

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 03/10/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. MWBH-27 Co-ordinates E=(-)4089 N=19900

Field Test	Nos	Samples	Nos	Commencement Date : 10/09/17
Penetrometer (SPT)	7	Undisturbed (UDS)	2	Completion Date : 10/09/17
Cone (Pc)		Penetrometer (SPT)	7	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	3	Level Of Ground : 78.345 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : Not Found

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m								DS-1	0.50
		4	9	13	22			SPT-1	1.00-1.45
								*UDS-1	2.00-2.45
		5	10	19	29			SPT-2	2.50-2.95
								DS-2	3.60
		8	16	23	39			SPT-3	4.00-4.45
								*UDS-2	5.00-5.12
					>100			SPT-4	5.50-5.70
5.50m		39	61		5.0 cm Pentn.			DS-3	6.40
								SPT-5	7.00-7.25
		32	68		10.0 cm Pentn.			*SPT-6	7.50-7.53
					Refusal			*SPT-7	7.60-7.62
7.50m		100	3.0 cm Pentn.		Refusal			R1	CR=32% RQD=NIL
		100	2.0 cm Pentn.					R2	CR=36% RQD=NIL
					NX, drilling from 7.80m to 10.00m			R3	CR=42% RQD=22%
								R4	CR=51% RQD=26%
10.00m									8.25 9.00 9.50 10.00

N.B. - '*' means sample could not be recovered.

Job No : 3975

Created by : Chandrani

Created on : 03/10/2017

Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO. MWBH-28

Co-ordinates

E= $\langle - \rangle$ 5125
N=21023

Field Test	Nos	Samples	Nos	Commencement Date :	09/09/17
Penetrometer (SPT)	3	Undisturbed (UDS)	1	Completion Date :	09/09/17
Cone (Pc)		Penetrometer (SPT)	3	Bore Hole Diameter :	150 mm.
		Disturbed (DS)	3	Level Of Ground :	80.043 M.
Vane (V)		Water Sample (WS)	0	Water Struck At :	
				Standing Water Level :	Not Found

DESCRIPTION	SYMBOL	N-VALUE								SAMPLES	
		EACH DIVN. = 15cm.								Ref. No	Depth (m)
0.00m <											

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 03/10/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. MWBH-30** Co-ordinates E=(-)6658 N=21624

Field Test	Nos	Samples	Nos	Commencement Date : 09/09/17
Penetrometer (SPT)	3	Undisturbed (UDS)	2	Completion Date : 09/09/17
Cone (Pc)		Penetrometer (SPT)	3	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	3	Level Of Ground : 83.300 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 4.50 m.

DESCRIPTION	SYMBOL	N-VALUE							SAMPLES	
		EACH DIVN. = 15cm.							Ref. No	Depth (m)
0.00m Filled up soil consists of grey, silty sand.										
0.50m									DS-1	0.50
									UDS-1	1.00-1.45
		3	3	4					SPT-1	1.45-1.90
Medium, light brown, silty clay. (CI)									DS-2	2.50
3.00m		4	4	6			10		SPT-2	3.00-3.45
									DS-3	4.00
4.50m									*UDS-2	4.50-4.95
Very loose, yellowish brown, silty sand. (SM)									SPT-3	5.05-5.50
5.50m		1	1	1			2			
N.B. - '*' means sample could not be recovered.										

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Job No : 3975 Created by : Chandrani Created on : 11/10/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. MWBH-31 Co-ordinates E=(-)12915.251
N=17702.404

Field Test	Nos	Samples	Nos	Commencement Date : 10/09/17
Penetrometer (SPT)	3	Undisturbed (UDS)	2	Completion Date : 10/09/17
Cone (Pc)		Penetrometer (SPT)	3	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	3	Level Of Ground : 80.913 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 3.80 m.

DESCRIPTION	SYMBOL	N-VALUE							SAMPLES	
		EACH DIVN. = 15cm.							Ref. No	Depth (m)
0.00m Filled up soil consists of grey, silty sand.									DS-1	0.50
0.70m									UDS-1	1.00-1.45
		8	13	15		28			SPT-1	1.45-1.90
									DS-2	2.50
		6	8	12		20			SPT-2	3.00-3.45
									DS-3	4.00
4.50m									UDS-2	4.65-5.10
		3	5	5		10			SPT-3	5.10-5.55
5.55m										

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Job No : 3975 Created by : Chandrani Created on : 11/10/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. MWBH-33 Co-ordinates E=(-)13553.451
N=17077.124

Field Test	Nos	Samples	Nos	Commencement Date : 09/09/17
Penetrometer (SPT)	4	Undisturbed (UDS)	1	Completion Date : 09/09/17
Cone (Pc)		Penetrometer (SPT)	4	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	3	Level Of Ground : 78.719 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 3.20 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
								DS-1	0.50
								*UDS-1	1.00-1.10
		10	24	29		53		SPT-1	1.20-1.65
								DS-2	2.10
		17	31	41		72		SPT-2	2.60-3.05
								DS-3	3.60
		29	48	23		>100		SPT-3	4.00-4.35
						5.0 cm Pentn.			
		41	59			>100		SPT-4	5.00-5.25
						10.0 cm Pentn.			
5.25m									

Hard, deep grey, silty clay with gravels, sand mixture & rock pieces. (CI)

N.B. - '*' means sample could not be recovered.

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 16/10/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. MWBH-34 Co-ordinates E=(-)13822.427 N=16928.393

Field Test	Nos	Samples	Nos	Commencement Date : 17/09/17
Penetrometer (SPT)	19	Undisturbed (UDS)	1	Completion Date : 20/09/17
Cone (Pc)		Penetrometer (SPT)	19	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	16	Level Of Ground : 81.3198 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 2.50 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN. = 15cm.					Ref. No	Depth (m)
0.00m Hard, reddish brown, silty clay / clayey silt with moorum, gravels & traces of sand mixture. (CI)		100	>100	11.0	cm	Pentn.	DS-1	0.50
		100	>100	13.0	cm	Pentn.	*UDS-1 SPT-1	1.00-1.10 1.20-1.31
		100	>100	12.0	cm	Pentn.	DS-2	2.00
		100	>100	10.0	cm	Pentn.	SPT-2	2.50-2.63
3.20m Very dense, brownish grey, silty sand with mica. Obs. disintegrated rock pieces. (SM)		100	>100	3.0	cm	Pentn.	DS-3	3.50
		100	>100	3.0	cm	Pentn.	SPT-3	4.00-4.12
		100	>100	3.0	cm	Pentn.	DS-4	5.00
		100	>100	3.0	cm	Pentn.	SPT-4	5.50-5.60
6.55m Completely weathered, light grey to steel grey, fine to medium grained, fully decomposed & disintegrated rock.		100	>100	3.0	cm	Pentn.	*SPT-5	6.10-6.13
		50	Refusal	3.0	cm	Pentn.	*SPT-6	6.55-6.58
		50	Refusal	3.0	cm	Pentn.	R1	CR=12% ROD=NIL
		50	Refusal	3.0	cm	Pentn.	*SPT-7	7.00-7.03
		50	Refusal	3.0	cm	Pentn.	R2	CR=NIL RQD=NIL
		50	Refusal	3.0	cm	Pentn.	*SPT-8	7.75-7.78
		50	Refusal	3.0	cm	Pentn.	R3	CR=NIL RQD=NIL
		50	Refusal	3.0	cm	Pentn.	*SPT-9	8.50-8.53
		50	Refusal	2.0	cm	Pentn.	R4	CR=NIL RQD=NIL
		50	Refusal	3.0	cm	Pentn.	*SPT-10	9.25-9.27
		50	Refusal	3.0	cm	Pentn.	R5	CR=NIL RQD=NIL
		50	Refusal	3.0	cm	Pentn.	*SPT-11	10.00-10.03
13.00m		52	Refusal	2.0	cm	Pentn.	R6	CR=NIL RQD=NIL
		50	Refusal	2.0	cm	Pentn.	*SPT-12	10.75-10.77
		50	Refusal	2.0	cm	Pentn.	R7	CR=NIL RQD=NIL
		51	Refusal	3.0	cm	Pentn.	*SPT-13	11.50-11.52
							R8	CR=NIL RQD=NIL
							*SPT-14	12.25-12.28
							R9	CR=NIL RQD=NIL

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Job No : 3975 Created by : Chandrani Created on : 16/10/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. MWBH-35 Co-ordinates E=(-)13804.776 N=16913.920

Field Test	Nos	Samples	Nos	Commencement Date : 11/09/17
Penetrometer (SPT)	17	Undisturbed (UDS)	1	Completion Date : 16/09/17
Cone (Pc)		Penetrometer (SPT)	17	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	16	Level Of Ground : 80.742 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 2.30 m.

DESCRIPTION	SYMBOL	N-VALUE							SAMPLES	
		EACH DIVN. = 15cm.							Ref. No	Depth (m)
0.00m Hard, reddish brown, silty clay with moorum, sand mixture & rock pieces. (CI)									DS-1	0.50
									*UDS-1	1.00-1.10
									SPT-1	1.10-1.23
		100								
3.50m Medium dense to dense, brownish grey, silty sand with mica. (SM)									DS-2	2.00
									SPT-2	2.70-2.89
		78								
6.60m Very dense, deep grey, silty sand with mica & decomposed rock. (SM)									DS-3	3.50
									SPT-3	4.00-4.45
									DS-4	5.00
		11							SPT-4	5.50-5.95
7.40m Completely weathered, light to steel grey, fine to medium grained, fully decomposed rock.									DS-5	6.50
									SPT-5	7.00-7.20
									*SPT-6	7.40-7.44
									R1 DS-6	CR=NIL RQD=NIL
									*SPT-7	8.00-8.03
									R2 DS-7	CR=NIL RQD=NIL
									*SPT-8	8.75-8.79
									R3 DS-8	CR=15% RQD=NIL
									*SPT-9	9.50-9.54
									R4 DS-9	CR=NIL RQD=NIL
									*SPT-10	10.25-10.28
									R5 DS-10	CR=NIL RQD=NIL
									*SPT-11	11.00-11.05
									R6 DS-11	CR=NIL RQD=NIL
									*SPT-12	11.75-11.79
									R7 DS-12	CR=NIL RQD=NIL
							*SPT-13	12.50-12.55		
13.00m								R8	CR=NIL RQD=NIL	

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BORE LOG DATA SHEET BORE HOLE NO. MWBH-35

Co-ordinates E=(-)13804.776
N=16913.920

Field Test	Nos	Samples	Nos	Commencement Date : 11/09/17
Penetrometer (SPT)	17	Undisturbed (UDS)	1	Completion Date : 16/09/17
Cone (Pc)		Penetrometer (SPT)	17	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	16	Level Of Ground : 80.742 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 2.30 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN. = 15cm.					Ref. No	Depth (m)
13.00m Completely weathered, light to steel grey, fine to medium grained, fully decomposed rock.		50	3.0	cm	Penth.	Refusal	DS-13 *SPT-14	13.25-13.2813.25
14.00m		50	4.0	cm	Penth.	Refusal	R9 DS-14 *SPT-15	14.00-14.0414.00
14.75m							R10	CR=23% RQD=NIL
15.50m		50	3.0	cm	Penth.	Refusal	R11 DS-15 *SPT-16	15.50-15.5315.50
16.25m		50	3.0	cm	Penth.	Refusal	R12 DS-16 *SPT-17	16.25-16.2816.25
17.00m							R13	CR=21% RQD=NIL
17.75m							R14	CR=34% RQD=NIL
18.50m							R15	CR=28% RQD=NIL
19.25m							R16	CR=30% RQD=13%
20.00m							R17	CR=36% RQD=NIL
20.75m							R18	CR=29% RQD=NIL
21.50m							R19	CR=35% RQD=NIL
22.25m							R20	CR=38% RQD=NIL
23.00m							R21	CR=32% RQD=NIL
23.75m							R22	CR=30% RQD=NIL
24.50m							R23	CR=34% RQD=NIL
25.00m							R24	CR=40% RQD=NIL

N.B. - '*' means sample could not be recovered.

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 11/10/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. MWBH-36 Co-ordinates E=(-)13800.149 N=16937.321

Field Test	Nos	Samples	Nos	Commencement Date : 06/09/17
Penetrometer (SPT)	17	Undisturbed (UDS)	2	Completion Date : 09/09/17
Cone (Pc)		Penetrometer (SPT)	17	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	12	Level Of Ground : 81.278 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 2.10 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN. = 15cm.					Ref. No	Depth (m)
0.00m							DS-1	0.50
Hard, reddish brown, silty clay with boulders & moorum. (CI)							*UDS-1	1.00-1.05
							SPT-1	1.05-1.15
							DS-2	2.00
							SPT-2	2.50-2.63
3.00m							DS-3	3.00
Medium dense to dense, brownish grey, silty sand. Obs. pocket of clayey silt at SPT-04. (SM)							SPT-3	3.50-3.95
							*UDS-2	4.20-4.65
							SPT-4	4.80-5.25
							DS-4	5.80
6.00m							SPT-5	6.20-6.41
Very dense, grey, silty fine grained sand. Obs. decomposed rock.							*SPT-6	6.50-6.54 6.50
							R1	CR=NIL RQD=NIL
6.50m							DS-5	7.25-7.28 7.25
Completely weathered, deep grey, fine grained, disintegrated & decomposed rock.							*SPT-7	7.25-7.28 7.25
							R2	CR=NIL RQD=NIL
							DS-6	8.00-8.02 8.00
							*SPT-8	8.00-8.02 8.00
							R3	CR=NIL RQD=NIL
							DS-7	8.75-8.78 8.75
							*SPT-9	8.75-8.78 8.75
							R4	CR=NIL RQD=NIL
							DS-8	9.50-9.53 9.50
							*SPT-10	9.50-9.53 9.50
							R5	CR=16% RQD=NIL
10.50m							*SPT-11	10.25-10.27 10.25

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Job No : 3975 Created by : Chandrani Created on : 11/10/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. MWBH-36** Co-ordinates E=(-)13800.149 N=16937.321

Field Test	Nos	Samples	Nos	Commencement Date : 06/09/17
Penetrometer (SPT)	17	Undisturbed (UDS)	2	Completion Date : 09/09/17
Cone (Pc)		Penetrometer (SPT)	17	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	12	Level Of Ground : 81.278 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 2.10 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
10.50m Completely weathered, deep grey, fine grained, disintegrated & decomposed rock.		50	Refusal					R6 DS-9 *SPT-12	CR=NIL RQD=NIL 11.00-11.0211.00
11.75m		50	Refusal					R7 DS-10 *SPT-13	CR=NIL RQD=NIL 11.75-11.7711.75
								R8	CR=20% RQD=NIL 12.50
		50	Refusal					R9 DS-11 *SPT-14	CR=NIL RQD=NIL 13.25-13.2713.25
		50	Refusal					R10	CR=13% RQD=NIL 14.00-14.0314.00
Completely to highly weathered, yellowish grey to brownish grey, medium grained, fractured hornblend gneiss.		50	Refusal					R11 *SPT-16	CR=NIL RQD=NIL 14.75-14.7714.75
		50	Refusal					R12	CR=12% RQD=NIL 15.50-15.5215.50
								R13	CR=22% RQD=NIL 16.25
								R14	CR=21% RQD=NIL 17.00
17.00m Highly weathered, whitish grey, fine grained, fractured hornblend gneiss.								R15	CR=23% RQD=NIL 17.75
								R16	CR=22% RQD=NIL 18.50
18.50m Highly weathered, whitish grey, fine grained, fractured hornblend gneiss.								R17	CR=31% RQD=20% 19.25
								R18	CR=32% RQD=19% 20.00
20.00m									

N.B. - '*' means sample could not be recovered.

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

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BORE LOG DATA SHEET **BORE HOLE NO. MWBH-49** Co-ordinates E=(-)13757.447 N=16949.047

Field Test	Nos	Samples	Nos	Commencement Date : 25/09/17
Penetrometer (SPT)	22	Undisturbed (UDS)	2	Completion Date : 01/10/17
Cone (Pc)		Penetrometer (SPT)	22	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	19	Level Of Ground : 74.312 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 4.10 m. above EGL.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN. = 15cm.					Ref. No	Depth (m)
0.00m							DS-1	0.50
Stiff, brownish grey to light grey, clayey silty sand / clayey silt with sand mixture. (CI)							*UDS-1	1.00-1.45
						12	SPT-1	1.50-1.95
		4	6	6				
2.50m							DS-2	2.50
Very dense, light grey, silty sand with decomposed rock. (SM)							*UDS-2	3.00-3.10
						>100	SPT-2	3.10-3.46
		28	44	28			DS-3	3.80
						6.0 cm Penth.	*SPT-3	3.90-3.93
						Refusal	*SPT-4	4.00-4.03
4.00m		100				3.0 cm Penth.	R1	CR=10% RQD=NIL
						Refusal	*SPT-5	4.75-4.78
						3.0 cm Penth.	R2	CR=NIL RQD=NIL
		50				Refusal	DS-4	
						3.0 cm Penth.	*SPT-6	5.50-5.52
		50				Refusal	R3	CR=NIL RQD=NIL
						2.0 cm Penth.	DS-5	
		50				Refusal	*SPT-7	6.25-6.27
						2.0 cm Penth.	R4	CR=NIL RQD=NIL
		50				Refusal	DS-6	
						3.0 cm Penth.	*SPT-8	7.00-7.03
		50				Refusal	R5	CR=NIL RQD=NIL
						2.0 cm Penth.	DS-7	
		50				Refusal	*SPT-9	7.75-7.77
						2.0 cm Penth.	R6	CR=NIL RQD=NIL
		50				Refusal	DS-8	
						3.0 cm Penth.	*SPT-10	8.50-8.53
		50				Refusal	R7	CR=NIL RQD=NIL
						2.0 cm Penth.	DS-9	
		50				Refusal	*SPT-11	9.25-9.27
						2.0 cm Penth.	R8	CR=14% RQD=NIL
		50				Refusal	*SPT-12	10.00-10.03
						3.0 cm Penth.	R9	CR=NIL RQD=NIL
		50				Refusal	DS-10	
						2.0 cm Penth.	*SPT-13	10.75-10.77
		50				Refusal	R10	CR=NIL RQD=NIL
						2.0 cm Penth.	DS-11	
		50				Refusal	*SPT-14	11.50-11.52
						2.0 cm Penth.	R11	CR=NIL RQD=NIL
		50				Refusal	DS-12	
						2.0 cm Penth.	*SPT-15	12.25-12.27
							R12	CR=NIL RQD=NIL
13.00m								

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BORE LOG DATA SHEET **BORE HOLE NO. MWBH-49** Co-ordinates E=(-)13757.447 N=16949.047

Field Test	Nos	Samples	Nos	Commencement Date : 25/09/17
Penetrometer (SPT)	22	Undisturbed (UDS)	2	Completion Date : 01/10/17
Cone (Pc)		Penetrometer (SPT)	22	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	19	Level Of Ground : 74.312 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 4.10 m above EGL

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN. = 15cm.				Ref. No	Depth (m)
Completely weathered, light grey, fine to medium grained, fully decomposed & disintegrated rock.	13.00m	50	Refusal			DS-13	13.00-13.03
		3.0	cm Penth.			*SPT-16	13.00-13.03
			Refusal			R13	CR=NIL RQD=NIL
		50	Refusal			DS-14	13.75-13.78
		3.0	cm Penth.			*SPT-17	13.75-13.78
			Refusal			R14	CR=NIL RQD=NIL
		50	Refusal			DS-15	14.50-14.52
		2.0	cm Penth.			*SPT-18	14.50-14.52
			Refusal			R15	CR=NIL RQD=NIL
		50	Refusal			DS-16	15.25-15.28
Highly weathered, light grey, medium grained, moderately fractured hornblend gneiss.	17.50m	50	Refusal			*SPT-19	15.25-15.28
		3.0	cm Penth.			R16	CR=NIL RQD=NIL
		50	Refusal			DS-17	16.00-16.03
		3.0	cm Penth.			*SPT-20	16.00-16.03
			Refusal			R17	CR=NIL RQD=NIL
		50	Refusal			DS-18	16.75-16.77
		2.0	cm Penth.			*SPT-21	16.75-16.77
			Refusal			R18	CR=NIL RQD=NIL
		50	Refusal			DS-19	17.50-17.53
		3.0	cm Penth.			*SPT-22	17.50-17.53
Highly weathered, light grey, medium grained, moderately fractured hornblend gneiss.	18.25m					R19	CR=24% RQD=NIL
						R20	CR=28% RQD=NIL
						R21	CR=30% RQD=NIL
						R22	CR=26% RQD=NIL
						R23	CR=24% RQD=NIL
						R24	CR=28% RQD=NIL
						R25	CR=33% RQD=NIL
						R26	CR=36% RQD=NIL
						R27	CR=34% RQD=NIL
						R28	CR=37% RQD=NIL
N.B. - '*' means sample could not be recovered.	25.00m						25.00

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 16/10/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. MWBH-50 Co-ordinates E=(-)13719.966 N=16995.310

Field Test	Nos	Samples	Nos	Commencement Date : 01/10/17
Penetrometer (SPT)	14	Undisturbed (UDS)	2	Completion Date : 03/10/17
Cone (Pc)		Penetrometer (SPT)	14	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	8	Level Of Ground : 75.012 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 3.40 m above EGL

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
Medium to stiff, brownish grey to deep grey, silty clay. Obs. sand mixture & kankars. (CI)								DS-1	0.50
								*UDS-1	1.00-1.45
		2	2	4		6		SPT-1	1.55-2.00
								DS-2	2.50
		2	3	5		8		SPT-2	3.00-3.45
								DS-3	3.80
								*UDS-2	4.00-4.45
		3	4	8		12		SPT-3	4.55-5.00
								DS-4	5.50
								SPT-4	6.00-6.36
5.50m									
Very dense, light grey, silty sand with decomposed rock. (SM)		18	30	52		>100		*SPT-5	6.50-6.54
		100	4.0	cm	Pentn.	Refusal		*SPT-6	6.60-6.63 6.60
6.60m		100	3.0	cm	Pentn.	Refusal		R1	CR=12% RQD=NIL
Completely weathered, light grey, fine to medium grained, fully decomposed & disintegrated rock.		50	3.0	cm	Pentn.	Refusal		*SPT-7	7.35-7.38 7.35
		50	3.0	cm	Pentn.	Refusal		R2	CR=NIL RQD=NIL
		50	3.0	cm	Pentn.	Refusal		DS-5	8.10-8.13 8.10
		50	2.0	cm	Pentn.	Refusal		*SPT-8	8.85-8.87 8.85
		50	3.0	cm	Pentn.	Refusal		R3	CR=NIL RQD=NIL
		50	2.0	cm	Pentn.	Refusal		DS-6	9.60-9.63 9.60
		50	3.0	cm	Pentn.	Refusal		*SPT-9	10.35-10.37 10.35
		50	2.0	cm	Pentn.	Refusal		R4	CR=NIL RQD=NIL
		50	2.0	cm	Pentn.	Refusal		DS-7	
		50	2.0	cm	Pentn.	Refusal		*SPT-10	
10.35m								R5	CR=NIL RQD=NIL
10.50m								DS-8	
								*SPT-11	

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). CETEST										
Job No : 3975			Created by : Chandrani			Created on : 16/10/2017			Sheet No:	
BORE LOG DATA SHEET				BORE HOLE NO. MWBH-50				Co-ordinates E=(-)13719.966 N=16995.310		
Field Test	Nos	Samples		Nos	Commencement Date : 01/10/17					
Penetrometer (SPT)	14	Undisturbed (UDS)		2	Completion Date : 03/10/17					
Cone (Pc)		Penetrometer (SPT)		14	Bore Hole Diameter : 150 mm. / N.X.					
Vane (V)		Disturbed (DS)		8	Level Of Ground : 75.012 M.					
		Water Sample (WS)		0	Water Struck At : Standing Water Level : 3.40 m above EGL					
DESCRIPTION				SYMBOL	N-VALUE				SAMPLES	
					EACH DIVN. = 15cm.				Ref. No	Depth (m)
10.50m Completely to highly weathered, light grey, medium grained, fractured hornblend gneiss.				 <						

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 16/10/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. MWBH-51** Co-ordinates E=(-)13546.798 N=17121.548

Field Test	Nos	Samples	Nos	Commencement Date : 04/10/17
Penetrometer (SPT)	13	Undisturbed (UDS)	2	Completion Date : 06/10/17
Cone (Pc)		Penetrometer (SPT)	13	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	8	Level Of Ground : 76.212 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 2.20 m above EGL.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m								DS-1	0.50
Stiff, reddish brown, silty clay. (CI)								*UDS-1	1.00-1.45
						10		SPT-1	1.55-2.00
		2	4	6				DS-2	2.50
						14		SPT-2	3.00-3.45
4.00m								*UDS-2	4.00-4.10
Very dense, light grey, silty sand with decomposed rock. (SM)						>100		SPT-3	4.15-4.51
		18	36	46				DS-3	4.80
5.10m								*SPT-4	5.00-5.04
								*SPT-5	5.10-5.14
								R1	CR=12% RQD=NIL
								*SPT-6	5.85-5.87
								R2	CR=NIL RQD=NIL
								DS-4	
								*SPT-7	6.60-6.63
								R3	CR=NIL RQD=NIL
								DS-5	
								*SPT-8	7.35-7.38
								R4	CR=NIL RQD=NIL
								DS-6	
								*SPT-9	8.10-8.12
								R5	CR=NIL RQD=NIL
Completely weathered, brownish grey to light grey, medium grained fractured hornblend gneiss.								DS-7	
								*SPT-10	8.85-8.88
								R6	CR=NIL RQD=NIL
								DS-8	
								*SPT-11	9.60-9.62
								R7	CR=12% RQD=NIL
11.10m								*SPT-12	10.35-10.37
								R8	CR=13% RQD=NIL
								*SPT-13	11.10-11.13
Highly weathered, light grey, medium grained, fractured hornblend gneiss.								R9	CR=21% RQD=NIL
								R10	CR=22% RQD=NIL
Highly to moderately weathered, light grey, medium grained, fractured hornblend gneiss.									11.85
									12.60
12.60m									
13.00m									

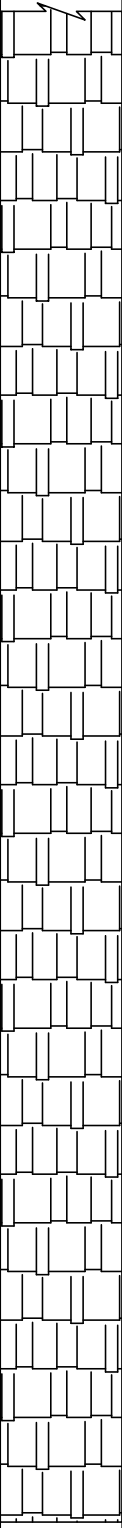
NXL drilling from 5.10m to 25.10m

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 16/10/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. MWBH-51** Co-ordinates E=(-)13546.798 N=17121.548

Field Test	Nos	Samples	Nos	Commencement Date : 04/10/17
Penetrometer (SPT)	13	Undisturbed (UDS)	2	Completion Date : 06/10/17
Cone (Pc)		Penetrometer (SPT)	13	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	8	Level Of Ground : 76.212 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 2.20 m above EGL.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
13.00m  Highly to moderately weathered, light grey, medium grained, fractured hornblend gneiss. 25.10m N.B. - '*' means sample could not be recovered.								R11	CR=28% RQD=16% 13.35
								R12	CR=30% RQD=NIL 14.10
								R13	CR=32% RQD=NIL 14.85
								R14	CR=30% RQD=NIL 15.60
								R15	CR=34% RQD=NIL 16.35
								R16	CR=28% RQD=NIL 17.10
								R17	CR=36% RQD=NIL 17.85
								R18	CR=32% RQD=NIL 18.60
								R19	CR=29% RQD=NIL 19.35
								R20	CR=39% RQD=NIL 20.10
								R21	CR=31% RQD=NIL 20.85
								R22	CR=39% RQD=18% 21.60
								R23	CR=36% RQD=16% 22.35
								R24	CR=42% RQD=NIL 23.10
								R25	CR=48% RQD=NIL 23.85
								R26	CR=39% RQD=NIL 24.60
								R27	CR=36% RQD=NIL 25.10

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 16/10/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. MWBH-52 Co-ordinates E=(-)13533.259 N=17153.087

Field Test	Nos	Samples	Nos	Commencement Date : 07/10/17
Penetrometer (SPT)	10	Undisturbed (UDS)	1	Completion Date : 09/10/17
Cone (Pc)		Penetrometer (SPT)	10	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	6	Level Of Ground : 76.412 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 2.00 m above EGL.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN. = 15cm.					Ref. No	Depth (m)
0.00m								
Hard, brownish grey, silty clay / clayey silt with rock pieces & sand mixture. (CI)							DS-1	0.50
							*UDS-1	1.00-1.15
		100				>100	SPT-1	1.20-1.32
			12.0	cm	Penth.			
							DS-2	2.50
							SPT-2	3.00-3.10
		100				>100		
			10.0	cm	Penth.			
							DS-3	4.00
							SPT-3	4.50-4.75
		42	58			>100		
			10.0	cm	Penth.			
4.80m							*SPT-4	4.90-4.94
		100				Refusal		
			4.0	cm	Penth.		*SPT-5	5.00-5.04
		100				Refusal		5.00
5.00m							R1	CR=10% RQD=NIL
							*SPT-6	5.75-5.77
		50				Refusal		5.75
			2.0	cm	Penth.		R2	CR=NIL RQD=NIL
							DS-4	
							*SPT-7	6.50-6.53
		50				Refusal		6.50
			3.0	cm	Penth.		R3	CR=NIL RQD=NIL
							*SPT-8	7.25-7.27
		50				Refusal		7.25
			2.0	cm	Penth.		DS-5	
							*SPT-9	8.00-8.03
							R4	CR=NIL RQD=NIL
		50				Refusal		8.00
			3.0	cm	Penth.		R5	CR=16% RQD=NIL
							*SPT-10	8.75-8.77
8.75m		50				Refusal		8.75
			2.0	cm	Penth.		R6	CR=25% RQD=NIL
								9.50
							R7	CR=23% RQD=15%
								10.25
								10.50m
Highly weathered, light grey, medium grained, fractured hornblend gneiss.								
Highly weathered, light grey, medium grained, fractured hornblend gneiss.								

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW).

Job No : 3975

Created by : Chandrani

Created on : 16/10/2017

Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO. MWBH-52

Co-ordinates

E=(-)13533.259

N=17153.087

Field Test	Nos	Samples	Nos	Commencement Date : 07/10/17
Penetrometer (SPT)	10	Undisturbed (UDS)	1	Completion Date : 09/10/17
Cone (Pc)		Penetrometer (SPT)	10	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	6	Level Of Ground : 76.412 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 2.00 m above EGL.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
10.50m Highly weathered, light grey, medium grained, fractured hornblend gneiss. 20.00m N.B. - '*' means sample could not be recovered.								R8	CR=34% RQD=22%
									11.00
								R9	CR=36% RQD=NIL
									11.75
								R10	CR=28% RQD=NIL
									12.50
								R11	CR=42% RQD=19%
									13.25
								R12	CR=38% RQD=17%
									14.00
								R13	CR=32% RQD=13%
									14.75
								R14	CR=40% RQD=NIL
									15.50
								R15	CR=39% RQD=NIL
									16.25
								R16	CR=42% RQD=NIL
									17.00
								R17	CR=45% RQD=NIL
									17.75
						R18	CR=42% RQD=NIL		
							18.50		
						R19	CR=37% RQD=NIL		
							19.25		
						R20	CR=48% RQD=NIL		
							20.00		

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BORE LOG DATA SHEET

Co-ordinates	E=689 N=4561
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Field Test	Nos	Samples	Nos	Commencement Date :	06/08/17
Penetrometer (SPT)	6	Undisturbed (UDS)	2	Completion Date :	06/08/17
Cone (Pc)		Penetrometer (SPT)	6	Bore Hole Diameter :	150 mm. / N.X.
		Disturbed (DS)	3	Level Of Ground :	71.662 m.
Vane (V)		Water Sample (WS)	0	Water Struck At :	
				Standing Water Level :	1.40 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
Filled up soil consists of deep grey to brownish grey, silty sand with boulders & ash.								DS-1	0.50
								*UDS-1	0.70-1.15
1.20m									
Stiff, grey, silty clay. Obs. calcareous nodules & kankars. (CI)		4	5	5		10		SPT-1	1.30-1.75
								DS-2	2.50
3.00m									
		5	6	12		18		UDS-2	3.00-3.45
								SPT-2	3.45-3.90
Very stiff, grey, silty clay. Obs. calcareous nodules & kankars. (CI)								DS-3	4.50
		6	8	12		20		SPT-3	5.00-5.45
5.50m									
Very dense, brownish grey, silty sand. Obs. decomposed rock. (SM)		46	54			>100		SPT-4	5.90-6.15
		100	10.0	cm	Pentn.	Refusal		*SPT-5	6.30-6.34
6.50m		100	4.0	cm	Pentn.	Refusal		*SPT-6	6.50-6.54
Highly weathered, brownish grey, medium grained, fractured sandstone.			4.0	cm	Pentn.			R1	CR=36% RQD=25%
7.25m		NX rotary drilling from 6.50m to 8.00m							7.25
Moderately weathered, brownish grey, medium grained, fractured sandstone.									
8.00m									8.00
N.B. - '*' means sample could not be recovered.									

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 18/08/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. ABH-2** Co-ordinates E=636 N=4148

Field Test	Nos	Samples	Nos	Commencement Date : 03/08/17
Penetrometer (SPT)	4	Undisturbed (UDS)	0	Completion Date : 05/08/17
Cone (Pc)		Penetrometer (SPT)	4	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	2	Level Of Ground : 75.856 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.50 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m Filled up soil consists of deep grey to brownish grey, moorum with boulders.								DS-1	0.50
0.80m Very dense, brownish grey, silty sand with decomposed rock. (SM)		59	41	≥ 100				SPT-1	1.00-1.22
		100	4.0	Refusal				*SPT-2	1.50-1.54
1.70m		100	4.0	Refusal				*SPT-3	1.70-1.74 1.70
Completely weathered, brownish grey, decomposed & disintegrated sandstone.			4.0	Refusal				R1	CR=NIL RQD=NIL
2.50m		100	3.0	Refusal				DS-2 *SPT-4	2.50-2.53 2.50
				NX rotary drilling from 1.70m to 8.00m				R2	CR=51% RQD=NIL
								R3	CR=66% RQD=NIL
								R4	CR=69% RQD=NIL
								R5	CR=68% RQD=NIL
5.50m								R6	CR=72% RQD=NIL
								R7	CR=76% RQD=NIL
								R8	CR=87% RQD=40%
8.00m Slightly weathered / fresh, grey, fine grained, fractured sandstone.									
N.B. - '*' means sample could not be recovered.									

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 18/08/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. ABH-3 Co-ordinates E=146 N=4057

Field Test	Nos	Samples	Nos	Commencement Date : 13/08/17
Penetrometer (SPT)	3	Undisturbed (UDS)	1	Completion Date : 14/08/17
Cone (Pc)		Penetrometer (SPT)	3	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	2	Level Of Ground : 79.568 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.20 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
Medium dense, reddish brown, silty sand. (SM)								DS-1	0.50
								*UDS-1	1.00-1.45
								SPT-1	1.60-2.05
								DS-2	2.20
								SPT-2	2.50-2.62
Very dense, yellowish brown, silty sand with decomposed rock. (SM)								*SPT-3	2.80-2.82 2.80
								R1	CR=27% RQD=NIL
									3.50
								R2	CR=43% RQD=33%
									4.25
Highly to moderately weathered, yellowish brown to light grey, medium grained, fractured sandstone.								R3	CR=41% RQD=24%
									5.00
								R4	CR=46% RQD=238%
									5.75
								R5	CR=48% RQD=16%
									6.50
								R6	CR=52% RQD=29%
									7.25
								R7	CR=65% RQD=52%
									8.00
8.00m									
N.B. - '*' means sample could not be recovered.									

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 18/08/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. ABH-4 Co-ordinates E=<->292 N=4069

Field Test	Nos	Samples	Nos	Commencement Date : 09/08/17
Penetrometer (SPT)	4	Undisturbed (UDS)	1	Completion Date : 10/08/17
Cone (Pc)		Penetrometer (SPT)	4	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	2	Level Of Ground : 72.325 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.80 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
Stiff, brownish grey, silty clay. Obs. kankars. (CI)								DS-1	0.50
								UDS-1	1.00-1.45
						14		SPT-1	1.45-1.90
		6	6	8					
Very dense, brownish yellow, silty sand with decomposed rock. (SM)								DS-2	2.50
						15		SPT-2	3.00-3.45
		6	7	8					
Moderately weathered, brownish yellow, medium grained, fractured sandstone.									
Highly weathered, light grey, medium grained, fractured sandstone.									
N.B. - '*' means sample could not be recovered.									

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 18/08/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. ABH-5 Co-ordinates E=(<-)811 N=4081

Field Test	Nos	Samples	Nos	Commencement Date : 11/08/17
Penetrometer (SPT)	3	Undisturbed (UDS)	1	Completion Date : 12/08/17
Cone (Pc)		Penetrometer (SPT)	3	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	2	Level Of Ground : 79.600 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.60 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
Medium dense, clayey silty sand. (SM)								DS-1	0.50
								*UDS-1	1.00-1.45
		4	5	7		12		SPT-1	1.55-2.00
								DS-2	2.50
2.60m									
Hard, brownish grey, clayey silt with decomposed rock. (CI)								SPT-2	3.00-3.10
		100						*SPT-3	3.20-3.23 3.20
3.20m		100						R1	CR=27% RQD=NIL
									4.00
								R2	CR=32% RQD=NIL
									4.75
								R3	CR=35% RQD=NIL
									5.50
Highly to moderately weathered, brownish grey to light grey, fine grained, fractured sandstone.								R4	CR=41% RQD=NIL
									6.25
								R5	CR=43% RQD=23%
									7.00
								R6	CR=45% RQD=NIL
									7.50
								R7	CR=48% RQD=44%
									8.00
8.00m									

N.B. - '*' means sample could not be recovered.

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 02/08/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. ABH-6** Co-ordinates E=(-)1263 N=4168

Field Test	Nos	Samples	Nos	Commencement Date : 24/07/17
Penetrometer (SPT)	6	Undisturbed (UDS)	2	Completion Date : 25/07/17
Cone (Pc)		Penetrometer (SPT)	6	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	3	Level Of Ground : 81.042 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.05 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
Medium, grey, silty clay. Obs. calcareous nodules & kankars. (CI)								DS-1	0.50
								UDS-1	1.00-1.45
		3	3	4				SPT-1	1.45-1.90
2.90m								DS-2	2.50
		5	9	16				SPT-2	3.00-3.45
Very stiff to hard, brownish grey, clayey silt. Obs. kankars. (CI)								*UDS-2	4.00-4.10
								SPT-3	4.10-4.55
		8	16	19					
5.20m								DS-3	5.00
								SPT-4	5.20-5.33
		102							
Hard, grey, clayey silt. Obs. decomposed wood. (CI)								*SPT-5	5.50-5.54
								*SPT-6	5.70-5.74
		100							
5.70m								R1	CR=42% RQD=NIL
		102							
Moderately weathered, grey, highly fractured sandstone.								R2	CR=49% RQD=NIL
7.00m								R3	CR=58% RQD=NIL
Moderately to slightly weathered, grey, highly fractured sandstone.								R4	CR=66% RQD=NIL
8.00m									
N.B. - '*' means sample could not be recovered.									

NX rotary drilling from 5.70m to 8.00m

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 18/08/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. ABH-7** Co-ordinates E=(-)1751 N=4239

Field Test	Nos	Samples	Nos	Commencement Date : 08/08/17
Penetrometer (SPT)	9	Undisturbed (UDS)	2	Completion Date : 09/08/17
Cone (Pc)		Penetrometer (SPT)	9	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	2	Level Of Ground : 81.200 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.80 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m Blackish grey, silty clay with coal dust.								DS-1	0.50
0.60m Very dense, whitish brown, clayey silty sand. Obs. moorum, boulders. (SM)		14	28	24	52			UDS-1	1.00-1.45
								SPT-1	1.45-1.90
2.30m Hard, brownish grey, silty clay. Obs. moorum. (CI)		12	12	14	26			DS-2	2.50
								SPT-2	3.00-3.45
3.70m Hard, brownish grey, clayey silt. Obs. decomposed rock. (CI)		12	30	39	69			*UDS-2	4.00-4.08
								SPT-3	4.20-4.65
								SPT-4	4.75-4.88
5.00m		100	13.0	cm	Penth.			*SPT-5	5.00-5.03 5.00
			3.0	cm	Penth.			R1	CR=NIL RQD=NIL
								*SPT-6	5.75-5.79 5.75
			4.0	cm	Penth.			R2	CR=NIL RQD=NIL
								*SPT-7	6.50-6.53 6.50
			3.0	cm	Penth.			R2	CR=NIL RQD=NIL
								*SPT-8	7.25-7.27 7.25
			2.0	cm	Penth.			R2	CR=NIL RQD=NIL
								*SPT-9	8.00-8.02 8.00
8.00m Completely weathered, brownish grey, fully decomposed sandstone, collected as sludge.		100	2.0	cm	Penth.				
N.B. - '*' means sample could not be recovered.									

NX rotary drilling from 5.00m to 8.00m

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 18/08/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. ABH-8**

Co-ordinates E=(-)2275
N=4316

Field Test	Nos	Samples	Nos	Commencement Date : 07/08/17
Penetrometer (SPT)	7	Undisturbed (UDS)	2	Completion Date : 07/08/17
Cone (Pc)		Penetrometer (SPT)	7	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	5	Level Of Ground : 87.150 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 3.40 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m Deep grey, clayey silty sand. (SM)								DS-1	0.50
1.40m Very dense, whitish brown, clayey silty sand with boulders. (SM)		17	39	44	≥ 100			UDS-1	1.00-1.45
		10.0	cm	Penth.				SPT-1	1.45-1.85
2.70m Stiff, yellowish brown, silty clay with sand mixture. Obs. steel grey spots. (CI)		4	7	7	14			DS-2	2.50
								SPT-2	3.00-3.45
4.50m Very stiff, yellowish brown, silty clay with sand mixture. Obs. steel grey spots. (CI)		6	12	18	30			UDS-2	4.00-4.45
								SPT-3	4.45-4.90
5.80m Hard, reddish brown, clayey silt with decomposed rock. (CI)		42	58		≥ 100			DS-3	5.50
		10.0	cm	Penth.				SPT-4	6.00-6.25
6.50m Completely weathered, reddish brown, fully decomposed sand stone collected as sludge.		100			Refusal			*SPT-5	6.50-6.53 6.50
			3.0	cm	Penth.			R1	CR=NIL RQD=NIL
								DS-4	
		100			Refusal			*SPT-6	7.25-7.28 7.25
			3.0	cm	Penth.			R2	CR=NIL RQD=NIL
8.02m N.B. - '*' means sample could not be recovered.		100			Refusal			DS-5	
			2.0	cm	Penth.			*SPT-7	8.00-8.02 8.00
					NX rotary drilling from 6.50m to 8.00m				

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW).

Job No : 3975

Created by : Chandrani

Created on : 18/08/2017

Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO. ABH- 9

Co-ordinates

E=(-)2549
N=4359

Field Test	Nos	Samples	Nos	Commencement Date : 05/08/17
Penetrometer (SPT)	6	Undisturbed (UDS)	2	Completion Date : 06/08/17
Cone (Pc)		Penetrometer (SPT)	6	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	4	Level Of Ground : 98.400 m.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 2.90 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES		
		EACH DIVN. = 15cm.						Ref. No	Depth (m)	
0.00m Filled up soil consists of blackish grey, coal dust.										
0.55m Very dense, whitish brown, silty sand with small pieces of boulders, moourm & calcareous nodules. (SM)									DS-1	0.50
2.10m		19	31	50	≥ 100				UDS-1	1.00-1.45
		10.0 cm Pentn.				SPT-1	1.45-1.85			
4.90m		5	7	10	17				DS-2	2.50
						SPT-2	3.00-3.45			
8.33m		7	9	12	21				UDS-2	4.00-4.45
						SPT-3	4.45-4.90			
		13	30	48	78				DS-3	5.50
						SPT-4	6.00-6.45			
		20	37	43	≥ 100				UDS-2	4.00-4.45
		13.0 cm Pentn.				SPT-5	7.50-7.93			
		32	56	12	≥ 100				DS-4	7.00
		3.0 cm Pentn.				SPT-6	8.00-8.33			

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Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW).

Job No : 3975

Created by : Chandrani

Created on : 18/08/2017

Sheet No:

CETEST

BORE LOG DATA SHEET

BORE HOLE NO. ABH-11

Co-ordinates E=(-)3567
E=4510

Field Test	Nos	Samples	Nos	Commencement Date : 04/08/17
Penetrometer (SPT)	6	Undisturbed (UDS)	2	Completion Date : 05/08/17
Cone (Pc)		Penetrometer (SPT)	6	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	4	Level Of Ground : 104.200 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.90 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m Blackish grey, silty clay with sand mixture. (CI)								DS-1	0.50
0.70m								UDS-1	1.00-1.45
Stiff, brownish grey, clayey sandy silt with moorum. (CI)		6	7	8		15		SPT-1	1.45-1.90
2.70m								DS-2	2.50
Very stiff, reddish brown, silty clay with sand mixture. Obs. steel grey patches. (CI)		8	11	14		25		SPT-2	3.00-3.45
								UDS-2	4.00-4.45
		11	13	15		28		SPT-3	4.45-4.90
5.60m								DS-3	5.50
Very dense, brownish grey, clayey silty sand. Obs. steel grey patches. (SM)		30	45	25		>100		SPT-4	6.00-6.35
				5.0	cm	Penth.		DS-4	7.00
		40	60			>100		SPT-5	7.50-7.75
8.13m		100				>100		SPT-6	8.00-8.13
				13.0	cm	Penth.			

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Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 18/08/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. ABH-12 Co-ordinates E=(-)3845 N=4554

Field Test	Nos	Samples	Nos	Commencement Date : 03/08/17
Penetrometer (SPT)	6	Undisturbed (UDS)	1	Completion Date : 03/08/17
Cone (Pc)		Penetrometer (SPT)	6	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	5	Level Of Ground : 115.120 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.80 m.

DESCRIPTION	SYMBOL	N-VALUE							SAMPLES	
		EACH DIVN. = 15cm.							Ref. No	Depth (m)
0.00m Filled up soil consists of blackish grey, coal dust.									DS-1	0.50
0.60m									UDS-1	1.00-1.45
		14	18	21		39			SPT-1	1.45-1.90
Hard, reddish brown to brownish grey, silty clay / clayey silt with moorum. Obs. sand mixture. (CI)									DS-2	2.50
		28	39	47		86			SPT-2	3.00-3.45
4.30m									DS-3	4.00
		11	15	17		32			SPT-3	4.50-4.95
Hard, brownish grey, silty clay with sand mixture. Obs. steel grey patches. (CI)									DS-4	5.50
		13	16	20		36			SPT-4	6.00-6.45
6.50m									DS-5	6.80
		17	25	37		62			SPT-5	7.00-7.45
Very dense, brownish grey, silty sand. Obs. traces of clay binders. (SM)										
		21	30	43		73			SPT-6	8.00-8.45
8.45m										

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). CETEST

Job No : 3975Created by : ChandraniCreated on : 02/08/2017Sheet No:

BORE LOG DATA SHEETBORE HOLE NO. ABH-14Co-ordinatesE=(-)4582N=4677

Field Test

Nos

Samples

Nos

Penetrometer (SPT)

6

Undisturbed (UDS)

2

Cone (Pc)

Penetrometer (SPT)

6

Vane (V)

Disturbed (DS)

4

Water Sample (WS)

0

Commencement Date : 27/07/17

Completion Date : 27/07/17

Bore Hole Diameter : 150 mm.

Level Of Ground : 110.742 m.

Water Struck At :

Standing Water Level : 1.45 m.

DESCRIPTION

SYMBOL

N-VALUE

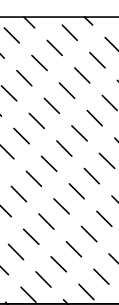
EACH DIVN. = 15cm.

SAMPLES

Ref. No

Depth (m)

0.00m



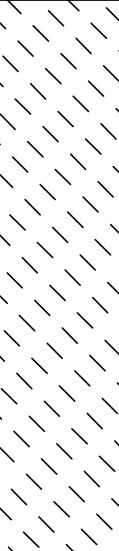
111315

28

DS-1

0.50

1.50m



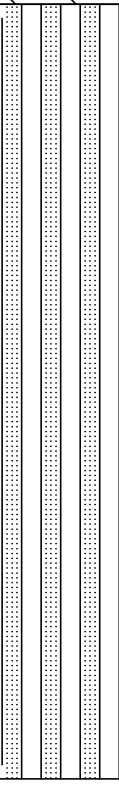
141310

23

*UDS-1

1.00-1.45

4.40m



173240

72

SPT-1

1.55-2.00

8.45m



193538

73

DS-2

2.50

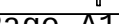


214042

82

SPT-2

3.00-3.45

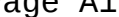


254347

90

UDS-2

4.00-4.45



SPT-3

4.45-4.90

DS-3

5.50

SPT-4

6.00-6.45

DS-4

7.00

SPT-5

7.20-7.65

SPT-6

8.00-8.45

Reddish brown, silty clay. Obs. moorum & boulders. (CI)

Very stiff, reddish brown, silty clay. Obs. moorum, sand mixture & stone pieces. (CI)

Very dense, whitish brown, sandy silt / silty sand. Obs. calcareous nodules. (SM)

N.B. - '*' means sample could not be recovered.

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Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 18/08/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. ABH-15** Co-ordinates E=(-)4804 N=4900

Field Test	Nos	Samples	Nos	Commencement Date : 30/07/17
Penetrometer (SPT)	8	Undisturbed (UDS)	1	Completion Date : 31/07/17
Cone (Pc)		Penetrometer (SPT)	8	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	6	Level Of Ground : 110.200 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.70 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
Blackish grey to brownish grey, silty clay. Obs. moorum, small of boulders & sand mixture. (CI)								DS-1	0.50
								UDS-1	1.00-1.45
1.50m		13	15	17		32		SPT-1	1.45-1.90
Dense, greyish brown, silty sand with gravels, kankars & moorum. (SM)								DS-2	2.50
		14	18	20		38		SPT-2	3.00-3.45
3.80m								DS-3	4.00
Very dense, yellowish brown, silty sand with decomposed rock. (SM)		26	33	45		78		SPT-3	4.50-4.95
		59	41			≥100		DS-4	5.10
		100				≥100		SPT-4	5.30-5.55
5.80m		100				Refusal		*SPT-5	5.65-5.68
		100				Refusal		*SPT-6	5.80-5.82 5.80
Completely weathered, yellowish brown, medium grained, completely decomposed & disintegrated sandstone collected as sludge.								R1	CR=NIL RQD=NIL
		100				Refusal		DS-5	
		100				Refusal		*SPT-7	6.50-6.52 6.50
		100				Refusal		R2	CR=NIL RQD=NIL
		100				Refusal		DS-6	
		100				Refusal		*SPT-8	7.25-7.28 7.25
		100				Refusal		R3	CR=20% RQD=NIL
8.00m									
N.B. - '*' means sample could not be recovered.									

NX rotary drilling from 5.80m to 8.00m

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 18/08/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. ABH-16 Co-ordinates E=(-)5170 N=4999

Field Test	Nos	Samples	Nos	Commencement Date : 29/07/17
Penetrometer (SPT)	9	Undisturbed (UDS)	2	Completion Date : 30/07/17
Cone (Pc)		Penetrometer (SPT)	9	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	7	Level Of Ground : 108.220 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 2.20 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
Filled up soil consists of blackish grey to brownish grey, clayey silt. Obs. coal dust & small pieces of boulders.								DS-1	0.50
								*UDS-1	1.00-1.10
								SPT-1	1.15-1.60
								DS-2	2.00
								SPT-2	2.50-2.95
								DS-3	3.50
								*UDS-2	4.00-4.07
Very dense, yellowish brown, silty sand with decomposed rock. (SM)									
								SPT-3	4.20-4.65
								DS-4	5.10
								SPT-4	5.50-5.70
								*SPT-5	5.80-5.83
								*SPT-6	6.00-6.02 6.00
								R1	CR=NIL RQD=NIL
Completely weathered, yellowish brown, medium grained, completely decomposed sandstone collected as sludge.								DS-5	
								*SPT-7	6.75-6.78 6.75
								R2	CR=NIL RQD=NIL
								DS-6	
								*SPT-8	7.50-7.52 7.50
								R3	CR=NIL RQD=NIL
								DS-7	
								*SPT-9	8.00-8.02 8.00
8.02m									
N.B. - '*' means sample could not be recovered.									

NX rotary drilling from 6.00m to 8.02m

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW).

Job No : 3975

Created by : Chandrani

Created on : 02/08/2017

Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO. ABH-17

Co-ordinates

E=(-)5653
N=5130

Field Test	Nos	Samples	Nos	Commencement Date : 28/07/17
Penetrometer (SPT)	6	Undisturbed (UDS)	1	Completion Date : 28/07/17
Cone (Pc)		Penetrometer (SPT)	6	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	5	Level Of Ground : 112.25 m.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.90 m.

DESCRIPTION	SYMBOL	N-VALUE							SAMPLES	
		EACH DIVN. = 15cm.							Ref. No	Depth (m)
0.00m										
Reddish brown, clayey sandy silt with moourm & small size stone pieces. (SM)									DS-1	0.50
1.10m									*UDS-1	1.00-1.04
		13	22	25			47		SPT-1	1.15-1.60
									DS-2	2.50
		15	24	28			52		SPT-2	3.00-3.45
									DS-3	4.00
Dense to very dense, reddish brown, clayey silty sand / sandy silt. Obs. moourm & boulders. (SM)		18	26	30			56		SPT-3	4.50-4.95
									DS-4	5.50
		20	29	33			62		SPT-4	6.00-6.45
									DS-5	7.00
		17	35	39			74		SPT-5	7.30-7.75
N.B. - '*' means sample could not be recovered.		21	39	48			87		SPT-6	8.00-8.45
8.45m										

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Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 11/09/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. ABH-18 Co-ordinates E=(-)6310 N=5370

Field Test	Nos	Samples	Nos	Commencement Date : 27/08/17
Penetrometer (SPT)	4	Undisturbed (UDS)	1	Completion Date : 28/08/17
Cone (Pc)		Penetrometer (SPT)	4	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	3	Level Of Ground : 102.50 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.60 m.

DESCRIPTION	SYMBOL	N-VALUE							SAMPLES	
		EACH DIVN. = 15cm.							Ref. No	Depth (m)
0.00m										
Filled up soil consists of blackish grey, coal dust.									DS-1	0.50
0.70m									*UDS-1	1.00-1.45
		13	29	58	>100				SPT-1	1.60-2.02
					12.0 cm Pentn.					
									DS-2	2.50
Filled up soil consists of blackish grey, clayey silt with coal & boulder pieces.										
		21	37	42	>100				SPT-2	3.00-3.35
					5.0 cm Pentn.					
									DS-3	4.00
		34	66		>100				SPT-3	4.50-4.75
					10.0 cm Pentn.					
5.11m		100			>100				SPT-4	5.00-5.11
					11.0 cm Pentn.					
N.B. - '*' means sample could not be recovered.										

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW).

Job No : 3975

Created by : Chandrani

Created on : 11/09/2017

Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO. ABH-20

Co-ordinates E=(-)6290
N=6050

Field Test

Nos

Samples

Nos

Commencement Date : 26/08/17

Completion Date : 26/08/17

Bore Hole Diameter : 150 mm.

Level Of Ground : 120.35 m.

Water Struck At :

Standing Water Level : 3.10 m.

Penetrometer (SPT)

4

Undisturbed (UDS)

1

Cone (Pc)

Penetrometer (SPT)

4

Disturbed (DS)

3

Vane (V)

Water Sample (WS)

0

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m Hard, yellowish grey, silty clay with sand & boulders. (CI) 5.33m N.B. - '*' means sample could not be recovered.								DS-1	0.50
		26	74					*UDS-1	1.00-1.10
								SPT-1	1.10-1.33
		16	41	43				SPT-2	2.50-2.86
								DS-3	3.50
		43	57					SPT-3	4.00-4.26
		33	51	16				SPT-4	5.00-5.33

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BH-20/Sheet-1

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW).

Job No : 3975

Created by : Chandrani

Created on : 11/09/2017

Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO. ABH-21

Co-ordinates E=(-)7010
N=5640

Field Test	Nos	Samples	Nos	Commencement Date : 26/08/17
Penetrometer (SPT)	4	Undisturbed (UDS)	2	Completion Date : 26/08/17
Cone (Pc)		Penetrometer (SPT)	4	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	2	Level Of Ground : 121.50 m.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 4.20 m.

DESCRIPTION	SYMBOL	N-VALUE							SAMPLES	
		EACH DIVN. = 15cm.							Ref. No	Depth (m)
0.00m Hard, brownish grey, silty clay with moorum. (CI) 2.70m									DS-1	0.50
									*UDS-1	1.00-1.10
		3367							SPT-1	1.50-1.79
		14.0 cm Pentn.								
Very stiff, brownish grey, silty clay. Obs. steel grey patches & traces of moorum. (CI) 4.50m		8	10	13					SPT-2	3.00-3.45
									UDS-2	4.00-4.45
		1215							SPT-3	4.45-4.90
		1418							SPT-4	5.00-5.45
Hard, whitish brown, silty clay. (CI) 5.45m N.B. - '*' means sample could not be recovered.										

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BH-21/Sheet-1

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW).

Job No : 3975

Created by : Chandrani

Created on : 11/09/2017

Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO. ABH-23

Co-ordinates

E=(-)7440
N=6210

Field Test	Nos	Samples	Nos	Commencement Date : 29/08/17
Penetrometer (SPT)	4	Undisturbed (UDS)	2	Completion Date : 30/08/17
Cone (Pc)		Penetrometer (SPT)	4	Bore Hole Diameter : 150 mm.
Vane (V)		Disturbed (DS)	3	Level Of Ground : 106.29 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 3.60 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES		
		EACH DIVN. = 15cm.						Ref. No	Depth (m)	
0.00m Hard, yellowish grey, silty clay with sand mixture & bolders. (CI) 5.35m									DS-1	0.50
		32	68						*UDS-1	1.00-1.08
									SPT-1	1.08-1.35
									DS-2	2.00
									SPT-2	2.50-2.84
									DS-3	3.50
							*UDS-2	4.00-4.10		
							SPT-3	4.10-4.31		
							SPT-4	5.00-5.35		

N.B. - '*' means sample could not be recovered.

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BH-23/Sheet-1

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 11/09/2017 Sheet No:

BORE LOG DATA SHEET **BORE HOLE NO. ABH-24** Co-ordinates E=(-)7010 N=5390

Field Test	Nos	Samples	Nos	Commencement Date : 28/08/17
Penetrometer (SPT)	5	Undisturbed (UDS)	1	Completion Date : 29/08/17
Cone (Pc)		Penetrometer (SPT)	5	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	3	Level Of Ground : 98.50 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.10 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m Filled up soil consists of blackish grey, coal dust.									
0.60m								DS-1	0.50
								*UDS-1	1.00-1.45
		17	38	55	≥ 100			SPT-1	1.55-1.90
				5.0	cm Pentn.			DS-2	2.50
Filled up soil consists of blackish grey, clayey silt with boulders. Obs. coal dust.									
		42	58		≥ 100			SPT-2	3.00-3.27
				12.0	cm Pentn.			DS-3	4.00
		63	37		≥ 100			SPT-3	4.50-4.72
				7.0	cm Pentn.				
5.20m Very dense, silty sand with decomposed rock. (SM)									
		100			≥ 100			SPT-4	5.50-5.64
6.50m Highly weathered, whitish grey, medium grained, fractured sandstone.		100			Refusal			*SPT-5	6.50-6.52 6.50
								R1	CR=27% RQD=NIL
7.25m									
								R2	CR=22% RQD=NIL
								R3	CR=21% RQD=NIL
								R4	CR=23% RQD=NIL
								R5	CR=34% RQD=20%
9.50m Highly weathered, whitish grey, medium grained, fractured sandstone.									
10.00m									
N.B. - '*' means sample could not be recovered.									

NX rotary drilling from 6.50m to 10.00m

7.25
8.00
8.75
9.50
10.00

Project : Preliminary G. I. Work for Talcher Thermal Power Project-III (2x660 MW). **CETEST**

Job No : 3975 Created by : Chandrani Created on : 11/09/2017 Sheet No:

BORE LOG DATA SHEET BORE HOLE NO. ABH-25 Co-ordinates E=(-)7080 N=5490

Field Test	Nos	Samples	Nos	Commencement Date : 29/08/17
Penetrometer (SPT)	6	Undisturbed (UDS)	1	Completion Date : 30/08/17
Cone (Pc)		Penetrometer (SPT)	6	Bore Hole Diameter : 150 mm. / N.X.
Vane (V)		Disturbed (DS)	4	Level Of Ground : 95.40 m.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 3.30 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN. = 15cm.						Ref. No	Depth (m)
0.00m									
Hard, brownish grey, silty clay with moorum. (CI)								DS-1	0.50
								*UDS-1	1.00-1.10
								SPT-1	1.50-1.95
2.30m									
Hard, whitish grey, clayey silt / silty clay. (CI)								DS-2	2.50
								SPT-2	3.00-3.45
								DS-3	4.00
								SPT-3	4.50-4.92
5.20m									
Very dense, whitish grey, sandy silt / silty sand. Obs. clay binders. (SM)								DS-4	5.50
								SPT-4	6.00-6.35
6.50m									
Very dense, yellowish brown, silty sand with decomposed rock. (SM)								SPT-5	7.00-7.13
7.30m								*SPT-6	7.30-7.32 7.30
								R1	CR=24% RQD=NIL
									8.00
								R2	CR=29% RQD=15%
									8.75
								R3	CR=26% RQD=17%
									9.50
								R4	CR=40% RQD=20%
									10.00
10.00m									
N.B. - '*' means sample could not be recovered.									

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits		IS SL % Classi ficati	Grain Size				Test Method
									Pc/Pn	Shear	Cohesn	Frictn	LL	PL		Gravl	Sand	Silt	Clay	
									kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%		%	%	%	%	
MWBH01	UDS01	1.00	Brownish grey, silty clay with traces of kankars.	1.86	1.60		15 S 16 T 14 C	0.548	TRSH-UU	0.77	0		33	16	CL		29	50	21	**See the Notes below
									3.0	0.796										
									2.0	0.766										
									1.0	0.745										
									UNCONFD	0.66	0									
									0.0	0.673										
									0.0	0.658										
									0.0	0.640										
									REMOULD	0.48	0									
									0.0	0.499										
									0.0	0.502										
									0.0	0.431										
MWBH01	UDS02	4.00	Brownish grey, silty clay with traces of kankars.	1.93	1.65	2.61	17 S 17 T 15 C	0.471	TRSH-UU	0.93	5				12 CI*		41	45	14	Do
									3.0	1.294										
									2.0	1.176										
									1.0	1.148										
									UNCONFD	0.88	0									
									0.0	0.921										
									0.0	0.853										
									0.0	0.867										
									REMOULD	0.62	0									
									0.0	0.606										
									0.0	0.634										
									0.0	0.618										
MWBH02	SPT01	1.55	Deep grey, silty clay / clayey silt with kankars.												CI*		39	44	17	Do
MWBH02	SPT03	5.00	Deep grey, clayey silt.										37	17	CI					Do
MWBH03	SPT02	2.80	Light grey, clayey silt with traces of sand mixture.										34	14	CL					Do
MWBH03	SPT03	4.20	Light grey, clayey silt with traces of sand mixture.												CI*		19	58	23	Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void Ratio	Strength Test Results				Atter. Limits		IS		Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.		Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL	Classi	Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%	ficati	%	%	%	%	
MWBH04	SPT02	3.00	Brownish grey, clayey silt with sand mixture and kankars.												CI*		59	23	18	Do	
MWBH04	SPT03	5.10	Yellowish grey, silty clay / clayey silt with sand mixture & decomposed rock.									35	12		CI					Do	
MWBH05	UDS02	4.60	Brownish grey, silty clay / clayey silt with traces of kankars.	1.92	1.66	2.61	17 S 16 T 17 C	0.497	TRSH-UU	1.09	0	36	14	11	CI		32	44	24	Do	
									3.0	1.116											
									2.0	1.093											
									1.0	1.055											
									UNCONFD	0.88	0										
									0.0	0.907											
									0.0	0.861											
									0.0	0.864											
									REMOULD	0.61	0										
									0.0	0.596											
									0.0	0.638											
									0.0	0.601											
MWBH06	SPT02	3.00	Brownish grey, clayey silt with sand mixture / clayey silty sand and mica.									31	14		CL					Do	
MWBH06	SPT03	4.20	Brownish grey, clayey silt with sand mixture / clayey silty sand and mica.												SM		60	27	13	Do	
MWBH07	SPT02	3.40	Brownish grey, silty clay / clayey silt with sand mixture.									35	14		CI					Do	
MWBH07	SPT04	5.00	Yellowish grey, silty sand with traces of clay binders and kankars.												SM-SP		89	5	6	Do	

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits		IS Classi ficati	Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc	Grav.	Mois. %	Ratio	Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %		Gravl %	Sand %	Silt %	Clay %	
MWBH08	SPT01	1.50	Brownish grey, silty clay / clayey silt with sand mixture.												CI*		40	36	24	Do
MWBH08	SPT02	3.00	Yellowish grey, silty clay / clayey silt with traces of sand mixture.										34	14	CL					Do
MWBH08	SPT04	5.10	Yellowish brown, silty clay / clayey silt with traces of sand mixture.										34	16	CL					Do
MWBH09	SPT01	1.40	Brownish grey, clayey silt with traces of sand mixture.										39	16	CI					Do
MWBH10	SPT01	1.55	Brownish grey, clayey silt with traces of sand mixture.				2.61								CI*		14	53	33	Do
MWBH10	SPT02	3.00	Brownish grey, clayey silt with sand mixture.										38	24	CI					Do
MWBH11	SPT01	1.60	Deep grey, silty clay / clayey silt.										36	19	CI					Do
MWBH11	SPT02	3.00	Light grey, clayey silt with traces of sand mixture.												CI*		11	58	31	Do
MWBH11	SPT03	4.50	Brownish grey clayey silt with sand mixture.										36	17	CI					Do
MWBH12	SPT01	1.35	Brownish grey, clayey silt with sand mixture.												CI*		39	52	9	Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void Ratio	Strength Test Results				Atter. Limits		IS		Grain Size				Test Method		
				Dens.	Dens.	Grav.	Mois.		Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL	Classi	Gravl	Sand	Silt	Clay			
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%	ficati	%	%	%	%			
MWBH12	SPT03	4.50	Brownish grey, silty clay / clayey silt with sand mixture.										37	15		CI					Do		
MWBH13	SPT02	3.00	Brownish grey, clayey silt with sand mixture.										45	19		CI					Do		
MWBH14	UDS01	1.00	Brownish grey, clayey silt with traces of sand mixture.	1.96	1.67	2.58	17 S 17 T 14 C	0.476	TRSH-UU		0.73	9	35	17		CI		38	50	12	Do		
									3.0	1.400													
									2.0	1.196													
									1.0	1.048													
									UNCONFD													0.99	0
									0.0	0.977													
									0.0	0.986													
									0.0	1.002													
									REMOULD													0.73	0
									0.0	0.713													
									0.0	0.658													
									0.0	0.821													
MWBH14	SPT03	4.50	Brownish grey, silty clay with traces of sand mixture.									46	19		CI					Do			
MWBH15	UDS01	1.00	Reddish brown clayey silt with sand mixture and rock pieces.	2.04	1.79	2.58	13 S 14 T 12 C	0.424	TRSH-UU		0.93	4	33	14	11	SC		66	26	8	Do		
									3.0	1.230													
									2.0	1.196													
									1.0	1.082													
									UNCONFD													0.92	0
									0.0	0.956													
									0.0	0.917													
									0.0	0.880													
									REMOULD													0.67	0
									0.0	0.671													
									0.0	0.689													
									0.0	0.644													
MWBH15	SPT02	3.00	Brownish grey, silty sand with traces of rock pieces.													SM	12	67 21(Silt+Clay)		Do			

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void Ratio	Strength Test Results				Atter. Limits		IS		Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.		Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL	Classi	Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%	ficati	%	%	%	%	
MWBH17	SPT01	1.60	Brownish grey, clayey silt with sand mixture and rock pieces.												CI*		4	32	64(Silt+Clay)		Do
MWBH17	SPT02	3.20	Brownish grey, clayey silt with sand mixture and rock pieces.										34	19		CL					Do
MWBH17	SPT04	5.05	Brownish grey, clayey silt with traces of sand mixture.													CI*		12	69	19	Do
MWBH18	UDS01	1.00	Greyish yellow, silty clay with sand mixture.	2.06	1.81	2.65	14 S 13 T 14 C	0.464	TRSH-UU 3.0 2.0 1.0 UNCONFD 0.0 0.0 0.0 REMOULD 0.0 0.0 0.0	0.74 0.765 0.761 0.686 0.63 0.637 0.643 0.622 0.46 0.452 0.429 0.488	0 0 0 0		34	13	9	CL-SC		61	25	14	Do
MWBH18	SPT03	4.50	Yellowish grey, clayey silt with traces of rock pieces.										36	14		CI					Do
MWBH18	SPT05	7.50	Reddish brown, clayey silt with sand mixture.						DRSH-CQ 0.5 1.0 2.0	0.48 0.748 0.867 1.412	25					CI*					Do
MWBH19	SPT02	2.60	Yellowish grey, clayey silt with sand mixture.													SM		51	31	18	Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits		IS		Grain Size				Test
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL	Classi	Gravl	Sand	Silt	Clay	Method
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%	ficati	%	%	%	%	
MWBH19	SPT04	5.80	Brownish grey, clayey silt with traces of calcareous nodules & kankars.										34	15		CL					Do
MWBH20	SPT03	4.00	Reddish brown with clayey silty sand with kankars & rock pieces.						DRSH-CQ	0.72	22					SM*					Do
									0.5	0.891											
									1.0	1.188											
									2.0	1.530											
MWBH21	SPT01	1.00	Reddish brown, clayey silty sand.										Non Plastic			SM*					Do
MWBH21	UDS01	2.00	Brownish grey, silty sand with clay binder / clayey silty sand.	1.81	1.56		16 S 16 T 26 C	0.620	TRSH-UU	0.52	10		32	16	12	CL		49	38	13	Do
									3.0	1.255											
									2.0	1.027											
									1.0	0.833											
									UNCONFD	0.42	0										
									0.0	0.416											
									0.0	0.434											
									0.0	0.422											
									REMOULD	0.32	0										
									0.0	0.326											
									0.0	0.302											
									0.0	0.319											
MWBH21	SPT03	4.00	Brownish grey, silty sand with clay binder and calcareous nodules.													SM		63	21	16	Do
MWBH22	SPT01	1.60	Reddish brown clayey silt with sand mixture / clayey silty sand.													SM		63 37(Silt+Clay)			Do
MWBH22	SPT02	3.05	Reddish brown, clayey silty sand with moorum & kankar.						DRSH-CQ	0.74	18					SM*					Do
									0.5	0.891											
									1.0	1.094											
									2.0	1.387											

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits		IS		Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc	Grav.	Mois. %	Ratio	Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Classi ficati	Gravl %	Sand %	Silt %	Clay %	
MWBH23	SPT01	1.00	Greyish brown clayey silty sand.										36	14		CI					Do
MWBH23	SPT02	2.50	Greyish brown clayey silty sand / clayey silt with sand mixture, kankar and moorum.													SM		68	18	14	Do
MWBH23	SPT04	5.00	Brownish grey, silty sand with traces of kankars.													SM	4	83	13(Silt+Clay)		Do
MWBH24	SPT02	2.55	Greyish brown clayey silt with sand mixture.													SM		58	30	12	Do
MWBH24	SPT04	5.05	Brownish grey, silty clay with traces of sand mixture.										37	14		CI					Do
MWBH25	SPT01	1.60	Brownish grey, clayey silt with traces of sand mixture and kankars.				2.72									CI*		42	39	19	Do
MWBH25	SPT02	3.05	Brownish grey, silty clay with traces of sand mixture.										38	14	10	CI					Do
MWBH25	SPT03	5.00	Brownish grey, clayey silt with traces of sand mixture.													CI*		48	34	18	Do
MWBH26	SPT02	2.80	Reddish brown, silty sand.	1.81	1.55		16 S 17 DR		DRSH-CQ 0.5 1.0 2.0	0.09 0.406 0.709 1.342		32				SM					Do
MWBH27	SPT01	1.00	Greyish brown, silty sand with clay binder / clayey silty sand.				2.70									SM		68	19	13	Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits		IS Classi ficati	Grain Size				Test Method
									Pc/Pn	Shear	Cohesn	Frictn	LL	PL		Gravl	Sand	Silt	Clay	
									kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%		%	%	%	%	
MWBH27	SPT03	4.00	Reddish brown, clayey silty sand with moorum, kankar and rock pieces.	1.80	1.60		13 S 13DR		DRSH-CQ	0.58	25				SM					Do
									0.5	0.799										
									1.0	1.019										
									2.0	1.551										
MWBH28	SPT01	1.40	Brownish grey clayey silt with sand mixture			2.64									CI*	40	37	23		Do
MWBH28	SPT02	3.00	Brownish grey, silty clay with sand mixture.										49	15	CI					Do
MWBH29	SPT01	1.25	Greyish brown, clayey silt with decomposed rock.										48	15	CI					Do
MWBH29	SPT02	3.00	Brownish grey, clayey silt with sand mixture												CI*	49	32	19		Do
MWBH30	UDS01	1.00	Reddish brown, clayey silt with traces of sand mixture.	2.12	1.81		15 S 17 T 17 C	0.475	TRSH-UU	0.43	9		38	16	12 CI		38	40	22	Do
									3.0	1.099										
									2.0	0.866										
									1.0	0.707										
									UNCONFD	0.61	0									
									0.0	0.607										
									0.0	0.588										
									0.0	0.635										
									REMOULD	0.42	0									
									0.0	0.404										
									0.0	0.431										
									0.0	0.439										
MWBH30	SPT02	3.00	Brownish grey, silty clay with traces of sand mixture.										37	14	CI					Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void Ratio	Strength Test Results				Atter. Limits		IS	Grain Size				Test Method	
				Dens.	Dens.	Grav.	Mois.		Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL	Classi	Gravl	Sand	Silt		Clay
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%	ficati	%	%	%		%
MWBH31	UDS01	1.00	Reddish brown, clayey silt with traces of sand mixture.						TRSH-UU	1.28	0	39	15	10	CI					Do	
				3.0	1.295																
				2.0	1.286																
				1.0	1.275																
				UNCONFD	1.08	0															
				0.0	1.151																
				0.0	1.094																
				0.0	0.996																
				REMOULD	0.73	0															
				0.0	0.702																
				0.0	0.733																
				0.0	0.758																
MWBH31	SPT02	3.00	Brownish grey, silty clay / clayey silt with traces of sand mixture.									30	13		CL				Do		
MWBH31	UDS02	4.00	Light grey, silty clay.					0.437	TRSH-UU	0.64	0				CI*		31	45	24	Do	
				3.0	0.674																
				2.0	0.651																
				1.0	0.595																
				UNCONFD	0.43	0															
				0.0	0.411																
				0.0	0.456																
				0.0	0.423																
				REMOULD	0.36	0															
				0.0	0.345																
				0.0	0.399																
				0.0	0.352																
MWBH32	SPT01	1.30	Brownish grey, silty clay / clayey silt with sand mixture.									44	18		CI				Do		
MWBH32	SPT03	4.00	Brownish grey, clayey silt with sand mixture.												CI*		47	46	7	Do	
MWBH33	SPT02	2.60	Brownish grey, clayey silt / silty clay with traces of rock pieces.									46	15		CI				Do		

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits		IS		Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc	Grav.	Mois. %	Ratio	Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Classi ficati	Gravl %	Sand %	Silt %	Clay %	
MWBH33	SPT04	5.00	Brownish grey, clayey silt / silty clay with traces of rock pieces.													CI*		42	43	15	Do
MWBH34	SPT01	1.20	Reddish grey, silty clay / clayey silt with moorum, gravels & traces of sand mixture.													SM	55	25	20 (Silt+Clay)		Do
MWBH34	SPT02	2.50	Reddish grey, silty clay / clayey silt with moorum, gravels & traces of sand mixture.													SM	57	25	18 (Silt+Clay)		Do
MWBH35	SPT02	2.70	Reddish brown, silty clay / clayey silt with sand mixture & rock pieces.				2.61									SM	16	37	47 (Silt+Clay)		Do
MWBH35	SPT03	4.00	Brownish grey, silty sand.										Non Plastic			SM*					Do
MWBH35	SPT05	7.00	Brownish grey, silty sand with rock pieces.													SM-SP	28	61	11 (Silt+Clay)		Do
MWBH36	SPT04	4.80	Greyish brown, clayey silt with sand mixture.				2.62									CI*		32	68 (Silt+Clay)		Do
MWBH37	DS01	0.60	Brownish grey silty clay with sand mixture & kankars.										44	17		CI					Do
MWBH37	SPT01	1.55	Brownish grey, silty sand with traces of mica.													SM		72	28(Silt+Clay)		Do
MWBH38	UDS01	1.00	Brownish grey clayey silt with rock pieces, sand mixture & calcareous nodules.										34	18	10	CL-SC		65	31	4	Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits		IS		Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL	Classi	Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%	ficati	%	%	%	%	
MWBH48	SPT07	11.30	Reddish brown, silty sand with clay binder.													SM		61	39	(Silt+Clay)	Do
MWBH49	SPT01	1.50	Brownish grey, clayey silty sand / clayey silt with sand mixture.													SM		59	30	11	Do
MWBH49	SPT02	3.10	Brownish grey, silty sand with rock pieces.													SM	19	54	27	(Silt+Clay)	Do
MWBH50	SPT01	1.55	Greyish brown, silty clay with sand mixture and decomposed rock.										46	16		CI	2	22	76	(Silt+Clay)	Do
MWBH51	SPT01	1.55	Reddish brown, clayey silt with traces of sand mixture.													CI*		25	53	22	Do
MWBH52	SPT03	4.50	Greyish brown, clayey silt with sand mixture and rock pieces.													SM	28	29	43	(Silt+Clay)	Do

* - Classification in this case is based on average layer properties.

LABORATORY ROCK TEST RESULTS

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohr's Scale)	Soundness (% Loss)	E (g/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-Situ	Saturated								
MWBH-27	2	8.25-9.00	Highly weathered, brownish grey, medium grained, fractured sandstone.	2.470	2.439	1.285	5.6044	2.584	--	--	--	8.00	--	--	--	--	--	**See the notes
MWBH-27	4	9.50-10.00	Highly weathered, brownish grey, medium grained, fractured sandstone.	2.362	2.301	2.651	10.3982	2.568	--	--	--	--	--	Medium Soft	--	--	--	Do
MWBH-34	14	16.00-16.75	Highly weathered, light grey, fine grained, fractured hornblend gneiss.	2.586	2.579	0.290	1.3154	2.531	--	--	--	9.11	--	--	--	--	--	Do
MWBH-34	23	22.75-23.50	Highly weathered, light grey, fine grained, fractured hornblend gneiss.	2.611	2.604	0.271	1.3484	2.648	--	85	--	--	--	--	--	--	--	Do
MWBH-35	15	17.75-18.50	Highly weathered, light grey to greyish black, medium to coarse grained, highly fractured hornblend gneiss.	2.557	2.553	0.143	0.5183	2.568	--	--	--	5.47	--	--	--	--	--	Do
MWBH-35	22	23.00-23.75	Highly weathered, light grey to greyish black, medium to coarse grained, highly fractured hornblend gneiss.	2.500	2.497	0.111	0.5012	2.612	--	--	--	32.99	--	--	--	--	--	Do
MWBH-36	13	15.50-16.25	Highly weathered, yellowish grey to brownish grey, medium grained fractured hornblend gneiss.	2.376	2.317	2.558	1.2898	2.557	--	--	--	1.92	--	--	--	--	--	Do
MWBH-36	17	18.50-19.25	Highly weathered, whitish grey, fine grained, fractured hornblend gneiss.	2.419	2.418	0.038	0.2160	2.624	--	277	--	--	--	--	--	--	--	Do
MWBH-37	2	3.00-3.75	Moderately weathered, brownish grey, medium to fine grained, fractured sandstone.	2.330	2.263	2.947	11.4284	--	--	--	--	1.64	--	--	--	--	--	Do
MWBH-37	3	3.75-4.50	Moderately weathered, brownish grey, medium to fine grained, fractured sandstone.	--	--	--	--	2.608	--	--	--	--	91.56	--	--	--	--	Do
MWBH-37	4	4.50-5.00	Moderately weathered, brownish grey, medium to fine grained, fractured sandstone.	2.409	2.341	2.911	9.8952	--	154	--	--	--	--	--	--	--	--	Do
MWBH-38	2	2.50-3.25	Highly weathered, brownish grey, medium to fine grained, fractured sandstone.	2.400	2.332	2.922	10.0412	2.592	--	--	--	1.64	--	--	--	--	--	Do
MWBH-38	3	3.25-4.00	Highly weathered, brownish grey, medium to fine grained, fractured sandstone.	2.375	2.280	4.154	13.5077	2.637	--	--	--	0.83	--	--	--	--	--	Do
MWBH-38	4	4.00-5.00	Highly weathered, brownish grey, medium to fine grained, fractured sandstone.	--	--	--	--	--	--	--	--	--	77.49	--	--	--	--	Do
MWBH-39	1	2.80-3.50	Highly weathered, yellowish grey, medium grained, fractured sandstone.	2.346	2.287	2.588	10.3620	2.552	--	--	--	1.63	--	--	--	--	--	Do
MWBH-39	3	4.25-5.00	Highly weathered, yellowish grey, medium grained, fractured sandstone.	2.407	2.343	2.734	8.8189	2.569	--	--	--	--	--	Medium Soft	--	--	--	Do
MWBH-49	19	17.50-18.25	Highly weathered, light grey, medium grained, moderately fractured hornblend gneiss.	2.679	2.606	2.801	1.2786	2.618	--	--	--	--	--	--	--	--	--	Do
MWBH-50	11	14.10-14.85	Highly weathered, light grey, medium grained, fractured hornblend gneiss.	2.601	2.595	0.232	0.8414	2.618	--	--	--	49.63	--	Hard	16.34	--	32.76	Do

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohr's Scale)	Soundness (% Loss)	E (g/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-Situ	Saturated								
MWBH-51	11	12.60-13.35	Highly weathered, light grey, medium grained, fractured hornblend gneiss.	2.379	2.302	3.333	1.2693	2.636	--	--	--	--	77.17	--	--	--	--	Do
MWBH-52	8	10.25-11.00	Highly weathered, light grey, medium grained, fractured hornblend gneiss.	2.738	2.634	3.952	1.0954	2.532	--	--	--	3.82	--	Medium Soft	21.45	7164	--	Do

Table G-4 (iv)
PHYSICAL AND GEOTECHNICAL PROPERTIES OF SOIL

WORK REFERENCE: Geo - technical Investigation for NTPC ,Talcher Thermal Stage-III (2 X 660 MW)

BORE HOLE NO	LOCATION	TYPE OF SAMPLE	DEPTH(M)	BULK DENSITY (γ) in gm/cc.	NATURAL MOISTURE CONTENT (%)	PARTICLE SIZE (%)							CONSISTENCY PROPERTIES				CLASSIFICATION	DIFFERENTIAL FREE SWELL INDEX IN %	SPECIFIC GRAVITY	VOID RATIO	STRENGTH TEST (Triaxial shear test)				COMPRESSION INDEX	(C _c)	CHEMICAL TEST OF SOIL			CHEMICAL TEST OF WATER				
						FINE GRAVEL IN % (25MM TO 4.75MM)	COARSE SAND IN % (4.75MM TO 2.06MM)	MEDIUM SAND IN % (2.06MM TO 0.425MM)	FINE SAND IN % (0.425MM TO 0.075MM)	SILT & CLAY IN % (<0.075MM)	SILT SIZE IN % (0.075MM TO 0.002MM)	CLAY SIZE IN % (<0.002MM)	LIQUID LIMIT IN % (LL)	PLASTIC LIMIT IN % (PL)	PLASTICITY INDEX IN % (PI)	SHRINKAGE LIMIT IN %					APPARENT COHESION "C" IN Kg/cm ²	ANGLE OF INTERNAL RESISTANCE "φ" IN DEGREE	UNCONFINED COMPRESSIVE STRENGTH IN Kg/cm ²	pH Value			Sulphates in PPM	Chloride in PPM	pH Value	Sulphates in mg/ltr.	Chloride in mg/ltr.			
3	E : 1306.11 & N : 3967.14	SPT	2.75-3.20	-	-	0.03	0.99	17.09	50.73	31.16	-	-	30	17	13	-	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	E : 1384.37 & N : 3966.57	SPT	3.00	2.048	4.61	82.38	3.70	0.96	6.46	6.50	-	-	21.1	-	NP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	E : 1292.96 & N : 4012.71	UDS	1.50-2.10	2.083	14.32	5.25	6.62	10.12	29.86	48.15	25.90	22.25	32	18	14	-	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	E : 1327.16 & N : 4038.11	SPT	3.00-3.45	1.920	13.78	0.00	0.65	7.04	51.91	40.40	-	-	23.6	-	NP	-	SM	-	-	-	-	-	0.30	-	-	-	-	-	-	-	-	-	-	-
12	E : 1283.28 & N : 4075.82	UDS	1.00-1.15	2.066	15.41	0.28	2.84	13.88	39.28	43.72	23.22	20.50	31	18	13	-	SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	E : 1363.83 & N : 4078.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
81	E : 1227.45 & N : 4090.27	UDS	1.50	1.793	14.81	2.84	3.01	6.57	41.09	46.49	28.24	18.25	31.1	17	21	9.2	SC	-	2.64	0.69	-	-	0.15	-	-	-	-	-	-	-	-	-	-	-

Table G-5 (iv)
PHYSICAL AND GEOTECHNICAL PROPERTIES OF SOIL

WORK REFERENCE:

Geo - technical Investigation for NTPC ,Talcher Thermal Stage-III (2 X 660 MW)

BORE HOLE NO	LOCATION	TYPE OF SAMPLE	DEPTH(M)	BULK DENSITY (k) in g/mcc.	NATURAL MOISTURE CONTENT (%)	PARTICLE SIZE (%)							CONSISTENCY PROPERTIES				CLASSIFICATION	DIFFERENTIAL FREE SWELL INDEX IN %	SPECIFIC GRAVITY	VOID RATIO	STRENGTH TEST (Triaxial shear test)			(C _c)	CHEMICAL TEST OF SOIL			CHEMICAL TEST OF WATER																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
						FINE GRAVEL IN % (20MM TO 4.75MM)	COARSE SAND IN % (4.75MM TO 2.50MM)	MEDIUM SAND IN% (2.50MM TO 0.425MM)	FINE SAND IN % (0.425MM TO 0.075MM)	SILT & CLAY IN % (<0.075MM)	SILT SIZE IN % (0.075MM TO 0.002MM)	CLAY SIZE IN % (<0.002MM)	LIQUID LIMIT IN % (LL)	PLASTIC LIMIT IN % (PL)	PLASTICITY INDEX IN % (PI)	SHRINKAGE LIMIT IN %					APPARENT COHESION "C" IN kg/cm ²	ANGLE OF INTERNAL RESISTANCE "φ" IN DEGREE	UNCONFINED COMPRESSIVE STRENGTH IN Kg/cm ²		COMPRESSION INDEX	pH Value	Sulphates in PPM	Chloride in PPM	pH Value	Sulphates in mg/ltr.	Chloride in mg/ltr.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
1	E - 1413.2 & N - 3923.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

WORK REFERENCE:

[illegible]

Table G-3 (iv)
PHYSICAL AND GEOTECHNICAL PROPERTIES OF SOIL

WORK REFERENCE:

Geo - technical Investigation for NTPC ,Talcher Thermal Stage-III (2 X 660 MW)

BORE HOLE NO	LOCATION	TYPE OF SAMPLE	DEPTH(M)	BULK DENSITY (γ _b) in gm/cc.	NATURAL MOISTURE CONTENT (%)	PARTICLE SIZE (%)							CONSISTENCY PROPERTIES				CLASSIFICATION	DIFFERENTIAL FREE SWELL INDEX IN %	SPECIFIC GRAVITY	VOID RATIO	STRENGTH TEST (Triaxial shear test)			COMPRESSION INDEX	CHEMICAL TEST OF SOIL			CHEMICAL TEST OF WATER			
						FINE GRAVEL IN % (20mm TO 4.75mm)	COARSE SAND IN % (4.75mm TO 2.00mm)	MEDIUM SAND IN% (2.00mm TO 0.425mm)	FINE SAND IN % (0.425mm TO 0.075mm)	SILT & CLAY IN % (<0.075mm)	SILT SIZE IN % (0.075mm TO 0.002mm)	CLAY SIZE IN % (<0.002mm)	LIQUID LIMIT IN % (LL)	PLASTIC LIMIT IN % (PL)	PLASTICITY INDEX IN % (PI)	SHRINKAGE LIMIT IN %					APPARENT COHESION "c" IN Kg/cm2.	ANGLE OF INTERNAL RESISTANCE φ IN DEGREE	UNCONFINED COMPRESSIVE STRENGTH IN Kg/cm2.		pH Value	Sulphates in PPM	Chloride in PPM	pH Value	Sulphates in mg/ltr.	Chloride in mg/ltr.	
18	E : 1413.04 & N 4115.92	UDS	1.50-1.95	1.985	14.38	5.82	10.65	15.32	30.56	37.65	24.15	13.50	29	18	11	-	SC	-	-	-	0.25	8.5	-	-	-	-	-	-	-	-	-
22	E : 1413.04 & N 4115.92	UDS	1.50-1.95	1.985	14.38	5.82	10.65	15.32	30.56	37.65	24.15	13.50	29	18	11	-	SC	-	-	-	0.25	8.5	-	-	-	-	-	-	-	-	-
23	E : 1452.04 & N 4181.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	E : 1476.59 & N 4225.03	UDS	1.50-2.00	2.093	13.15	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	0.25	9.50	-	-	-	-	-	-	-	-
27	E : 1549.06 & N 4231.53	UDS	1.50-2.10	1.900	18.64	0.27	0.39	5.96	49.46	43.92	25.67	18.25	30.00	18	12.00	11.2	SC	10	2.69	0.68	-	-	-	-	-	-	-	-	-	-	-
28	E : 1569.7 & N 4140.01	UDS	0.80-1.00	-	-	62.42	11.57	5.37	14.00	6.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[illegible]

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classifi cation	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH01	DS01	0.50	Yellowish grey, silty sand with traces of boulders and kankars.													SM	26	55	19(Silt+Clay)		**See the Note
BH02	UDS01	1.00	Brownish grey, clayey silty sand / sandy silt.						DRSH-CU		0.09	30				SM*					Do
									0.5	0.385											
									1.0	0.663											
									2.0	1.245											
BH02	SPT02	3.00	Yellowish grey, clayey silt with sand mixture and calcareous nodules.										35	24	14	CI					Do
BH02	SPT03	5.45	Brownish grey, clayey sandy silt.													CI*		43	57(Silt+Clay)		Do
BH03	SPT01	1.55	Brownish grey silty clay with sand mixture.										45	21		CI					Do
BH03	SPT02	2.10	Brownish grey, clayey silt with sand mixture			2.67										CI*		23	60	17	Do
BH03	DS02	2.50	Brownish grey, silty sand with traces of decomposed rockdust.													SM		77	23(Silt+Clay)		Do
BH04	UDS01	1.00	Brownish grey, clayey silty sand / sandy silt.	1.76	1.44		22 S		DRSH-CU		0.07	33				SM*					Do
							22DR		0.5	0.388											
									1.0	0.729											
									2.0	1.356											
BH04	SPT02	3.00	Yellowish grey, clayey silty sand.													SM		60	40(Silt+Clay)		Do
BH06	SPT01	2.30	Light grey, clayey silt with decomposed rock & sand mixture													CI*		38	46	16	Do
BH06	DS03	3.00	Light grey, clayey silt with sand mixture & decomposed rockdust.										38	24		CI					Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH07	SPT01	1.60	Brownish grey, silty clay / clayey silt with traces of sand mixture.													CI*		15	61	24	Do
BH07	SPT02	3.00	Brownish grey, silty clay with traces of sand mixture.										46	20		CI					Do
BH07	SPT03	4.00	Brownish grey, silty sand.	1.78	1.52		17DR		DRSH-CU		0.03	39				SM*					Do
									0.5	0.439											
									1.0	0.829											
									2.0	1.658											Do
BH08	SPT01	1.45	Brownish grey, silty sand. Observed clay binders.	1.76	1.53		15 S									SM*					
BH09	UDS01	0.70	Brownish grey, clayey silt with brick bats, sand mixture and kankars.	1.78	1.42		23 S	0.802	UNCONFD		0.38	0				CI*	2	38	53	7	Do
							25 T		0.0	0.395											
							26 C		0.0	0.364											
									0.0	0.378											
									REMOULD		0.30	0									
									0.0	0.307											
									0.0	0.303											
									0.0	0.302											
BH09	DS02	2.00	Brownish grey, silty sand.										N.P.			SM*					Do
BH09	SPT02	2.50	Brownish grey, silty sand.													SM-SP	90	10(Silt+Clay)			Do
BH10	SPT01	1.50	Brownish grey, silty sand.													SM	70	30(Silt+Clay)			Do
BH11	DS01	0.50	Deep grey, clayey silt with sand mixture.										36	23		CI					Do
BH11	SPT01	1.60	Deep grey, silty clay / clayey silt with sand mixture.			2.63										CI*					Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classifi cation	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH12	UDS01	1.00	Light grey, silty clay with traces of sand mixture.	1.84	1.44		28 S	0.836	TRSH-UU		0.58	0				CI*					Do
							28 T		3.0	0.604											
							27 C		2.0	0.578											
									1.0	0.562											
BH12	UDS02	4.00	Brownish grey, silty clay with traces of kankars.						UNCONFD		0.46	0				CI*					Do
									0.0	0.442											
									0.0	0.441											
									0.0	0.507											
									REMOULD		0.33	0									
									0.0	0.308											
									0.0	0.313											
									0.0	0.368											
BH12	SPT03	4.45	Brownish grey, silty sand. Observed decomposed rockdust.													SM		78	22(Silt+Clay)		Do
BH13	UDS01	1.00	Reddish brown, clayey sandy silt with brick bats and kankars.	1.87	1.52	2.59	23 S	0.668	UNCONFD		0.51	0	28	19	15	SC	3	48	44	5	Do
							23 T		0.0	0.524											
							24 C		0.0	0.503											
									0.0	0.509											
									REMOULD		0.39	0									
									0.0	0.398											
									0.0	0.394											
									0.0	0.380											
BH13	DS02	2.50	Brownish grey, clayey silt with sand mixture.													CI*		23	59	18	Do
BH14	UDS01	1.00	Brownish grey, clayey silt with sand mixture & brick bats.	1.78	1.39	2.64	29 S	0.824	UNCONFD		0.34	0	44	23		CI		35	53	12	Do
							28 T		0.0	0.337											
							30 C		0.0	0.355											
									0.0	0.332											
									REMOULD		0.28	0									
									0.0	0.287											
									0.0	0.270											
									0.0	0.285											
BH14	SPT02	3.00	Yellowish grey, clayey silt with fine sand mixture.													CI*		30	52	18	Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classifi cation	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH15	UDS01	1.00	Brownish grey, silty clay with sand mix & calcareous nodules.	1.82	1.50		23 S	0.705	TRSH-UU		0.31	3	45	20	13	CI		46	37	17	Do
							20 T		3.0	0.494											
							23 C		2.0	0.414											
									1.0	0.376											
BH15	SPT01	1.45	Brownish grey, silty clay with sand mixture.										42	19		CI					Do
BH15	SPT02	3.00	Brownish grey, silty clay with sand mixture.													CI*		39	47	14	Do
BH16	UDS01	1.00	Brownish grey, silty clay with sand mixture & traces of kankars.						TRSH-UU		1.08	3	51	21		CH		22	50	28	Do
									3.0	1.298											
									2.0	1.254											
									1.0	1.193											
									UNCONFD		0.72	0									
									0.0	0.695											
									0.0	0.737											
									0.0	0.732											
									REMOULD		0.56	0									
									0.0	0.539											
BH16	UDS02	4.10	Brownish grey, silty clay with sand mixture, kankars and rustv spots.	1.92	1.63		17 S	0.571	TRSH-UU		0.97	9	39	24		CI		41	38	21	Do
							18 T		3.0	1.692											
							19 C		2.0	1.501											
									1.0	1.327											
									UNCONFD		0.86	0									
									0.0	0.857											
									0.0	0.882											
									0.0	0.845											
									REMOULD		0.64	0									
									0.0	0.651											
BH16	SPT04	5.80	Brownish grey, clayey silt with sand mixture and rockdust.													CI*		23	77(Silt+Clay)		Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classifi cation	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH17	UDS01	1.00	Brownish grey, silty clay with traces of calcareous nodules and kankars.	1.88	1.53		26 S						52	17		CH		20	68	12	Do
BH17	UDS02	4.00	Brownish grey, silty clay with traces of kankars and sand mixture.			2.66			TRSH-UU	0.93	3		49	20		CI		19	50	31	Do
									3.0	1.146											
									2.0	1.091											
									1.0	1.027											
									UNCONFD	0.70	0										
									0.0	0.719											
									0.0	0.679											
									0.0	0.703											
									REMOULD	0.51	0										
									0.0	0.504											
									0.0	0.517											
									0.0	0.507											
BH17	SPT05	6.80	Brownish grey, clayey silt stone with sand mixture.													SM	9	50	41(Silt+Clay)		Do
BH18	UDS01	1.00	Greyish brown, silty clay with traces of kankars & sand mixture.	1.98	1.58	2.67	24 S		TRSH-UU	0.67	5		48	18		CI		19	49	32	Do
							25 T		3.0	1.010											
									2.0	0.950											
									1.0	0.820											
BH18	UDS02	4.20	Brownish grey, silty clay with calcareous nodules and sand mixture.					0.531	TRSH-UU	1.09	6		51	18	14	CH					Do
									3.0	1.561											
									2.0	1.444											
									1.0	1.327											
									UNCONFD	0.82	0										
									0.0	0.827											
									0.0	0.819											
									0.0	0.806											
									REMOULD	0.65	0										
									0.0	0.632											
									0.0	0.652											
									0.0	0.650											
BH18	SPT05	7.20	Brownish grey, silty sand. Observed decomposed rockdust.													SM		73	27(Silt+Clay)		Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH19	UDS02	4.00	Brownish grey silty clay with sand mixture.	2.03	1.66	2.62	23 S	0.656	TRSH-UU		0.56	7	43	25	16	CI		46	45	9	Do
							21 T		3.0	1.049											
							22 C		2.0	0.911											
									1.0	0.772											
									UNCONFD		0.65	0									
									0.0	0.653											
									0.0	0.681											
									0.0	0.614											
									REMOULD		0.52	0									
									0.0	0.531											
BH19	SPT04	6.00	Brownish grey, silty sand with traces of mica and kankars.													SM		67	33(Silt+Clay)		Do
BH20	UDS01	1.00	Brownish grey, clayey sandy silt / clayey silt with sand mixture.	1.91	1.57		22 S		DRSH-CU		0.15	27				SM		54	46(Silt+Clay)		Do
							21DR		0.5	0.399											
									1.0	0.663											
									2.0	1.156											
BH20	UDS02	4.10	Greyish brown, silty clay with high percentage of sand mixture.					0.792	TRSH-UU		0.56	6	40	23		CI		41	38	21	Do
									3.0	0.975											
									2.0	0.882											
									1.0	0.734											
									UNCONFD		0.62	0									
									0.0	0.631											
									0.0	0.669											
									0.0	0.562											
									REMOULD		0.49	0									
									0.0	0.495											
BH21	SPT01	1.60	Dark grey, silty sand with ash.													SM		73	27(Silt+Clay)		Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classifi cation	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH21	UDS02	3.00	Light grey, silty clay with traces of sand mixture and kankars.	1.83	1.49		22 S	0.524	TRSH-UU		0.63	6	43	24		SC		52	35	13	Do
							24 T		3.0	1.057											
							22 C		2.0	0.925											
									1.0	0.818											
									UNCONFD		0.44	0									
									0.0	0.457											
									0.0	0.420											
									0.0	0.446											
									REMOULD		0.37	0									
									0.0	0.380											
									0.0	0.363											
									0.0	0.369											
BH22	UDS02	4.00	Light grey, silty clay. Obs. sand mixture and kankars.	1.86	1.46	2.66	25 S	0.724	TRSH-UU		0.80	0	49	20		CI		10	62	28	Do
							28 T		3.0	0.817											
							27 C		2.0	0.797											
									1.0	0.781											
									UNCONFD		0.61	0									
									0.0	0.610											
									0.0	0.602											
									0.0	0.623											
									REMOULD		0.49	0									
									0.0	0.502											
									0.0	0.493											
									0.0	0.472											
BH22	SPT05	7.10	Grey, silty sand with decomposed rockdust.													SM		71	29(Silt+Clay)		Do
BH23	UDS01	1.00	Deep grey, silty clay. Obs. kankars & sand mixture.	1.82	1.41		30 S	0.756	TRSH-UU		0.65	0				CI*		9	58	33	Do
							29 T		3.0	0.659											
							28 C		2.0	0.651											
									1.0	0.643											
									UNCONFD		0.53	0									
									0.0	0.546											
									0.0	0.521											
									0.0	0.524											
									REMOULD		0.45	0									
									0.0	0.470											
									0.0	0.448											
									0.0	0.434											

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH23	UDS02	4.00	Deep grey, silty clay. Obs. kankars & sand mixture.	1.85	1.46	2.65	27 S	0.685	TRSH-UU		0.79	0				CI*		12	69	19	Do
							27 T		3.0	0.798											
							26 C		2.0	0.794											
									1.0	0.779											
									UNCONFD		0.59	0									
									0.0	0.604											
									0.0	0.577											
									0.0	0.587											
									REMOULD		0.48	0									
									0.0	0.477											
									0.0	0.504											
									0.0	0.457											
BH24	UDS02	4.00	Light grey, silty clay with traces of sand mixture. Obs. kankars.	1.86	1.46	2.64	27 S	0.690	TRSH-UU		0.68	0	51	21	16	CH		13	62	25	Do
							28 T		3.0	0.702											
							27 C		2.0	0.676											
									1.0	0.664											
									UNCONFD		0.51	0									
									0.0	0.517											
									0.0	0.509											
									0.0	0.507											
									REMOULD		0.43	0									
									0.0	0.455											
									0.0	0.424											
									0.0	0.409											
BH25	UDS01	1.00	Grey silty clay. Obs. sand mixture.	1.83	1.43		29 S	0.708	TRSH-UU		0.69	0	54	20	17	CH		8	68	24	Do
							27 T		3.0	0.714											
							30 C		2.0	0.689											
									1.0	0.675											
									UNCONFD		0.57	0									
									0.0	0.601											
									0.0	0.553											
									0.0	0.567											
									REMOULD		0.48	0									
									0.0	0.485											
									0.0	0.491											
									0.0	0.458											
BH25	SPT02	3.00	Brownish grey, silty clay with traces of sand mixture.										52	19		CH					Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH25	SPT03	4.10	Brownish grey, silty sand with traces of decomposed rockdust.													SM		73	27(Silt+Clay)		Do
BH26	UDS01	1.00	Deep grey, silty clay. Obs. kankars & sand mixture.	1.80	1.40		28 S	0.801	TRSH-UU		0.61	0				CI*		9	69	22	Do
							30 T		3.0	0.634											
							30 C		2.0	0.608											
									1.0	0.601											
									UNCONFD		0.44	0									
									0.0	0.464											
									0.0	0.425											
									0.0	0.439											
									REMOULD		0.38	0									
									0.0	0.377											
									0.0	0.377											
									0.0	0.386											
BH26	UDS02	4.00	Light grey, silty clay with traces of sand mixture. Obs. kankars.	1.88	1.49		27 S	0.593	TRSH-UU		0.94	0	47	22	16	CI		15	64	21	Do
							26 T		3.0	0.976											
							26 C		2.0	0.938											
									1.0	0.911											
									UNCONFD		0.67	0									
									0.0	0.675											
									0.0	0.693											
									0.0	0.650											
									REMOULD		0.56	0									
									0.0	0.565											
									0.0	0.544											
									0.0	0.569											
BH27	UDS01	1.00	Deep grey, silty clay with traces of sand mixture. Obs. kankars.	1.89	1.48		28 S	0.649	TRSH-UU		0.83	0	50	19	14	CH		12	63	25	Do
							27 T		3.0	0.839											
							27 C		2.0	0.831											
									1.0	0.813											
									UNCONFD		0.64	0									
									0.0	0.639											
									0.0	0.646											
									0.0	0.635											
									REMOULD		0.55	0									
									0.0	0.570											
									0.0	0.535											
									0.0	0.554											

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH27	UDS02	4.00	Deep grey, silty clay with traces of sand mixture. Obs. kankars.	1.91	1.52		26 S	0.607	TRSH-UU		1.02	0	48	20		CI		15	65	20	Do
							26 T		3.0	1.047											
							26 C		2.0	1.033											
									1.0	0.985											
									UNCONFD		0.76	0									
									0.0	0.754											
									0.0	0.771											
									0.0	0.758											
									REMOULD		0.63	0									
									0.0	0.654											
									0.0	0.622											
									0.0	0.620											
BH28	UDS01	1.00	Brownish grey silty clay with sand mixture. Obs. kankars.	1.94	1.54	2.65	26 S	0.592	TRSH-UU		0.81	0	53	21	15	CH		24	59	17	Do
							27 T		3.0	0.821											
							25 C		2.0	0.808											
									1.0	0.803											
									UNCONFD		0.59	0									
									0.0	0.614											
									0.0	0.593											
									0.0	0.572											
									REMOULD		0.48	0									
									0.0	0.502											
									0.0	0.477											
									0.0	0.465											
BH28	SPT02	3.00	Brownish grey, silty clay with traces of sand mixture.										58	19		CH					Do
BH28	SPT03	4.60	Brownish grey, silty sand with traces of decomposed rockdust.													SM		64	36(Silt+Clay)		Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%	%	%	%	%	%	
BH29	UDS01	1.00	Brownish grey silty clay with traces of calcareous nodules	1.95	1.56	2.63	24 S	0.559	TRSH-UU		0.75	0			16	CI*		14	68	18	Do
							25 T		3.0	0.768											
							23 C		2.0	0.745											
									1.0	0.744											
									UNCONFD		0.70	0									
									0.0	0.718											
									0.0	0.700											
									0.0	0.679											
									REMOULD		0.55	0									
									0.0	0.559											
									0.0	0.544											
									0.0	0.543											
BH29	SPT02	3.00	Brownish grey silty clay with traces of sand mixture.										54	17		CH				Do	
BH29	SPT03	4.00	Brownish grey, silty sand with traces of decomposed rockdust.													SM	7	67	26(Silt+Clay)	Do	
BH30	UDS02	4.00	Reddish brown clayey silt with sand mixture	1.88	1.53	2.64	23 S	0.572	TRSH-UU		0.66	8			12	CI*		44	50	6	Do
							22 T		3.0	1.244											
							23 C		2.0	1.083											
									1.0	0.921											
									UNCONFD		0.50	0									
									0.0	0.515											
									0.0	0.491											
									0.0	0.497											
									REMOULD		0.37	0									
									0.0	0.379											
									0.0	0.364											
									0.0	0.362											
BH30	SPT03	4.45	Brownish grey, silty claywith sand mixture.										54	16		CH				Do	
BH30	SPT04	5.30	Grey, silty sand with traces of decomposed rockdust.													SM	70	30(Silt+Clay)		Do	
BH31	SPT02	3.00	Brownish grey, silty clay with sand mixture.										42	23		CI				Do	

Bore Hole	Sample Number	Depth M	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
				Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL		Gravl	Sand	Silt	Clay	
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH31	SPT03	4.55	Brownish grey, silty sand with traces of mica.													SM-SP		91	9(Silt+Clay)		Do
BH32	UDS01	1.00	Brownish grey silty clay with traces of sand mixture.	1.90	1.50		27 S	0.617	TRSH-UU		0.91	0	47	20		CI		27	56	17	Do
							27 T		3.0	0.920											
							26 C		2.0	0.918											
									1.0	0.892											
									UNCONFD		0.68	0									
									0.0	0.718											
									0.0	0.700											
									0.0	0.679											
									REMOULD		0.60	0									
									0.0	0.559											
									0.0	0.544											
									0.0	0.543											
BH32	SPT02	2.50	Brownish grey, clayey silt with sand mixture & calcareous nodules.													SM	5	45	50(Silt+Clay)		Do
BH33	UDS01	1.00	Brownish grey silty clay with traces of kankars & calcareous nodules	1.81	1.40		27 S	0.689	TRSH-UU		0.75	0	48	17	14	CI		16	68	16	Do
							29 T		3.0	0.784											
							27 C		2.0	0.739											
									1.0	0.731											
									UNCONFD		0.56	0									
									0.0	0.581											
									0.0	0.553											
									0.0	0.559											
									REMOULD		0.41	0									
									0.0	0.429											
									0.0	0.414											
									0.0	0.381											
BH33	SPT03	3.80	Brownish grey, silty sand with traces of decomposed rockdust.													SM	8	65	27(Silt+Clay)		Do
BH34	UDS01	1.00	Brownish grey, clayey sandy silt.	1.79	1.48		20 S		DRSH-CU		0.12	28				CI*					Do
							21DR		0.5	0.396											
									1.0	0.641											
									2.0	1.192											
BH34	SPT02	3.00	Brownish grey, silty sand with traces of clay binders and mica.													SM		67	33(Silt+Clay)		Do

Bore	Sample	Depth	Sample Description	Bulk	Dry	Spec.	Nat.	Void	Strength Test Results				Atter. Limits			IS	Grain Size				Test
Hole	Number	M		Dens.	Dens.	Grav.	Mois.	Ratio	Pc/Pn	Shear	Cohesn	Frictn	LL	PL	SL	Classifi cation	Gravl	Sand	Silt	Clay	Method
				gms/cc	gms/cc		%		kg/sqcm	kg/sqcm	kg/sqcm	Deg.	%	%	%		%	%	%	%	
BH35	UDS01	1.00	Brownish grey silty claywith calcareous nodules &sand mixture	1.84	1.48		24 S	0.706	TRSH-UU		0.47	6	47	24	17	CI		38	46	16	Do
							23 T		3.0	0.873											
							23 C		2.0	0.754											
									1.0	0.637											
									UNCONFD		0.52	0									
									0.0	0.532											
									0.0	0.512											
									0.0	0.517											
									REMOULD		0.46	0									
									0.0	0.456											
									0.0	0.472											
									0.0	0.455											
BH36	SPT02	3.10	Light grey, clayey silt with sand mixture.													CI*		25	65	10	Do
BH37	SPT02	2.80	Brownish grey, silty clay with traces of sand mixture.										44	22		CI					Do
BH37	SPT03	3.40	Brownish grey, clayey silt with sand, traces of calcareous nodules.													CI*		41	46	13	Do

LABORATORY ROCK TEST RESULTS

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ	Saturated								
BH-01	1	1.10-1.85	Moderately weathered, yellowish grey, fine grained, highly fractured sand stone.	2.385	2.336	2.09	4.8928	2.456	--	--	--	1.64	--	--	--	--	--	** See the Note
BH-01	9	7.10-7.85	Slightly weathered, greyush, moderately fractured sandstone.	--	--	--	--	--	115	82	0.71	--	--	--	--	6592	--	Do
BH-01	16	12.35-13.10	Slightly weathered, greyush, moderately fractured sandstone.	--	--	--	--	--	--	--	--	--	96.05	Hard	15.62	--	--	Do
BH-02	7	9.30 - 10.05	Highly weathered, greyish yellow, fine to medium grained fractured sand stone.	--	--	--	--	--	--	--	--	--	76.46	--	--	--	--	Do
BH-02	10	11.50 - 12.25	Slightly weathered, deep grey, fine to medium grained, moderately fractured sand stone with inter-bedded shale.	2.396	2.348	2.054	4.822	--	--	183	--	--	--	--	--	3748	--	Do
BH-02	13	13.75 - 14.50	Slightly weathered, deep grey, fine to medium grained, moderately fractured sand stone with inter-bedded shale.	--	--	--	--	--	--	--	--	6.47	--	Hard	22.35	--	--	Do
BH-02	22	22.75 - 24.25	Fresh, deep grey, fine to medium grained, moderately fractured sand stone with inter-bedded shale in layer.	--	--	--	--	2.476	--	--	--	--	--	--	--	--	--	Do
BH-03	2	3.25-4.00	Highly weathered, yellowish brown, fine to medium grained, highly fractured sandstone.	2.440	2.395	1.86	4.4459	2.507	--	--	--	--	--	--	--	--	--	Do
BH-03	6	6.25-7.00	Moderately weathered, yellowish brown, fine to medium grained, highly fractured sandstone.	--	--	--	--	--	251	--	--	--	--	--	--	5178	--	Do
BH-03	9	8.50-9.25	Moderately weathered, yellowish brown, fine to medium grained, highly fractured sandstone.	--	--	--	--	--	--	87	--	--	--	Medium Soft	--	--	--	Do
BH-03	15	13.00-13.75	Moderately weathered, yellowish brown, fine to medium grained, highly fractured sandstone.	2.409	2.365	1.90	4.4907	--	--	--	--	1.83	--	--	--	--	--	Do
BH-03	20	16.75-17.50	Slightly weathered, brownish grey, medium grained, moderately fractured sandstone.	--	--	--	--	2.375	131	95	0.73	--	--	--	--	--	--	Do

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ	Saturated								
BH-03	22	18.25-19.00	Slightly weathered, brownish grey, medium grained, moderately fractured sandstone.	2.340	2.289	2.21	5.0689	--	--	--	--	--	--	--	--	--	37.62	Do
BH-04	1	4.00 - 4.75	Slightly weathered, greyish yellow, fine to medium grained, fractured sand stone.	--	--	--	--	2.400	--	116	--	--	--	--	--	--	--	Do
BH-04	5	7.00 - 7.75	Slightly weathered, greyish yellow, fine to medium grained, fractured sand stone.	2.351	2.306	1.952	4.502	--	300	--	--	--	--	Hard	--	--	--	Do
BH-04	10	10.75 - 11.50	Fresh, deep grey, fine to medium grained, fractured sand stone.	--	--	--	--	--	--	251	--	--	--	--	--	--	36.23	Do
BH-04	14	16.00 - 17.50	Fresh, deep grey, fine to medium grained, fractured sand stone.	--	--	--	--	--	295	--	--	--	97.03	--	--	--	--	Do
BH-05	1	2.50- 3.25	Moderately weathered, brownish grey, fine grained, fractured sandstone.	2.400	2.357	1.81	4.2552	2.462	--	150	--	--	--	--	--	--	--	Do
BH-05	6	7.00- 8.50	Fresh, brownish grey, fine grained, fractured sandstone.	--	--	--	--	--	221	176	0.80	--	--	--	--	--	39.14	Do
BH-06	6	7.40- 8.15	Slightly weathered, grey, medium grained, fractured sand stone.	--	--	--	--	--	--	--	--	1.62	--	--	--	--	--	Do
BH-06	19	17.15- 17.90	Slightly weathered, grey, medium grained, fractured sand stone.	2.340	2.302	1.67	3.8366	2.394	263	179	0.68	--	--	--	--	--	--	Do
BH-07	4	6.75- 7.50	Slightly weathered, brownish grey, medium to fine grained, fractured sand stone.	--	--	--	--	--	145	--	--	--	--	--	--	--	--	Do
BH-07	7	9.00- 9.75	Fresh, deep grey, fine grained, fractured sandstone.	--	--	--	--	--	324	246	0.76	--	91.72	Hard	--	--	--	Do
BH-08	2	4.50- 5.25	Moderately weathered, yellowish grey, medium to fine grained, fractured sandstone.	--	--	--	--	--	--	--	--	2.13	--	--	--	--	--	Do
BH-08	7	8.25- 9.00	Fresh, deep grey, fine grained, fractured sandstone.	2.440	2.395	1.88	4.5110	2.508	--	--	--	--	--	--	--	--	--	Do

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ	Saturated								
BH-09	2	3.40 - 4.15	Highly weathered, yellowish grey, medium grained, highly fractured sand stone.	2.396	2.342	2.305	5.399	--	--	--	--	0.93	--	--	--	--	--	Do
BH-09	4	4.90 - 5.65	Highly weathered, yellowish grey to grey, medium grained, highly fractured sand stone.	--	--	--	--	--	--	29	--	--	--	Medium Soft	--	--	--	Do
BH-09	13	12.20 - 13.70	Fresh, deep grey, medium grained, fractured sand stone.	--	--	--	--	--	178	--	--	--	--	--	--	2652	--	Do
BH-10	2	3.50 - 4.25	Moderately weathered, yellowish grey, medium grained, fractured sand stone.	2.368	2.316	2.213	5.125	--	--	126	--	--	54.15	--	--	--	--	Do
BH-10	5	5.75 - 6.50	Slightly weathered, grey, fine to medium grained, fractured sand stone.	--	--	--	--	2.404	396	--	--	--	--	Hard	17.52	--	--	Do
BH-10	8	8.00 - 9.50	Fresh, grey, fine to medium grained, slightly fractured sand stone.	--	--	--	--	--	--	346	--	--	--	--	--	--	--	Do
BH-11	1	2.40 - 3.00	Slightly weathered, yellowish grey, medium grained, fractured sand stone.	2.465	2.421	1.815	4.393	--	167	98	0.59	9.29	--	--	--	--	--	Do
BH-11	4	4.50 - 5.25	Slightly weathered, light grey, medium grained, fractured sand stone.	--	--	--	--	--	254	191	0.75	--	76.82	--	--	5078	--	Do
BH-11	9	8.25 - 9.75	Fresh, light grey, medium grained, fractured sand stone.	--	--	--	--	2.863	514	473	0.92	--	--	--	--	--	--	Do
BH-12	3	6.50 - 7.25	Fresh, light grey, fine grained, fractured sand stone.	2.422	2.381	1.701	4.052	--	--	187	--	--	--	--	--	--	39.58	Do
BH-12	7	9.50 - 10.25	Fresh, light grey, fine grained, fractured sand stone.	--	--	--	--	--	296	--	--	--	--	Hard	--	--	--	Do
BH-12	16	18.50 - 20.00	Fresh, light grey, fine grained, fractured sand stone.	--	--	--	--	--	361	322	0.89	--	88.62	--	--	5234	--	Do
BH-13	5	7.75 - 8.50	Fresh, grey, fine grained, fractured sandstone.	--	--	--	--	--	225	168	0.75	--	--	--	18.52	--	--	Do

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ	Saturated								
BH-14	3	6.50 - 7.25	Slightly weathered, grey, medium grained, fractured sand stone.	2.378	2.328	2.160	5.028	--	--	166	--	--	--	Hard	--	--	--	Do
BH-14	4	7.25 - 8.00	Slightly weathered, grey, medium grained, fractured sand stone.	--	--	--	--	2.459	--	--	--	6.47	--	--	19.59	--	--	Do
BH-14	7	9.50 - 11.00	Fresh, grey, medium grained, fractured sand stone.	2.356	2.312	1.926	4.453	--	263	--	--	--	94.95	--	--	--	--	Do
BH-15	2	5.00 - 5.75	Slightly weathered, greyish yellow, medium grained, fractured sand stone.	--	--	--	--	--	226	--	--	--	91.77	Hard	--	2448	--	Do
BH-15	4	6.50 - 7.25	Fresh, yellowish grey, medium grained, fractured sand stone.	--	--	--	--	2.416	--	320	--	--	--	--	--	--	--	Do
BH-15	6	8.00 - 9.50	Fresh, yellowish grey, medium grained, fractured sand stone.	2.343	2.303	1.716	3.954	--	--	307	--	1.79	--	--	--	--	--	Do
BH-16	1	6.50 - 7.00	Moderately weathered, yellowish brown, medium grained, fractured sand stone.	2.369	2.321	2.090	4.850	--	--	--	--	2.02	--	--	--	--	--	Do
BH-16	3	7.75 - 8.50	Slightly weathered, yellowish brown, medium grained, fractured sand stone.	--	--	--	--	2.379	166	--	--	--	--	Medium Soft	--	--	--	Do
BH-16	11	13.75 - 14.50	Slightly weathered, grey, medium to fine grained, fractured sand stone.	--	--	--	--	--	139	84	0.60	--	89.63	--	--	--	--	Do
BH-16	17	18.25 - 19.00	Slightly weathered, grey, medium to fine grained, fractured sand stone.	--	--	--	--	2.439	--	--	--	--	--	--	--	--	--	Do
BH-17	1	7.40 - 8.00	Moderately weathered, brownish grey, fine to medium grained, highly fractured sand stone.	--	--	--	--	2.293	--	89	--	--	--	--	26.32	--	--	Do
BH-17	4	9.50 - 10.25	Slightly weathered, brownish grey to deep grey, fine to medium grained, highly fractured sand stone.	2.336	2.304	1.360	3.135	--	--	--	--	0.99	--	--	--	--	38.65	Do
BH-17	6	11.00 - 11.75	Slightly weathered, deep grey, fine to medium grained, highly fractured sand stone.	--	--	--	--	--	222	--	--	--	71.29	--	--	--	--	Do

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ	Saturated								
BH-17	10	14.00 - 15.50	Fresh, deep / light grey, fine to medium grained, fractured sand stone.	--	--	--	--	2.471	371	321	0.87	--	--	Hard	--	--	--	Do
BH-18	1	7.50 - 8.25	Slightly weathered, yellowish grey, medium grained, fractured sand stone.	2.352	2.294	2.529	5.803	--	--	93	--	4.26	--	--	--	--	--	Do
BH-18	4	9.75 - 10.50	Slightly weathered, yellowish grey, medium grained, fractured sand stone.	--	--	--	--	2.436	166	--	--	--	--	--	23.22	--	--	Do
BH-18	10	14.25 - 15.00	Fresh, grey, medium to fine grained, fractured sand stone.	--	--	--	--	2.434	297	245	0.83	--	--	--	--	--	--	Do
BH-19	1	6.20- 7.00	Highly weathered, yellowish brown, fine to medium grained, fractured sandstone.	--	--	--	--	--	--	112	--	--	--	--	--	--	--	Do
BH-19	10	13.00- 13.75	Fresh, light grey, medium to fine grained, moderately fractured sandstone.	--	--	--	--	--	251	214	0.85	--	90.27	Hard	--	--	--	Do
BH-20	2	8.00 - 8.75	Moderately weathered, grey, medium grained, fractured sand stone.	2.371	2.326	1.958	4.555	--	175	--	--	0.99	--	--	--	--	--	Do
BH-20	9	13.25 - 14.00	Highly weathered, grey, medium grained, fractured sand stone.	--	--	--	--	--	--	--	--	7.65	--	Medium Soft	--	--	--	Do
BH-21	2	6.50 - 7.25	Moderately weathered, yellowish grey, fine grained, fractured sand stone.	2.350	2.296	2.337	5.366	2.426	227	130	0.57	--	--	--	--	--	--	Do
BH-21	3	7.25 - 8.00	Moderately weathered, yellowish grey to grey, fine grained, fractured sand stone.	--	--	--	--	--	--	132	--	2.46	--	--	--	--	--	Do
BH-21	6	9.50 - 10.00	Highly weathered, grey, fine grained, fractured sand stone.	--	--	--	--	--	--	--	--	0.97	--	--	--	--	--	Do
BH-22	1	8.10- 8.75	Moderately weathered, deep grey, fine grained, fractured sandstone.	--	--	--	--	--	187	--	--	--	--	--	--	--	--	Do
BH-22	3	9.50- 10.00	Slightly weathered, deep grey, fine grained, fractured sandstone.	2.381	2.330	2.18	5.0849	2.455	277	197	0.71	--	--	--	--	--	--	Do

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ	Saturated								
BH-23	5	10.25-11.00	Slightly weathered, brownish grey, medium to fine grained, fractured sandstone.	--	--	--	--	--	341	210	0.62	--	--	--	--	--	--	Do
BH-24	3	7.75-8.50	Moderately weathered, brownish grey, fine grained, fractured sandstone.	--	--	--	--	--	--	215	--	--	84.36	Medium Soft	--	4894	--	Do
BH-24	10	13.00-13.75	Fresh, grey, fine grained, fractured sandstone.	2.386	2.335	2.15	5.0245	2.459	102	78	0.76	--	--	--	--	--	--	Do
BH-25	5	7.75-8.50	Moderately weathered, yellowish grey, medium to fine grained, fractured sandstone.	--	--	--	--	--	134	--	--	--	--	--	--	--	--	Do
BH-25	7	9.25-10.00	Slightly weathered, yellowish grey, medium to fine grained, fractured sandstone.	--	--	--	--	--	318	261	0.82	--	--	--	--	--	--	Do
BH-26	2	6.25-7.00	Slightly weathered, yellowish grey, fine grained, fractured sandstone.	2.322	2.283	1.68	3.8248	2.374	--	--	--	1.14	78.41	Medium Soft	--	--	--	Do
BH-26	6	9.25-10.00	Slightly weathered, yellowish grey, fine grained, fractured sandstone.	--	--	--	--	--	167	117	0.70	--	--	--	--	--	--	Do
BH-27	2	7.00-7.75	Moderately weathered, brownish grey, medium to fine grained, fractured sandstone.	--	--	--	--	--	--	71	--	--	67.5	--	--	--	--	Do
BH-27	4	8.50-9.25	Moderately weathered, brownish grey, medium to fine grained, fractured sandstone.	2.355	2.300	2.39	5.5039	--	149	89	0.60	--	--	--	--	6135	--	Do
BH-27	7	10.75-11.50	Slightly weathered, brownish grey, medium to fine grained, fractured sandstone.	--	--	--	--	2.429	--	--	--	5.21	--	--	22.14	--	--	Do
BH-27	9	12.25-13.00	Slightly weathered, brownish grey, medium to fine grained, fractured sandstone.	2.421	2.369	2.18	5.1648	--	--	--	--	--	--	--	--	--	--	Do
BH-27	10	13.00-13.75	Fresh, brownish grey, medium to fine grained, fractured sandstone.	--	--	--	--	2.498	355	--	--	8.74	--	Hard	--	--	--	Do
BH-28	7	10.75-11.50	Slightly weathered, brownish grey, medium to fine grained, fractured sandstone.	--	--	--	--	--	131	87	0.66	--	82.61	--	--	--	--	Do

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ	Saturated								
BH-28	10	13.00-13.75	Slightly weathered, deep grey, medium to fine grained, fractured sandstone.	--	--	--	--	--	--	--	--	2.47	--	--	26.47	--	--	Do
BH-29	1	4.50-5.25	Moderately weathered, light grey, medium grained, fractured sand stone.	2.334	2.290	1.93	4.4266	2.396	--	84	--	--	--	--	--	--	--	Do
BH-29	7	9.00-9.75	Moderately weathered, light grey, medium grained, fractured sand stone.	--	--	--	--	--	321	283	0.88	--	--	--	--	--	--	Do
BH-30	3	7.25-8.00	Slightly weathered, yellowish grey, fine grained, fractured sandstone.	--	--	--	--	--	234	--	--	--	94.35	Medium Soft	--	--	--	Do
BH-30	5	8.75-9.50	Slightly weathered, yellowish grey, fine grained, fractured sandstone.	2.371	2.320	2.21	5.1219	2.445	314	149	0.48	--	--	--	--	--	--	Do
BH-31	5	8.50-9.25	Moderately weathered,brownish grey, medium to fine grained, fractured sand stone.	--	--	--	--	--	--	--	--	3.54	--	--	--	--	--	Do
BH-31	8	10.75-11.50	Slightly weathered, grey, medium to fine grained, fractured sandstone.	--	--	--	--	--	349	271	0.78	--	--	--	16.47	7.148	--	Do
BH-32	3	4.75-5.50	Slightly weathered, brownish grey, fine grained, fractured sandstone.	2.309	2.255	2.40	5.4139	2.384	201	112	0.56	--	--	--	--	--	41.63	Do
BH-33	4	6.50-7.25	Moderately weathered, yellowish brown, medium grained, fractured sand stone.	--	--	--	--	--	211	--	--	--	87.62	Medium Soft	--	--	--	Do
BH-33	10	11.00-11.75	Slightly weathered, light grey, medium grained, fractured sandstone.	--	--	--	--	--	--	184	--	--	--	--	--	--	--	Do
BH-34	1	4.00-4.75	Highly weathered, yellowish brown, medium grained, fractured sandstone.	--	--	--	--	--	134	--	--	--	--	--	--	--	--	Do
BH-34	6	7.75-8.50	Slightly weathered, whitish grey, medium grained, moderately fractured sandstone.	2.283	2.213	3.15	6.9780	2.379	98	39	0.40	--	--	--	--	--	--	Do
BH-35	4	6.50-7.25	Highly weathered, yellowish brown, medium grained, fractured sandstone.	--	--	--	--	--	--	--	--	0.97	--	--	--	--	--	Do

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ	Saturated								
BH-35	8	9.50-10.00	Slightly weathered, brownish grey, medium grained, moderately fractured sandstone.	--	--	--	--	--	145	91	0.63	--	83.76	Medium Soft	--	--	--	Do
BH-36	5	7.50-8.25	Highly weathered, yellowish brown, fine grained, highly fractured sandstone.	--	--	--	--	--	--	--	--	2.64	--	--	19.24	--	--	Do
BH-36	7	9.00-10.00	Moderately weathered, yellowish brown, fine grained, highly fractured sandstone.	2.447	2.408	1.62	3.8899	2.505	--	179	--	--	--	--	--	13466	--	Do
BH-37	2	4.25-5.00	Moderately weathered, yellowish brown, medium grained, highly fractured sandstone.	--	--	--	--	--	88	--	--	--	--	--	--	--	--	Do
BH-37	8	8.75-9.50	Slightly weathered, grey, fine grained, moderately fractured sandstone.	--	--	--	--	--	--	38	--	--	--	--	--	--	--	Do

TEST RESULTS OF ROCK CORES

Name of Work :	Geotechnical Investigation for N.T.P.C Talcher Thermal Stage -III (2x660) MW.
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Sr. No.	Bore Hole No.	Core No.	Depth, m		Diameter, cm	Height, cm	H : D (1:H/D)	Correction Factor	Condition of Test	Failure Load	Uniaxial Compressive Strength	Modulus of Elasticity	Point Load Index	Slake Durability Index *	Porosity	Water Absorption	Dry Density	Specific Gravity	Soundness	Hardness by Schmidt Hammer value	Remarks
			From	To	cm	cm				kN	kg/cm ²	kg/cm ²	kg/cm ²	%	%	%	gm/cm ³		%		

Table G-5 (v)

[illegible]

TEST RESULTS OF ROCK CORES

Name of Work :																					
Geotechnical Investigation for N.T.P.C Talcher Thermal Stage -III (2x660) MW.																					
Sr. No.	Bore Hole No.	Core No.	Depth, m		Diameter, cm	Height, cm	H : D (1:H/D)	Correction Factor	Condition of Test	Failure Load	Uniaxial Compressive Strength	Modulus of Elasticity	Point Load Index	Slake Durability Index *	Porosity	Water Absorption	Dry Density	Specific Gravity	Soundness	Hardness by Schmidt Hammer value	Remarks
			From	To																	

Table G-4 (v)

1	4	18	3.15	4.50											10.30	4.60	2.243	2.64			
2		44	6.50	7.50	5.30	10.25	1.93	0.992	Soaked	36.3	167.00								8.15		
3		118	11.50	12.50	5.38	7.05	1.31		Soaked	0.30			0.22								
4	9	13	4.70	5.70	4.90	5.20	1.06	0.836	Soaked	33.40	151.00										
5		67	11.70	12.70	5.00	5.30	1.06	0.836	Soaked	43.8	190.00										
6		208	18.70	19.70	5.30	7.80	1.47		Soaked	0.40			0.29								
7	13	184	16.90	17.90	5.40	10.62	1.97	0.996	Soaked	20.70	92.00										
8		207	18.90	20.00	5.40	8.00	1.48		Soaked	0.30			0.22								
9	81	15	6.20	7.20	5.40	10.30	1.91	0.989	Soaked	41.00	180.60										
10		35	10.20	11.20	5.39	10.32	1.91	0.990	Soaked	81.0	358.40								6.54		
11		86	18.20	19.20	5.42	8.02	1.48	0.928	Soaked	30.00	123.00										

TEST RESULTS OF ROCK CORES

Name of Work : Geotechnical Investigation for N.T.P.C Talcher Thermal Stage -III (2x660) MW.

Sr. No.	Bore Hole No.	Core No.	Depth, m		Diameter, cm	Height, cm	H : D (1:H/D)	Correction Factor	Condition of Test	Failure Load	Uniaxial Compressive Strength	Modulus of Elasticity	Point Load Index	Slake Durability Index *	Porosity	Water Absorption	Dry Density	Specific Gravity	Soundness	Hardness by Schmidt Hammer value	Remarks
			From	To																	
18		233	19.40	20.00	5.23	6.83	1.31		Soaked	0.90			0.67								
19	10	15	4.00	5.00					Soaked						6.10	2.70	2.315	2.61	9.03		
20		22	5.00	6.00																	
21		167	15.00	16.00	5.37	7.91	1.47		Soaked	0.60			0.44								
22		232	19.00	20.00	5.20	5.40	1.04	0.829	Soaked	46.90	187.00										
23		367	25.00	26.00	5.20	5.20	1.00	0.982	Soaked	45.90	180.0										
24		385	26.00	27.00	5.20	10.40	2.00	1.000	Soaked	20.20	97.0										
25		403	27.00	28.00																22.00	
26		11	2	3.20	4.20	5.30	5.50	1.04	0.829	Soaked	29.60	113.0			9.30	4.1	2.29				
27	21		6.20	7.20	5.30	10.30	1.94	0.994	Soaked	29.70	136.0										
28	106		13.20	14.20														9.12			
29	131		16.20	17.20	5.40	5.50	1.02	0.824	Soaked	21.20	78.0										
30	14	25	5.00	6.00	5.10	9.75	1.91	0.990	Soaked	44.10	218.0										
31		34	6.00	7.00	4.30	6.70	1.56		Soaked	0.00			0.00								
32		159	19.10	20.00	5.24	10.27	1.97	0.995	Soaked	38.10	179.00										
33	15	47	11.00	12.00										8.00	2.4	2.34					
34		50	11.00	12.00	5.40	5.46	1.01	0.822	Soaked	32.60	119.0										
35		101	16.00	17.00															24.00		
36	73	4	2.20	3.20	5.09	9.62	1.89	0.987	Soaked	43.00	212.7										
37		178	14.20	15.20	5.24	9.57	1.83	0.979	Soaked	36.00	166.70										

TEST RESULTS OF ROCK CORES

Name of Work : Geotechnical Investigation for N.T.P.C Talcher Thermal Stage -III (2x660) MW.																					
Sr. No.	Bore Hole No.	Core No.	Depth, m		Diameter, cm	Height, cm	H : D (1:H/D)	Correction Factor	Condition of Test	Failure Load	Uniaxial Compressive Strength	Modulus of Elasticity	Point Load Index	Slake Durability Index *	Porosity	Water Absorption	Dry Density	Specific Gravity	Soundness	Hardness by Schmidt Hammer value	Remarks
			From	To						cm	cm	kN	kg/cm ²	kg/cm ²	kg/cm ²	%	%		%		

Table G-2 (v)

1	16	10	3.70	4.70	5.20	10.40	2.00	1.000	Soaked	45.0	216.04										
2	17	29	3.75	4.75											11.30	5.1	2.197				
3		21	3.45	4.45	5.37	7.00				0.20			0.27								
4		59	3.75	8.75	5.35	10.50	1.96	0.996	Soaked	56.70	256.08								6.96		
5		98	14.75	15.75	5.40	10.70	1.98	0.998	Soaked	54.50	242.18										
6		85	11.75	12.75	5.40	10.00						2.97 E + 05								30.00	
7	20	23	3.80	4.80	5.40	10.00	1.85	0.983	Soaked	37.0	161.84										
8		42	9.80	10.80	5.40	10.40				63.5	280.4										
9		43	9.80	10.80	5.40	10.00						2.62 E + 05									
10	21	9	2.10	3.10											9.63	4.29	2.244				
11		169	15.10	16.10	5.40	10.00						1.15 E + 05								20.00	
12	24	5	2.00	3.00	5.35	10.45	1.95	0.995	Soaked	45.6	205.73										
13	25	20	3.65	4.65											11.27	5.10	2.210				
14		40	4.65	6.65	5.10	9.70	1.90	0.989	Soaked	29.2	144.00										
15		123	11.65	12.65	5.13	10.10				0.6			0.45								
16		138	12.65	13.65	5.30	10.40	2.00	0.996	Soaked	63.00	289.92										

TEST RESULTS OF ROCK CORES

Name of Work : Geotechnical Investigation for N.T.P.C Talcher Thermal Stage -III (2x660) MW.

Sr. No.	Bore Hole No.	Core No.	Depth, m		Diameter, cm	Height, cm	H : D (1:H/D)	Correction Factor	Condition of Test	Failure Load kN	Uniaxial Compressive Strength kg/cm ²	Modulus of Elasticity kg/cm ²	Point Load Index kg/cm ²	Slake Durability Index * %	Porosity %	Water Absorption %	Dry Density gm/cm ³	Specific Gravity	Soundness %	Hardness by Schmidt Hammer value	Remarks
			From	To	cm	cm															

Table G-3 (v)

1	19	20	5.15	6.15	5.30	10.50	2.00	0.998	Soaked	40.00	184.47									
2		48	9.15	10.15	5.25	5.50	1.05	0.832	Soaked	20.20	79.16									
3		15	3.20	4.20											8.75	3.85	2.275			
4	23	51	5.20	6.20	5.50	5.70	1.04	0.829	Soaked	43.3	154.02									
5		100	8.20	9.20	5.60	7.40				0.20			0.14							
6		147	11.20	12.20															21.00	
7	26	72	9.00	10.00	5.40	10.67	1.98	0.997	Soaked	8.70	38.63									
8		108	12.00	13.00	4.91	9.50				0.20			0.16							
9	27	3	2.25	3.25	5.30	10.60	2.00	1.000	Soaked	31.80	147.00									
10		30	5.25	6.25	5.24	5.46	1.04	0.830	Soaked	17.0	67.00							9.42		
11		127	13.25	14.25	5.16	9.14	1.77	0.972	Soaked	25.00	118.0									
12	28	108	9.00	10.00													2.62			
13		117	9.00	10.00	4.73	5.05				0.4			0.32							
14		157	12.00	13.00													2.53			
15		162	12.00	13.00	5.02	9.79	1.95	0.994	Soaked	36.20	185.00									
16		188	14.00	15.00													2.54			
17		249	17.00	18.00													2.59			

5.9. CHEMICAL TESTS:

Chemical tests were performed on few soil and water samples for determining the pH value, Sulphate, Chloride, organic matter content etc. The results are given in a tabular form below:

CHEMICAL TEST RESULTS ON SOIL SAMPLES:-

BH/Sample No.	Depth (m)	pH value	Sulphate as SO ₃ (%)	Chloride as Cl (%)	Organic Matter (%)
BH-20 / UDS01	1.00-1.45	8.06	B.D.L.*	0.0070	0.196
BH-25 / UDS01	1.00-1.45	7.41	B.D.L.*	0.0080	0.208
BH-27 / UDS01	1.00-1.45	7.84	B.D.L.*	0.0080	0.226
BH-35 / UDS01	1.00-1.45	6.20	B.D.L.*	0.0080	0.225

*B.D.L. = Below Detection Limit (i.e. below 0.050%)

CHEMICAL TEST RESULTS ON WATER SAMPLES:-

BH/Sample No.	Depth (m)	pH value	Sulphate as SO ₃ (mg/Ltr.)	Chloride as Cl (mg/Ltr.)	Organic Matter (mg/Ltr.)
BH-02 / WS01	1.20	6.38	60	10	21.82
BH-21 / WS01	2.45	6.65	60	16	16.36
BH-33 / WS01	1.10	6.82	60	24	19.09

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2.11. ELECTRICAL RESISTIVITY TEST:

Twenty one (21) nos. Electrical Resistivity Tests were carried out at the following locations around Plant Area. The test procedure and results are presented under Section-8.

ERT No.	Co-ordinates (M)		Reduced Level (M)	ERT No.	Co-ordinates (M)		Reduced Level (M)
	Easting	Northing			Easting	Northing	
ERT-1	572	4788	67.242	ERT-12	1112	3790	69.612
ERT-2	673	4909	70.454	ERT-13	1110	3635	70.619
ERT-3	844	4781	74.382	ERT-14	1380	3785	68.711
ERT-4	1216	4530	69.352	ERT-15	1448	3690	68.612
ERT-5	604	4638	68.743	ERT-16	1253	3732	69.517
ERT-6	1344	4370	71.619	ERT-17	1405	3429	68.219
ERT-7	1473	4245	71.042	ERT-18	1060	3206	67.412
ERT-8	1632	4230	70.514	ERT-19	893	3079	67.912
ERT-9	1277	4281	70.811	ERT-20	1156	3690	71.649
ERT-10	1566	4151	71.716	ERT-21	632	4180	76.177
ERT-11	1134	3976	72.713				

ERT No. 01

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	22.929	22.944	22.913	22.928	22.93
2	1.0	11.183	11.246	11.309	11.152	11.22
3	2.0	7.979	8.104	8.042	8.167	8.07
4	3.0	7.916	7.539	7.822	7.916	7.80
5	4.0	9.424	9.424	9.298	9.047	9.30
6	5.0	9.581	9.267	9.424	9.738	9.50
7	6.0	10.555	11.497	11.309	10.932	11.07
8	7.0	10.995	11.874	12.314	11.655	11.71
9	8.0	11.057	12.063	11.058	11.058	11.31
10	10.0	12.251	12.880	11.623	13.058	12.45

Mean Resistivity at ERT-01 is 11.54 Ohm - m.

ERT No. 02

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	35.022	34.865	34.708	35.179	34.94
2	1.0	23.529	23.592	23.529	23.498	23.54
3	2.0	13.256	13.445	13.382	13.445	13.38
4	3.0	15.833	15.833	16.304	16.115	16.02
5	4.0	17.592	18.220	17.969	17.717	17.87
6	5.0	17.906	18.377	18.849	18.377	18.38
7	6.0	17.341	18.849	18.472	17.718	18.10
8	7.0	17.592	15.613	15.833	16.053	16.27
9	8.0	17.592	17.341	16.838	17.592	17.34
10	10.0	19.163	18.848	18.534	19.791	19.08

Mean Resistivity at ERT-02 is 19.49 Ohm - m.

ERT No. 03

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	28.488	28.410	28.457	28.457	28.45
2	1.0	33.016	33.111	33.079	33.111	33.08
3	2.0	38.702	39.079	38.828	39.080	38.92
4	3.0	39.771	40.336	40.242	40.242	40.15
5	4.0	37.195	37.195	37.321	37.823	37.38
6	5.0	36.127	36.284	35.812	36.598	36.21
7	6.0	34.117	33.740	34.683	34.117	34.16
8	7.0	32.106	31.447	33.206	32.106	32.22
9	8.0	30.649	30.410	30.159	30.912	30.53
10	10.0	32.357	32.986	32.357	31.415	32.28

Mean Resistivity at ERT-03 is 34.34 Ohm - m.

ERT No. 04

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	43.345	43.345	43.345	43.345	43.35
2	1.0	42.724	43.038	44.295	43.352	43.35
3	2.0	28.964	29.090	29.152	29.153	29.09
4	3.0	25.634	25.634	26.011	25.728	25.75
5	4.0	21.990	22.492	22.115	22.367	22.24
6	5.0	21.048	21.519	21.833	21.519	21.48
7	6.0	19.037	19.226	19.226	19.603	19.27
8	7.0	18.692	19.571	19.132	18.692	19.02
9	8.0	20.608	21.111	20.106	20.357	20.55
10	10.0	23.561	22.933	23.875	23.875	23.56

Mean Resistivity at ERT-04 is 26.77 Ohm - m.

ERT No. 05

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	19.442	19.426	19.474	19.458	19.45
2	1.0	6.376	6.345	6.314	6.220	6.31
3	2.0	4.963	5.152	5.340	5.277	5.18
4	3.0	5.560	5.748	6.031	5.937	5.82
5	4.0	7.036	7.288	7.664	7.664	7.41
6	5.0	8.324	9.267	9.895	8.481	8.99
7	6.0	9.424	9.989	10.555	9.989	9.99
8	7.0	10.115	10.555	11.215	9.895	10.45
9	8.0	11.058	10.555	10.304	10.304	10.56
10	10.0	12.880	12.251	19.937	12.565	14.41

Mean Resistivity at ERT-05 is 9.86 Ohm - m.

ERT No. 06

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	34.865	34.865	35.022	35.179	34.98
2	1.0	28.022	28.053	28.022	27.990	28.02
3	2.0	30.283	30.095	30.284	30.346	30.25
4	3.0	30.157	29.969	30.063	30.252	30.11
5	4.0	34.933	35.561	35.310	35.058	35.22
6	5.0	37.383	37.540	37.697	37.855	37.62
7	6.0	39.583	40.337	40.337	40.337	40.15
8	7.0	41.782	42.442	42.222	41.122	41.89
9	8.0	42.976	42.222	43.227	42.724	42.79
10	10.0	47.122	46.494	47.123	46.180	46.73

Mean Resistivity at ERT-06 is 36.78 Ohm - m.

ERT No. 07

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	52.140	52.140	52.925	52.140	52.34
2	1.0	45.896	45.803	45.896	45.834	45.86
3	2.0	36.441	36.504	36.818	36.626	36.60
4	3.0	37.792	38.074	38.168	38.074	38.03
5	4.0	48.253	48.630	48.755	48.504	48.54
6	5.0	50.578	50.106	50.253	49.949	50.22
7	6.0	45.803	46.557	46.557	46.369	46.32
8	7.0	52.778	52.778	52.778	52.118	52.61
9	8.0	55.793	55.794	56.799	55.542	55.98
10	10.0	46.180	47.437	47.122	46.808	46.89

Mean Resistivity at ERT-07 is 47.34 Ohm - m.

ERT No. 08

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	44.131	44.445	44.602	44.288	44.37
2	1.0	36.692	36.535	36.598	36.692	36.63
3	2.0	36.880	36.566	36.944	36.944	36.83
4	3.0	45.049	45.520	45.331	45.802	45.43
5	4.0	52.902	53.530	53.028	53.028	53.12
6	5.0	57.960	57.332	56.861	57.018	57.29
7	6.0	67.669	68.046	67.858	67.481	67.76
8	7.0	76.748	76.968	77.188	76.968	76.97
9	8.0	81.429	80.926	80.675	79.921	80.74
10	10.0	93.617	94.874	93.618	93.932	94.01

Mean Resistivity at ERT-08 is 59.31 Ohm - m.

ERT No. 09

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	119.672	119.829	119.358	119.672	119.63
2	1.0	42.158	42.096	42.252	42.189	42.17
3	2.0	40.022	40.399	40.399	40.211	40.26
4	3.0	56.358	56.641	56.075	56.452	56.38
5	4.0	65.091	65.468	65.594	65.719	65.47
6	5.0	62.830	63.144	62.358	62.201	62.63
7	6.0	69.743	70.120	70.308	70.120	70.07
8	7.0	78.947	79.167	78.947	79.387	79.11
9	8.0	75.899	78.664	75.899	77.156	76.90
10	10.0	94.560	96.131	96.445	94.560	95.42

Mean Resistivity at ERT-09 is 70.81 Ohm - m.

ERT No. 10

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	113.233	113.076	113.390	113.547	113.31
2	1.0	46.180	46.085	46.117	46.180	46.14
3	2.0	17.278	17.529	17.529	17.780	17.53
4	3.0	17.152	16.681	17.246	17.152	17.06
5	4.0	12.188	12.942	12.314	12.691	12.53
6	5.0	13.508	14.136	12.880	13.037	13.39
7	6.0	14.325	14.702	14.702	15.267	14.75
8	7.0	13.194	14.074	14.074	14.294	13.91
9	8.0	13.068	13.822	14.325	14.827	14.01
10	10.0	13.822	12.251	12.880	13.194	13.04

Mean Resistivity at ERT-10 is 27.57 Ohm - m.

ERT No. 11

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	49.156	49.313	48.685	48.528	48.92
2	1.0	75.710	76.338	76.024	76.338	76.10
3	2.0	63.269	63.269	63.269	63.080	63.22
4	3.0	54.473	54.756	54.756	54.285	54.57
5	4.0	45.739	45.991	45.865	46.242	45.96
6	5.0	41.153	40.996	40.525	42.095	41.19
7	6.0	39.583	40.148	40.525	39.583	39.96
8	7.0	35.625	36.065	36.065	36.065	35.96
9	8.0	30.661	31.163	30.159	30.158	30.54
10	10.0	35.185	35.813	35.813	34.871	35.42

Mean Resistivity at ERT-11 is 47.18 Ohm - m.

ERT No. 12

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	73.342	73.499	73.499	73.813	73.54
2	1.0	43.729	43.760	43.697	43.760	43.74
3	2.0	20.859	20.984	20.733	20.922	20.87
4	3.0	14.607	14.984	14.701	14.796	14.77
5	4.0	15.832	16.084	16.084	16.084	16.02
6	5.0	12.251	12.880	12.723	12.565	12.60
7	6.0	11.120	11.309	11.120	11.874	11.36
8	7.0	9.895	10.335	11.215	11.655	10.78
9	8.0	8.042	8.042	8.796	9.801	8.67
10	10.0	8.482	9.110	9.738	10.052	9.35

Mean Resistivity at ERT-12 is 22.17 Ohm - m.

ERT No. 13

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	47.429	47.272	46.957	47.115	47.19
2	1.0	36.535	36.441	36.598	36.441	36.50
3	2.0	13.822	14.010	13.822	14.136	13.95
4	3.0	8.576	9.047	9.518	8.953	9.02
5	4.0	7.664	7.413	8.167	8.041	7.82
6	5.0	8.167	8.953	8.796	8.482	8.60
7	6.0	9.047	9.801	9.801	9.801	9.61
8	7.0	9.016	8.576	7.696	8.796	8.52
9	8.0	8.544	9.299	9.801	8.796	9.11
10	10.0	12.251	13.508	13.508	13.822	13.27

Mean Resistivity at ERT-13 is 16.36 Ohm - m.

ERT No. 14

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	37.377	36.592	36.435	36.592	36.75
2	1.0	32.765	32.702	32.734	32.639	32.71
3	2.0	22.744	22.869	22.744	22.870	22.81
4	3.0	14.513	14.796	14.890	14.984	14.80
5	4.0	13.947	13.571	13.947	13.947	13.85
6	5.0	15.078	15.079	15.550	15.393	15.28
7	6.0	16.587	17.152	17.341	16.964	17.01
8	7.0	18.032	18.252	18.032	18.472	18.20
9	8.0	18.597	19.100	18.849	18.346	18.72
10	10.0	21.676	22.304	21.362	20.734	21.52

Mean Resistivity at ERT-14 is 21.16 Ohm - m.

ERT No. 15

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	9.972	9.988	10.003	10.051	10.00
2	1.0	6.314	6.251	6.314	6.220	6.27
3	2.0	6.220	6.345	6.534	6.471	6.39
4	3.0	5.937	6.031	5.842	5.937	5.94
5	4.0	6.534	6.282	6.408	6.408	6.41
6	5.0	7.382	7.539	7.696	7.068	7.42
7	6.0	7.916	8.104	8.670	7.916	8.15
8	7.0	8.576	8.356	8.356	8.576	8.47
9	8.0	9.801	9.550	10.304	9.047	9.68
10	10.0	10.995	10.680	10.995	11.309	10.99

Mean Resistivity at ERT-15 is 7.97 Ohm - m.

ERT No. 16

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	12.359	12.375	12.375	12.375	12.37
2	1.0	5.968	6.062	5.999	5.937	5.99
3	2.0	6.157	6.220	6.157	6.345	6.22
4	3.0	7.256	7.350	7.256	7.445	7.33
5	4.0	8.544	8.419	8.795	8.670	8.61
6	5.0	10.995	11.152	10.995	10.995	11.03
7	6.0	12.251	11.497	12.063	12.063	11.97
8	7.0	13.634	14.074	14.284	14.733	14.18
9	8.0	14.827	15.079	15.330	16.335	15.39
10	10.0	20.105	20.419	20.419	21.047	20.50

Mean Resistivity at ERT-16 is 11.36 Ohm - m.

ERT No. 17

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	47.586	47.272	47.743	47.429	47.51
2	1.0	45.551	45.645	45.645	45.677	45.63
3	2.0	25.822	25.885	25.885	25.697	25.82
4	3.0	18.189	18.566	18.471	18.660	18.47
5	4.0	17.340	17.340	17.717	17.717	17.53
6	5.0	16.335	16.335	16.021	16.492	16.30
7	6.0	17.152	17.341	17.906	17.906	17.58
8	7.0	15.833	16.053	16.492	16.053	16.11
9	8.0	17.592	16.838	17.341	17.341	17.28
10	10.0	20.733	20.105	20.734	20.734	20.58

Mean Resistivity at ERT-17 is 24.28 Ohm - m.

ERT No. 18

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	18.092	18.107	18.060	18.092	18.09
2	1.0	14.984	15.016	15.016	15.047	15.02
3	2.0	10.052	10.115	10.052	10.052	10.07
4	3.0	10.272	10.366	10.555	10.460	10.41
5	4.0	12.566	12.314	13.193	12.188	12.57
6	5.0	14.450	14.450	14.607	14.136	14.41
7	6.0	16.964	16.210	16.398	16.210	16.45
8	7.0	18.692	18.692	18.032	18.692	18.53
9	8.0	19.854	20.859	20.105	19.603	20.11
10	10.0	23.561	25.446	23.561	22.304	23.72

Mean Resistivity at ERT-18 is 15.94 Ohm - m.

ERT No. 19

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	23.321	23.290	23.260	23.227	23.27
2	1.0	27.770	27.676	27.739	27.582	27.69
3	2.0	26.136	26.137	26.325	26.576	26.29
4	3.0	21.298	21.581	21.958	22.241	21.77
5	4.0	16.712	17.089	17.340	17.843	17.25
6	5.0	13.351	14.136	14.607	14.922	14.25
7	6.0	12.251	13.005	13.382	13.571	13.05
8	7.0	13.414	15.173	16.493	14.294	14.84
9	8.0	12.566	13.319	14.074	14.074	13.51
10	10.0	15.079	15.079	16.021	15.393	15.39

Mean Resistivity at ERT-19 is 18.73 Ohm - m.

ERT No. 20

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	30.310	30.467	30.153	30.624	30.39
2	1.0	24.440	24.471	24.534	24.471	24.48
3	2.0	12.314	12.566	12.314	12.503	12.42
4	3.0	8.104	8.293	8.010	8.199	8.15
5	4.0	8.293	7.916	7.664	7.539	7.85
6	5.0	9.581	9.424	9.581	9.581	9.54
7	6.0	10.555	10.932	10.932	11.120	10.88
8	7.0	12.534	13.414	14.294	13.634	13.47
9	8.0	13.068	13.068	13.822	13.068	13.26
10	10.0	14.765	16.021	15.707	15.393	15.47

Mean Resistivity at ERT-20 is 14.59 Ohm - m.

ERT No. 21

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	10.962	11.008	10.993	11.040	11.00
2	1.0	14.984	15.047	15.047	15.110	15.05
3	2.0	22.932	22.932	22.681	22.870	22.85
4	3.0	19.602	19.885	19.791	19.696	19.74
5	4.0	19.225	19.351	20.230	19.100	19.48
6	5.0	22.932	22.461	23.561	23.718	23.17
7	6.0	33.240	33.929	34.683	35.814	34.42
8	7.0	31.667	31.227	33.206	34.085	32.55
9	8.0	32.923	32.923	33.928	35.436	33.80
10	10.0	32.043	31.729	32.357	34.242	32.59

Mean Resistivity at ERT-21 is 24.46 Ohm - m.

ELECTRICAL RESISTIVITY TEST

Project : Geotechnical Investigation for NTPC Talcher Thermal Stage 3rd (2 x 660 MW)

Test No. : ERT 1

Location : Near BH 1

Co ordinate : E= 1413.20; N = 3923.08

Date : 20.08.09

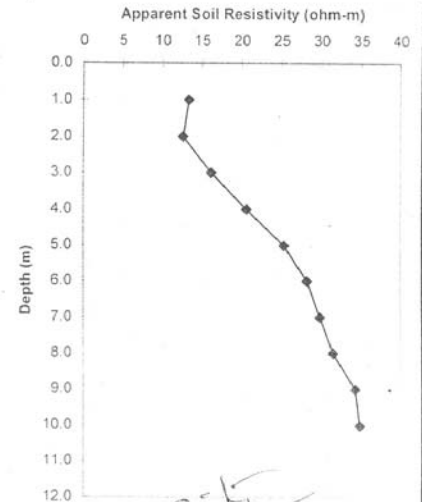
Current : 7Amp

Voltage : 50 V

Reduced Level :

Survey Method :

Sr. No	Electrode Spacing, a m	Direction - N - S	Direction - NE - SW	Direction - E - W	Direction - SE-NW	Average Apparent Soil Resistivity $\rho = 2 \pi a R$ ohm - m
		Apparent resistivity ohm-m	Apparent resistivity ohm-m	Apparent resistivity ohm-m	Apparent resistivity ohm-m	
1	1.0	13.58	--	13.00	--	13.29
2	2.0	12.76	--	12.37	--	12.57
3	3.0	15.87	--	16.35	--	16.11
4	4.0	20.00	--	21.20	--	20.60
5	5.0	23.40	--	27.20	--	25.30
6	6.0	25.20	--	31.10	--	28.15
7	7.0	29.10	--	30.50	--	29.80
8	8.0	25.40	--	37.50	--	31.45
9	9.0	30.50	--	38.00	--	34.25
10	10.0	33.80	--	35.80	--	34.80



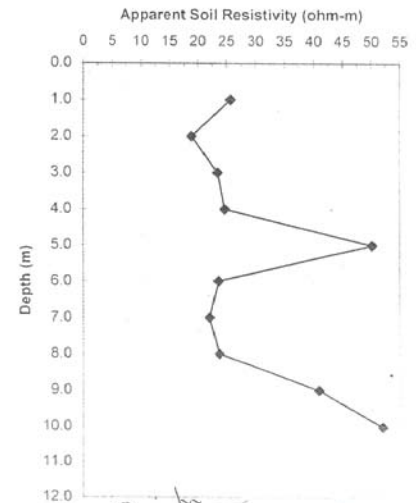
ELECTRICAL RESISTIVITY TEST

Project : Geotechnical Investigation for NTPC Talcher Thermal Stage 3rd (2 x 660 MW)
 Test No. : ERT 2
 Location : Near BH 3
 Co ordinate : E= 1806.11; N = 3967.14

Date : 08.10.2009
 Current : 7Amp
 Voltage : 50 V

Reduced Level :
 Survey Method :

Sr. No	Electrode Spacing, a m	Direction - N - S	Direction - NE - SW	Direction - E - W	Direction - SE-NW	Average Apparent Soil Resistivity $\rho = 2\pi a R$ ohm - m
		Apparent resistivity ohm-m	Apparent resistivity ohm-m	Apparent resistivity ohm-m	Apparent resistivity ohm-m	
1	1.0	16.85	--	34.60	--	25.73
2	2.0	24.20	--	13.61	--	18.91
3	3.0	32.40	--	14.51	--	23.46
4	4.0	36.20	--	13.18	--	24.69
5	5.0	38.10	--	62.20	--	50.15
6	6.0	22.80	--	24.30	--	23.55
7	7.0	20.50	--	23.40	--	21.95
8	8.0	33.70	--	13.60	--	23.65
9	9.0	65.80	--	15.84	--	40.82
10	10.0	67.50	--	36.40	--	51.95



ELECTRICAL RESISTIVITY TEST

Project : Geotechnical Investigation for NTPC Talcher Thermal Stage 3rd (2 x 660 MW)

Test No. : ERT 3

Location : Near BH 5

Co ordinate : E= 1415.33; N = 3966.91

Date : 20.08.09

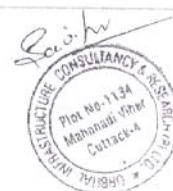
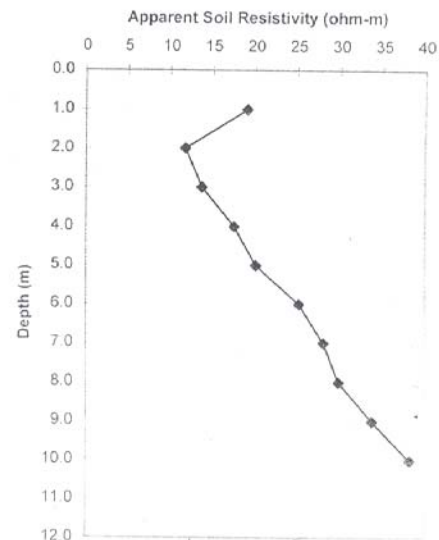
Current : 7Amp

Voltage : 50 V

Reduced Level :

Survey Method :

Sr. No	Electrode Spacing, a m	Direction - N - S	Direction - NE - SW	Direction - E - W	Direction - SE-NW	Average Apparent Soil Resistivity $\rho = 2 \pi a R$ ohm - m
		Apparent resistivity	Apparent resistivity	Apparent resistivity	Apparent resistivity	
		ohm-m	ohm-m	ohm-m	ohm-m	
1	1.0	18.43	--	19.63	--	19.03
2	2.0	11.40	--	12.09	--	11.75
3	3.0	13.70	--	13.71	--	13.71
4	4.0	16.74	--	18.30	--	17.52
5	5.0	20.30	--	19.92	--	20.11
6	6.0	24.30	--	26.10	--	25.20
7	7.0	26.50	--	29.60	--	28.05
8	8.0	30.40	--	29.10	--	29.75
9	9.0	32.90	--	34.50	--	33.70
10	10.0	37.40	--	38.80	--	38.10



ELECTRICAL RESISTIVITY TEST

Project : Geotechnical Investigation for NTPC Talcher Thermal Stage 3rd (2 x 660 MW)

Test No. : ERT 4

Location : Near BH 13

Co ordinate : E= 1363.83; N = 4078.14

Date : 08.10.2009

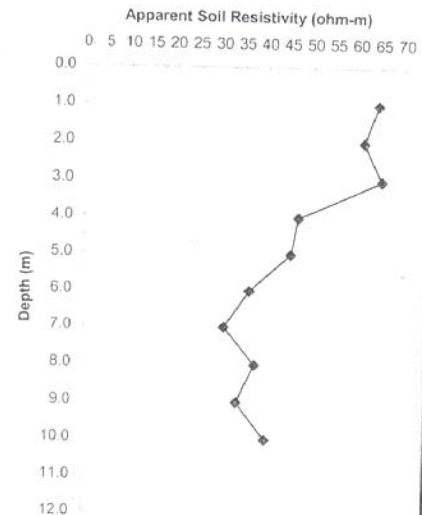
Current : 7Amp

Voltage : 50 V

Reduced Level :

Survey Method :

Sr. No	Electrode Spacing, a m	Direction - N - S	Direction - NE - SW	Direction - E - W	Direction - SE-NW	Average Apparent Soil Resistivity $\rho = 2 \pi a R$ ohm - m
		Apparent resistivity	Apparent resistivity	Apparent resistivity	Apparent resistivity	
		ohm-m	ohm-m	ohm-m	ohm-m	
1	1.0	43.90	--	84.60	--	64.25
2	2.0	52.00	--	70.50	--	61.25
3	3.0	53.80	--	76.70	--	65.25
4	4.0	43.40	--	50.60	--	47.00
5	5.0	44.20	--	46.60	--	45.40
6	6.0	37.50	--	35.10	--	36.30
7	7.0	29.20	--	32.40	--	30.80
8	8.0	36.40	--	38.70	--	37.55
9	9.0	31.30	--	35.80	--	33.55
10	10.0	33.40	--	46.40	--	39.90



ELECTRICAL RESISTIVITY TEST

Project : Geotechnical Investigation for NTPC Talcher Thermal Stage 3rd (2 x 660 MW)
 Test No. : ERT 5
 Location : Near BH 21
 Co ordinate : E= 1374.24; N = 4180.08

Date : 08.10.2009

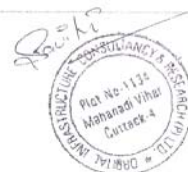
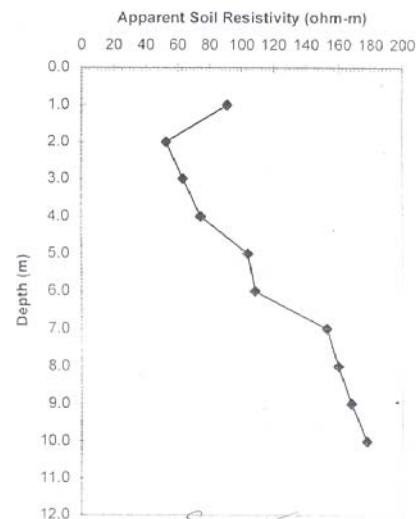
Current : 7Amp

Voltage : 50 V

Reduced Level :

Survey Method :

Sr. No	Electrode Spacing, a	Direction - N - S	Direction - NE - SW	Direction - E - W	Direction - SE-NW	Average Apparent Soil Resistivity $\rho = 2\pi a R$
		Apparent resistivity	Apparent resistivity	Apparent resistivity	Apparent resistivity	
		m ohm-m	m ohm-m	m ohm-m	m ohm-m	
1	1.0	84.30	--	97.40	--	90.85
2	2.0	50.60	--	54.50	--	52.55
3	3.0	66.00	--	60.60	--	63.30
4	4.0	74.70	--	74.30	--	74.50
5	5.0	82.40	--	125.70	--	104.05
6	6.0	71.10	--	145.20	--	108.15
7	7.0	117.90	--	186.30	--	152.10
8	8.0	134.10	--	184.20	--	159.15
9	9.0	149.30	--	185.60	--	167.45
10	10.0	164.40	--	190.50	--	177.45



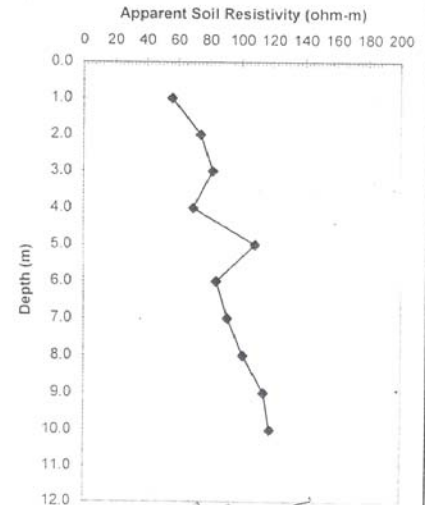
ELECTRICAL RESISTIVITY TEST

Project : Geotechnical Investigation for NTPC Talcher Thermal Stage 3rd (2 x 660 MW)
 Test No. : ERT 6
 Location : Near BH 25
 Co ordinate : E= 1386.16; N = 4247.92

Date : 08.10.2009
 Current : 7Amp
 Voltage : 50 V

Reduced Level :
 Survey Method :

Sr. No	Electrode Spacing, a m	Direction - N - S	Direction - NE - SW	Direction - E - W	Direction - SE-NW	Average Apparent Soil Resistivity $\rho = 2 \pi a R$ ohm - m
		Apparent resistivity ohm-m	Apparent resistivity ohm-m	Apparent resistivity ohm-m	Apparent resistivity ohm-m	
1	1.0	39.60	--	71.90	--	55.75
2	2.0	62.60	--	85.50	--	74.05
3	3.0	86.10	--	77.10	--	81.60
4	4.0	66.00	--	72.60	--	69.30
5	5.0	141.90	--	74.70	--	108.30
6	6.0	77.30	--	90.10	--	83.70
7	7.0	88.90	--	92.60	--	90.75
8	8.0	103.30	--	97.60	--	100.45
9	9.0	116.20	--	111.00	--	113.60
10	10.0	112.00	--	122.90	--	117.45



5.9. CHEMICAL TESTS:

Chemical tests were performed on few soil and water samples for determining the pH value, Sulphate, Chloride, organic matter content etc. The results are given in a tabular form below:

CHEMICAL TEST RESULTS ON SOIL SAMPLES:-

BH/Sample No.	Depth (m)	pH value	Sulphate as SO ₃ (%)	Chloride as Cl (%)	Organic Matter (%)
BH-20 / UDS01	1.00-1.45	8.06	B.D.L.*	0.0070	0.196
BH-25 / UDS01	1.00-1.45	7.41	B.D.L.*	0.0080	0.208
BH-27 / UDS01	1.00-1.45	7.84	B.D.L.*	0.0080	0.226
BH-35 / UDS01	1.00-1.45	6.20	B.D.L.*	0.0080	0.225

*B.D.L. = Below Detection Limit (i.e. below 0.050%)

CHEMICAL TEST RESULTS ON WATER SAMPLES:-

BH/Sample No.	Depth (m)	pH value	Sulphate as SO ₃ (mg/Ltr.)	Chloride as Cl (mg/Ltr.)	Organic Matter (mg/Ltr.)
BH-02 / WS01	1.20	6.38	60	10	21.82
BH-21 / WS01	2.45	6.65	60	16	16.36
BH-33 / WS01	1.10	6.82	60	24	19.09

Bore Hole	Sample Number	Depth M	Sample Description	Bulk		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits				IS Classification	Grain Size			Test Method
				Dens. gms/cc						Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %			Gravl %	Sand %	Silt %	Clay %
ABH01	SPT01	1.30	Brownish grey, silty clay.											51	24			CH				**See the Note
ABH01	UDS02	3.00	Brownish grey, silty clay with calcareous nodules and sand mixture.	1.95		1.52	2.68	29 S 27 T 28 C	0.738	TRSH-UU	0.82	0		45	22	16		CI	20	54	26	Do
										3.0	0.841											
										2.0	0.815											
										1.0	0.808											
										UNCONFD	0.54	0										
										0.0	0.541											
										0.0	0.530											
										0.0	0.547											
										REMOULD	0.41	0										
										0.0	0.450											
										0.0	0.392											
										0.0	0.395											
ABH01	SPT02	3.45	Brownish grey, silty clay with traces of calcareous nodules.											54	21			CH				Do
ABH02	SPT01	1.00	Brownish grey, clayey silty sand with gravels & decomposed rock.															SM	4	50	46(Silt+Clay)	Do
ABH04	DS01	0.50	Brownish grey, silty clay / clayey silt with sand mixture.															CI*	25	47	28	Do
ABH04	UDS01	1.00	Brownish grey, silty clay with calcareous nodules and sand mixture.	1.94		1.50		28 S 29 T		TRSH-UU	0.76	0		43	23	18		CI				Do
										3.0	0.770											
										2.0	0.767											
										1.0	0.749											
										UNCONFD	0.62	0										
										0.0	0.621											
										0.0	0.653											
										0.0	0.597											
										REMOULD	0.50	0										
										0.0	0.498											
										0.0	0.508											
										0.0	0.505											
ABH04	SPT01	1.45	Brownish grey, silty clay with traces of kankars.											45	21			CI				Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits			IS Classification	Grain Size				Test Method
				Dens. gms/cc	Pc/Pn kg/sqcm					Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %	Sand %		Silt %	Clay %			
ABH04	SPT02	3.00	Brownish grey, silty clay / clayey silt with traces of sand mixture.														CI*		27	53	20	Do	
ABH05	SPT01	1.55	Brownish grey, clayey silty sand.														SM		58	42(Silt+Clay)		Do	
ABH05	SPT02	3.00	Brownish grey, clayey silt with sand mixture.							41	22						CI					Do	
ABH06	UDS01	1.00	Brownish grey, silty clay with traces of kankars & calcareous nodules.	2.04	1.62			27 S	0.849	TRSH-UU		0.65	5				CI*					Do	
								25 T		3.0	1.039												
								27 C		2.0	0.897												
										1.0	0.835												
										UNCONF		0.69	0										
										0.0	0.757												
										0.0	0.696												
										0.0	0.628												
										REMOULD		0.52	0										
										0.0	0.507												
										0.0	0.528												
										0.0	0.534												
ABH06	SPT02	3.00	Brownish grey, silty clay / clayey silt.											47	19		CI					Do	
ABH06	SPT04	5.00	Light grey, clayey silt.														CI*		2	87	11	Do	
ABH07	UDS01	1.00	Brownish grey, clayey silty sand.	1.91	1.66			14 S		DRSH-CU		0.07	35				SM*					Do	
								16DR		0.5	0.438												
										1.0	0.768												
										2.0	1.473												
ABH07	SPT02	3.00	Brownish grey, silty clay with sand mixture. Obs moorum.				2.65										CI*		24	57	19	Do	
ABH07	SPT04	4.75	Brownish grey, silty clay / clayey silt with sand mixture.											40	22		CI					Do	

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits				IS Classification	Grain Size				Test Method
									Pc/sqcm kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
ABH08	UDS01	1.00	Yellowish grey, clayey silty sand.	1.98	1.69		18 S			DRSH-CU	0.13	31				SM	64	36	(Silt+Clay)	Do		
							17DR			0.5	0.440											
										1.0	0.711											
										2.0	1.341											
ABH08	UDS02	4.00	Brownish grey, silty clay with sand mixture.	1.89	1.49		28 S	0.723		UNCONF	0.79	0	41	24	19	CI				Do		
							26 T			0.0	0.805											
							25 C			0.0	0.792											
										0.0	0.783	0										
										REMOULD	0.65											
										0.0	0.649											
										0.0	0.673											
										0.0	0.621											
ABH08	SPT04	6.00	Brownish grey, clayey silt with sand mixture.			2.65										CI*	25	61	14	Do		
ABH09	UDS01	1.00	Light grey, silty sand with gravel, boulder & calcareous nodules.													SM	33	53	14	(Silt+Clay)	Do	
	UDS02	4.00	Yellowish grey, clayey silty sand.							DRSH-CU	0.14	29				SM*				Do		
										0.5	0.425											
										1.0	0.692											
										2.0	1.247											
	ABH09	SPT06	8.00	Brownish grey, silty sand.			2.64									SM*				Do		
	ABH10	SPT02	2.50	Brownish grey, silty sand with gravels.												SM	5	63	32	(Silt+Clay)	Do	
ABH10	SPT05	7.40	Yellowish grey, clayey silt with decomposed rock dust and sand mixture.	1.71	1.51		14DR			DRSH-CU	0.05	34				SM*				Do		
										0.5	0.379											
										1.0	0.729											
										2.0	1.384											
ABH11	UDS01	1.00	Brownish grey, clayey silty sand.													SM	69	20	11	Do		

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits				IS Classification	Grain Size				Test Method
									Pc/sqcm kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %	Sand %		Silt %	Clay %			
ABH11	UDS02	4.00	Reddish brown, clayey silt with sand mixture.	1.98	1.58		24 S	0.731	UNCONFD	0.78	0					CI*				Do			
				0.0	0.806																		
				0.0	0.733																		
				0.0	0.798																		
				REMOULD	0.69	0																	
				0.0	0.715																		
				0.0	0.680																		
				0.0	0.684																		
ABH11	SPT04	6.00	Brownish grey, silty sand with treaes of kankars.												SM		81	19(Silt+Clay)	Do				
ABH12	UDS01	1.00	Reddish brown, silty clay with sand mixture and kankars.					0.543	TRSH-UU	1.16	6		31	22	19	CL				Do			
				3.0	1.631																		
				2.0	1.528																		
				1.0	1.405																		
				UNCONFD	0.82	0																	
				0.0	0.867																		
				0.0	0.810																		
				0.0	0.799																		
									REMOULD	0.75	0												
									0.0	0.760													
									0.0	0.746													
									0.0	0.735													
ABH12	SPT03	4.50	Yellowish grey, clayey silty sand / sandy silt with kankars.												SM	5	60	24	11	Do			
ABH13	SPT01	1.55	Reddish Brown, clayey silt with sand mixture / clayey silty sand.	1.72	1.50		14DR		DRSH-CU	0.05	33					SM*				Do			
					0.5	0.379																	
					1.0	0.689																	
					2.0	1.347																	
ABH13	SPT05	7.00	Brownish grey, silty sand.													SM		80	20(Silt+Clay)	Do			
ABH14	UDS02	4.00	Reddish brown, clayey sandy silt with gravel and boulders.						TRSH-UU	0.74	7		26	15	13	CL				Do			
				3.0	1.258																		
				2.0	1.114																		
				1.0	0.972																		
									UNCONFD	0.53	0												
									0.0	0.514													
									0.0	0.530													
									0.0	0.547													

Bore Hole	Sample Number	Depth M	Sample Description	Bulk		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits				IS Classification	Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc					Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %	Sand %		Silt %	Clay %			
										REMOULD	0.46	0												
										0.0	0.450													
										0.0	0.458													
										0.0	0.463													
ABH14	SPT03	4.45	Brownish grey, silty sand with rock pieces and clay binders.															SM	18	49	33(Silt+Clay)	Do		
ABH14	SPT06	8.00	Brownish grey, silty sand/decomposed rock dust with clay binders.							DRSH-CU	0.03	37					SM*						Do	
										0.5	0.415													
										1.0	0.776													
										1.5	1.541													
ABH15	UDS01	1.00	Blackish clayey silt with sand. Obs. rock pieces, gravel, coal dust etc.	1.96	1.69			16 S	0.522	TRSH-UU	0.80	12	32	18			CL						Do	
								17 T		3.0	1.772													
								18 C		2.0	1.519													
										1.0	1.252													
ABH15	SPT01	1.45	Greyish brown, silty sand with gravels.										N.P.											
ABH15	SPT02	3.00	Greyish brown, silty sand with kankars and moorum.				2.66										SM	11	60	25	4	Do		
ABH16	SPT01	1.15	Dark grey, clayey silty sand with kankars and coal pieces.														SM	13	57	22	8	Do		
ABH16	SPT02	2.50	Greyish brown, clayey silt with sand mixture and rock pieces.										24	14	12		CL						Do	
ABH17	DS01	0.50	Brownish grey, silty sand with gravels.				2.63										SM	42	40	15	3	Do		
ABH17	SPT02	3.00	Reddish brown, clayey moorum with decomposed rock dust and rock pieces.	1.77	1.53			16DR		DRSH-CU	0.02	36					SM*						Do	
										0.5	0.378													
										1.0	0.753													
										1.5	1.466													

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits				IS Classification	Grain Size				Test Method
									Pc/sqcm kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
ABH18	SPT01	1.60	Blackish grey, clayey sandy silt with rock fragments.													SM	23	37	30	10	Do	
ABH19	SPT02	2.50	Yellowish grey silty clay with sand. Obs. gravels.										32	22		CL					Do	
ABH18	SPT03	4.50	Blackish grey, silty sand with coal dust, coal pieces and rock fragments.										NP								Do	
ABH20	SPT01	1.10	Yellowish grey, clayey silt with sand mixture													CI*		38	52	10	Do	
ABH20	SPT03	4.00	Yellowish grey silty clay with sand.										39	18		CI					Do	
ABH21	SPT01	1.50	Reddish brown, clayey moorum.													CI*	34	29	20	17	Do	
ABH21	UDS02	4.00	Brownish grey silty clay with sand mixture. Obs. traces of moorum.	1.95	1.57		25 S 24 T 23 C	0.857	TRSH-UU 3.00 1.422 2.00 1.319 1.00 1.234		1.04	5			18	CI*					Do	
									UNCONFD 0.00 1.133 0.00 1.106 0.00 1.091		1.11	0										
									REMOULD 0.00 0.853 0.00 0.833 0.00 0.804		0.83	0										
ABH21	SPT04	5.00	Whitish brown silty clay,										38	19		CI					Do	
ABH22	SPT01	1.05	Brownish grey, clayey silt with sand mixture and kankars.													CI*	39	38	23		Do	

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits				IS Classification	Grain Size			Test Method
ABH23	SPT01	1.08	Brownish grey, silty clay with traces of sand mixture.															CI				Do
ABH24	SPT01	1.55	Blackish grey, clayey silty sand. Obs. traces of coal pieces.																			Do
ABH25	SPT01	1.50	Yellowish grey, clayey silt with rock fragments.															CI				Do
ABH25	SPT02	3.00	Whitish grey, clayey silt with sand mixture.					2.63										CI*				Do

LABORATORY ROCK TEST RESULTS

BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Strength (kg/sqcm)	Compressive Strength (kg/sqcm)	Saturated	Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness * (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ										
ABH-01	1	6.50 - 7.25	Highly weathered, brownish grey, medium grained fractured sandstone.	--	--	--	--	--	204	--	--	--	--	--	--	--	--	--	* See the Note
ABH-01	2	7.25 - 8.00	Moderately weathered, brownish grey, medium grained fractured sandstone.	2.3335	2.2726	2.68	6.090	2.420	282	165	--	0.59	--	--	--	--	--	--	Do
ABH-02	2	2.50 - 3.25	Moderately weathered, brownish grey, fine grained fractured sandstone.	--	--	--	--	--	--	--	--	--	0.93	--	--	23.14	--	--	Do
ABH-02	4	4.00 - 4.75	Moderately weathered, brownish grey, fine grained fractured sandstone.	--	--	--	--	--	--	--	--	--	1.91	--	--	--	--	--	Do
ABH-02	5	4.75 - 5.50	Moderately weathered, brownish grey, fine grained fractured sandstone.	--	--	--	--	--	--	--	--	--	1.89	--	--	--	--	--	Do
ABH-02	7	6.25 - 7.00	Slightly weathered, grey, fine grained, fractured sandstone.	--	--	--	--	--	--	--	--	--	1.83	94.72	Hard	--	--	--	Do
ABH-02	8	7.00 - 8.00	Fresh, grey, fine grained, fractured sandstone.	--	--	--	--	--	311	190	--	0.61	--	--	--	--	--	--	Do
ABH-03	1	2.80 - 3.50	Highly weathered, yellowish brown, medium grained fractured sandstone.	2.3365	2.2927	1.91	4.384	2.398	--	--	--	--	0.99	--	--	--	--	--	Do
ABH-03	3	4.25 - 5.00	Moderately weathered, light grey, medium grained fractured sandstone.	--	--	--	--	--	--	204	--	--	--	--	--	--	--	--	Do
ABH-03	6	6.50 - 7.25	Moderately weathered, light grey, medium grained fractured sandstone.	--	--	--	--	--	--	--	--	--	--	--	--	17.61	--	--	Do
ABH-04	1	3.70 - 4.50	Moderately weathered, brownish yellow, medium grained, fractured sand stone.	--	--	--	--	--	--	--	--	--	0.98	--	--	29.69	--	--	Do
ABH-04	2	4.50 - 5.25	Highly weathered, light grey, medium grained, fractured sand stone.	--	--	--	--	--	--	--	--	--	--	--	Hard	--	--	--	Do
ABH-05	2	4.00 - 4.75	Highly weathered, brownish yellow, fine grained, fractured sand stone.	--	--	--	--	2.455	--	--	--	--	0.95	78.52	--	--	--	--	Do
ABH-05	5	6.25 - 7.00	Moderately weathered, brownish yellow to light grey, fine grained, fractured sand stone.	2.749	2.736	0.451	1.235	--	465	--	--	--	--	--	--	--	--	--	Do
ABH-05	7	7.50 - 8.00	Moderately weathered, light grey, fine grained, fractured sand stone.	--	--	--	--	--	238	176	--	0.74	--	--	--	--	--	--	Do

LABORATORY ROCK TEST RESULTS

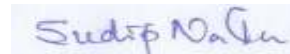
BH No.	Run No.	Depth (M)	Description	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive Strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness * (% Loss)	E (Kg/sqcm)	Impact Value	Test Method
				Bulk	Dry				In-situ	Saturated								
ABH-06	1	5.70 - 6.25	Moderately weathered, grey, fine grained, highly fractured sand stone.	--	--	--	--	--	--	--	--	--	71.62	Very Soft	--	--	--	Do
ABH-15	3	7.25 - 8.00	Completely weathered, yellowish brown, medium grained, fractured sand stone.	--	--	--	--	2.713	--	--	--	--	--	--	15.84	--	--	Do
ABH-24	2	7.25 - 8.00	Highly weathered, whitish grey, medium grained, fractured sandstone.	--	--	--	--	--	--	--	--	0.91	--	--	--	--	37.34	Do
ABH-24	5	9.50 - 10.00	Highly weathered, whitish grey, medium grained, fractured sandstone.	2.3107	2.2535	2.54	5.719	2.390	--	--	--	--	--	--	--	--	--	Do
ABH-25	2	8.00 - 8.75	Highly weathered, yellowish brown medium grained, fractured sandstone.	--	--	--	--	--	--	--	--	--	--	--	--	3415	--	Do

SWELLING TEST RESULTS

Bore Hole No.	Sample No.	Depth (M)	Description	Free Swell Index, (%)	Swelling Pressure, (kg/sqcm)	Water Content (%)	PI (%)	Test Method
ABH01	UDS-02	3.00	Brownish grey, silty clay with calcareous nodules.	13.26	0.11	28	23	**See the Note
ABH04	UDS-01	1.00	Brownish grey, clayey silt with sand mixture.	47.50	0.32	29	20	Do
ABH08	UDS-02	4.00	Brownish grey, clayey silt with sand mixture.	9.09	0.01	26	17	Do
ABH11	UDS-01	1.00	Brownish grey, silty clay with calcareous nodules.	5.25	0.05	22	--	Do
ABH14	UDS-02	4.00	Brownish grey, clayey silt with sand mixture.	0.00	0.00	24	11	Do

Note: Test Methods*Bulk Density & Dry Density:** Ref. CET/SOP/01, Issue No. 01-(Page 27 & 39 of 40)**Natural Moisture Content:** IS 2720 (Part 2)**Specific Gravity:** IS 2720 (Part 3).**Grain size analysis:** IS 2720 (Part 4)**Liquid Limit & Plastic Limit:** IS 2720 (Part 5)**Shrinkage Limit:** IS 2720 (Part 6)**Standard Proctor Compaction Test (Light Compaction):** IS 2720 (Part 7)**Unconfined Compressive Strength Test:** IS 2720 (Part 10)**Triaxial Test (TRSH-UU):** IS 2720 (Part 11)**Direct Shear Test (DRSH-CQ):** IS 2720 (Part 13)**Consolidation Properties (Void Ratio):** IS 2720 (Part 15)**Free Swell Index:** IS 2720 (Part 40)**Swelling Pressure:** IS 2720 (Part 41)**Point Load Index:** IS 8764.**Water Content, Bulk & Dry Density and Porosity:** IS 13030**Slake Durability Index :** IS 10050.**Unconfined Compressive Strength:** IS 9143.**C.E. Testing Company Pvt. Ltd.****Prepared By**

(I. Chowdhury)
Sr. Geotechnical Engineer

Checked & Approved By

Sudip Nath
Technical Manager

****End of Report****

2.6. ROTARY CORE DRILLING:

This drilling technique is regarded as the most satisfactory method of assessing the characteristics of rock formations, which lie at a depth below the ground surface. Specimens of rock in the form of cylindrical cores are recovered from the drill holes by means of a core barrel. Double barrel technique is adopted according to field condition. The core barrel is provided at its lower end with a detachable shoe or core bit, which is of diamond. All rotary core bits were of NX size.

2.7. ELECTRICAL RESISTIVITY TEST:

Four (04) nos. Electrical Resistivity Tests were carried out at the following locations. The test procedure and results are presented under Section-8.

ERT No.	Co-ordinates (M)		Reduced Level (M)
	Easting	Northing	
ERT-22	(-)3488	4487	103.352
ERT-23	(-)5366	5054	106.942
ERT-24	(-)6980	5390	98.640
ERT-25	(-)7040	5470	96.750

ERT No. 22

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	29.069	29.022	29.101	29.085	29.07
2	1.0	22.963	22.932	22.744	22.995	22.91
3	2.0	16.775	16.649	16.838	16.775	16.76
4	3.0	21.110	21.487	21.487	21.581	21.42
5	4.0	27.016	27.519	27.393	27.896	27.46
6	5.0	30.786	30.629	30.943	31.100	30.86
7	6.0	32.044	32.232	32.609	32.609	32.37
8	7.0	31.886	31.667	32.766	31.667	32.00
9	8.0	31.415	32.169	32.169	31.666	31.85
10	10.0	33.928	34.871	34.871	34.871	34.64

Mean Resistivity at ERT-22 is 27.93 Ohm-m.

ERT No. 23

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	65.332	65.961	65.646	65.646	65.65
2	1.0	94.873	94.873	96.129	95.815	95.42
3	2.0	100.967	100.528	101.281	101.532	101.08
4	3.0	95.375	94.715	95.940	95.469	95.37
5	4.0	99.271	99.522	98.517	99.648	99.24
6	5.0	89.375	88.433	87.490	88.119	88.35
7	6.0	78.036	78.601	79.167	79.167	78.74
8	7.0	64.213	66.192	65.313	67.072	65.70
9	8.0	57.301	59.815	58.558	60.820	59.12
10	10.0	49.007	50.578	49.322	50.264	49.79

Mean Resistivity at ERT-23 is 79.85 Ohm-m.

ERT No. 24

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	117.159	117.473	116.845	116.688	117.04
2	1.0	94.873	95.187	94.244	95.501	94.95
3	2.0	87.836	88.150	87.961	87.962	87.98
4	3.0	95.186	95.092	94.904	94.998	95.05
5	4.0	107.941	108.067	107.941	108.318	108.07
6	5.0	117.649	118.434	116.706	116.706	117.37
7	6.0	100.467	99.336	101.787	101.221	100.70
8	7.0	88.623	88.183	87.084	88.183	88.02
9	8.0	74.391	75.899	75.899	74.392	75.15
10	10.0	68.171	70.056	68.799	67.857	68.72

Mean Resistivity at ERT-24 is 95.30 Ohm-m.

ERT No. 25

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.50	179.979	180.293	180.450	179.979	180.18
2	1.0	196.029	196.971	197.286	196.971	196.81
3	2.0	167.756	164.614	165.242	162.101	164.93
4	3.0	141.555	141.555	141.838	141.461	141.60
5	4.0	124.026	124.152	123.900	124.403	124.12
6	5.0	101.784	102.569	102.412	103.041	102.45
7	6.0	107.630	108.761	108.007	109.704	108.53
8	7.0	91.702	90.822	90.822	91.922	91.32
9	8.0	75.397	76.151	75.899	76.151	75.90
10	10.0	74.140	75.082	75.082	75.397	74.93

Mean Resistivity at ERT-25 is 126.08 Ohm-m.

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC								
D-1-12(D)	Annexure- (D) CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All structures shall be designed for wind forces in accordance with IS:875 (Part-3) and as specified in this document. See Annexure – I for site specific information. Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard. Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method. Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz. Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards. It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects. Damping in Structures The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for: <table><tr><td>a) Welded steel structures</td><td>: 1.0%</td></tr><tr><td>b) Bolted steel structures/ RCC structures</td><td>: 2.0%</td></tr><tr><td>c) Prestressed concrete structures</td><td>: 1.6%</td></tr><tr><td>d) Steel stacks</td><td>: As per IS: 6533 & CICIND Model Code whichever is more critical.</td></tr></table>				a) Welded steel structures	: 1.0%	b) Bolted steel structures/ RCC structures	: 2.0%	c) Prestressed concrete structures	: 1.6%	d) Steel stacks	: As per IS: 6533 & CICIND Model Code whichever is more critical.
a) Welded steel structures	: 1.0%											
b) Bolted steel structures/ RCC structures	: 2.0%											
c) Prestressed concrete structures	: 1.6%											
d) Steel stacks	: As per IS: 6533 & CICIND Model Code whichever is more critical.											
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-D-1-12(D) CIVIL WORKS WIND DESIGN CRITERIA	PAGE 1 OF 2								

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	<u>ANNEXURE-I</u> <u>SITE SPECIFIC DESIGN PARAMETERS</u> The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows: a) The basic wind speed “V_b” at ten metres above the mean ground level : 50 metres/second b) The risk coefficient “K_1” : 1.08 c) Category of terrain : Category-2	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-D-1-12(D) CIVIL WORKS WIND DESIGN CRITERIA
		PAGE 2 OF 2

CLAUSE NO.	TECHNICAL REQUIREMENTS			
D-1-12(E)	Annexure-(E)			
	CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT			
	All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1 to Part 4). Pending finalization of Part 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for embankments.			
	A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Appendix-I.			
	Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.			
	The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Appendix-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 to Part 4).			
	Damping in Structures			
	The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:			
	a)	Steel structures	:	2%
	b)	Reinforced Concrete structures	:	5%
	c)	Reinforced Concrete Stacks	:	3%
	d)	Steel stacks	:	2%
	Method of Analysis			
	Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1).			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2		SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA
				PAGE 1 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS:1893. The spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the structure falls to the left of the peak in the spectral acceleration curve. For buildings, if the design base shear (V_B) obtained from modal combination is less than the base shear ($\bar{V}_B$) computed using the approximate fundamental period (T_a) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of $\bar{V}_B / V_B$. However, no reduction is permitted if $\bar{V}_B$ is less than V_B. Design/Detailing for Ductility for Structures The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA	PAGE 2 OF 6	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	APPENDIX-I <u>SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT</u> The various site specific seismic parameters for the project site shall be as follows: 1) Peak ground horizontal acceleration (MCE) : 0.16 g 2) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra a) for special moment resisting steel frames designed and detailed as per IS:800 : 0.04 b) for special concentrically braced steel frames designed and detailed as per IS:800 : 0.03 c) For special moment resisting RC frames designed and detailed as per IS:456 and IS:13920 : 0.024 d) for RCC chimney, RCC Natural Draft Cooling Tower : 0.08 e) for liquid retaining tanks : 0.048 f) for Steel chimney, Absorber tower, Vessels : 0.06 g) for design of structures not covered under 2 (a) to 2 (f) above and under 3 below, in general (excluding special structure/configuration/ materials) : 0.04 3) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted : 0.08 Note: g = acceleration due to gravity The horizontal seismic acceleration spectral coefficients are furnished as Annexure – S in subsequent pages.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA	PAGE 3 OF 6	

ANNEXURE - S

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS for
Talcher TPP
(In units of 'g')

Time Period (Sec)	Damping Factor (as a percentage of critical damping)		
	2%	3%	5%
0	1	1	1
0.03	1	1	1
0.04	1.388	1.338	1.261
0.05	1.790	1.676	1.509
0.06	2.204	2.015	1.748
0.07	2.627	2.355	1.980
0.08	3.059	2.696	2.205
0.09	3.499	3.036	2.424
0.097	3.810	3.275	2.575
0.098	3.810	3.310	2.596
0.1	3.810	3.310	2.640
0.11	3.810	3.310	2.640
0.108	3.810	3.310	2.640
0.11	3.810	3.310	2.640
0.115	3.810	3.310	2.640
0.12	3.810	3.310	2.640
0.125	3.810	3.310	2.640
0.13	3.810	3.310	2.640
0.135	3.810	3.310	2.640
0.14	3.810	3.310	2.640
0.145	3.810	3.310	2.640
0.15	3.810	3.310	2.640
0.2	3.810	3.310	2.640
0.25	3.810	3.310	2.640
0.3	3.810	3.310	2.640
0.35	3.810	3.310	2.640
0.37	3.810	3.310	2.640
0.38	3.810	3.310	2.640
0.39	3.713	3.310	2.640
0.4	3.620	3.310	2.640
0.43	3.367	3.079	2.456
0.45	3.218	2.942	2.347
0.52	2.785	2.546	2.031

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
	Time Period (Sec)		Damping Factor (as a percentage of critical damping)		
			2%	3%	5%
	0.555	2.609	2.386	1.903	
	0.56	2.586	2.364	1.886	
	0.565	2.563	2.343	1.869	
	0.57	2.540	2.323	1.853	
	0.575	2.518	2.303	1.837	
	0.58	2.497	2.283	1.821	
	0.585	2.475	2.263	1.805	
	0.59	2.454	2.244	1.790	
	0.595	2.434	2.225	1.775	
	0.6	2.413	2.207	1.760	
	0.65	2.228	2.037	1.625	
	0.7	2.069	1.891	1.509	
	0.75	1.931	1.765	1.408	
	0.8	1.810	1.655	1.320	
	0.85	1.704	1.558	1.242	
	0.9	1.609	1.471	1.173	
	0.95	1.524	1.394	1.112	
	1	1.448	1.324	1.056	
	1.05	1.379	1.261	1.006	
	1.1	1.316	1.204	0.960	
	1.15	1.259	1.151	0.918	
	1.2	1.207	1.103	0.880	
	1.25	1.158	1.059	0.845	
	1.3	1.114	1.018	0.812	
	1.35	1.073	0.981	0.782	
	1.4	1.034	0.946	0.754	
	1.45	0.999	0.913	0.728	
	1.5	0.965	0.883	0.704	
	1.55	0.934	0.854	0.681	
	1.6	0.905	0.828	0.660	
	1.65	0.878	0.802	0.640	
1.7	0.852	0.779	0.621		
1.75	0.827	0.757	0.603		
1.8	0.804	0.736	0.587		
1.85	0.783	0.716	0.571		
1.9	0.762	0.697	0.556		
1.95	0.743	0.679	0.542		
2	0.724	0.662	0.528		
2.05	0.706	0.646	0.515		
2.1	0.690	0.630	0.503		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2		SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA	PAGE 5 OF 6

Time Period (Sec)	Damping Factor (as a percentage of critical damping)		
	2%	3%	5%
2.15	0.673	0.616	0.491
2.2	0.658	0.602	0.480
2.25	0.644	0.588	0.469
2.3	0.630	0.576	0.459
2.35	0.616	0.563	0.449
2.4	0.603	0.552	0.440
2.45	0.591	0.540	0.431
2.5	0.579	0.530	0.422
2.55	0.568	0.519	0.414
2.6	0.557	0.509	0.406
2.65	0.546	0.500	0.398
2.7	0.536	0.490	0.391
2.75	0.527	0.481	0.384
2.8	0.517	0.473	0.377
2.85	0.508	0.465	0.371
2.9	0.499	0.457	0.364
2.95	0.491	0.449	0.358
3	0.483	0.441	0.352
3.05	0.467	0.434	0.346
3.1	0.452	0.427	0.341
3.15	0.438	0.427	0.335
3.2	0.424	0.414	0.330
3.25	0.411	0.401	0.320
3.3	0.399	0.389	0.310
3.35	0.387	0.378	0.301
3.4	0.376	0.367	0.292
3.45	0.365	0.356	0.284
3.5	0.355	0.346	0.276

CLAUSE NO.	TECHNICAL REQUIREMENTS			
D-1-12(F)	Annexure-(F) QA REQUIREMENT All Civil, Structural and Architectural construction work at the project shall be executed strictly in accordance with the Quality Assurance guidelines specified in separate part of the Specification.			
		TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-12(F) CIVIL WORKS QA REQUIREMENT PAGE 1 OF 1

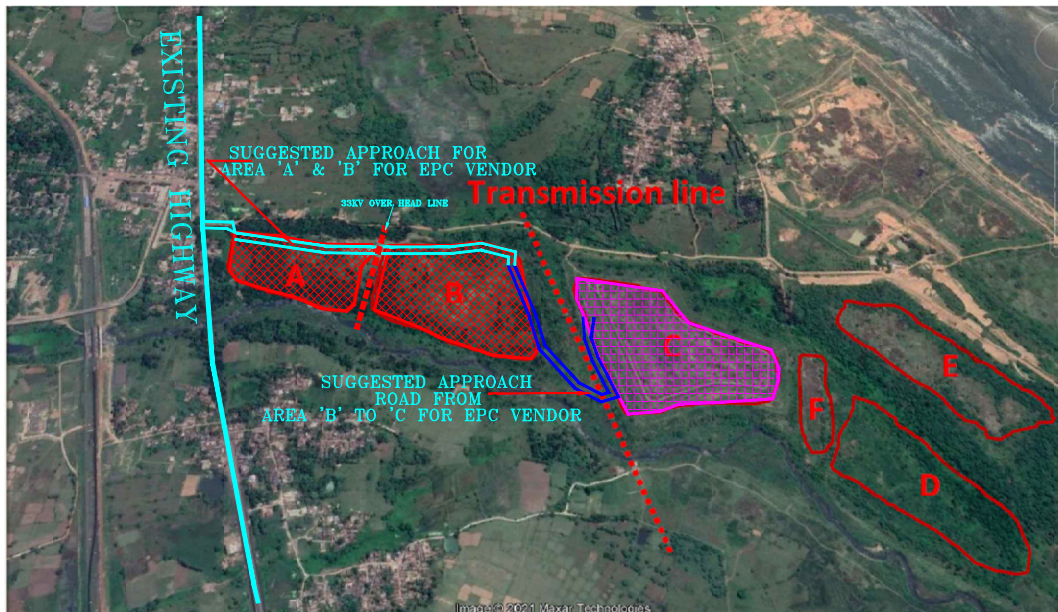
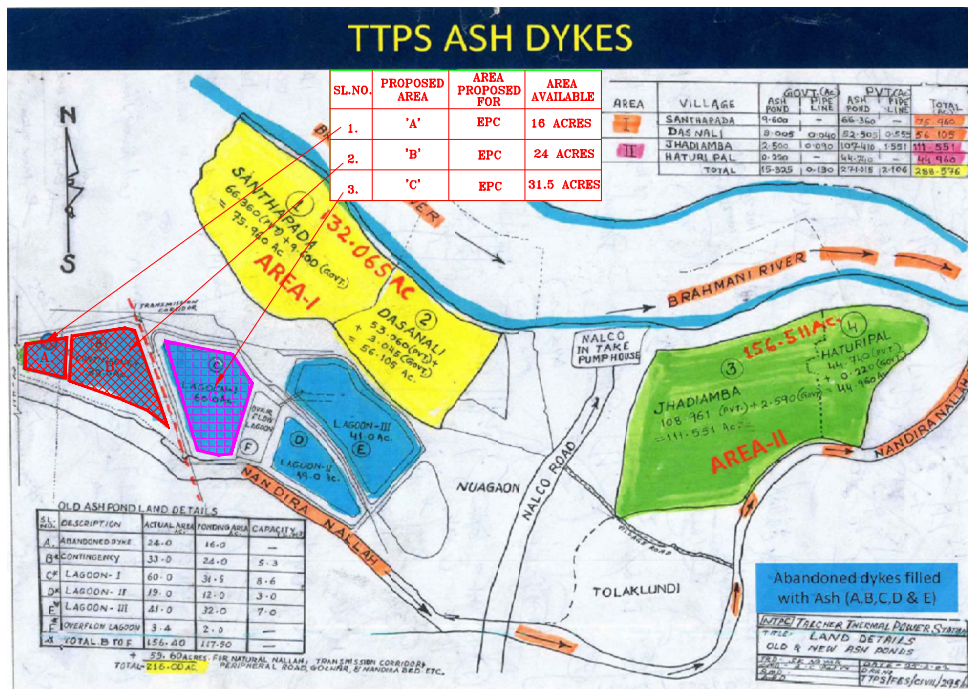
Clause No.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
D-1-12(I)	ANNEXURE-(I)			
1.0.0	DEVELOPMENT OF LAYDOWN AREA IN ABANDONED ASH DYKE This section covers general guidelines and activities to be undertaken by the EPC contractor for using abandoned ash dyke as a Lay down area. An area of 70 acre (approx.) (16 Acres + 24 Acres +30 Acres) indicated in Annexure-J as Area ‘A’, ‘B’& ‘C’ has been identified for this purpose. Construction, Maintenance, and upkeep of the approach road shall be the responsibility of the bidder.			
1.02.0	DESCRIPTION OF SITE, LOCATION AND APPROACH AND ITS PRELIMINARY ASSESSMENT The abandoned ash dyke area is in vicinity of Talcher TTP-III. The capacity of the dyke has exhausted, and the maximum depth of deposited ash is approximately 15m. For using abandoned ash dyke for creation of laydown area for Talcher-III, following measures needs to be taken by the EPC contractor: a. Any work should be minimum 50 m away from the Heel of dyke embankment to ensure the dyke stability and safety. b. Suitable measures to avoid fugitive dust emission shall be adopted within the preassembly area and adjoining area. c. Regular inspection of the abandoned dyke to be carried out and remedial measures be taken when any abnormal behavior is noticed in the dyke. Contingency arrangements in form of stacking of sandbags, soil etc. should be in place in order to address the problem of any imminent failure in the dyke. Any adverse effect on the dyke due to creation of laydown area needs to be immediately attended d. The contractor shall plan the laydown area in accordance with the prevailing site condition/ strata and geotechnical parameters so as to ensure that there is no adverse impact on the dyke e. Toe drain in the toe of the dyke shall be examined and it shall be ensured that the seepage water/ rain water is flowing in the drain unhindered. f. Soil cover of minimum 500 mm, turfing along with surface drainage arrangement has to be maintained in areas which are not hard crusted. g. The drain in the downstream slopes shall be properly maintained so that rainwater properly flows through it.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-4540-001A-2	SUBSECTION D-1-12(I) CIVIL WORKS DEVELOPMENT OF LAYDOWN AREA	Page 1 of 4

Clause No.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	h. Roads over the toe drain if any shall be provided with suitable cross drainage arrangement to avoid blockage of toe drain i. At locations where heavy equipments are to be placed and are to be used as fabrication yards, heavy duty paving/ hard crusting shall be carried out. j. It should be ensured that there is no vehicular movement in any part of dyke embankment except on the new roads that shall be constructed connecting laydown area in the dyke lagoon. No vehicular movement should be there along dyke embankment top.		
1.3.0	CONTRACTOR'S OBLIGATIONS The EPC vendor shall be deemed to have full knowledge of the site and site limitations, whether he visits site or not and no extra charges consequent on any misunderstanding or otherwise shall be allowed. EPC Contractor is advised to visit site and its surroundings to assess and satisfy themselves about the local conditions such as access roads to the site, water and power supply, application / details of taxes, duties, royalties and levies, nature of ground and subsoil conditions, general topography of the site, availability of construction materials, environmental and safety laws, acts and regulations and any other relevant information, as required by them. The EPC Contractor may obtain all necessary information as to risk, contingencies and other circumstances, which may influence or affect their tender. EPC Contractor shall be deemed to have considered local conditions and information and to have satisfied himself in all respects. before quoting terms and no claim whatsoever in this regard shall be entertained by the Owner at a later date.		
1.4.0	SOIL DATA Not Available. Vendor to carry out the same.		
1.5.0	ACCESS TO WORK SITE		
1.5.1	The Contractor shall make his own arrangement for access to the work site and for movement of men, machinery, other equipments, etc. required for carrying out the work included under this contract.		
1.5.2	Roads over the toe drain if any shall be provided with suitable cross drainage arrangement to avoid blockage of toe drain.		
1.6.0	Rainfall run-off As part of the work may have to be carried out in wet season. The Contractor shall supply, install and operate his own temporary pumping installation along with DG set that may be required for dewatering. Proper drainage arrangement in the area shall be developed.		
1.7.0	CONSTRUCTION POWER AND CONSTRUCTION WATER In order to meet Construction Power requirement for this area and construction water, the EPC Contractor shall make its own arrangement.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-4540-001A-2	SUBSECTION D-1-12(I) CIVIL WORKS DEPEVELOPMENT OF LAYDOWN AREA
			Page 2 of 4

Clause No.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
1.8.0	GENERAL ENVIRONMENTAL REQUIREMENTS			
1.8.1	The contractor shall be solely responsible and liable for all damage caused by any pollution that may take place during the execution of the works, and he shall make arrangements, as the Engineer may approve, for preventing pollution but, notwithstanding such approval, the entire responsibility for any pollution shall rest with the contractor.			
1.8.2	Measures for sprinkling of water to suppress the fugitive dust emission in the area like construction, haulage roads during transportation, filling areas etc. shall be done by the contractor.			
1.9.0	BORROW PITS/ QUARRY AREA			
1.9.1	For carrying filling work in the abandoned dyke area borrow pits/quarry area shall be identified in consultation with Engineer-in-charge. The Contractor shall formulate a detailed proposal for working in borrow pits identified outside ash lagoon areas as per the requirements. The proposal shall be submitted to the Engineer for his approval. Obtaining Engineer's prior approval is mandatory to start any work in borrow areas/Quarry areas.			
1.9.2	Borrow area/quarry material is to be arranged by the contractor at his cost. The contractor shall conduct test to check the suitability of the fill material. The Contractor shall not incorporate in the works, material which has not been passed as satisfactory by the Engineer in charge.			
1.9.3	Contractor's Borrow areas shall not be within the land boundary of ash dyke area and shall also be outside the NTPC property line. For materials to be borrowed & supplied by the contractor from pits / quarries, it shall be the Contractor's responsibility for identification and arranging of such quarry areas, obtaining approval for their use from concerned authorities, the Contractor shall pay any levies, royalties, etc., that may have to be paid for utilisation of borrow areas as per the provisions of SCC & GCC.			
2.0.0	GENERAL TECHNICAL REQUIREMENT			
	Specification of various works covered in the scope of work has been mentioned in the section. The content mentioned herein shall be read in conjugation with other relevant portions of the technical specification. For details not mentioned in this section relevant clauses in Part A and Part B of Technical specification may be referred.			
2.1.0	AREA FILLING, BACKFILLING, PAVING & HARD CRUSTING			
	Any existing area which falls in the working area shall be made suitable for the purpose of being used as a laydown area by carrying out filling using suitable material. Hard crusting of Laydown area, fabrication, and pre-assembly yard area has to be carried out as per specifications mentioned below. At locations where hard crusting is not present, Soil cover of minimum 500 mm shall be maintained on top of the abandoned dyke. Soil of approved type shall be obtained from identified borrow area.			
	Specification for area filling & compaction shall be in accordance with Stipulations under relevant clause of Site Levelling and Slope Protection Works, Subsection D-01 Part B of Technical specification, Section VI.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-4540-001A-2		SUBSECTION D-1-12(I) CIVIL WORKS DEPEVELOPMENT OF LAYDOWN AREA
Page 3 of 4				

Clause No.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
2.2.0	Specification for backfilling shall be in accordance with Stipulations under relevant clause of Area Paving, Subsection D-01 Part B of Technical specification, Section VI.		
	Hard crusting shall be of minimum 200mm thickness comprising of compacted filling using 63 mm and down aggregate having interstices filled with well graded selected moorum/ non-expansive soil on compacted and dressed sub - grade.		
	ROAD WORKS		
	Construction of flexible pavement (WBM roads with bituminous top) wherever constructed shall be in accordance with the IRC, MORTH and IS specifications. The road shall have 300mm thk subbase course 225mm thk base course, 75 thk bituminous macadam surface and 25 mm thk premix bituminous carpet. The roads shall be double lane.		
	Drains shall be designed as per local conditions. However, drains shall be of minimum 1m width x 1.5m depth.		
2.3.0	TURFING		
2.3.1	Scope		
	This section of the specification covers turfing on selected locations of the laydown area which are not hard crusted.		
2.3.2	General Requirements		
	The Contractor shall furnish all labour, equipment and materials required for the complete performance of the work in accordance with the drawings, Schedule of Quantities and as described here in.		
2.3.3	Material		
	50 mm thick grass turf sods of locally available variety shall be used in this work. Direct planting of grass on the dyke slope shall not be permitted.		
2.3.4	Placing		
	Selected locations of the laydown area, which are not hard crusted, shall be turf sodded. Area to be turf sodded shall be slightly roughened and covered with a layer of turf sod consisting of blocks of dense lining grass growth of locally available species. The sod shall include a mat of roots and earth at least 5 cm. thick. Sod containing an excessive amount of obnoxious weed growth shall be excluded. Sod shall be carefully handled in transportation and placing so that a minimum amount of earth will be lost from the root mass. The blocks of sod shall be laid in close contact and then tamped firmly in place so as to fill and close the joints between blocks. Immediately after placing, the sodded area shall be thoroughly wetted and then kept moist for 3 months or till such time the grass establishes itself uniformly on the surface whichever is later. The watering shall be done so as to avoid erosion and prevent damage to sodded areas by water tanker, etc. The growth of weeds on the turfing shall be prevented by removing them and disposing off.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-4540-001A-2	SUBSECTION D-1-12(I) CIVIL WORKS DEPEVELOPMENT OF LAYDOWN AREA
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LABOUR COLONY
SKETCH FOR PROPOSED AREA FOR LAYDOWN & PREASSEMBLY FOR EPC
PACKAGE FOR STAGE-III (2X660MW)



NOTES:

1. AREA 'A', 'B' & 'C' PROPOSED FOR EPC VENDOR.
2. APPROACH ROAD DEVELOPMENT FROM EXISTING HIGHWAY TO AREA 'A' 'B' & 'C' IS IN SCOPE OF EPC VENDOR ALONG WITH AREA DEVELOPMENT OF 'A' 'B' AND 'C' FOR LAYDOWN AND PREASSEMBLY AS MENTIONED IN THE SPECIFICATIONS.

Bidder may use Area-A for Labour Colony. For safety of labour, bidder to provide separate approach road for their movement, as per site conditions, which shall be completely isolated from material movement road/path. No material movement shall be allowed on approach road meant for Labour colony.

SL.NO.	PROPOSED AREA	AREA PROPOSED FOR	AREA AVAILABLE
1.	'A'	EPC	16 ACRES
2.	'B'	EPC	24 ACRES
3.	'C'	EPC	31.5 ACRES

Area Drainage Study for Proposed Talcher Thermal Power Project –III (2×660 MW) in the State of Odisha

Sponsor: Talcher Thermal Power Station, NTPC Ltd., Distt. Angul



Submitted by
Dr. U.C. Chaube, Ex Emeritus Fellow
Dr. Ashish Pandey, Associate Professor (IIT Roorkee)



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July, 2019

IITR Project No. WRC/6004/18-19

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Final Report

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Talcher Thermal Power Station (TTPS) is situated near Talcher town in Angul district of Odisha having capacity of 460 MW [Stage-I (4×60 MW) + Stage-II (2×110 MW)]. The project was implemented by erstwhile Orissa State Electricity Board (OSEB) and was subsequently taken over by NTPC on 03.06.1995 and is under commercial operation.

In view of the power generation capacity requirements and future capacity addition plans, NTPC is proposing to enhance the capacity of Talcher Thermal Power Station (TTPS) by adding 2 nos. units of 660 MW each, as Talcher Thermal Power Project (TTPP) Stage-III (2×660 MW).

The proposed Talcher Thermal Power Project Stage-III (2×660 MW) is envisaged as an interregional base load station for meeting the power demand of eastern region beneficiaries and the home state- Odisha.

M/s NTPC Limited have issued a purchase order vide letter number 550001779-025-1027 dated 14.12.2018 to Indian Institute of Technology Roorkee to carry out Area Drainage Study for the proposed Talcher Thermal Power Project Stage-III (2×660 MW).

1.2 LOCATION OF THE PROJECT

The proposed site is at a distance of about 4 km from Talcher town and about 25 km from district headquarters Angul in Odisha state, India. Nearest railway station named Talcher is on Talcher-Cuttack section of North Eastern Railway (renamed East Coast Railway) at about 2 kms. However, a small railway station named ‘Talcher Thermal’ is located near project boundary. The area is accessible by NH-23 (renamed NH-149) at about 1 km. The nearest commercial airport is at Bhubaneswar at an aerial distance of 90 km approx. and about 150 km by road. The location map of the proposed Project site is presented in Figure 1.1. Physical environmental setting of the plant site is explained in chapter 2.



Figure 1.1: Location of the Talcher TPP Stage III

1.3 SCOPE OF WORK

1. Study of existing natural drainage pattern/system, available information in the form of reports, literature, satellite imageries, etc. having a bearing on the storm water drainage system for proposed areas of the project and its adjoining areas. The study shall include review of topographical features of the proposed site and its surrounding area.
2. Review and analysis of rainfall information to arrive at design storm scenarios.
3. Review and analysis of relevant Survey of India Topographical Sheets, topographic survey and satellite imageries.
4. Estimation of flood hydrographs considering historical as well as design rainfall to suggest complete scheme for storm water drainage of sites and its adjoining area including diversion of nallas/streams, if any.
5. Estimation and routing of design flood hydrograph through the drainage system of concerned catchments considering appropriate boundary conditions including pre-construction scenario as well as post-construction scenario for suggesting remedial measures for the site.
6. Suggesting final disposal point and size of the storm water disposal drain from sites.
7. Site visit for acquaintance of prevailing conditions and collection of available data
8. Visit to NTPC Corporate Engineering Office for discussions regarding the studies if required.

1.4 SITE VISIT

IIT Roorkee team along with NTPC officers visited the site from 15th to 17th March, 2019 for acquaintance of prevailing conditions and collection of available data. The visit covered existing plant (stage I and II), site for stage III, past and present ash disposal sites (ash ponds, mine voids), existing drains and outfalls on Nandira nala. The visual inspection of drains and topographic features of site as well as discussion with NTPC project managers helped in understanding the field problems related to internal and external drainage relevant to the existing and proposed plant.

CHAPTER 2

STUDY AREA CHARACTERISTICS

2.1 PHYSICAL ENVIRONMENTAL SETTING

The basic environmental setting of the proposed site is given in Table 2.1. Figure 2.1 is the vicinity map showing plant site and other features within 10 km radius area.

Table 2.1 Environmental setting of the Talcher TPP site

Sl. No.	Particulars	Details
1	Project Location	Near Talcher town, Angul district, Odisha
2	Present land use at the site	Industrial, within the existing project
3	Villages within 1 km (approx..) radius area	Nuagaon (S), Gurujangli (SE), Dighi (W), Kendupali (W), Bhoghabereni (S), Nuapada (N) and Pudiabangha (W), Jagannathpur (W), Bantol (NE), Bangu (E) etc.
4	Nearest highway	NH-23 (renamed NH-149) (about 1 km, East)
5	Nearest railway station	Talcher on Talcher-Cuttack section of North Eastern Railway (renamed East Coast Railway) at about 2 Km. However, a small railway station named 'Talcher Thermal' is located near project boundary.
6	Nearest airport	Bhubaneswar (about 150 km by road, about 90 km aerial distance South East)
7	Nearest town/City /	Talcher (4 km, North), Angul District HQ (about 25 km)
8	Hills/valleys	There are some hillocks of upto 170 m height(approx.) above mean sea level, which are located beyond 4 km approx. distance from plant site towards NW & W.
9	Climatic conditions (IMD, Angul)	Annual (IMD Climatological Table 1971-2000) Daily Mean Temperature: (Max) 39.8 ⁰ C ; (Min) 15.1 ⁰ C Total Rainfall (mm) : 1300.1 Relative Humidity % (Max) : 83 Relative Humidity % (Min) : 35 Wind Direction : W, NW
10	Topography	Mild slopes
11	Seismicity	Seismic Zone-III, Low damage risk zone
12	Surface water bodies	River Brahmani, about 2.0 km (E) Nandir Jhor (A small rivulet), leading to Brahmani river, passes adjacent to the southern boundary wall (existing) of the project.
13	Water Source for project	Samal Barrage on the River Brahmani, about 30 km.
14	List of Major Industries (Operating)	Distance is approx. aerial distance NALCO Captive Power plant (7 km), NALCO Smelter (8 km), MCL Mines (8 km), Aryan Coal washery (5 km), Rana Sponge Iron Ltd. (7.5 km), GMR Kamalanga Power Plant (7.5 km) etc.

2.2 LAYOUT PLAN AND LAND REQUIREMENT

Figure 2.2 shows the layout plan of proposed Talcher TPP stage-III. About 190 acres (76.9 ha) is available to accommodate TTPS Stage III within 427 acres (172.8 ha) land of existing TTPS Stage I & II. The existing township/ infrastructures spread over 190 acres will be demolished in phased manner to make the land available for stage III. Existing raw water reservoir of Talcher TPS would be relocated and utilized for Stage-III also. In addition, about 2.337 acres (0.95 ha) is required near Samal Barrage on Brahmani River for make-up water pump house.

A railway siding already exists within project site which will be extended with use of proposed railway land. The ash pipeline is envisaged to be laid along the existing ash pipeline towards MCL mine voids.

Make-up water pipelines (about 26 km) are proposed to be laid along the Right Bank Canal of Samal Barrage up to Talcher TPP. About 125 acres of land would be required for right of use (without land acquisition).

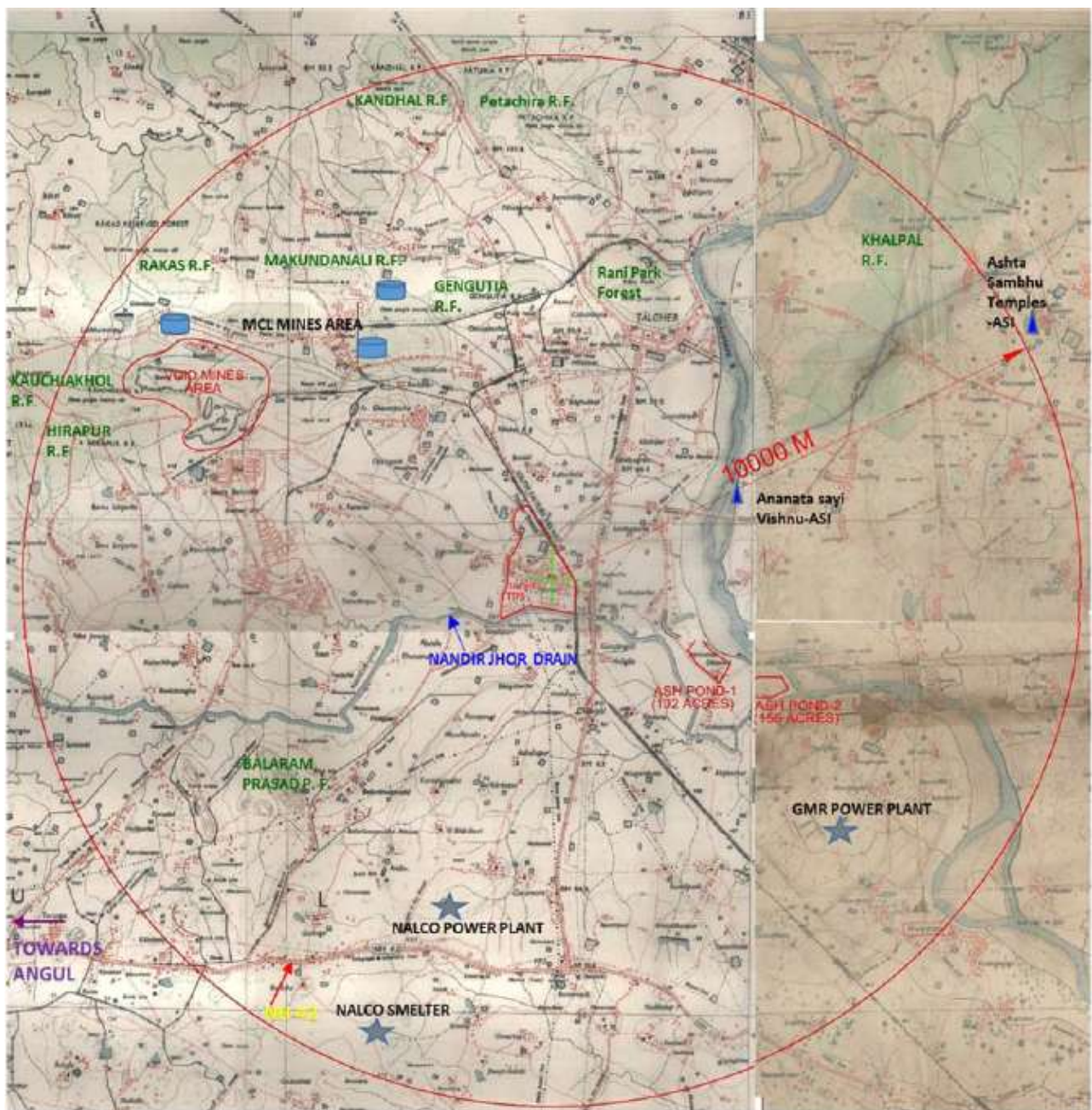


Figure 2.1: Vicinity map showing plant site and other features within 10 km radius area

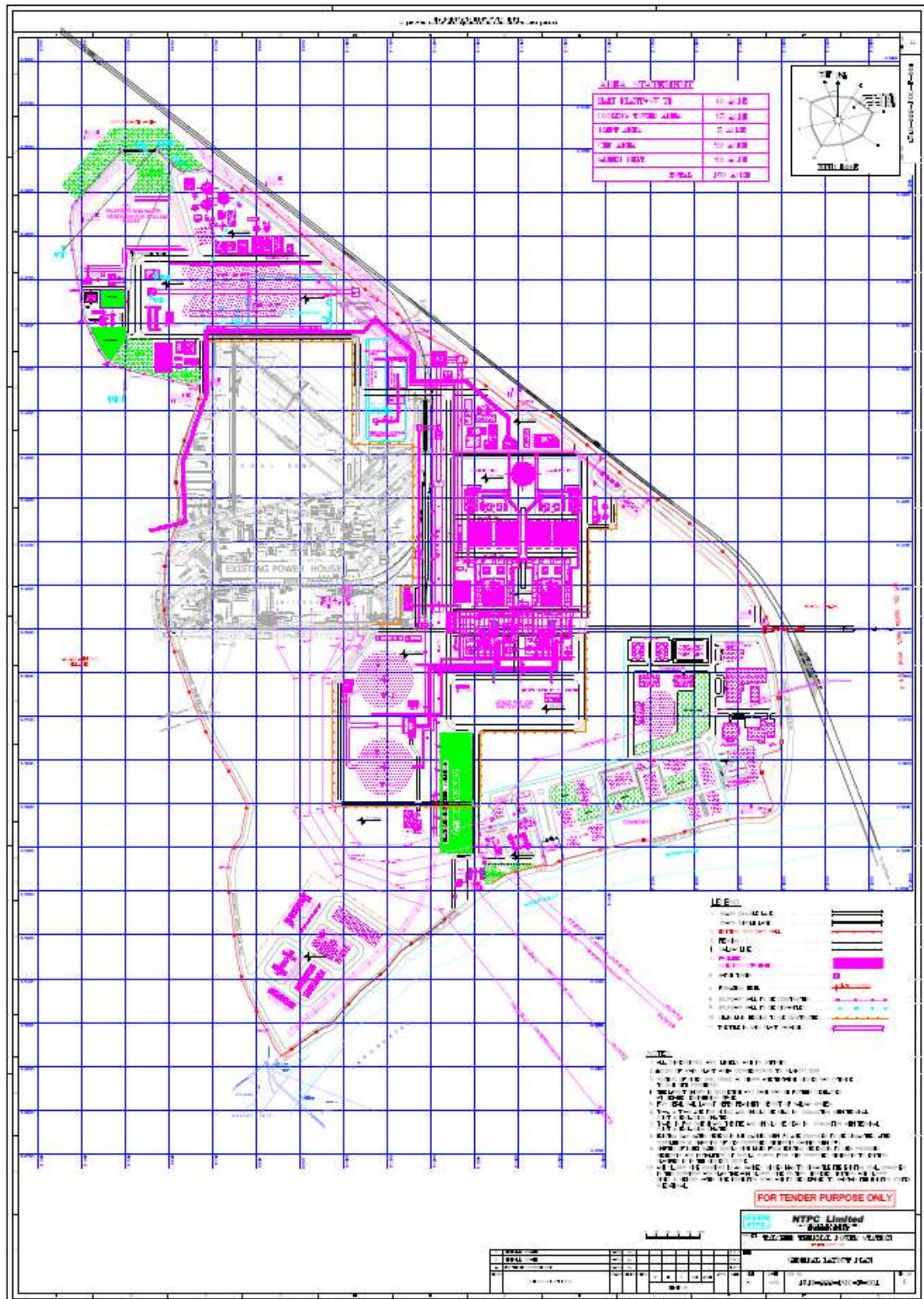


Figure 2.2 (a): Layout plan of Talcher TPP stage III and existing plant

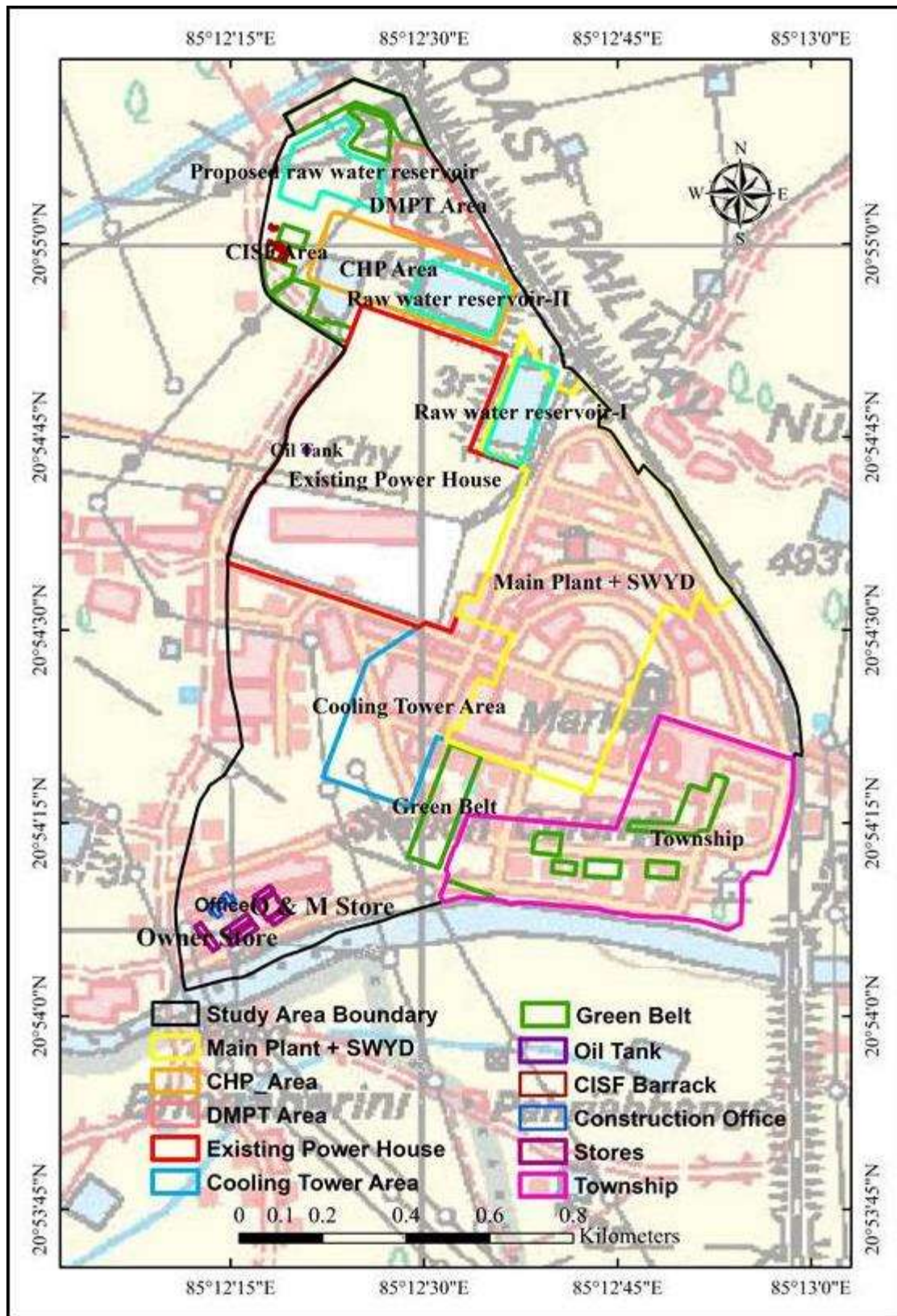


Figure 2.2 (b): Layout plan of Talcher TPP stage III and existing plant superimposed on toposheet

2.3 EXISTING AND PROPOSED ASH DISPOSAL AREA

2.3.1 Ash Disposal System of existing Talcher TPP Station (460 MW)

Ash disposal system is sized for 100% generation of ash. Bottom ash generated from the boiler and part fly ash generated from ESP is fed to the ash slurry sump in the form of lean slurry through ash slurry trenches. Ash slurry pumps are utilized to pump lean ash slurry from the ash slurry sump upto the ash disposal area through pipelines.

Earlier Scheme (Not in service): Figure 2.3 shows locations of abandoned ash dykes A, B, C, D, E & F and incomplete ash dykes 1, 2, 3 & 4. Further work of ash dykes 1, 2, 3 and 4 has been stopped due to environmental considerations (figure 2.3).

Existing Scheme (in service): Ash disposal area identified at abandoned South Balanda OCP mine voids of MCL (Quarry No. 2 & 3) through pipelines (figure 2.4) (details in chapter 7).

2.3.2 Ash Disposal System for proposed Talcher TP Project, Stage-III (2×660 MW)

Ash disposal area is identified at abandoned Jagannath OCP mine voids of MCL (Quarry No. 4 & 7) located about 14 km from the plant (figure 2.4) (details in chapter 7).

TTPS ASH DYKES



Figure 2.3: Ash dykes A, B, C, D, E&F (Abandoned) and Ash dykes 1,2,3&4

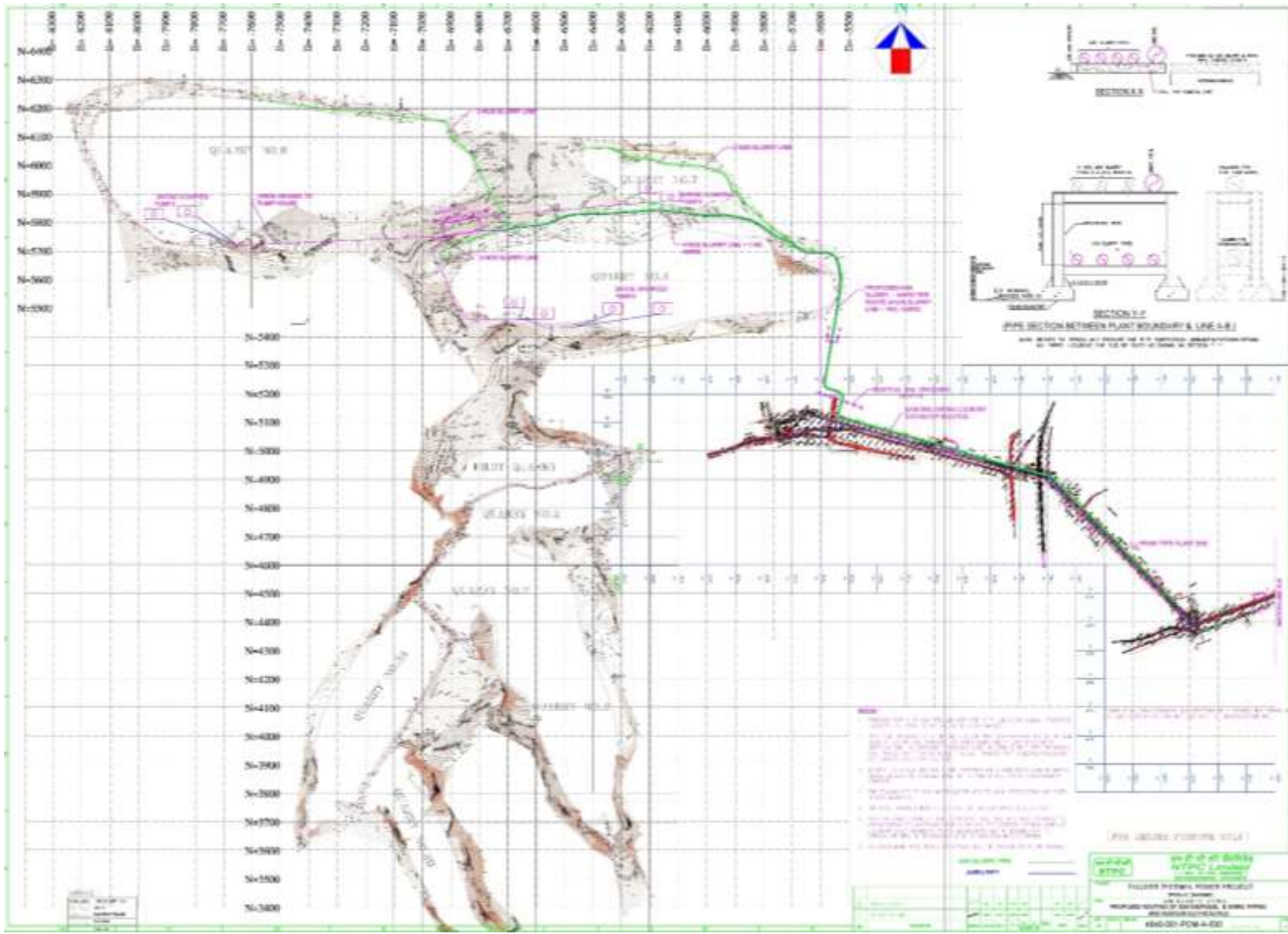


Figure 2.4: South Balanda OCP mine voids of MCL (Quarry No. 2 & 3) & Jagannath OCP mine voids of MCL (Quarry No. 4 & 7) located about 14 Km from the plant

2.4 TOPOGRAPHY

Digital elevation model (DEM) study of the plant area is presented in chapter 3. The central part of the study area has highest elevations of 73.25 m. The higher elevations are on the northern and western side and low elevation area is located towards the southern and eastern side. The DEM study in chapter III will provide a guideline for economizing the cost of earth work for land levelling. Elevation in cooling tower site varies from 72.25 m to 68.75 m.

Only two formation levels (71 m and 69 m) are proposed by NTPC for Stage III plant. GIS switch yard of stage III is located on 69 m FGL whereas plant area is at 71 m FGL. Formation level of new township could be between 69.0m and present existing 66.5m as some of the facilities of existing township may be retained.

2.5 NATURAL DRAINAGE

The major part of the Angul district lies between two major river systems i.e. River Brahmani flowing in the North East and River Mahanadi which forms the South-South Western boundary of the district. Photos of important drains are provided in Photos 2.1 to 2.5.

River Brahmani

The Brahmani, known as the South Koel in the upper reaches, originates near Nagri village in Ranchi district of Jharkhand at an elevation of about 600 m. The total length of its run is about 799 km. The principal tributaries of this river are Sankh, Tikra and Karo.

Talcher TPS boundary is located about 2.0 km west of the Brahmani River. The High Flood Level of Brahmani River is 62.1 amsl. The lowest elevation of the eastern boundary of the plant site is 67.25 amsl. No flooding has occurred in the plant area in last 30 years.

Nandiri Nala (Jhor)

Nandiri nala flowing in the southern part of the study area is one of the main drainage tributary of the Brahmani river in study area. The nala originates near Barkerjang and traverses almost 29 km from its place of origin before it meets Brahmani river. The total catchment area of Nandiri nala is about 193 km².

2.6 PHYSICAL CHARACTERISTICS OF SOIL

Information given below is from the Final EIA Report of the TTPS Stage III. Soil sampling location are shown in Figure 2.5 and Table 2.2. Soil analysis results are presented in Table 2.3.

Texturally the soils of study area are observed as Clay, Clay Loam and Sandy Soils. The bulk density of the soils was found in the range of 1.13 to 1.39 gm/cm³. Water holding capacity of study area soils was observed as 29 to 42 %.

Table 2.2 Soil Sampling Locations

Sl. No.	Location	Distance (Approx.) & Direction from TTPS	Geo-coordinates
S-1	Santhapara (Near Ash Pond No.1)	1.4 km E	200 53.399-N& 850 15.346-E
S-2	Santhapara (Near Ash Pond No.2)	1.3 km E	200 53.651-N& 850 14.330-E
S-3	Jagannathpur (Near Plant & Township)	1.7 km NW	200 54.659-N& 850 12.422-E
S-4	South Balanda (Old coal mines void/existing ash disposal area)	6.3 km W	200 55.650-N& 850 08.582-E
S-5	South Balanda (Jagannath mines)	6.2 km W	200 55.603-N& 850 09.460-E
S-6	Sarang (AnanthaSayiVishnu)	5.7 km NE	200 55.644-N& 850 15.024-E
S-7	Jharimba (Agricultural Field)	2.2 km E	200 53.015-N& 850 14.623-E
S-8	Gurujangali (Agricultural Field)	1.0 km SE	200 53.821-N& 850 13.278-E
S-9	Baghmara (Agricultural Field)	3.9 km NW	200 55.535-N& 850 10.598-E
S-10	Kendupali (Near Nandirajhor)	1.2 km W	200 53.751-N& 850 12.109-E
S-11	Khamana (Near Nandirajhor)	2.6 km W	200 53.744-N& 850 11.195-E
S-12	Bhogaberni(Agricultural Field)	1.5 km S	200 53.440-N& 850 12.598-E
S-13	Mukandnali (RF)	6.1 km NW	200 57.727-N& 850 10.116-E
S-14	Kualo/Near Ashthashumbhu Temple (Agricultural Field)	10.5 km NE	200 56.897-N& 850 18.051-E



Figure 2.5. Soil Sampling Locations

Table 2.3: Physical Characteristics of Soil

Sl. No.	Parameters	Analytical Results													
		S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	S-12	S-13	S-14
		Physical Characteristics													
1.	Texture	Clay	Clay	Clay	Clay Loam	Sandy	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay	Clay	Clay	Clay Loam	Clay
2.		Particle Size Distribution													
i	Sand (%)	32	30	22	18	54	22	24	35	26	25	36	32	15	30
ii	Silt (%)	28	26	30	36	24	32	30	24	23	33	24	22	34	22
iii	Clay (%)	40	44	48	46	22	46	46	41	51	42	40	46	51	48
3.	Porosity (%)	56.6	55.5	56.2	49.1	47.6	54.3	50.2	49.4	56.9	55.5	53.2	52.4	50.6	57.4
4.	Bulk Density (gm/cm ³)	1.15	1.18	1.16	1.35	1.39	1.21	1.32	1.34	1.14	1.18	1.24	1.26	1.31	1.13
5.	Water Holding Capacity, (%)	36	41	38	35	29	36	32	34	30	42	38	40	32	39

2.7 LAND USE /LAND COVER MAP

Land use pattern of the study area (10 km radius around the project site) has been determined using the latest high resolution (5.8m) satellite (IRS-ID, sensor P6, LISS IV) imagery from National Remote Sensing Agency (EIA report). Land use/land cover map of 10 km study area is shown in Figure 2.6 and Table 2.4.

Table 2.4: Land use of Study Area based on NRSC Satellite Imagery (Nov. 2016)

Class	Area(Sq. km)	Area in %
Agricultural land	147.29	41.65
Settlement	18.97	5.55
Water body	13.84	4.05
Vegetation\Forest	30.93	9.05
Dry river bed	6.93	2.03
Waste land	105.3	30.82
Barren land	23.4	6.85
Total	341.69	100

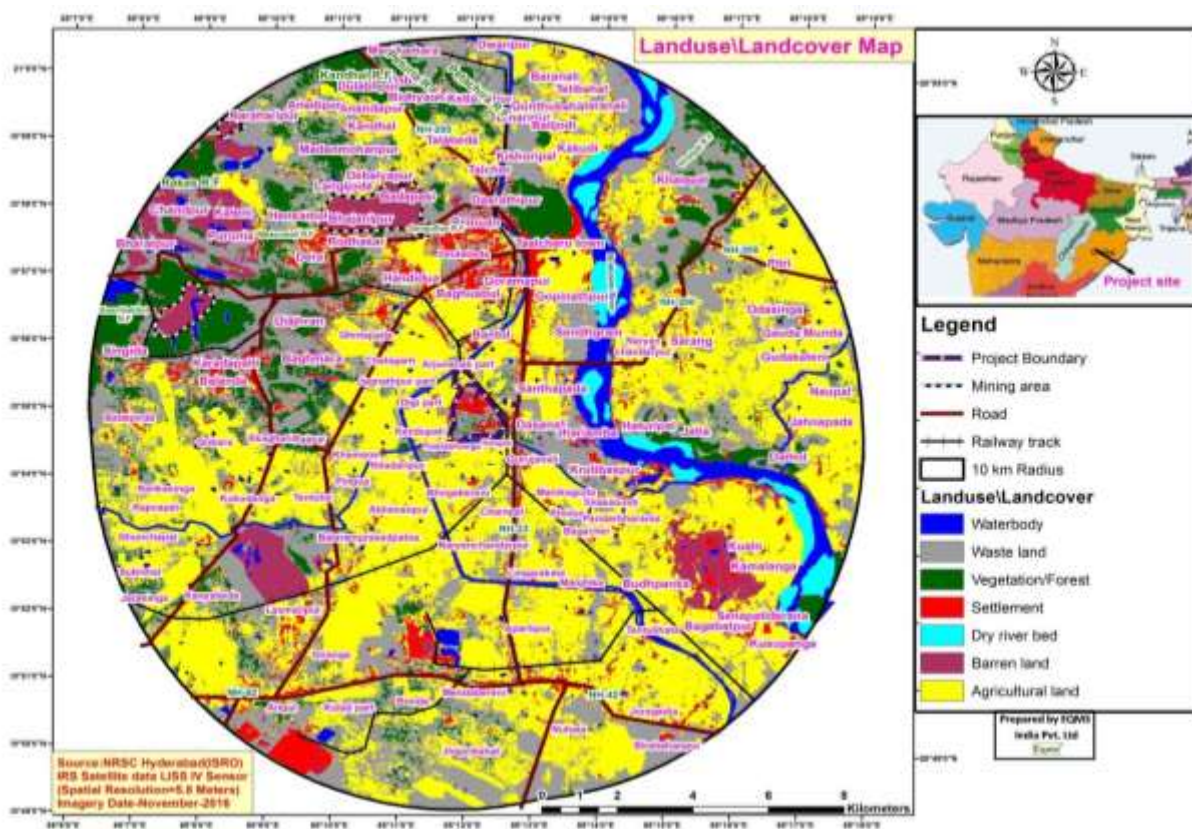


Figure 2.6: Land use/ Land Cover in vicinity of plant

2.8 CLIMATE

The year may broadly be divided into four seasons:

- Winter season : December to February
- Pre-Monsoon season : March to May
- Monsoon season : June to August
- Post-Monsoon season : September to November

IMD meteorological data 30 years average (1971-2000) at Angul station have been reviewed (TTPS Stage III EIA Report).

1) Temperature –Daily mean minimum temperature ranges from 15.1⁰C to 26.0⁰C in May. Daily mean maximum temperature ranges from 27.7⁰C to 39.8⁰C in May.

2) Relative Humidity – IMD data (1971-2000) depicts that the air is generally dry in the region except during monsoon. March is driest with relative humidity below 67%. The maximum

humidity during rainy season is 83%. High humidity is found during daytime and low humidity values during night time.

3) Rainfall – The annual total rainfall is around 1300.1 mm. Around 80% of the total annual rainfall is received during the monsoon period between June to September.



Photo 2.1: Road bridge on Nandiri nala



Photo 2.2: Effluent and storm water is pumped back for treatment as part of zero discharge plan



Photo 2.3: Waterlogged area in existing plant area



Photo 2.4: Drain Water pumping to STP as part of zero discharge plan



Photo 2.5. Existing drain at OP2

CHAPTER 3

DIGITAL ELEVATION MODEL STUDY

3.1 INTRODUCTION

Digital elevation model (DEM) is the digital representation (digital map) of the ground elevation data in meters (m). This digital map, a type of Digital Terrain Model (DTM) is raster data that it is made up of equally sized grid cells with a unique elevation.

The projection and datum for a DEM may vary. In the present study, Polyconic coordinates (m) have been used for geo-referencing of all maps. The following data have been used for the DEM study:

- i) Contour map of the plant area with contour interval of 1m. This map has been prepared using recent grid survey data of the plant area provided by Talcher Thermal Power Project, NTPC Limited.
- ii) Geographic referencing points: These have been extracted from the features common in the toposheet and the map based on recent topographic survey and georeference points provided by Talcher Thermal Power Project, NTPC Limited, Orissa.
- iii) Survey of India Toposheet (1: 50000 scale): Toposheet Number 73 H/1
- iv) Plant layout map showing location and ground formation levels of various components of the Talcher Thermal Power Project.

3.2 PROCEDURE FOR DIGITAL ELEVATION MODEL (DEM)

ARC-GIS software has been used for preparation of the DEM. Each contour was assigned its value and converted into TIN.

Different component of the Talcher Thermal Power Project is shown in Figure 3.1. The contours in shape file have been interpolated to obtain digital elevations of the equally sized grid cells. Size of a grid cell is 1 m × 1 m in this study. The DEM of the study area is shown as contour zoning map in Figure 3.2 and elevation variation from 65.25 m to 74.75 m is depicted through different colours. The DEM of the study area is also shown as single colour intensity map in Figure 3.2b. The DEM of the main plant and SWYD, cooling tower area, DMPT area, CHP area, green belt, CISF, reservoirs, oil tank, township area and central stores & office area is also presented separately in Figures 3.3, 3.4, 3.5, 3.6, 3.7 and 3.8 respectively.

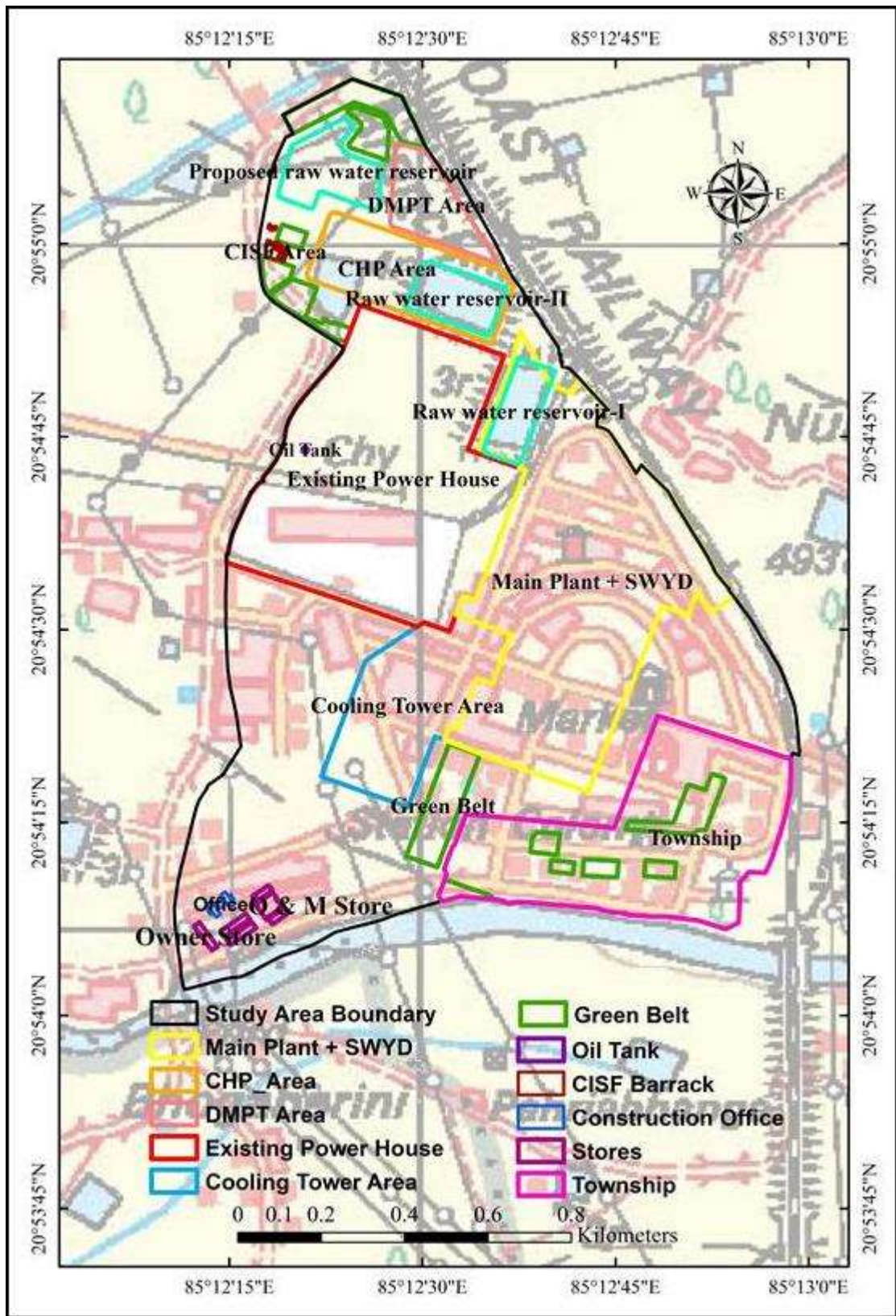


Figure 3.1: Different components of the Talcher Thermal Power Project

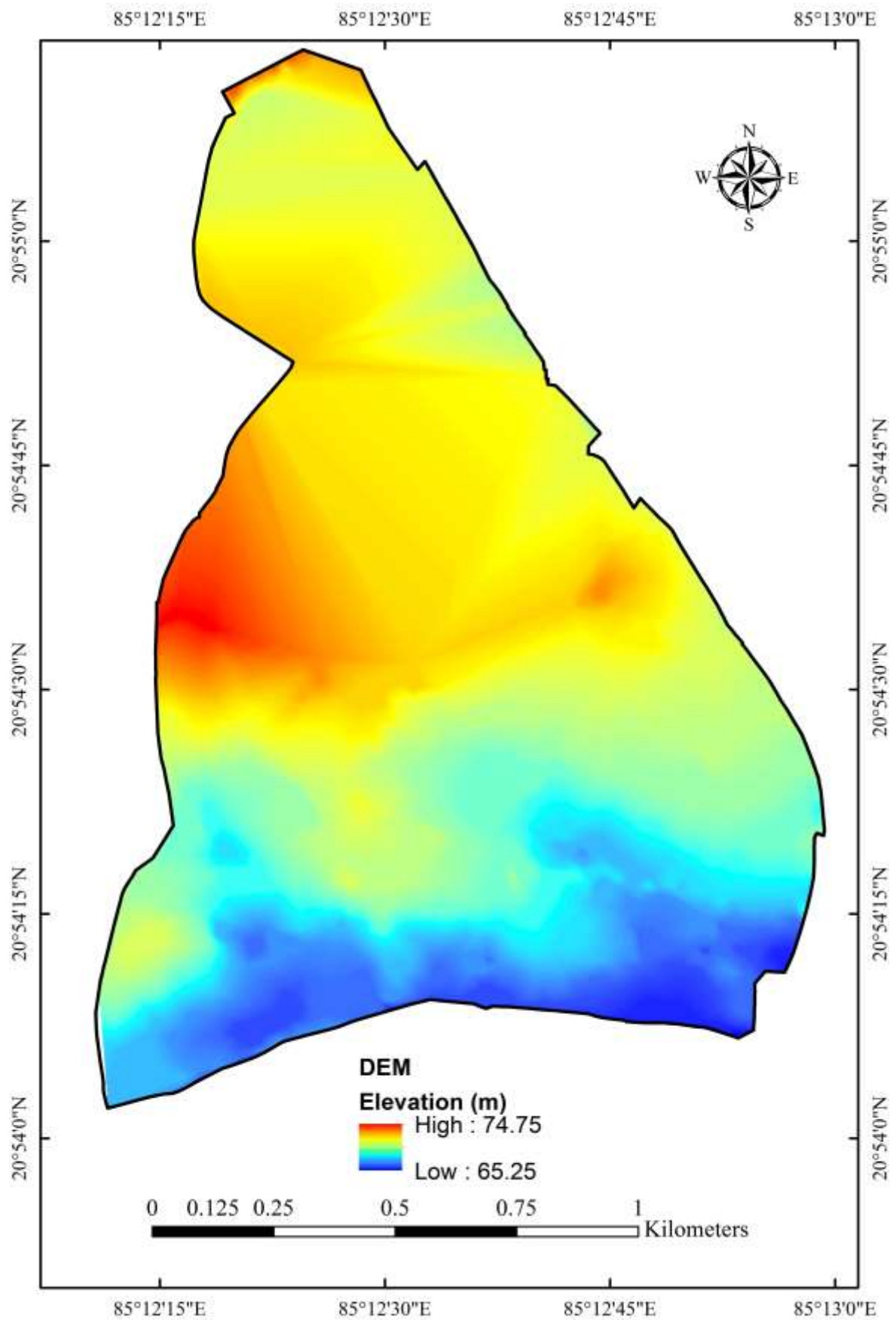


Figure 3.2a: DEM - contour zonation map of the study area

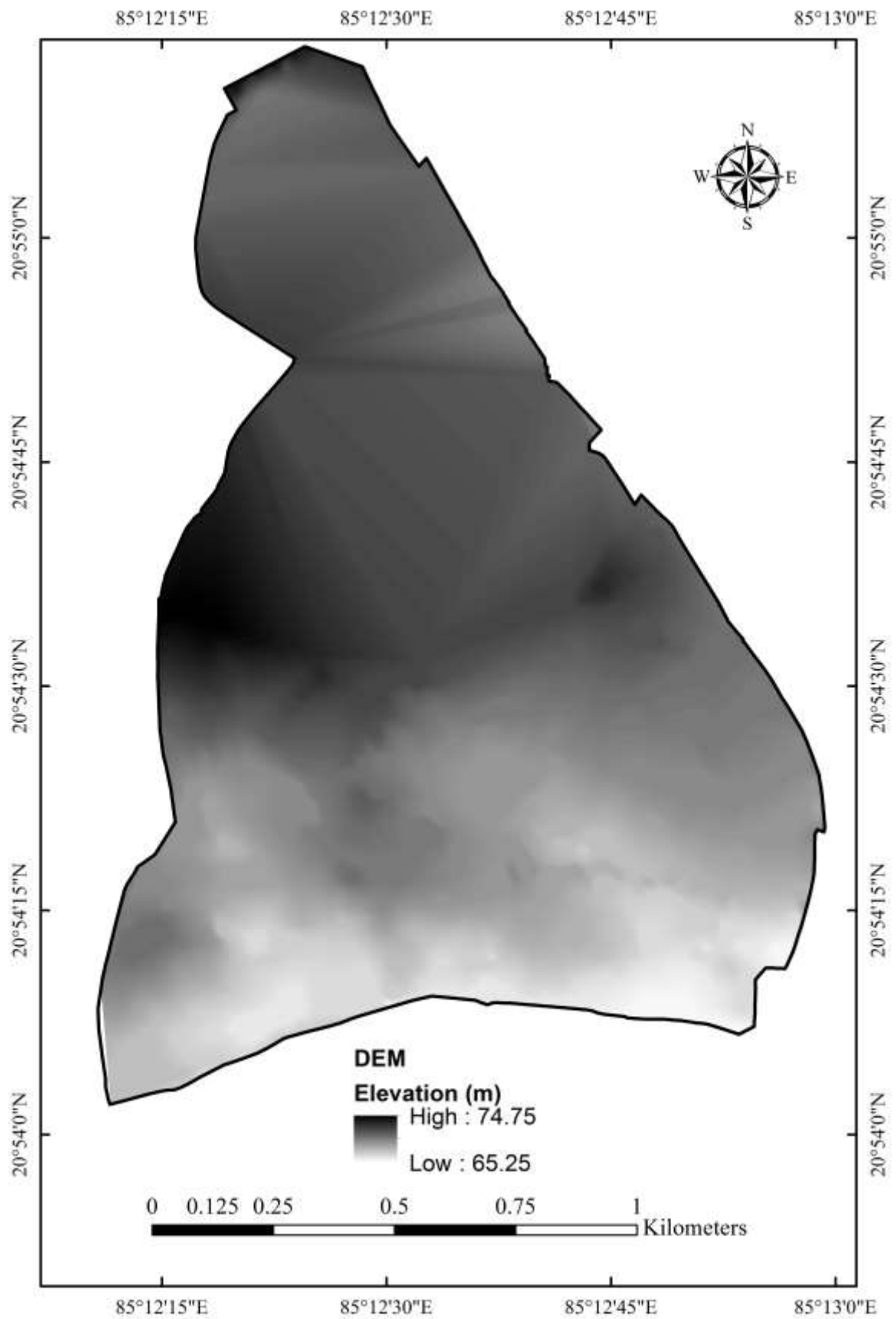


Figure 3.2b: DEM - terrain colour intensity map of the study area

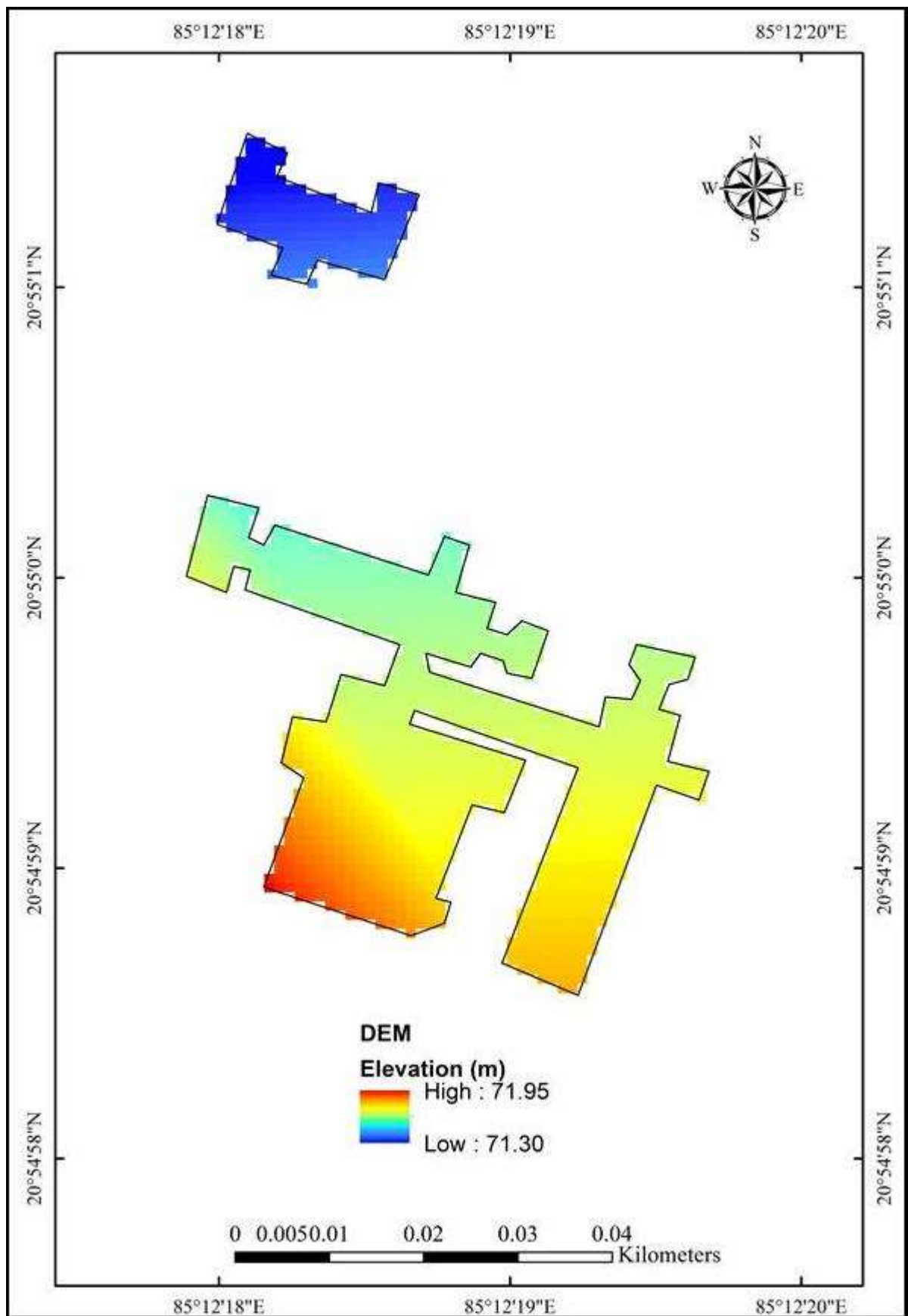


Figure 3.3: DEM – CISF Area

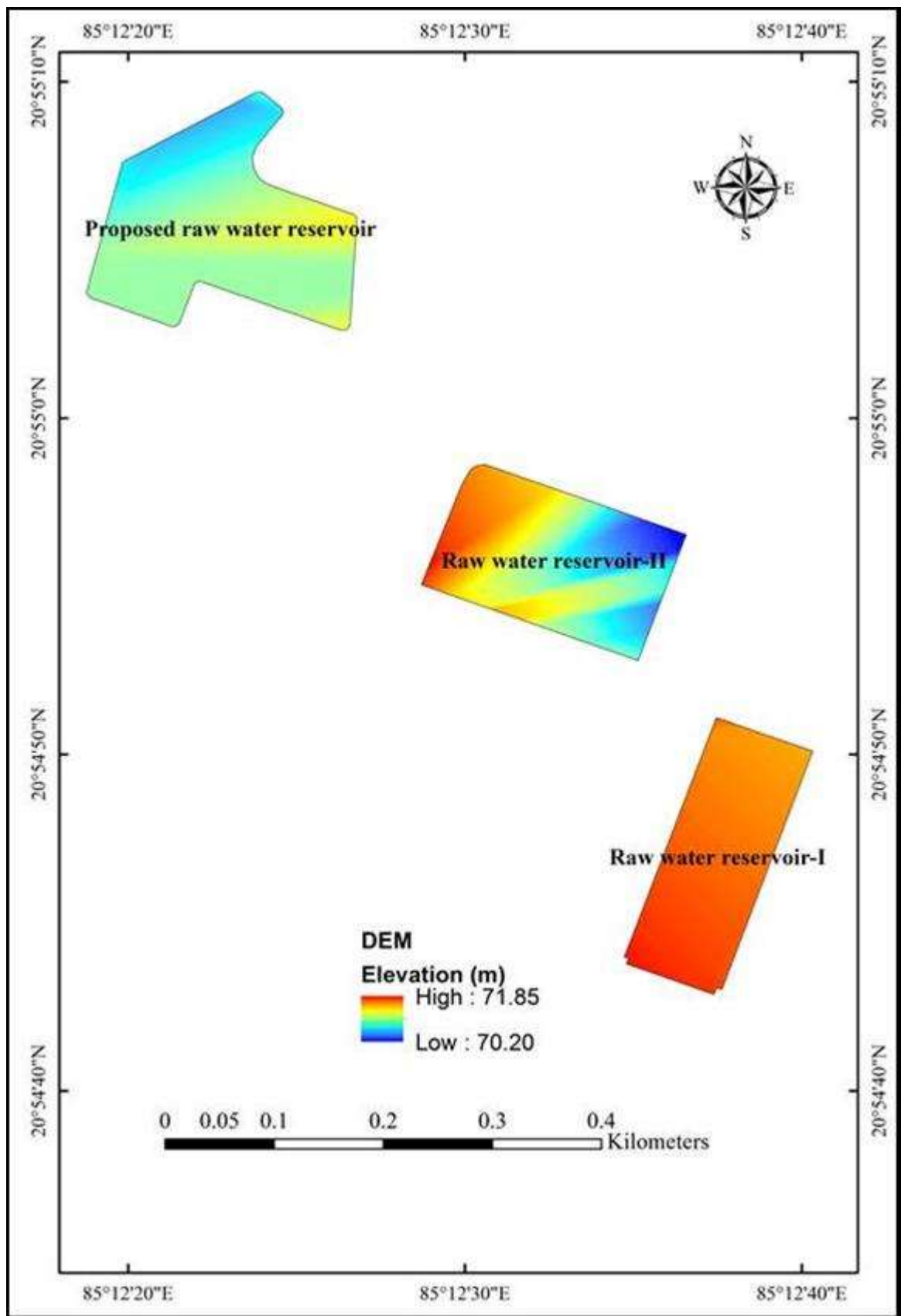


Figure 3.4: DEM – Reservoirs

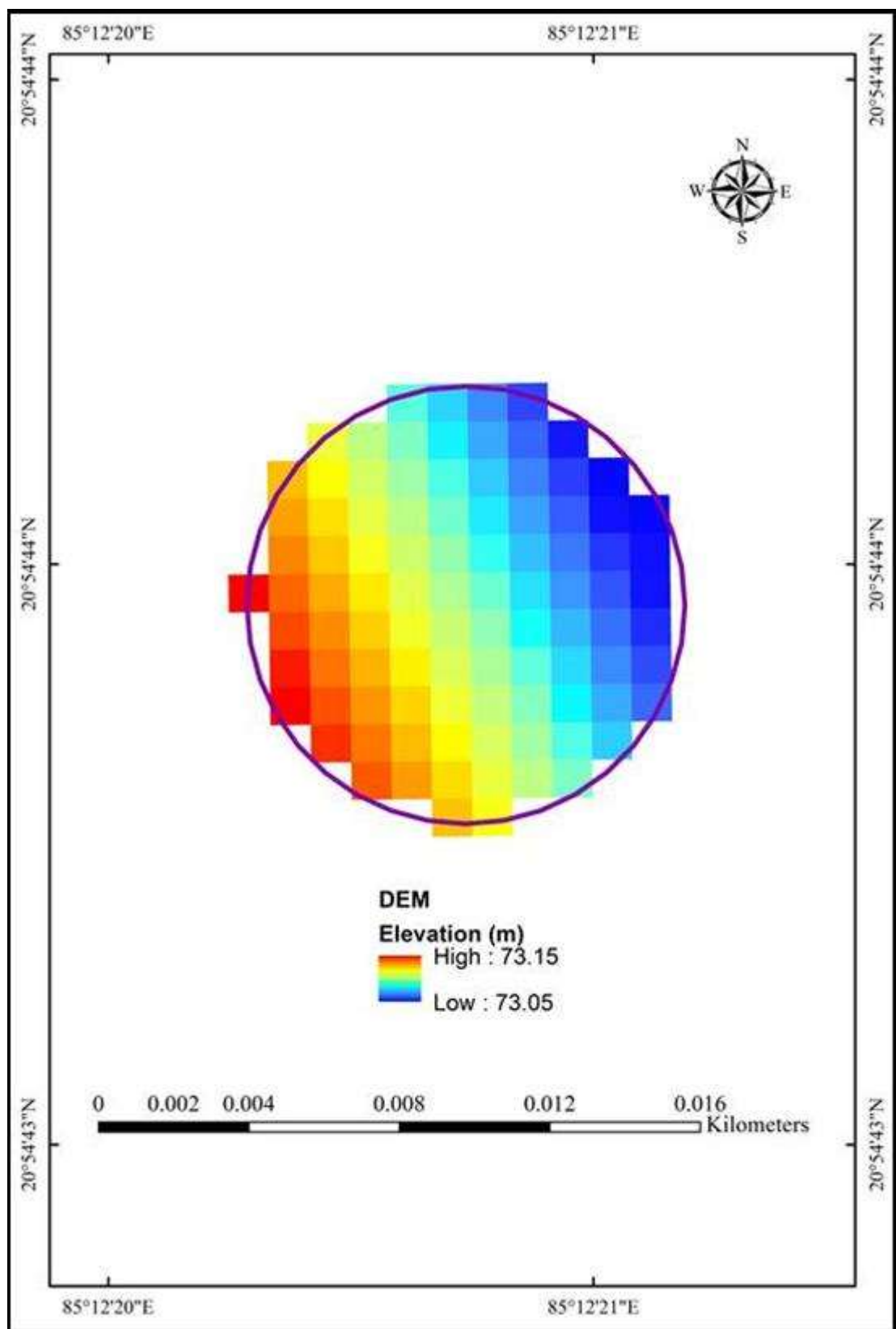


Figure 3.5: DEM – Oil Tank

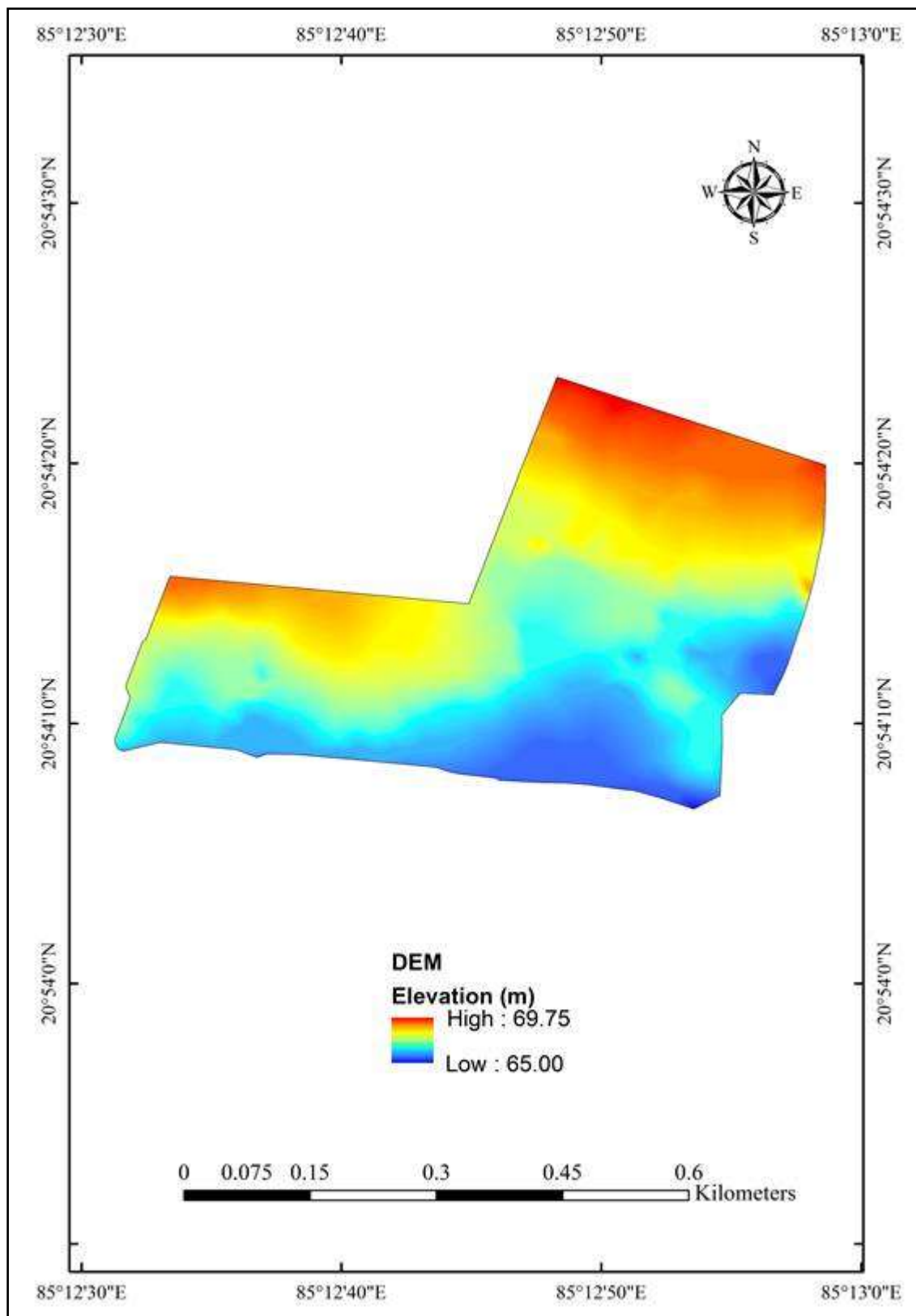
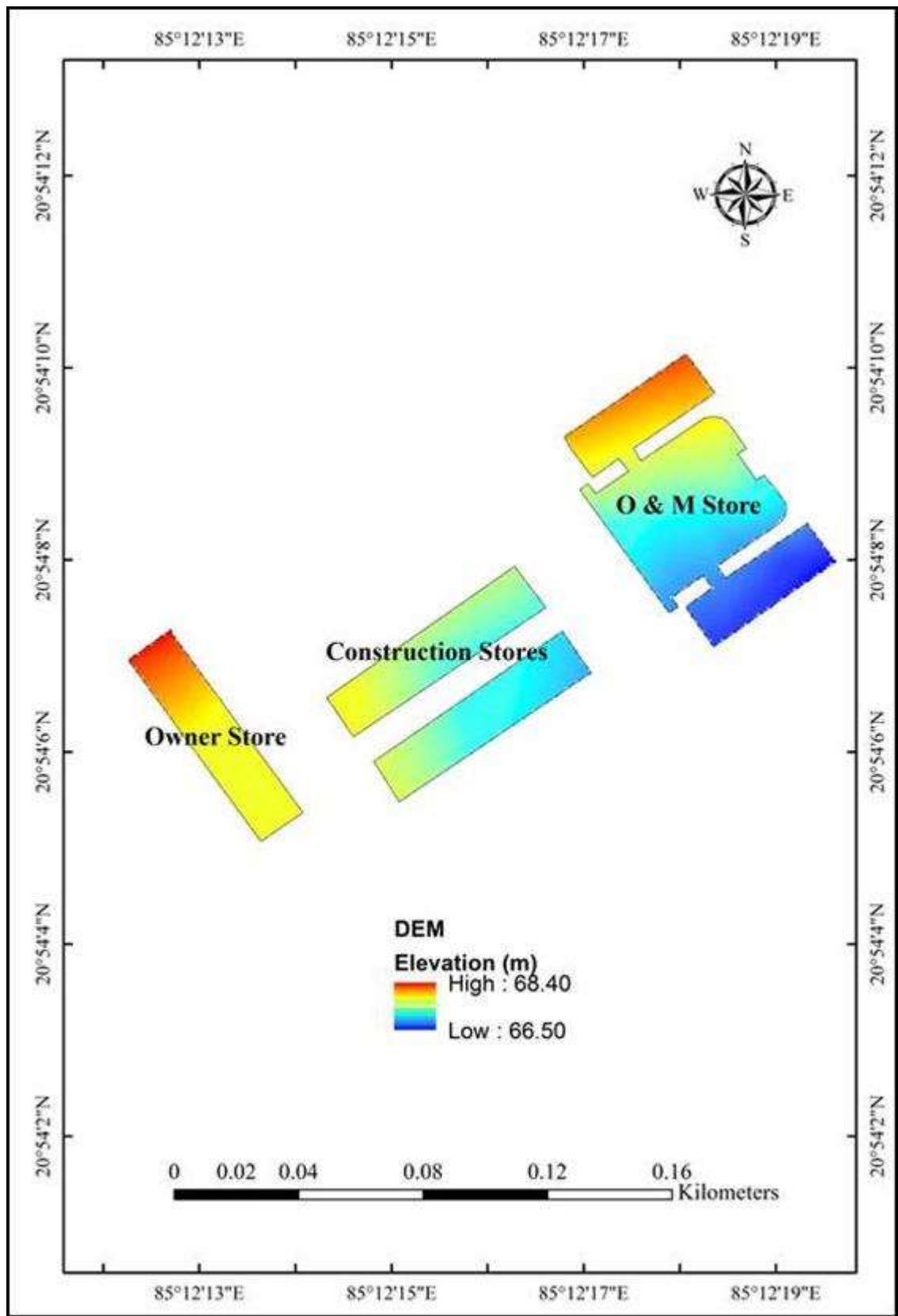


Figure 3.6: DEM – Township Area



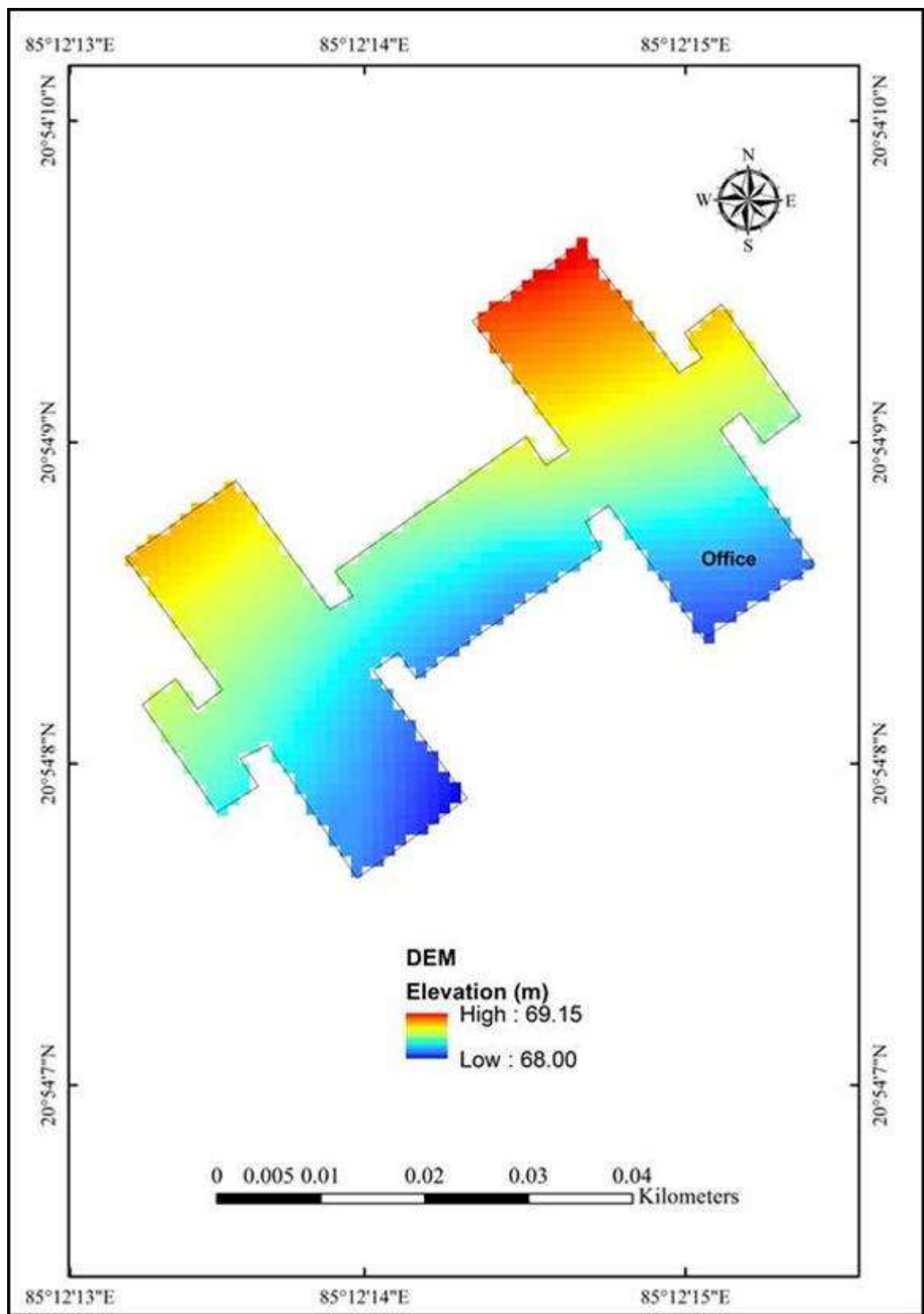


Figure 3.8: DEM – Office

3.2.1 DEM of the main plant area and SWYD

Figure 3.9 shows that the Southern part of the area has lowest elevation of 67.25 m. The central part of the study area has highest elevations of 73.25 m. The higher elevations are on the northern side and low elevation area is located towards the southern side which has been allocated for GIS switch yard. These elevations will provide a guideline for economizing the cost of earth work during the design of plant.

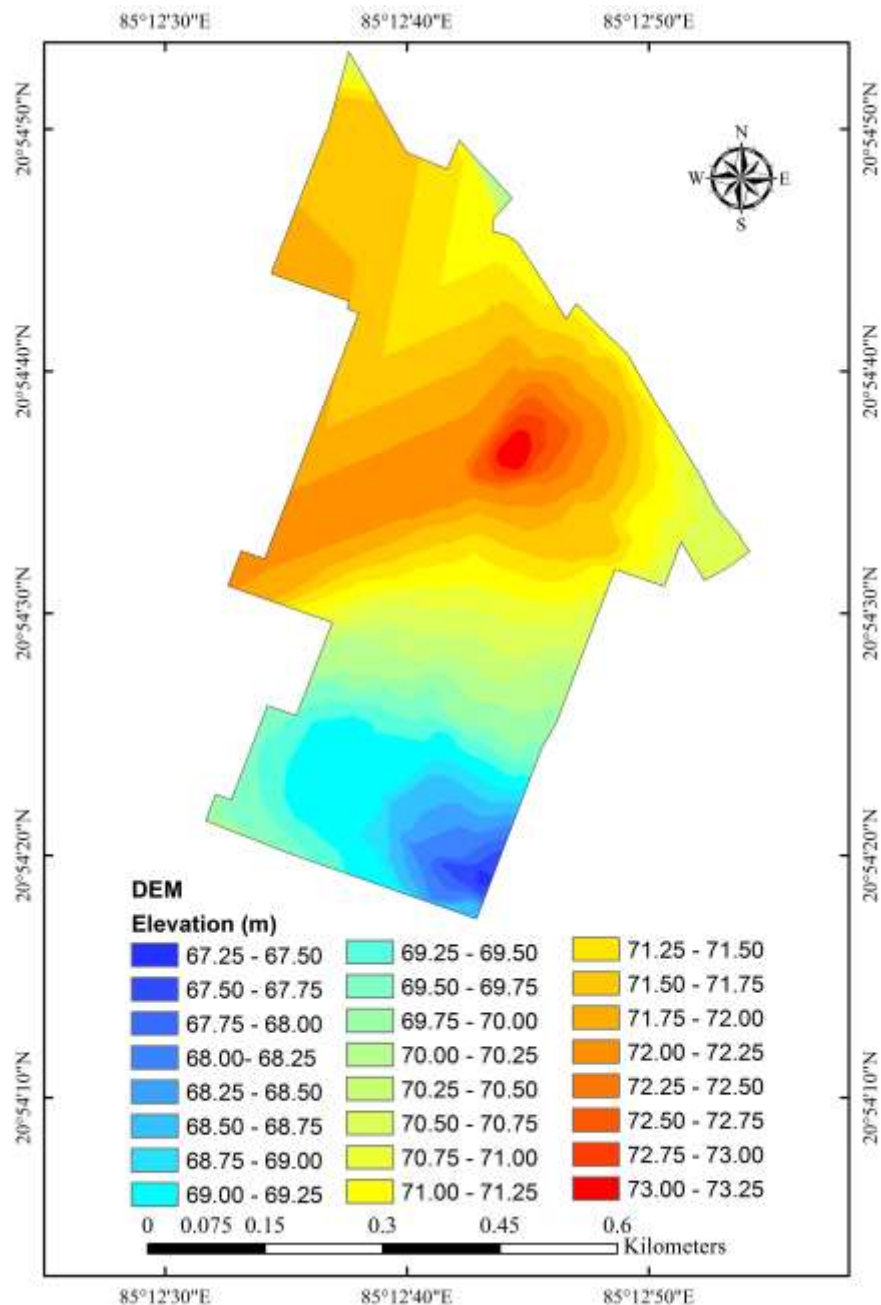


Figure 3.9: DEM - contour zonation map of the main plant and SWYD

3.2.2 DEM of the cooling tower area

Figure 3.10 shows the variation in elevation from 72.25 m to 68.75 m in the cooling tower area. North-eastern part of the area has highest elevation of 72.25 m. The south western part of the area has lowest elevation of 68.75 m.

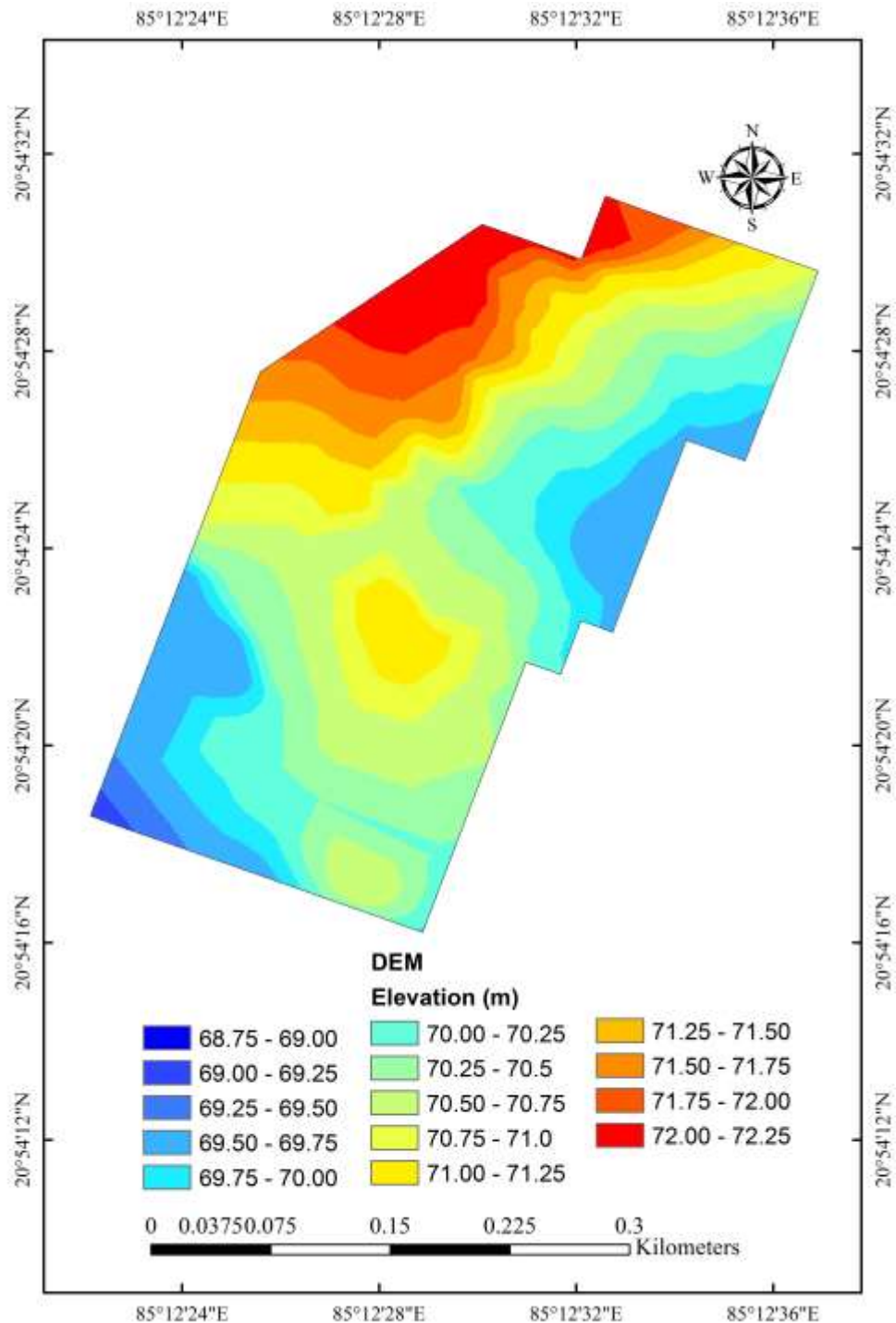


Figure 3.10: DEM - contour zonation map of the cooling tower area

3.2.3 DEM of DMPT area

Figure 3.11 shows that the south eastern part of the DMPT area has lowest elevation of 70.75 m. The small portion in the south western part of the study area has highest elevation of 71.75 m. These elevations will provide a guideline for economizing the cost of earth work during the design for DMPT.

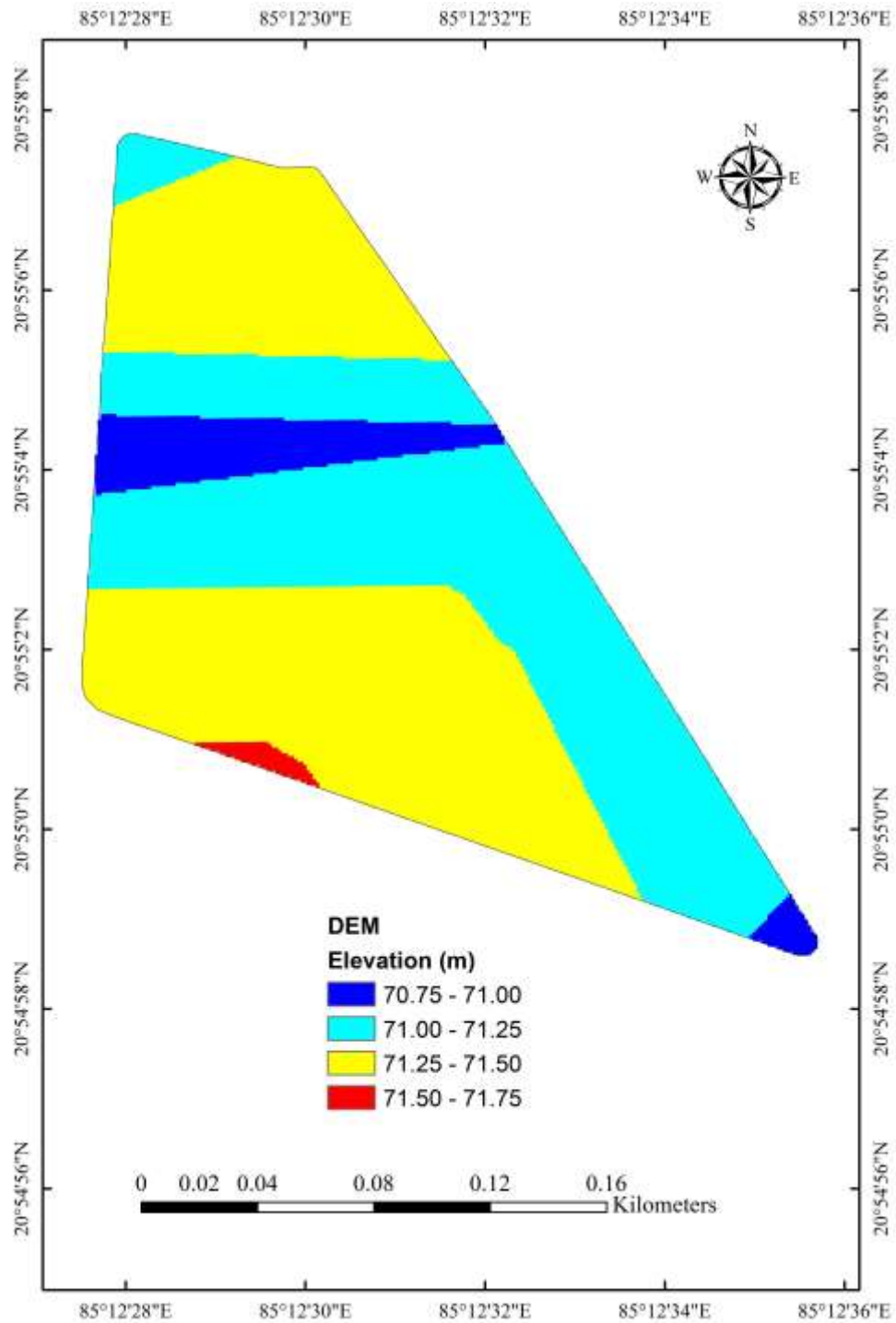


Figure 3.11: DEM - contour zonation map of DMPT area

3.2.4 DEM of the CHP area

Figure 3.12 shows that the CHP area which has elevation varying between 70.00 m to 72.25 m.

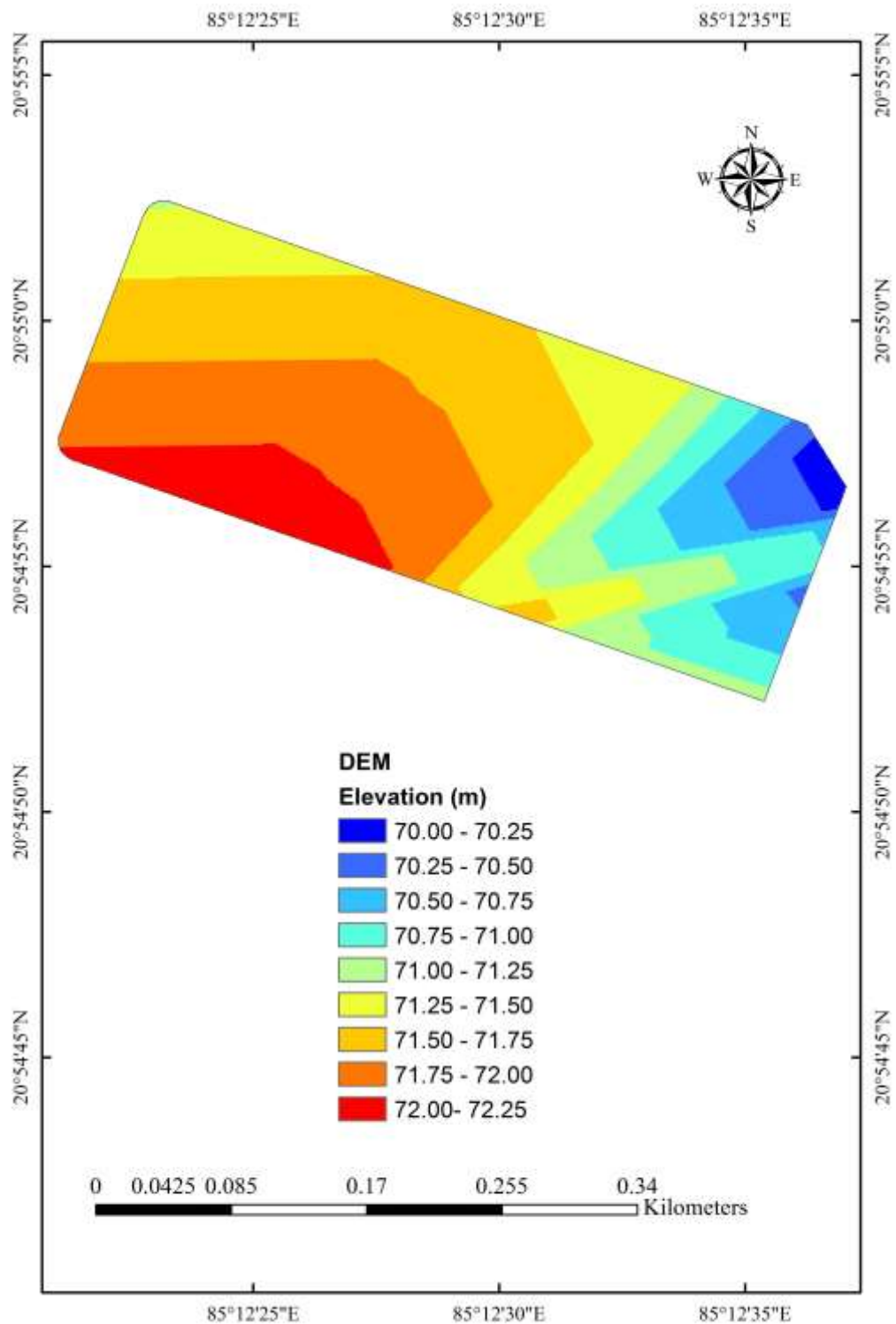


Figure 3.12: DEM - contour zonation map of CHP area

3.2.5 DEM of the Green belt area

Figure 3.13 shows the Green belt areas in the study area having highest elevation of 74.50 m and lowest elevation of 66 m.

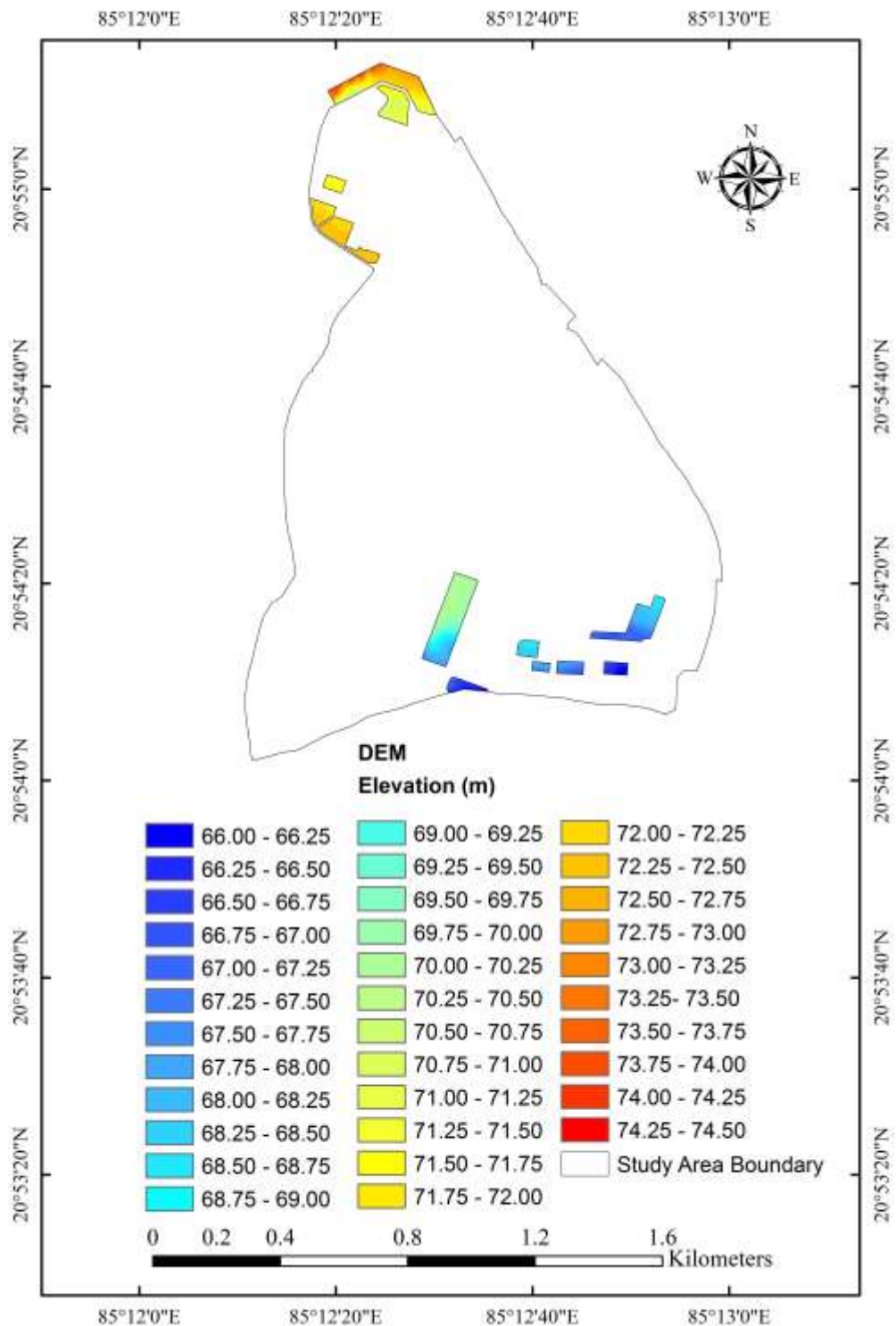


Figure 3.13: DEM - contour zonation map of the Green belt area

3.3 GENERATION OF STREAM NETWORK

The Spatial analyst tools of ARC-GIS software has been used in the present study for further processing in the context of stream generation.

DEM has been smoothened out for eliminating uneven irregularities using Fill tool to remove the sinks. Corrected DEM has been used to generate pattern of flow directions and for identification of flow accumulation through each pixel of given elevation. Generated information on flow pattern and flow accumulation considers Eight-Point Pour model for the purpose of computing flow directions for use in basin delineation with DEMs directions. With the flow directions assigned for each DEM point, the flow accumulation at each DEM point has been computed. The flow accumulation at a given DEM point is defined as the number of earlier DEM points whose flow paths eventually pass through that point.

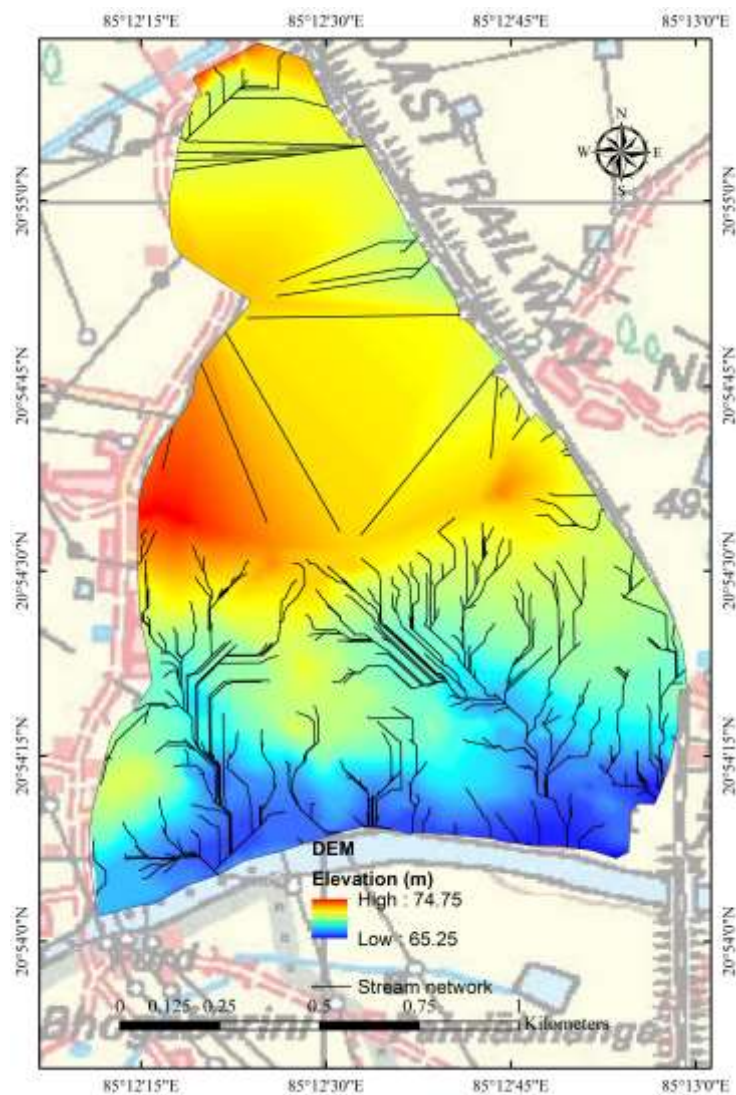


Figure 3.14a: Drainage network derived from DEM

Streams are identified by large values of flow accumulation since the flow paths of many points pass through the stream points. Outlet of a watershed has the highest value of flow accumulation of any of the DEM points since the flow paths of all points in the watershed will eventually pass through the outlet point. Streams have been identified by displaying all DEM points with a flow accumulation value of 500. Figure 3.14a and b shows the generated stream network in the study area.

Drainage network created from DEM was overlaid with the toposheet drainage network (Figure 3.14 b). It is evident from the Figures 3.14 that major drainage of the study area is matching with the drainage created from DEM.

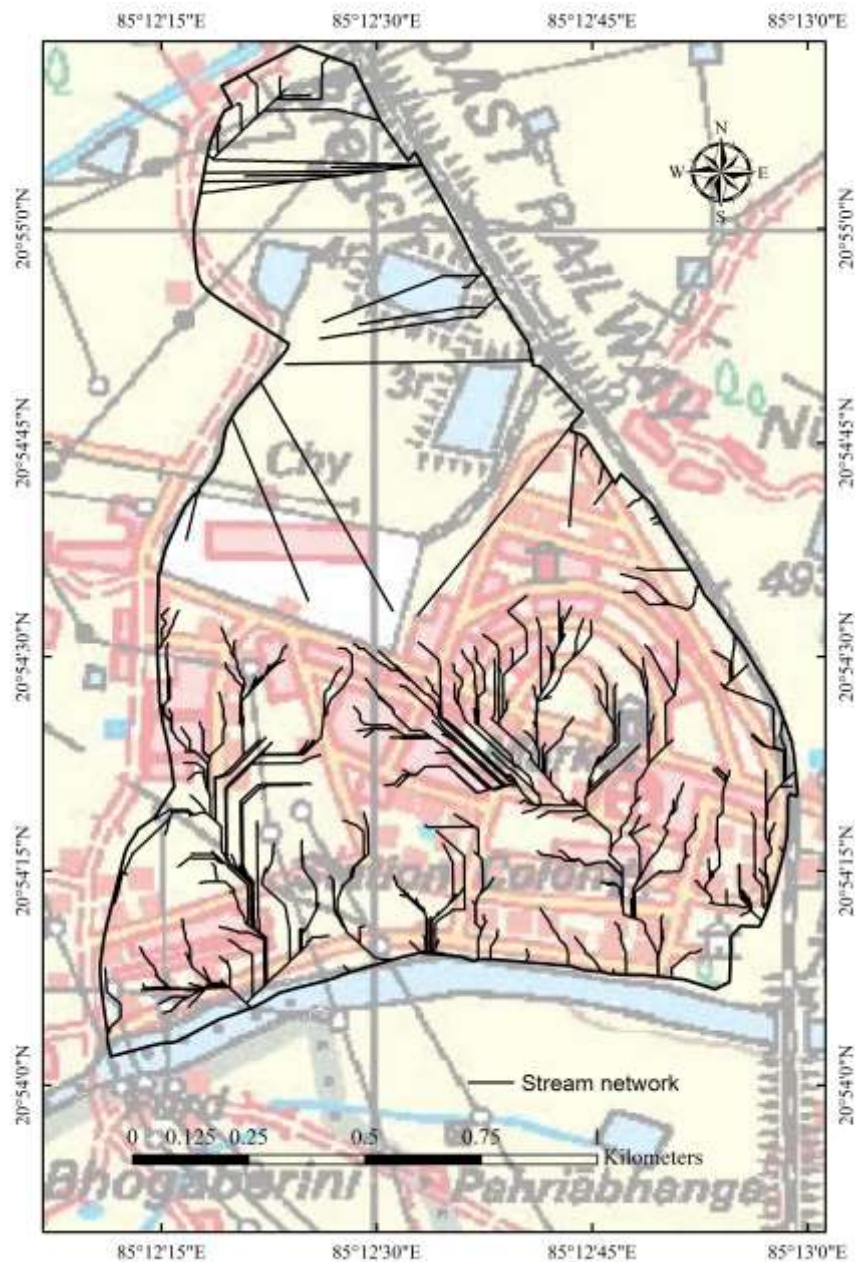


Figure 3.14b: Comparisons of drainage network from toposheets drainage

3.4 DISTRIBUTION OF LAND AREA IN DIFFERENT ELEVATION

3.4.1 PLANT AREA and SWYD

The Digital Elevation Model prepared in ARC-GIS has been used to compute the natural drainage area (within plant boundaries) between different elevation ranges. The DEM computes the number of pixels in each interval. Table 3.1 shows distribution of area from 67.75 m to 73.25 m elevation. The DEM pixel size used in this study is 1 m × 1 m.

Proposed formation level of plant area is 71m whereas that of switch yard is 69 m. As per DEM,16.93 ha (50%) of the plant area including SWYD lies below 71.35 m elevation.

Table 3.1: Areal distribution with elevation in the plant area and SWYD as per DEM

Elevation	No. of	Area (m ²)	Area (ha)	Area %	Cumulative	Cumulative Area
67.50	280	280	0.03	0.08	0.03	0.08
67.75	1575	1575	0.16	0.47	0.19	0.55
68.00	1926	1926	0.19	0.57	0.38	1.12
68.25	4201	4201	0.42	1.24	0.80	2.36
68.50	4542	4542	0.45	1.34	1.25	3.70
68.75	6814	6814	0.68	2.01	1.93	5.71
69.00	4916	4916	0.49	1.45	2.43	7.16
69.25	23606	23606	2.36	6.97	4.79	14.13
9.50	12459	12459	1.25	3.68	6.03	17.81
69.75	12362	12362	1.24	3.65	7.27	21.46
70.00	9175	9175	0.92	2.71	8.19	24.17
70.25	11758	11758	1.18	3.47	9.36	27.64
70.50	9159	9159	0.92	2.70	10.28	30.34
70.75	16131	16131	1.61	4.76	11.89	35.11
71.00	13632	13632	1.36	4.02	13.25	39.13
71.25	26163	26163	2.62	7.72	15.87	46.86
71.50	34430	34430	3.44	10.17	19.31	57.02
71.75	59942	59942	5.99	17.70	25.31	74.72
72.00	38607	38607	3.86	11.40	29.17	86.12
72.25	34290	34290	3.43	10.12	32.60	96.24
72.50	4713	4713	0.47	1.39	33.07	97.63
72.75	4083	4083	0.41	1.21	33.48	98.84
73.00	2440	2440	0.24	0.72	33.72	99.56
73.25	1519	1519	0.15	0.45	33.87	100.01
Total		334942	33.87	100		

Figure 3.15 is graphical depiction of the cumulative area distribution up to different elevation in the plant area. The information derived from the DEM study can be used to arrive at cost effective levels at which different plant components should be finally located. It is recommended that in detailed project planning this aspect may be carefully examined.

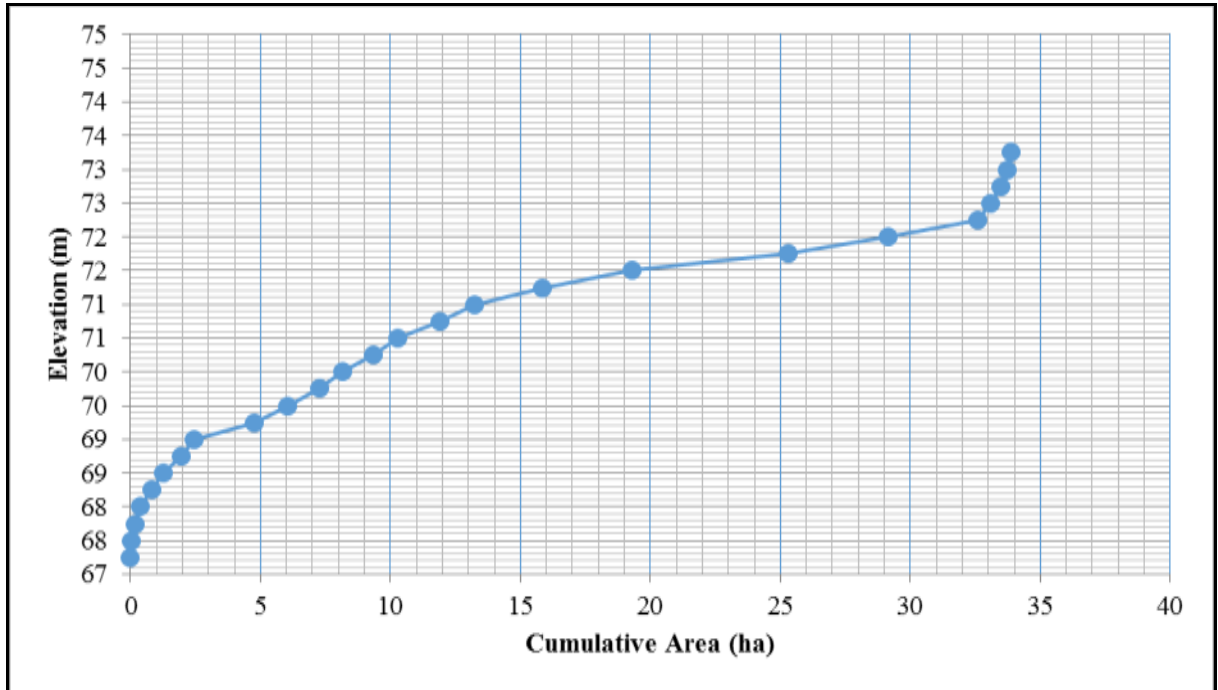


Figure 3.15: Cumulative areal distributions with elevation in plant area and SWYD
3.4.2a COOLING TOWER

Table 3.2 shows distribution of area in the cooling tower area from 69 m to 72.25 m elevation. The DEM pixel size used in this study is 1 m × 1 m. Figure 3.16 is graphical depiction of the cumulative area distribution up to different elevation in the cooling tower area.

Table 3.2: Areal distribution with elevation in the Cooling Tower area

Elevation	No. of Pixel	Area (m ²)	Area (ha)	Area %	Cumulative Area (ha)	Cumulative Area (%)
69.00	1	1	0.00	0.00	0.00	0.00
69.25	248	248	0.02	0.25	0.02	0.25
69.5	1053	1053	0.11	1.04	0.13	1.29
69.75	10496	10496	1.05	10.37	1.18	11.66
70.00	7631	7631	0.76	7.54	1.94	19.20
70.25	12347	12347	1.23	12.20	3.18	31.40
70.50	15509	15509	1.55	15.33	4.73	46.72
70.75	18079	18079	1.81	17.86	6.54	64.59

71.0	9103	9103	0.91	9.00	7.45	73.58
71.25	8332	8332	0.83	8.23	8.28	81.82
71.5	4377	4377	0.44	4.33	8.72	86.14
71.75	4694	4694	0.47	4.64	9.19	90.78
72.0	4622	4622	0.46	4.57	9.65	95.35
72.25	4720	4720	0.47	4.66	10.12	100.01
Total		101212	10.12	100		

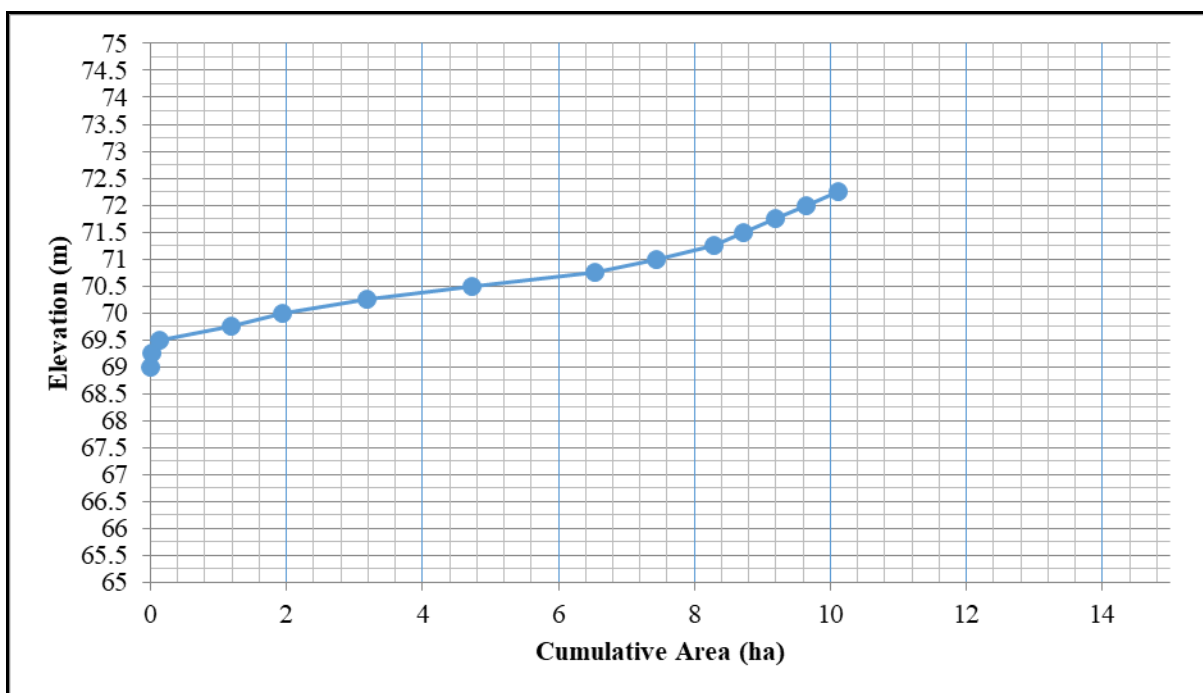


Figure 3.16: Cumulative areal distributions with elevation in cooling tower area

3.4.2b DMPT

Table 3.3 shows distribution of area in the DMPT area from 71 m to 71.75 m elevation. The DEM pixel size used in this study is 1 m x 1 m. Figure 3.17 is graphical depiction of the cumulative area distribution up to different elevation in DMPT area.

Table 3.3: Areal distribution with elevation in the DMPT area as per Survey data

Elevation (m)	No. of Pixel	Area (sq. m)	Area (ha)	Area (%)	Cumulative Area (ha)	Cumulative Area (%)
71.00	2464	2464	0.25	7.54	0.25	7.54
71.25	14266	14266	1.43	43.63	1.67	51.16
71.50	15734	15734	1.57	48.12	3.25	99.28
71.75	229	229	0.02	0.70	3.27	99.98
Total		32693	3.27	100		

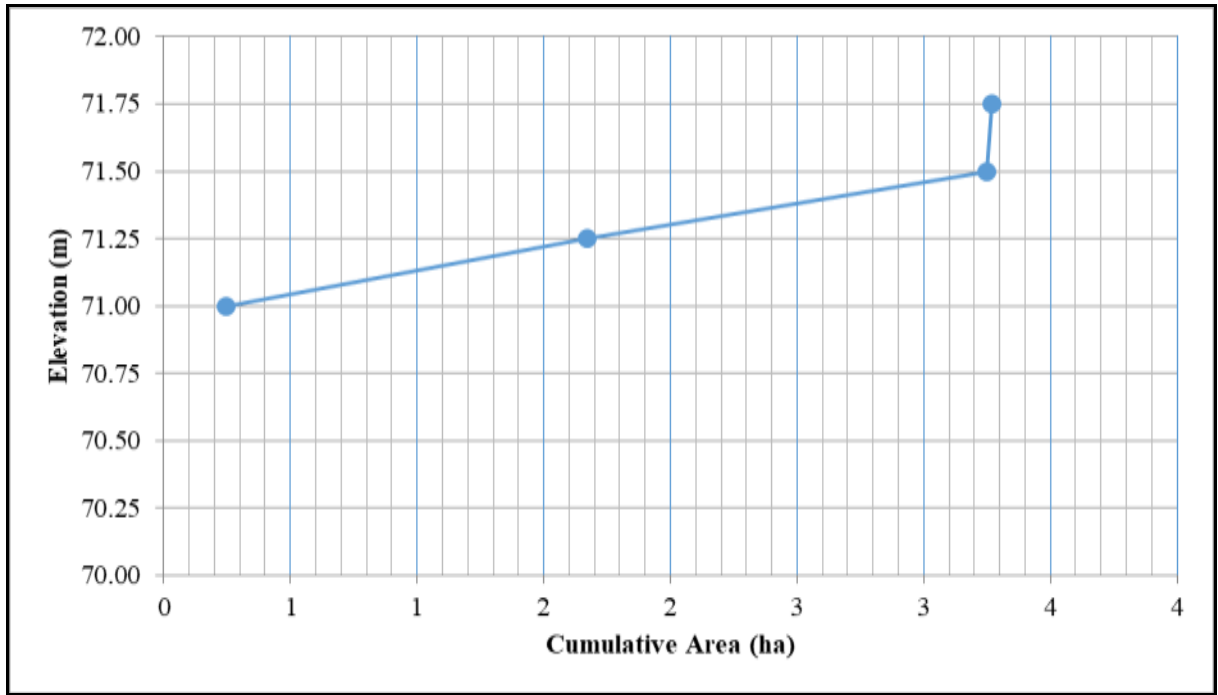


Figure 3.17: Cumulative areal distributions with elevation in DMPT area

3.4.3 CHP

Table 3.4 shows distribution of area in the CHP area from 70.25 m to 72.25 m elevation. The DEM pixel size used in this study is 1 m × 1 m. Figure 3.18 is graphical depiction of the cumulative area distribution up to different elevation in the CHP area.

Table 3.4: Areal distribution with elevation in CHP

Elevation	No. of Pixel	Area (m ²)	Area (ha)	Area %	Cumulative Area (ha)	Cumulative Area (%)
70.25	766	766	0.08	1.01	0.08	1.01
70.50	2474	2474	0.25	3.25	0.32	4.25
70.75	4572	4572	0.46	6.00	0.78	10.25
71.00	7160	7160	0.72	9.40	1.50	19.65
71.25	6633	6633	0.66	8.70	2.16	28.35
71.50	11236	11236	1.12	14.75	3.28	43.10
71.75	20081	20081	2.01	26.35	5.29	69.45
72.00	16834	16834	1.68	22.09	6.98	91.54
72.25	6430	6430	0.64	8.44	7.62	99.98
Total		76186	7.62	100		

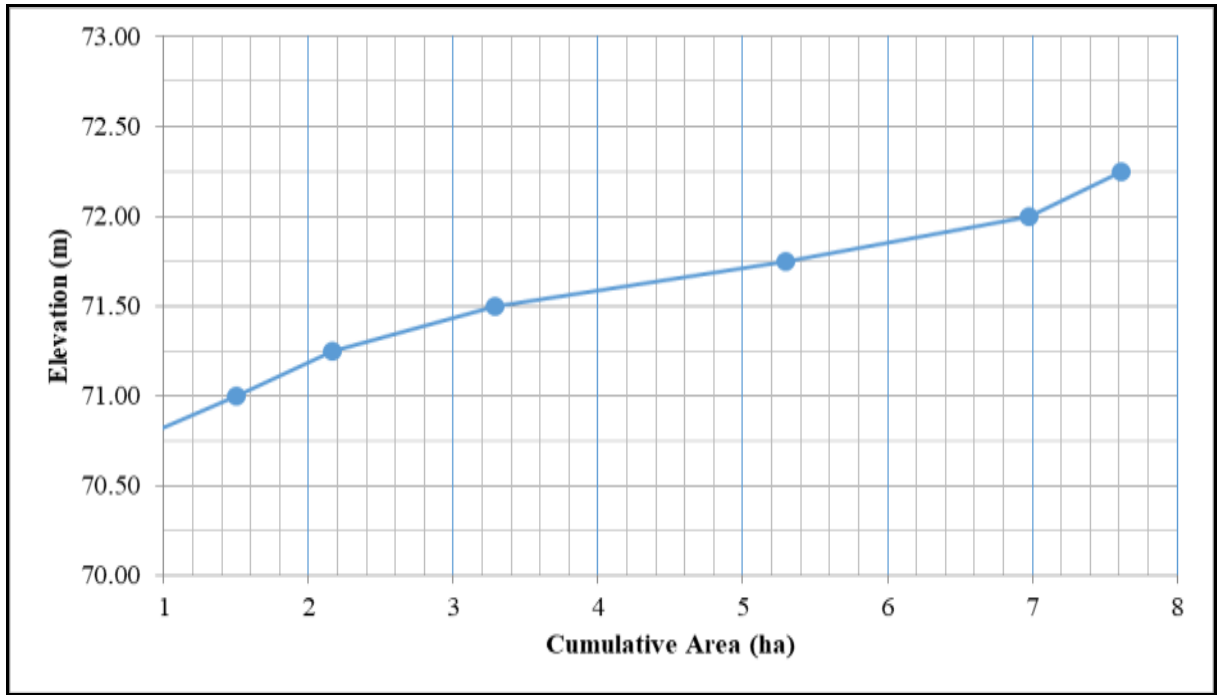


Figure 3.18: Cumulative areal distributions with elevation in CHP

3.4.4 Green Belt

Table 3.5 shows distribution of area in the Green Belt area from 70.25 m to 72.25 m elevation. The DEM pixel size used in this study is 1 m × 1 m. Figure 3.19 is graphical depiction of the cumulative area distribution up to different elevation in the green belt area.

Table 3.5: Areal distribution with elevation in Green Belt

Elevation	No. of Pixel	Area (m ²)	Area (ha)	Area %	Cumulative Area (ha)	Cumulative Area (%)
66.25	1200	1200	0.12	1.40	0.12	1.40
66.50	2525	2525	0.25	2.95	0.37	4.35
66.75	1179	1179	0.12	1.38	0.49	5.72
67.00	1762	1762	0.18	2.06	0.67	7.78
67.25	3920	3920	0.39	4.57	1.06	12.35
67.50	1646	1646	0.16	1.92	1.22	14.27
67.75	2249	2249	0.22	2.62	1.45	16.90
68.00	3566	3566	0.36	4.16	1.80	21.06
68.25	4228	4228	0.42	4.93	2.23	25.99
68.50	4249	4249	0.42	4.96	2.65	30.95
68.75	3350	3350	0.34	3.91	2.99	34.86
69.00	1061	1061	0.11	1.24	3.09	36.10
69.25	1025	1025	0.10	1.20	3.20	37.29
69.50	1170	1170	0.12	1.37	3.31	39.66
69.75	1357	1357	0.14	1.58	3.45	40.24
70.00	2602	2602	0.26	3.04	3.71	43.28

70.25	8414	8414	0.84	9.82	4.55	53.10
70.50	407	407	0.04	0.47	4.59	53.57
70.75	273	273	0.03	0.32	4.62	53.89
71.00	3148	3148	0.31	3.67	4.93	57.56
71.25	4464	4464	0.45	5.21	5.38	62.77
71.50	2579	2579	0.26	3.01	5.64	65.78
71.75	4009	4009	0.40	4.68	6.04	70.46
72.00	2557	2557	0.26	2.98	6.29	73.44
72.25	5965	5965	0.60	6.96	6.89	80.40
72.50	10037	10037	1.00	11.71	7.89	92.11
72.75	2180	2180	0.22	2.54	8.11	94.66
73.00	1645	1645	0.16	1.92	8.28	96.58
73.25	788	788	0.08	0.92	8.36	97.50
73.50	766	766	0.08	0.89	8.43	98.39
73.75	705	705	0.07	0.82	8.50	99.21
74.00	620	620	0.06	0.72	8.56	99.94
74.25	43	43	0.00	0.05	8.57	99.99
74.5	19	19	0.00	0.02	8.57	100.01
		85708	8.57	100		

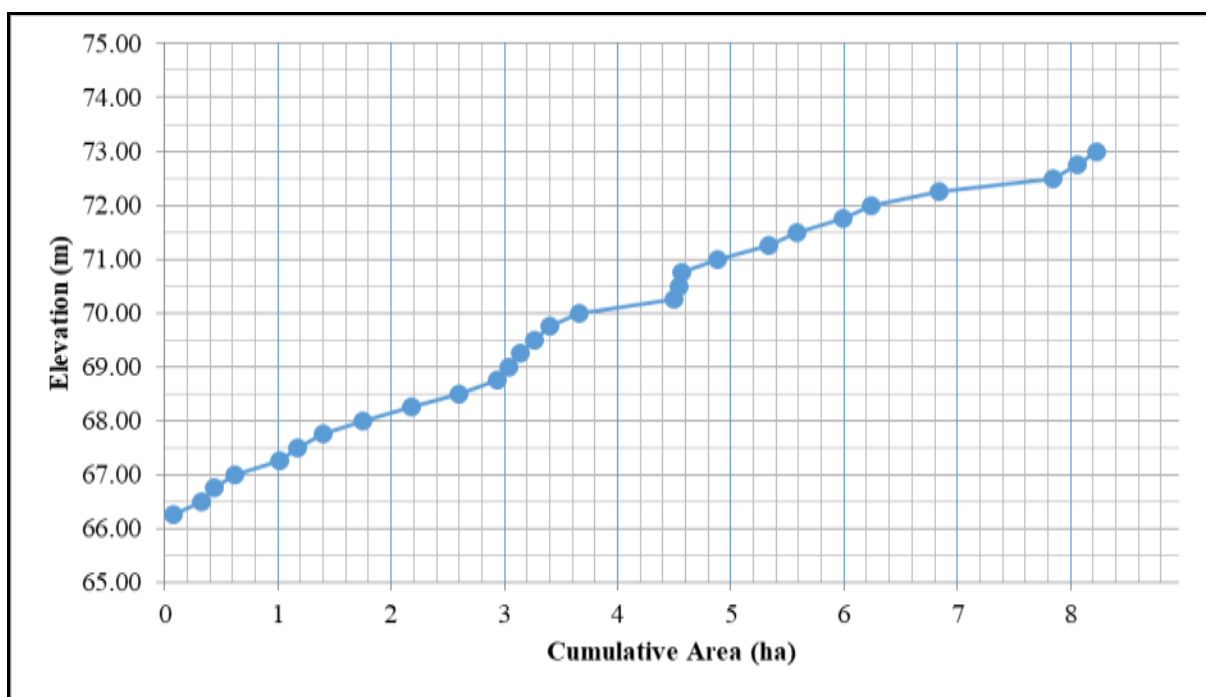


Figure 3.19: Cumulative areal distributions with elevation in the green belt

CHAPTER 4

DESIGN STORM

Design storm and flood scenarios are required for (i) planning of drainage in the plant area and vicinity, and (ii) for assessing possible submergence in the plant area from internal and external flooding. The storm rainfall of a given duration and return period is the main input in deciding the design flood.

4.1 FREQUENCY ANALYSIS OF 1-DAY ANNUAL MAXIMUM RAINFALL

Daily rainfall data from year 1988 to 2018 (31 years) are available at Angul (Odisha) 1-Day annual maximum rainfall series was prepared and the EV Type I probability distribution was applied (Table 4.1a). Figure 4.1 shows graphical frequency analysis of 1-Day annual maximum rainfall at Angul.

1-Day rainfall has been converted to 24 hr rainfall using a factor of 1.15 (as per Flood Estimation Report for Mahanadi Subzone-3(d), May-1982, by Central Water Commission). 1-day rainfall and corresponding 24 hr rainfall for various return periods are given in Table 4.1b.

Table 4.1a: Frequency analysis of daily rainfall data available at Angul, Odisha

Year	Maximum rainfall (mm)	Rank	Probability of occurrence (P)	Return period (T)
1992	217.00	1	0.03	32.00
1990	203.00	2	0.06	16.00
2005	186.00	3	0.09	10.67
1997	141.80	4	0.13	8.00
1999	134.20	5	0.16	6.40
2011	132.60	6	0.19	5.33
1998	130.40	7	0.22	4.57
1993	126.40	8	0.25	4.00
2009	125.40	9	0.28	3.56
2010	123.80	10	0.31	3.20
1996	117.20	11	0.34	2.91
2001	114.80	12	0.38	2.67
2018	112.40	13	0.41	2.46
2016	111.60	14	0.44	2.29
2013	110.80	15	0.47	2.13
2007	106.70	16	0.50	2.00

1989	105.80	17	0.53	1.88
2006	105.00	18	0.56	1.78
1994	95.80	19	0.59	1.68
2000	95.60	20	0.63	1.60
1991	93.40	21	0.66	1.52
1995	92.50	22	0.69	1.45
2014	85.00	23	0.72	1.39
2012	73.40	24	0.75	1.33
2003	70.60	25	0.78	1.28
2004	69.40	26	0.81	1.23
2008	68.20	27	0.84	1.19
2002	67.60	28	0.88	1.14
2017	65.20	29	0.91	1.10
2015	63.40	30	0.94	1.07
1988	58.80	31	0.97	1.03

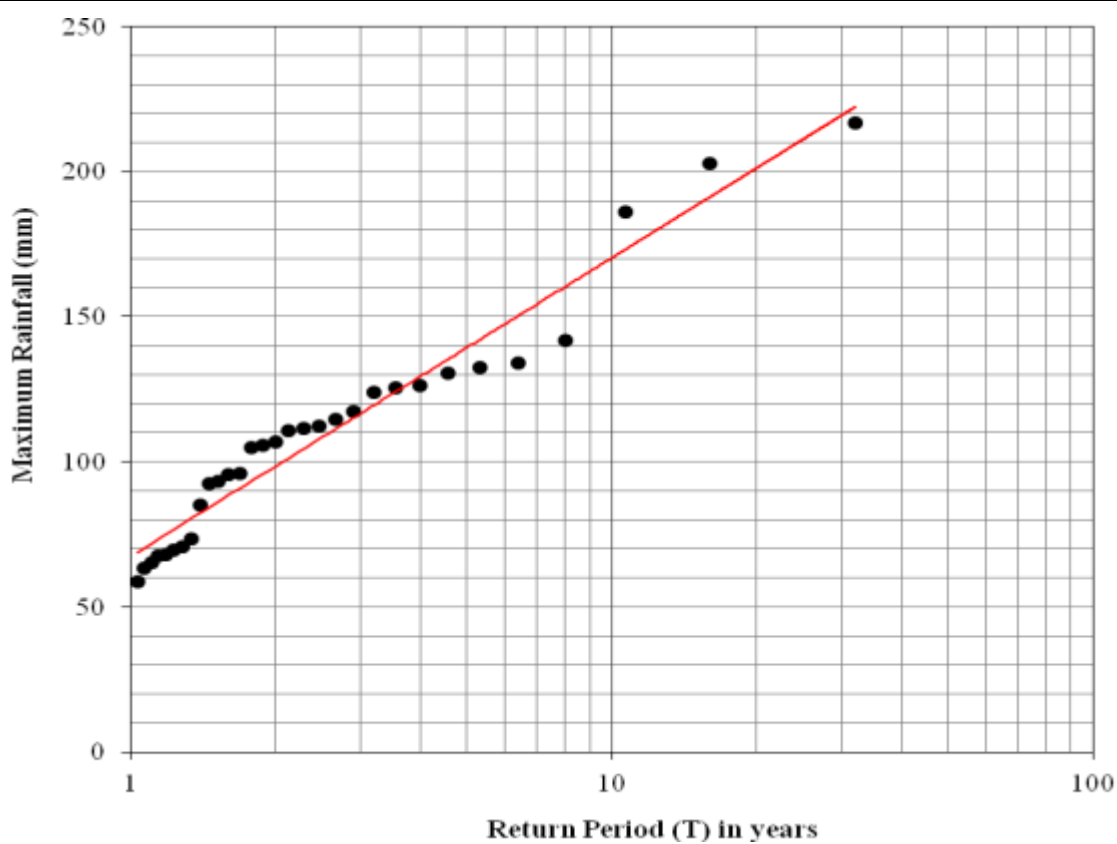


Figure 4.1: EV Type I Graphical frequency analysis of 1-Day annual maximum rainfall at Angul, Odisha

Table 4.1b: 1-Day rainfall (mm) of various return periods at Angul, Odisha

Station	Return period(years)			
	10	25	50	100
1-Day rainfall (mm) at Angul	170	211	242	273
24 hr. rainfall (mm)	196	243	278	314

4.2 REGIONAL DEPTH-DURATION FREQUENCY STUDIES

The study area lies in Mahanadi Subzone-3(d) defined by Central Water Commission (CWC, 1995). The India Meteorological Department (IMD) has conducted detailed rainfall study for Mahanadi Subzone-3(d) (CWC, 1982) utilizing the data of 31 self-recording rain gauge stations, maintained by the IMD and 38 ordinary rain gauge stations, maintained by the South-Eastern Railways in the 13 bridge catchments in subzone 3(d).

The annual series of 1-day maximum rainfall was formed for all the ordinary rain gauge stations. These annual extreme values were subjected to frequency analysis using Gumbel's extreme value probability distribution, and 1-day rainfall corresponding to 25,50 and 100 years return period were computed. The daily values of 25 year, 50 year and 100 year return period rainfall estimates were converted to 24 hr rainfall estimate using a factor of 1.15. These 24-hour rainfall estimates for all the stations in the subzone-3(d) were plotted on base map and the isopluvial maps of 25 year, 50 year and 100 year return periods were drawn.

4.3 RECOMMENDATION

The 24 hr rainfall of various return periods based on rainfall data at Angul is shown in Table 4.1b. The 24 hr rainfall of 25 year, 50 year and 100 year return period as per isopluvial map are similar to the 24 hr rainfall estimates as per frequency analysis of 31 years data at Angul, as shown in Table 4.2.

Table 4.2: 24-hour rainfall (mm) of various return periods as per Angul data and as per CWC (1982) maps

Return period	Based on 31years recent rainfall data at Angul	Based on CWC (1982) map
25	243 mm	250mm
50	278 mm	290mm
100	314 mm	325 mm

The 24-hour rainfall (mm) of various return periods as per Angul data and as per CWC map are found to be almost similar. This gives confidence in the estimated values. It is recommended that the 24 hr storm rainfall values, obtained from frequency analysis of 31 years rainfall data at Angul, can be used in further analysis as the station is close to the study area. The data of recent period (1988 to 2018) and of sufficient length (31 years) have been used in the frequency analysis whereas; isopluvial maps are based on rain gauge data of 31 IMD stations and 38 South-Eastern Railways stations.

4.4 DESIGN STORM SCENARIOS

4.4.1 Conversion of 24 hr rainfall into short duration rainfall

In the CWC report 1982, the isopluvial maps giving point rainfall for durations of 1 hr, 3 hr, 6 hr, 9 hr, 12 hr, 15 hr, 18 hr and 24 hr, of 50 year return period were drawn. These short duration rainfall values with respect to 24 hr rainfall are given in Table 4.3. The CWC has recommended that these ratios for rainfall are applicable to storm rainfall of other return periods also.

Table 4.3: Average ratio (t hr rainfall/24 hr point rainfall) for various durations at 50 year return period

Storm duration (hrs)	1	3	6	9	12	15	18	24
Ratio	0.28	0.45	0.55	0.69	0.81	0.83	0.97	1.00

4.4.2 Conversion of point to areal rainfall

The point rainfall for different durations at each of the rain gauge stations in the subzone-3(d) were find the ratios for different duration of storms and for different size of catchments.

The hourly rainfall data of 22 SRRG stations (5 inside the subzone and 17 outside) were used to Detailed procedure is given in CWC (1982) report. The areal reduction factors (ARF) for different catchment areas and for different duration of storm durations (1 hr, 3 hr, 6 hr, 12 hr and 24 hr) are given in Table 4.4.

T-year, 24-hr rainfall values for the study area as recommended earlier (Table 4.1b) has been used for estimation of flood using regional flood formula and rational method.

Table 4.4: Point to areal rainfall ratios (percentages) for various durations and areas

Areal reduction factor (%)					
Area (km ²)	1 hour	3 hour	6 hour	12 hour	24 hour
50	82	93	96	97	99
100	72	88	92	95	98
150	66	84	89	94	97
200	63	81	87	93	96
250	62	79	85	92	95
300	61	78	85	90	95

CHAPTER 5

DESIGN FLOOD ESTIMATION

5.1 CRITERIA FOR DESIGN FLOOD

Design flood estimation is required for two purposes:

- i) For planning of internal drainage in the plant area so as to safely discharge the flood caused by design storm rainfall.
- ii) For assessing possible submergence from flooding in plant area under existing and post project conditions and suggest diversion plan for the existing drains.

Return period of 50 years has been considered in flood estimation as suggested by Talcher TPP. According to norms of Central Electricity Authority the main plant area should preferably be above HFL and the ash pond area could be low lying.

5.2 CHANGES IN NATURAL DRAINAGE PATTERN IN POST PROJECT CONDITION

The Talcher power plant, ash dykes and mine voids lie between two major river systems i.e. River Brahmani flowing in the North East and River Mahanadi which forms the South-South Western boundary of the district. Talcher TPS boundary is located about 2.0 km west of the Brahmani River. The High Flood Level of Brahmani River is 62.1m amsl. The lowest elevation in southern and eastern part of plant area and township is 65.5m amsl as per recent topographic map of the area. Hence, there is no need to realign the plant boundary with reference to the Brahmani river course.

Nandira nala (A perennial nala), leading to Brahmani river, passes adjacent to the southern boundary wall of the existing plant. It is one of the main drainage tributary of the Brahmani river near TTPS. Natural drainage within existing TTPS stage I&II area has already been replaced by a planned network of internal drains having several outfalls on Nandira nala.

The road in between the nala and plant boundary is at a level higher than 65.75m amsl as per topography (contour) map of Talcher TPS. As per standard design practice, road is always constructed above HFL of a drain, Further hutment on the left bank between nala left bank (64.5 m) and the road (65.75 m) is observed. Therefore, HFL in Nandira nala near plant is expected to

be 64.0 m considering level of the road and location of hutments at 64.5 m and above. It is to be noted that flooding has not occurred in the existing plant area in the last 30 years.

Therefore, flooding in the stage III plant area due to Nandira nala is not possible. There is no need to realign this natural drain. Figure 6.1 in chapter 6 shows the contours and spot levels along road, plant boundary and nala bank (left and right bank).

5.3 METHODS FOR FLOOD ESTIMATION

5.3.1 Method I: Modified Rational Method

The Rational equation is the simplest method to determine peak discharge from drainage basin runoff. It is the most common method used for sizing sewer systems.

For small catchments of area less than 25 km², the modified rational method as explained in the following document is recommended by Central Water Commission.

Report No RBF-16 'Flood Estimation Methods for Catchments Less Than 25 Km² in Area' prepared by Research, Design & Standards Organization(RDSO) of Indian Railway, Government of India

Rational Equation in metric units is given below.

$$Q = CIA / (1000 \times 3600)$$

Where, Q = Peak discharge, cubic meter per second; C= Rational method runoff coefficient;

I = Rainfall intensity in mm/hour during the time of concentration; A = Drainage area in m²

Time of concentration is taken as 1 hour for small runoff contributing areas to the drains

The Runoff coefficient (C): It is a function of the soil type, drainage basin slope and land cover and may be taken from the formula given in table 5.1 below:

Table 5.1: Formula to obtain Runoff Coefficient C

Sl. No.	Description of catchment	Formula for C
1	Sandy soil/sandy loam/arid areas	$C = 0.249(R.F)^{0.2}$
2	Alluvium/silty loam/coastal areas	$C = 0.332(R.F)^{0.2}$
3	Red soil/clayey loam/grey or brown alluvium/cultivated plains/tall crops/ wooden areas	$C = 0.415(R.F)^{0.2}$
4	Black cotton/clayey soil/lightly covered, lightly wooded/plain and barren/ sub montane and plateau	$C = 0.456(R.F)^{0.2}$
5	Hilly soils/plateau and barren	$C = 0.498(R.F)^{0.2}$

Texturally the soils of study area are observed as Clay and Clay Loam. The bulk density of the soils was found in the range of 1.13 to 1.39-gm/cm³. Water Holding Capacity of study area soils was observed as 29 to 42 %. Soil characteristics indicate that soil is clay loam and grey. C for this soil is given as

$$C=0.415 (R.F)^{0.2}$$

where, R =T year 24-hr point rainfall(cm) and F=area reduction factor depending upon catchment area and duration of rainfall.

5.3.1.1 Specific Discharge of 25 Year Return Period

Rainfall Intensity: 24 hr rainfall corresponding to 25 year return period is 243 mm as explained in chapter 4.

So 1 hr rainfall corresponding to 25 year return period is 0.28 (from table 4.3 in chapter 4) × 243=68.04 mm.

Applying area correction factor of 0.82(from table 4.4 in chapter 4), the 1 hr rain fall over small runoff contributing area is 0.82×68.04=55.8 mm

Hence design rainfall intensity is 55.8 mm/hour

$$\text{Runoff coefficient}=0.415(24.3 \times 0.82)^{0.2}=0.754$$

Therefore Specific discharge i.e. discharge per unit area of 1 ha using Modified rational formula is $0.754 \times 55.8 \times 10000 / (1000 \times 3600) = 0.117 \text{ cumec/ha}$

5.3.1.2 Specific Discharge of 50 Year Return Period

Rainfall Intensity: 24 hr rainfall corresponding to 50 year return period is 278 mm as explained in chapter 4 and area correction factor is 0.82(from table 4.4 in chapter 4). So

$$\text{Runoff coefficient}=0.415(27.8 \times 0.82)^{0.2}=0.77557$$

As per procedure explained in chapter 4, 1 hr rainfall corresponding to 50 year return period is 0.28 (from table 4.3 in chapter 4) × 278=77.84 mm. Applying area correction factor of 0.82(from table 4.4 in chapter 4), the 1 hr rain fall over small runoff contributing area is 0.82×77.84=63.8 mm. However, Talcher TPP management has suggested to adopt rainfall intensity of 75 mm/hr (as a conservative scenario).

Therefore Specific discharge i.e. discharge per unit area of 1 ha is $0.0.77557 \times 75.0 \times 10000 / (1000 \times 3600) = 0.1616$ cumec/ha. Drainage design considering this specific discharge is explained in chapter 6.

5.3.2 Method 2: Regional Flood Formula of National Institute of Hydrology (Roorkee)

Whenever storm rainfall or flood discharge data are not available at or near the site of interest, the regional flood formula developed for the region may be adopted for estimation of design flood especially for small catchments. National Institute of Hydrology (NIH-1995) has developed regional flood formula for Mahanadi Subzone-3D comprising of Mahanadi, Brahmini and Baitrani basins. The homogeneity of the region was tested by the U.S.G.S. homogeneity test.

The annual peak flood series data for 11 to 31 years for 20 gauging sites were used for developing regional flood frequency curves. The method is based on fitting Gumbel's Extreme Value distribution to the station year data of Q/Q_{mean} values.

The regional flood formula for Mahanadi subzone is:

$$Q_T = [12.08\{(-\ln(1-1/T))\}^{-0.14} - 9.512]A^{0.76}$$

Where : Q_T = Estimated flood (m^3/sec) corresponding to T year return period

T = return period in years

A = catchment area in sq. km.

The conventional Dicken's and other flood formula cannot provide design flood estimates for the desired return periods. The regional flood formula developed by NIH is capable of providing flood estimates corresponding to different return periods. NIH recommends ".....*field engineers may use this formula for estimation of design floods of desired periods for small catchments of subzone 3D within reasonable accuracy*".

The NIH formula was used to estimate flood in the Nandira nala and Bangaru nala, Results are tabulated below

Name of nala	CA (km^2)	25-year flood (Q_{25}) Cumec	Specific flood(q_{25}) Cumec/hectare	50-year flood (Q_{50}) Cumec	Specific flood(q_{50}) Cumec/hectare
Nandira	193	574	0.02974	687.2	0.0356
Bangaru	130	425.1	0.0327	508.9	0.039

5.3.3 Recommendation

The specific flood estimated using NIH formula is much smaller compared to the specific flood estimated using modified rational method. Larger the catchment area, more is the damping effect of catchment on flood peak for same storm rainfall. Runoff contributing area are in terms of few hectares only for hydraulic design of plant drains. Therefore, it is more appropriate to use specific flood estimate obtained by modified rational method.

It is considered prudent to use a specific discharge of 0.117 cumec/ha (return period 25 years) for hydraulic design of drains. However, drainage design has been carried out considering specific discharge of 0.1616 cumec/ha (return period 50 years) as desired by Talcher TPP.

CHAPTER 6

DRAINAGE PLAN FOR CONTROL OF INTERNAL AND EXTERNAL FLOODING

Drainage plan consists of

- a) Internal drainage plan for proposed stage III plant area and township taking into consideration existing drains inside the stage I & II plant.
- b) Drainage plan to control flooding in the plant area due to inlet of storm runoff from Jagannathpur village area. Existing 600 m drain on western boundary is included in the plan. Two options (one with outfall on Nandira nala and another with outfall on Mundabasti nala) are considered.
- c) Drainage plan to control flooding in north west part of plant area due to inlet of storm runoff from Mundabasti village area. Two options (one with outfall on Nandira nala and another with outfall on Mundabasti nala) are considered.
- d) Jagannathpur trunk drain and Mundabasti trunk drain shall cater exclusively to the storm water from outside NTPC premises for safe disposal. Accordingly, storm water from the existing Stage I & II area shall be carried to Nandira nala and Mundabasti nala through network of stage III as per suitability
- e) FGL for township is not yet fixed. It has been assumed as 69.0 m which is safely much higher than HFL in Nandira nala.

6.1 MEASURES TO CONTROL EXTERNAL FLOODING

6.1.1 Flooding Due to Brahmani River: Talcher TPS boundary is located about 2.0 km west of the Brahmani River (Photo 6.1). The High Flood Level of Brahmani River is 62.1 amsl. As per records no flooding has occurred in the plant area in last 30 years. Formed Ground Level (FGL) of Stage III is 69.0 m amsl and 71m amsl. Therefore, no flooding is possible in the post project condition.



Photo 6.1: Brahmani river near Talchar Power Plant

6.1.2 Flooding Due to Nandira Nala: Nandira nala flows along the southern boundary of the plant area (Photo 6.2). Figure 6.1 shows contours and spot levels along road, plant boundary and nala bank (left and right bank). The road in between the nala and plant boundary is at level higher than 65.75m amsl as per topography (contour) map of Talcher TPS. Hutment is observed on the left bank between nala left bank (64.5 m) and the road (65.75 m). Therefore, HFL in Nandira nala near plant is reasonably at 64.0 m considering level of the road, location of hutments and flood level in Brahmini river. The road is constructed above HFL of the nala, Therefore, flooding in the plant area due to Nandira nala is not possible as Formed Ground Level (FGL) of Stage III is 69.0 m amsl and 71m amsl. However, it is necessary to control encroachment of nala bank (due to hutment) so as to maintain the carrying capacity of Nandira nala.



Photo 6.2: Nandira nala near Talchar Power Plant

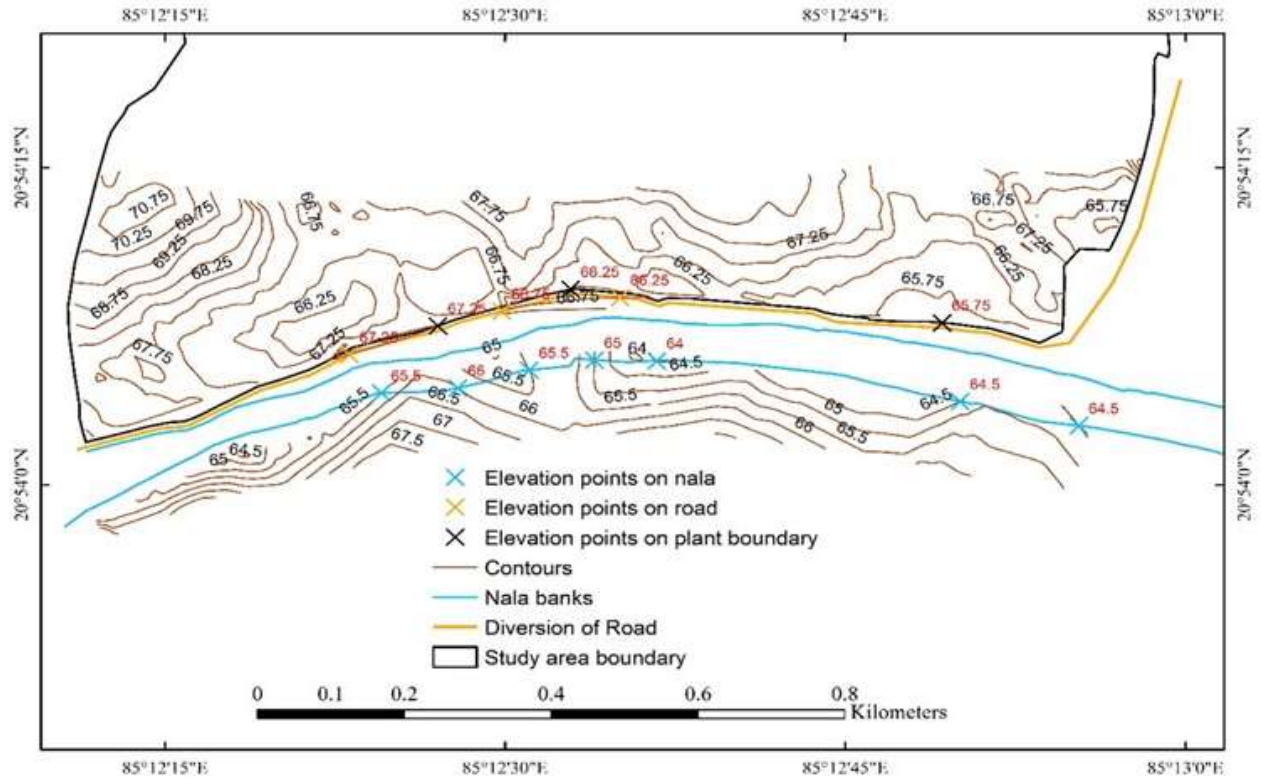


Figure 6.1: contours and spot levels along road, plant boundary and nala bank

6.1.3 Flooding Due to Storm Runoff from Mundabasti Village Area: There is a drain in north west side of the plant area. For discussion it is referred as Mundabasti nala. It carries runoff from an area (approximately 70 ha) triangular in shape and enclosed by the Samal branch canal, road and railway line on the three sides (Photo 6.3). Storm water enters the north west part of plant area through a culvert causing water logging condition due to poor drainage. The storm runoff is then further carried by this drain between the plant boundary and railway track and then through a culvert of rail siding (near watch tower) (Photo 6.4). There is heavy weed growth in the waterlogged area in north-west part of plant (Photo 6.5).



Photo 6.3. Runoff from Mundabasti agricultural fields enters plant area at I1

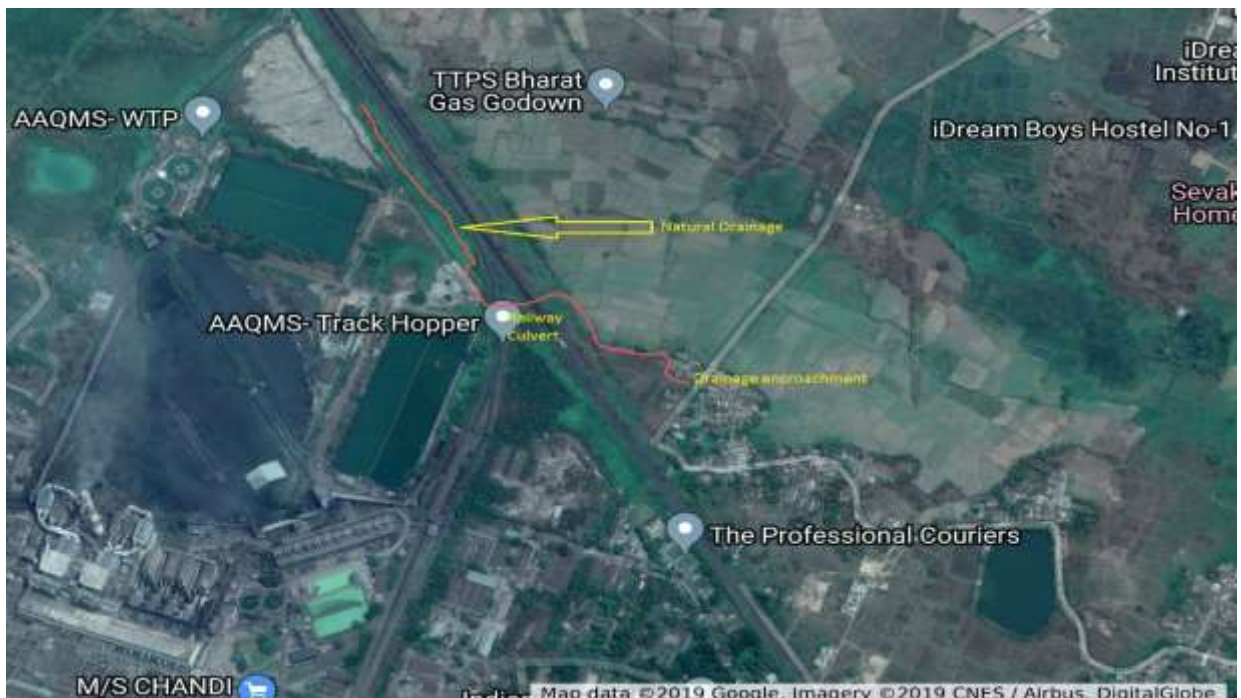


Photo 6.4. Mundabasti nala (red line) is partly encroached by agricultural fields (google map: dated May 12, 2019)



Photo 6.5: Waterlogged area in north west part of plant area.

Components of stage III (raw water reservoir, CISF quarters, etc.) are proposed in this area. A trunk drain is proposed to control flooding in north west part of plant area.

6.1.4 Flooding Due to Storm Runoff from Jagannathpur Village Area: Jagannathpur village is adjacent to the west side boundary (Photo 6.6). Storm runoff from Jagannathpur village enters plant area through unauthorized inlets on west side boundary (Photo 6.7) causing flooding in the plant area. A 600 m long trunk drain (rectangular, concrete) along and inside western boundary has been constructed to carry part of this storm runoff into Nandiri nala. Discharge capacity of the trunk drain and its upward extension are discussed in subsequent sections.



Photo: 6.6. Jagannathpur road adjacent to west side boundary



Photo: 6.7 Inlet of Jagannathpur storm water into plant area

6.2 PARTITION OF PLANT AREA IN DRAINAGE ZONES

6.2.1 Area of Major Facilities

The plant facilities and township for Stage-III (190 acres or 76.9 ha) would be accommodated within the 427 acres (172.8 ha) land available in the existing stage I & II plant.

The plant components have been located on different ground formation levels (71 m and 69 m) by NTPC to economize the cost of earth work. The DEM (Chapter 3) can be used to identify areas requiring cutting and filling and to estimate the volume of earthworks required to level the undulating topography of the study area. Due consideration has been given to the existing slope of project area towards Nandra nala and Mundabasti nala (on north side) in deciding the layout of internal drainage. The area allocated for major facilities are given in Table 6.1. The location of various facilities/plant components is shown in Figure 6.1a.

Table 6.1: Area of Major Plant Facilities of TTPS stage III

System/ Facility	Type of land	Gross Area	
		(acre)	(hectare)
Main Plant and Switch Yard area	Industrial(existing)	80.0	32.4
Cooling Tower area	Industrial(existing)	25.0	10.1
DM and PT area	Industrial(existing)	5.0	2.0
Coal Handling Plant(CHP) area	Industrial(existing)	20.0	8.1
Green Belt/Plantation area	Industrial(existing)	20.0	8.1
New Township	Industrial(existing)	40.0	16.2
Make-up water pump house(near Samal barrage)	Government forest land	2.337	0.95
Total		192.337	77.85
Make-up water Pipeline(Right of use without land acquisition)	Government/private	125.0	50.56
Railway siding Marshaling(on lease)	Railway land	30.0	12.1

(Source: Final EIA report of TTPP Stage III; NTPC communication)

6.2.2 Existing Natural Drains: At present, storm runoff from plant area and township drains into following nalas;

Nandira Nala: Storm runoff from existing plant area, existing township and existing switch yard is carried to Nandiri nala through several outfalls.

East Side Drain (Tributary of Nandira Nala): There is a small drain running in north to south direction along east side boundary of the TTPP. Runoff from temporary sector of township