GOVERNMENT OF TELANGANA
TELANGANA DRINKIMG WATER SUPPLY PROJECT
Rural Water Supply & Sanitation Department

TELANGANA WATER GRID

L&T Construction - Water, Smart World & Communication
CHENNAI

CLIENT:	CONSULTANT :
RURAL WATER SUPPLY AND SANITATION DEPARTMENT (WATER GRID), TELUNGANA.	WAPCOS LIMITED

PROJECT :	PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT
SUPPLIER / CONTRACTOR:	L&T Construction, Water, Smart World and Communication

JOB Ref. No. : LE150883

	NAME	SIGN	DATE
DSGN			
CHKD			
APPD			

TITLE :

DESIGN OF SUMP - 40KL CAPACITY
SAMAKKA JN AT INDERVELLY MANDAL

DOC./DRG. No.	SIZE	REV.
LE150883-C-WS-RW-DC-1392	A4	A

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☐ PRELIMINARY	☐ INFORMATION	☑ APPROVAL	☐ CONSTRUCTION

Submitted sir,

Sub: RWS&S- TDWSP- Samakka Jn 40KL clear water sump in Indervelly Mandal– Komarambheem Asifabad Segment-Adilabad District-Designs -Approval-Reg.

*****

Kindly puruse the Designs of the following 40KL Clear Water sump at Samakka Jn (V) ,Indervelly (M), submitted by the Executive Engineer TDWSP Asifabad Division ,Adilabad district for approval.

1. **40 KL Clear Water Sump.**

The Executive Engineer TDWSP Asifabad Division has submitted Structural Designs & Drawings of 40KL Clear Water sump based on the field conditions and as per the estimate provisions , the structural designs & drawings for the above structure is verified with RWS&S standard Type Designs and submitted for approval.

The following design parameters were considered:

- Capacity : 40KL
- Net SBC of Soil : 10.0 t/sqm
- Grade of concrete & Steel : M 30 & Fe 415
- Dia of sump Inner to Inner : 5.00m
- Sidewall Height : 2.65mts
- Sidewall Thickness:150mm
- Top Slab thickness: 150 mm
- Raft Slab thickness: 250mm

As per the above parameters the structural design and drawings of the clear water sump is verified, as per similar Type designs available and approved by the RWS&S Department considering the SBC and type of soil , duly following IS codes, IS: 456-4000, SP:16, 34, IS:3370 and IS 1893-4002 (seismic codes).The sizes and steel proposed in the designs and drawings of all components are safe and sufficient.

The additional points noted after checking the designs are:

- Detailed Estimate of the Structure with these specifications has to be prepared and compared with the provision made in sanctioned estimate. Such that deviation if any is within authorized limits. If any deviations noticed, the Estimate should be submitted for obtaining approval from the Competent Authority.

Subject to approval a draft memo addressed to the EE, TDWSP Asifabad Division , for communicating approved Structure is put up for kind perusal and approval.

AEE (Designs)	DEE (Designs)	Superintending Engineer,
TDWSP,Nirmal Circle	TDWSP,Nirmal Circle	TDWSP,Nirmal Circle

Design Of 40 KL Capacity Sump at

(WITH FLAT TOP SLAB)

Not more than 5m Span

Data

Location							
Safe bearing Capacity	sbc		safe for sbc		100	Kn/m^2	
Capacity	v				40	KL	
Free Board	fb				0.30	m	
Dead Storage	ds				0.30	m	
Dia of sump	d				5.00	m	
Projection of Bottom slab from side wall				ps = d/16 to d/8	0.35	m	OK
Depth of tank above GL	dgl		Uplift check required		0.80	m	
Depth of Water table below GL,	wl			Safe Against Uplift	0.90	m	
Depth of the tank	h				2.65	m	1.85
Thickness of Slab	td	Min 150mm thick		OK	0.150	m	0.121 m
Th. Of Side wall	sth	Min 150mm thick		OK	0.150	m	0.086 m
Th. Of Bottom Slab	bsth	Min 150mm thick		thick is Sufficient OK	0.25	m	0.090 m

Top Slab

							slab projection
Radius of Top slab	rs				2.50		0.3 m
Thickness of Slab	td	Min 150mm thick		OK	0.15	m	0.121 mm is required
Effective depth of slab	d				100	mm	
Total Load on slab		Self wt			3.75	kN/sqm	
		Live load			1.5	kN/sqm	
		Finishings			1	kN/sqm	
	w	Total load			6.25	kN/sqm	
Bending Moment	bm	(2/16*w*rs^2)			4.88	kN-m/m	
Area of Steel required	ast	(bm/(σstjd)			436	sqmm/m	
		σst		N/mm2	130.00	N/sqmm	
		j=1-k/3			0.86		
		k=1/1+σst/mσcbc			0.42		
		m=280/3σcbc			9.33		
		σcbc			10	N/sqmm	
		Grade of steel		Fe 415 , σst=	130	N/sqmm	
		Grade of Concrete		M 30			
Dia of Reinforcement	db		10mm				
Spacing required	min of		150 mm	170 mm	floor to	10mm	
Spacing provided				OK	150	mm	c/c

Provide 10 mm dia Tor @ 150 mm C/c both radially and in the form of circular rings

Side Wall

Depth of the tank	h		2.65	m	
Th. Of Side wall	sth	Min 150mm thick	0.15	m	0.086 mm
Depth of tank above GL	dgl		0.80	m	
Moments					
	Inner Side		2.41	Kn-m	
	Outer Side		2.468	Kn-m	
Hoop force					
	Inner Side		47.68	Kn	(Tension)
	Outer Side		44.79	Kn	(Compression)

Reinforcement				Dia	Spacing Provided	floor to
Inner face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		183.5 mm^2	10 mm	150 mm	50
Outer face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		183.5 mm^2	10 mm	150 mm	

Bottom slab Min 150mm thick

Safe bearing Capacity	sbc			100	Kn/m^2	
Th. Of Bottom Slab	bsth		thick is Sufficient	0.250	m	0.090 m
Dia of Bottom Slab	dbs			6.00	m	
Size of Haunch	bh			0.25	m	
effective cover to reinforcement for raft slab			covraft	65	mm	
Moments Radial				4.18	Kn-m	
Circumferential				4.14	Kn-m	

			Ast (Min 10mm dia)	Dia	Spacing Provided	floor to	
Reinforcement	Top	mesh	300 mm^2	10 mm	225 mm	25	150
	Bottom	mesh	300 mm^2	10 mm	200 mm	50	200

Provide 10 mm dia TOR @ 150 mm C/c on both faces in staggered fashion

Design Of Bottom Slab
CASE-1

Projection from side wall	ps		0.35	m
Dia of Bottom Slab	dbs	d+2*sth+2*ps	6.00	m
Size of Haunch	bh		0.25	m
Dia of Bar top	dbbs		10	mm
bottom	dbbsb		10	mm
Net Load on Bottom Slab				
Wt of Top Slab		pi/4*(d+sth+topproj)^2*td*25	102.53	Kn
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25	148.65	Kn
Wt of Haunch		pi*(d-bh)*bh^2/2*25	11.66	Kn
Total Load	wbs		262.84	Kn
LL on TOP slab		pi/4*(d+sth+topproj)^2*LL	58.32	Kn
			3.212 sq m	0.199
Effective foundation width of sidewall load on bottom slab, ewf		ps+sth+bh+bsth=	1.000	m
Max Pr on Soil	prb	Wbs/(pi*(d+sth)*ewf)	16.25	Kn/m^2

Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges

			r = 2.575	2.5	
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2*l	-4.18	mrb	-4.14 Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2	-4.14	mtb	-4.14 Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/16,0.01))	4.18	Kn-m	
Max Circumferential mon	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16,0.01))	4.14	Kn-m	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mr=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))^	0.112	m
			Provided th is Sufficient	
Eff Depth	de	bsth*1000-covraft	185	mm
Area of Steel				
Min Steel	Astmin	0.24	0.24	%
			300	mm^2
Area of Steel	Astr	mr*10^6/(130*.87*de)	202	mm^2
Spacing				
Top Steel	Asttp	pi*(dbbs^2/4)*1000/max(Astmn,astr)	262	mm
Provide 10 mm dia TOR @ 225 mm c/c in the form of mesh at top				
Bottom Steel	Astb	pi*(dbbsb^2/4)*1000/(Astmin)	262	mm
Provide 10 mm dia TOR @ 200 mm c/c in the form of mesh at bottom				

Check For SBC

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Load from tank Portion	wbs			262.84	Kn
Weight of Bottom Slab	wbsi	pi*(dbs^2/4)*bsth*25		176.71	Kn
Weight of water	ww	pi*(d^2/4)*h*10		520.32	Kn
Total	W	wbs+wbsi+ww		959.87	Kn
Pr on Soil	pr s	w/(pi*dbs^/4)	safe for sbc	33.95	Kn/m^2

CASE-2

Bottom Slab is designed as circular Slab loaded with Uplift and continuous Supported on edges

Load on Bottom Slab (Uplift)

Max Pr on Soil	pru	10*(h-dgl-wl)-bsth*25	Uplift check requir	3.25	Kn/m^2
			r =	2.575	
Radial moment	mru	2/16*pru*(r)^2		2.69	
Circuferential Moment	mtu	1/16*pru*(r)^2		1.35	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mru=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))	0.09	m
			thick is Sufficient	
Eff Depth	de	bsth*1000-covraft	185	mm
Area of Steel				
Min Steel	Astmin	0.24	0.24	%

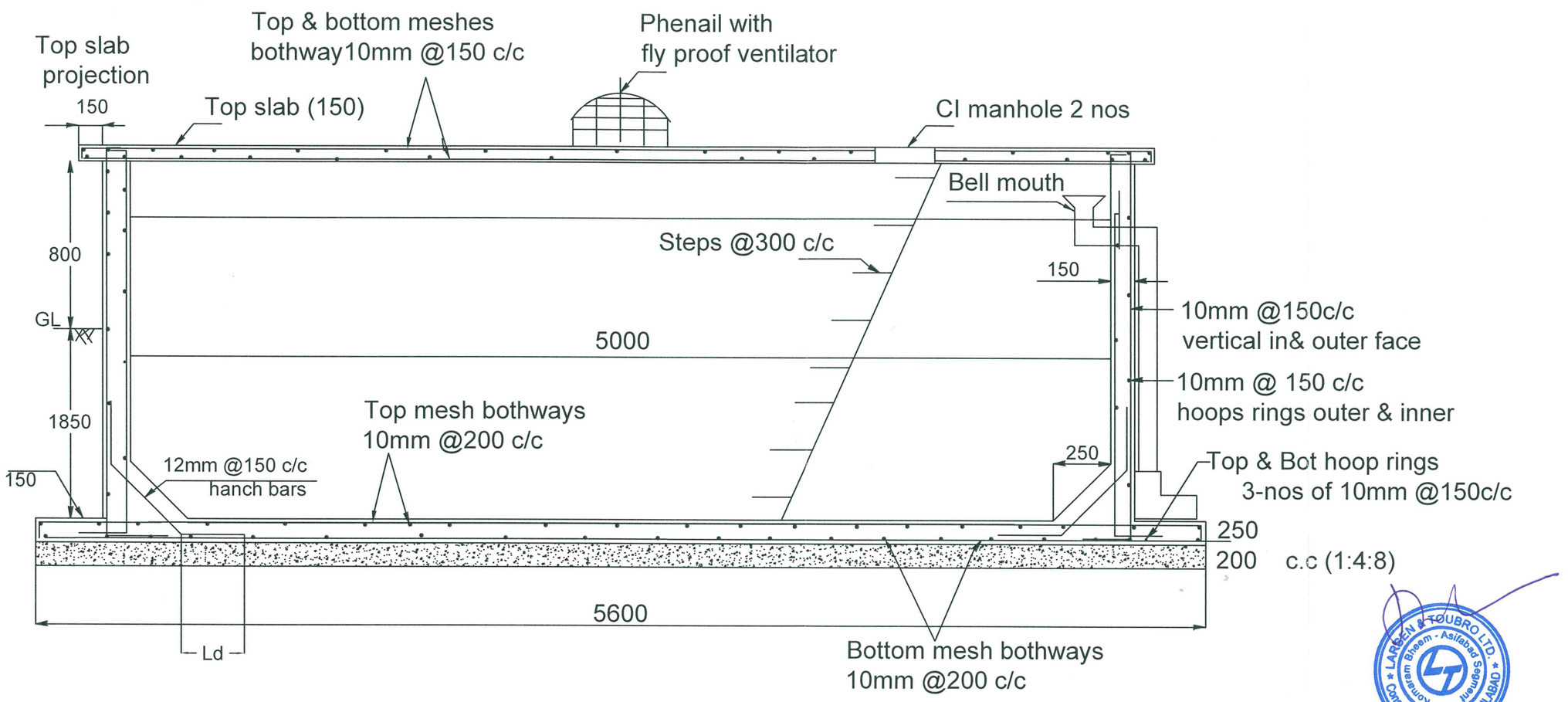
LARSEN & TOUBRO LTD. Komarram Bheem - Asifabad Segment Construction-TDWSP -ADILABAD

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer

40KL SUMP



All dimenstions are in 'mm'
Concrete mix V.R.C.C M30
Steel Fe-415
Reinforcement details shall be as per IS-SP34

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

APPROVED
15/4/16
SE, NIRMAL

REV.NO.	DESCRIPTION	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR INFORMATION				

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT :

PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT (PRIMARY GRID)

SUPPLIER/CONTRACTOR : L&T Construction
Water & Effluent Treatment SBG

JOB No : LE150883

	NAME	SIGN	DATE
CHECKED BY			
CIVIL & STRUCTURAL			
MECHANICAL			
ELECTRICAL			
INSTRUMENTATION			

TITLE : SAMAKKA AT INDERVELLY MANDAL
SUMP - 40KL

SCALE
PROJECTION

DRAWING No. LE1508833-C-WS-RW-DC-1392 SIZE A3 REV. A

RELEASED FOR ☐PRELIMINARY ☐ TENDER ☐INFORMATION ☑APPROVAL ☐CONSTRUCTION

GEOTECHNICAL INVESTIGATION REPORT

TELANGANA DRINKING WATER SUPPLY PROJECT

KOMARAM BHEEM - ASIFABAD- SEGMENT 22

ASIFABAD , ADILABAD DISTRICT

40KL SUMP AT SAMAKKA, INDERVELLY MANDAL AT ADILABAD DISTRICT

***CONTRACTOR* :**

M/s. LARSEN& TOUBRO LIMITED,L&T CONSTRUCTION,

WATER & EFFLUENT TREATMENT SBG, CHENNAI

Drilling By:

M/s. ANJI DRILLING & GROUTING WORKS

Report Prepared by

DR. D. BABU RAO,

M.E.(IIT,Roorkee), Ph.D.(USA), MIGS

MCH Panellist No. 2490 /TP/2000-2

GEOTECHNOLOGIES

CONSULTING GEO TECHNICAL ENGINEER

FORMER PROFESSOR &HEAD OF CIVIL ENGINEERING

OSMANIA UNIVERSITY

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TELANGANA DRINKING WATER SUPPLY PROJECT

40KL SUMP AT SAMAKKA, INDERVELLY MANDALIN ADILABAD DIST

1. INTRODUCTION

M/s. L &T Construction, Water & Effluent Treatment is proposing to construct 60 KL Sump Kammargaon (V), Bejjur (M), Asifabad (Dt) .The work is taken up under Segment 22 , Komaram Bheem Project , TDWSP, in Adilabad Dt.

The present Report presents the results of (1) Bore hole.

M/S Anji Drilling & Grouting works; Anantapur has carried out the drilling of bore holes, collection of soil and rock samples and conduct of Standard Penetration Tests at different levels in the respective bore holes at the proposed site.

Analysis of borehole data , Laboratory tests and geotechnical investigation report have been made by Prof. D Babu Rao, ME (IIT,R) , Ph.D. (USA), MIGS, Empanelled Consulting Geo technical Engineer &,Director, Geo technologies, Former Professor of Civil Engineering, Osmania University.

2. SCOPE OF WORK

The following is the scope of work of M/s. Anji Drilling and Grouting Works:

- Drilling Borehole at (1) location for 40KL Sump for Samakka, Indervelly (M) Asifabad (Dt)
- Conducting SPT at regular intervals, where feasible
- Collection of undisturbed / disturbed samples from the Bore holes

M.E.,Ph.D.(USA)
Consulting Geotechnical Engineer

- Preparation of Technical Report recommending suitable foundations and safe bearing capacity

Following is the scope of work of Prof. D Babu Rao ,

Testing of soil samples in the Laboratory

Preparation of Technical Report

3. SUB SOIL INVESTIGATION

The sub soil investigation was carried out to determine:

Nature of sub stratum and engineering properties of sub strata which may affect the mode of construction of the proposed work.

FIELD INVESTIGATION PROCEDURE:

The following technique is adopted for sub soil investigations.

a) BORINGS:

Rotary Drilling was done using TC / Diamond bits. The size of the casing used was 125 to 75 mm, yielding samples of NX size.

TC bits were employed for the overburden, and Impregnated Diamond Core bits were used for rock formation.

Drilling was performed on 22-23 Jan ,2016.

The following relevant data was recorded during Rotary drilling operations.

- Nature of strata
- Details of samples

Dr. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

- Core Recovery (CR)
- Rock Quality Designation (RQD)

b) STANDARD PENETRATION TEST (SPT):

SPT split spoon sampler of standard dimensions was driven into the soil from the borehole bottom using 63.5 kg hammer with a fall of 75 cm height. The SPT weight was lifted to the specified height and allowed to fall freely on the anvil with the use of cat-head winch with one to one and half turn of the drum. Blow counts for the penetration of every 15 cm were recorded and the 'N' value is reported as the blow counts for 30 cm penetration of the sampler excluding the first 15 cm penetration as seating drive.

When the number of blows exceeded 50 to penetrate the first or second 15 cm length of the sampler, the SPT 'N' is regarded as more than 100 as described in IS 2131 - 1981. The test is terminated in such case and a record of the penetration of the sampler under 50 blows is made. SPT refusal is recorded when there is no penetration of the sampler at any stage and also when a rebound of the sounding system is recorded. These tests were conducted at close intervals of 1.0m so that a continuous SPT 'N' profile is available.

Disturbed soil collected in the SPT sampler was preserved in polythene covers and transported to the laboratory. Additional polythene cover was used to prevent the loss of moisture during the transit period.

c) DEPTH OF BORING: The depth of the Bore hole was as follows:

BH No	Drilled depth
1	6 m

M.E., Ph.D.

Consulting Geotechnical

d) LOG OF BORE HOLE:

All the results obtained from the field operations are presented in Log of Bore hole in Fig. 1 .

4. LABORATORY TESTING:

The laboratory tests are conducted in the laboratory of Geotechnolgies, Hyderabad, an ISO- 9000 approved Laboratory.

From GL to 6 m , weathered rock was seen. N value exceeded 100 blows (Refusal) .. Few small rock pieces were procured .

5. SUB SOIL PROFILE

Based on Field and Laboratory tests, the following idealized sub soil profile is evolved.

Depth	Strata	N value
0 – 6 m	Weathered rock	>100

. In Hard rock, no SPT can be conducted. However, in SDR strata, SPT can be conducted with N values tending to be 'refusal'. This is the criterion for distinguishing between Soft rock /Weathered rock and Hard rock.

6.0 SHALLOW FOUNDATIONS

In general, the following pertains to foundations resting in soils.

. A properly designed foundation has to satisfy the following two limit states.

Dr. D. BABU RAO
M.E., Ph.D. (US)
Consulting Geotechnical Engineer
GEO TECHNOLOGIES

1) Limit state of collapse (i.e. Shear strength)

2) Limit state of serviceability (i.e. Settlement)

SHEAR CRITERIA:

The first criterion is depends on shear strength. The calculations are based on "TERZAGHI" bearing capacity equation as recommended by IS: 6403 (with factor of Safety) which takes care of L/B ratio (shape), foundation depth etc., along with other parameters.

SETTLEMENT CRITERIA:

The intensity of loading that will cause a permissible settlement or specified settlement of the structure is termed as allowable bearing pressure. The settlement in this type of layer will be elastic settlement.

These foundation settlements are evaluated using elastic theory. The pressure distribution below the footing is assumed as 2 V: 1 H for estimating the settlement. Since rock formation is available at shallow depth. The settlement will be within the permissible limit. Hence open foundation is suitable.

ALLOWABLE BEARING CAPACITY:

Allowable Bearing capacity (ABC) is the net intensity of the loading which the foundation will carry without undergoing settlement in excess of the permissible value for the structure under consideration but not exceeding the net safe bearing capacity (SBC).

7.0 DISCUSSION ON FOUNDATION OPTIONS :

From sub soil profile and laboratory test data, it can be seen that weathered rock exists from GL to 6 m depth . Hence shallow foundation is feasible and same is recommended.

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8.0 RECOMMENDATIONS

Based on Field Investigations and laboratory testing, the following Recommendations are made for construction of 40KL Sump at Samakka,Indervelly (M), Asifabad (Dt)

a) Open foundations resting at 2 m below GL ,are recommended. The structure is likely to result in saturation and inundation of the sub soil during long – time operation,

b) SBC is recommended as follows :

Location		BH 1
S. No.	Depth (m)	Recommended SBC t/ sq m
1	2.0	10
2	3.0	11
3	4.5	13

c) The actual size of foundations will be based on loads from the superstructure.

For ANJI DRILLING AND GROUTING WORKS

(DR. D. BABU RAO)

M. E(IIT,R), Ph. D. (USA), MIGS

Former Professor of Civil Engineering

Consulting Geotechnical Engineer

MCH Panelist No. 2490/TP/2000-2

GEO TECHNOLOGY

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TELANGANA DRINKING WATER SUPPLY PROJECT

FIG 1 : Record of Boring, *Bore Hole No : 1*

40KL Sump at Samakka, Indervelly Mandal at Adilabad District

Type of Boring: Core drilling **Dia of Boring: NX**

Date : 22-23 Jan 2016 **Drilled depth :6 m**

Depth, m	Profile	Soil	Sample Depth m	N value	CR, %	RQD%
0			0	>100		
1.0			1.5	>100		
2.0		Weathered				
3.0		rock	3.0	>100		
4.0			4.5	>100		
5.0						
6.0						-
7.0						-
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						
16.0						

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Consulting Geotechnical Engineer

APPENDIX

CALCULATION OF SBC

40KL Sump At Samakka, Indervelly Mandal In Adilabad District

TYPICAL CALCULATIONS FOR OPEN FOUNDATIONS AT 2 M DEPTH

a) Shear Criterion :

Assumed value of N = 50

Assumed width of foundation =4 m

Assumed depth of foundation = 1,5 m inside rock

Correction factors Rq = Rr = 0.5

With a F.S. of 3.0 ,

Allowable $q = 1 / 18 \ [2 N^2 B Rr + 6 (100 + N^2) D Rq]$ =1205 kN / sq m

b) Settlement Criterion :

For permissible settlement of 40 mm,

Allowable Bearing Pressure = 12.25 N (B + 0.3) / B

= 658 kN / sq m

Adopt 250 kN / sq m .

c) As per IS : 8009 (Fig. 2) Code of Practice for calculation of settlements of foundations:

For N = 50, B = 4,

Settlement = 0.0045 m per unit pressure of 1 kg / sq cm

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For a pressure of 25 t/ sq m,

Settlement = 0.0025 x 4.5 x1000 = 11.25 mm OK

d) As per IS : 12070 (Code of Practice for Design & Construction of Shallow Foundations on Rocks) :

Weathered and disintegrated rock is treated under Classification No. V of Table 3 of the Code

For this *very poor* rock , net allowable bearing pressure is recommended as

25 t / sq m , for settlement less than 12 mm.

Keeping the above considerations in view, Recommended Safe Bearing Capacity is 10t per sq m

LARSEN & TOUBRO LTD. Komarvaram Bheem - Asifabad Segment Construction-TDWSP -ADILABAD

GEO TECHNOLO

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Consulting Geotechnical Engineer

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

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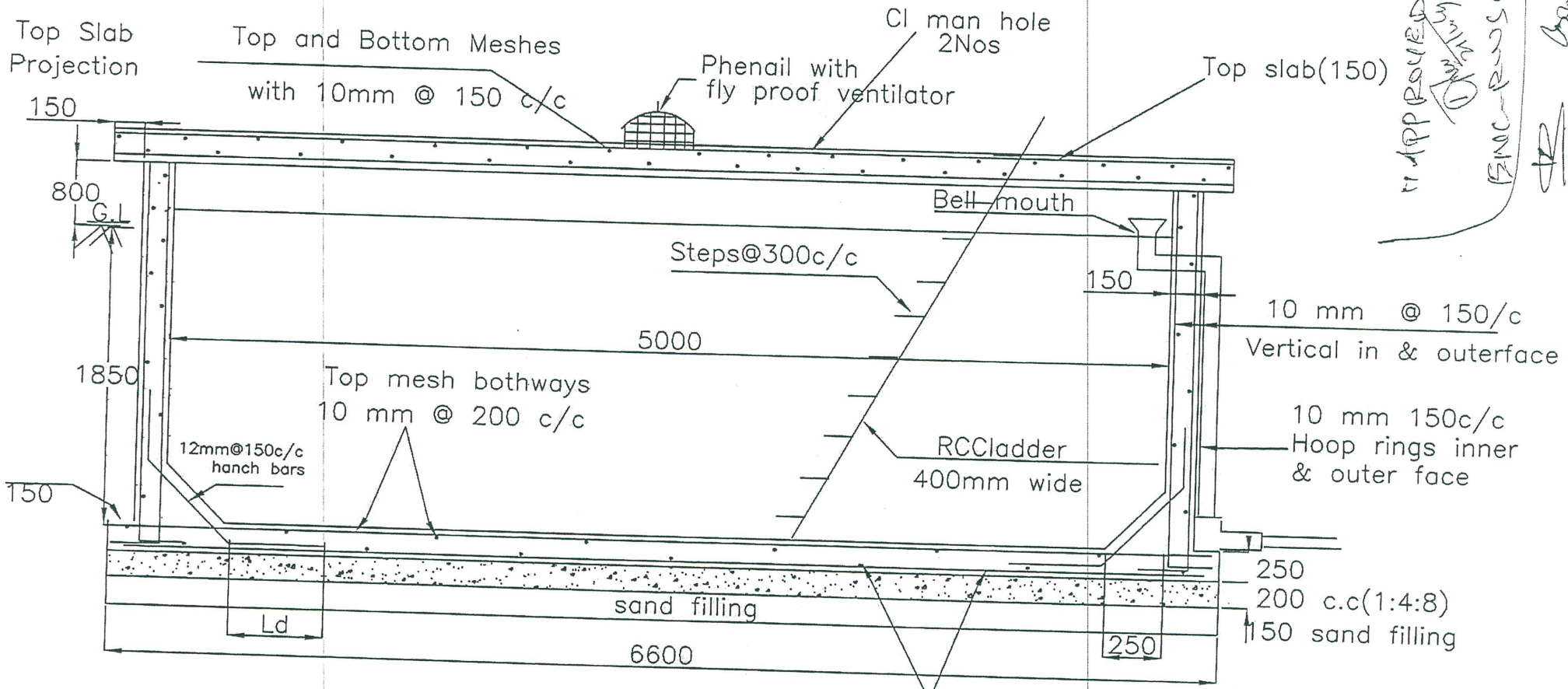

All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

40 KL SUMP

SCHEME :CPWS Schemes
LOCATION: Adilabad District
DWG.NO..