP	-						
4	Rock Flour					8	90	2	-	NP	-						
4.5	Rock Flour	48	R	R	R	15	85	0	-	NP	-						
5	ROCK					45	55	0	-	NP	-						
5.5						75	25	0	-	NP	-						
6																	

Fig. 4 SOIL PROPERTIES AT B.H.-1

At Site for 1000 KL CAPACITY O.H.T. in GARHWALI COLONY, AYUDH VIHAR, RAIPUR, DEHRADUN (U.K.)

अधिकासी अभियन्ता
उत्तराखण्ड जल संस्थान
रायपुर, देहरादून