Tables

Table 1 PHYSICAL PROPERTIES OF THE SOILS IN THE STUDY AREA

Hole	Depth (m)	Type of Soil	Gs	Wn (%)	gn t/m3	gd (t/m3)	gsat (t/m3)	en	n (%)	Sr (%)	Wsat (%)	% Fines (%)	%Clay (%)	LL (%)	PL (%)	PI (%)
A-1	6.45-7	sandy silt	2.752	43.85	1.56	1.087	1.692	1.533	60.5	78.73	55.7	62.1	22	59.7	24.3	35.3
	8.45-9	clay	2.729	98.07	1.462	0.738	1.468	2.697	72.953	99.226	98.8	94.1	34	145.4	35.9	109.5
	14.45-15	sady silt	2.738	47.44	1.676	1.137	1.722	1.409	58.48	92.21	51.45	64.4	6	55.3	26.2	29.1
	18.45-19	silty clay	2.711	57.93	1.676	1.061	1.67	1.555	60.86	101.02	57.34	97.5	41	99.6	29.4	70.2
	21-22	silty sand	2.71	42.2	1.54	1.085	1.685	1.498	59.96	76.38	55.26	92.2	52	106.5	48.2	58.3
	23.45-24	silty clay	2.661	42.79	1.819	1.274	1.795	1.089	52.13	104.57	40.9	92.8	41	84.2	30	54.2
	28.45-29	clay	2.768	41.14	1.846	1.308	1.835	1.116	52.75	102	40.33	95.1	42	112.4	27.7	84.7
	33.45-34	clay	2.57	45.44	1.789	1.23	1.751	1.089	52.14	107.2	42.39	97.6	40	129	27.8	101.3
B-1	2.4-2.9	silty sand	2.755	28	1.65	1.29	1.8	1.136	53.17	67.9	41.22	30	11	40.7	16.1	24.6
	4.45-5	sandy silt	2.666	43.16	1.907	1.332	1.832	1.001	50.04	115	37.56	54.8	4	113.1	34.7	78.3
	9.45-10	silty clay	2.78	71.52	1.43	0.834	1.534	2.334	70.01	85.17	83.97	92.7	39	91.1	24.1	67
	14.45-15	clayey silt	2.688	65.09	1.606	0.973	1.611	1.763	63.81	99.23	65.59	92.7	38	104.6	45.7	59
	17-17.5	silty clay	2.662	52.18	1.699	1.116	1.697	1.384	58.06	100.34	52	76.6	18	117.4	38.6	78.8
	21.3-21.7	silty clay	2.685	41.44	1.685	1.191	1.743	1.231	55.18	89.5	46.3	94.9	60	132.6	36.4	96.2
	28.45-29	clay/silt	2.629	23.86	1.895	1.53	1.948	0.781	41.8	87.3	27.3	95.8	60	94.5	24.2	70.3
B-2	4.45-5	clay	2.48	59.62	1.617	1.013	1.605	1.448	59.15	102.1	58.39	97.6	44	84.5	28.8	55.7
	10-10.55	clay	2.663	52.11	1.661	1.092	1.682	1.439	59	96.45	54.02	69	16	70.9	29	42
	11-11.7	clayey silt	2.686	49.9	1.501	1.002	1.629	1.682	62.7	79.6	62.62	78.9	35	82.1	40.4	41.7
	15-15.35	sand/clay /silt	2.722	44.9	1.71	1.18	1.747	1.307	56.6	93.54	48	64.5	8	66.2	26.5	39.7
	22.45-22.9	clay + silt, sandy	2.633	55.56	1.669	1.073	1.665	1.454	59.25	100.6	55.23	76.9	24	95.4	27.7	67.7
	25-25.35	clay + silt	2.733	64.7	1.636	0.993	1.63	1.751	63.66	101	64.01	90	37	101	32.3	68.6
C-1	5.5-5.9	clay	2.554	63.08	1.607	0.985	1.6	1.592	61.42	101.2	62.33	95.2	38	91.1	30.4	60.7
	10.6	silty sand	2.727	26.23	1.753	1.389	1.879	0.964	49.1	74.23	35.34	36.4	5			
	15-15.3	silty clay	2.571	55.15	1.651	1.064	1.65	1.416	58.61	100.1	55.08	85.8	30	91.7	28.1	63.6
	19-19.25	silty clay	2.428	59.25	1.558	0.978	1.575	1.482	59.7	97.1	61.03	90.9	18	108.9	38.8	70.1
D-1	5-5.3	silt + clay, sandy	2.454	78.61	1.495	0.837	1.496	1.932	65.9	99.8	78.72	83	18	72.3	34.8	37.6
	12-13	silty sand	2.775	30.1	1.879	1.445	1.924	0.921	47.94	90.61	33.19	21.8	3			
O-1	5-5.45	silty clay	2.574	57.21	1.671	1.063	1.65	1.422	58.7	103.6	55.23	94.4	42	128	33	95
	10-10.35	silty clay	2.438	84.84	1.442	0.78	1.46	2.125	68	97.3	87.17	95.8	41	138.6	54.2	84.4
	14.4-15	sandy siltstone	2.57	30.5	1.696	1.3	1.794	0.978	49.43	80.19	38.04	61.5	22	59.5	32.7	26.8
B-2	proctor	clay + silt, sandy	2.556	28.96	1.985			13.6	93.15	5.45	5.32	72.9	36	55.2	19.1	36.2

Table 2 RESULTS OF UNCONFINED AND TRIAXIAL COMPRESSION TESTS

Sample Hole	Depth (m)	Soil nature Type of Soil	% Fines (%)	%Clay (%)	Unconf. compression qu kg/cm2	Triaxial Tests c (kg/cm2)	UU c(kg/cm2)	UU φ°	CU c(kg/cm2)	CU φ°	CU c'(kg/cm2)	CU φ °	CD c(kg/cm2)	CD φ°
A-1	8.45-9	clay	94.1	34	0.19	0.095	0.11	3.8						
	14.45-15	sady silt	64.4	6	0.34	0.17	0.62	27					0.62	27
	18.45-19	silty clay	97.5	41	0.34	0.17			1.01	9.3	0.28	27		
	23.45-24	silty clay	92.8	41	0.47	0.235	0.36	8.5						
	28.45-29	clay	95.1	42	0.64	0.32	0.66	4.6						
	33.45-34	clay	97.6	40	0.51	0.255	0.194	2.5						
B-1	4.45-5	sandy silt	54.8	4	0.24	0.12							0.25	29
	9.45-10	silty clay	92.7	39	0.2	0.1	0.401	6.7						
	14.45-15	clayey silt	92.7	38	0.67	0.335	0.46	8.6						
	17-17.5	silty clay	76.6	18	0.61	0.305	0.6	2.5						
	21.3-21.7	silty clay	94.9		0.63	0.315	0.4	3.3						
	28.45-29	clay/silt	95.8		0.7	0.35	0.6	3.9						
B-2	4.45-5	clay	97.6	44	0.35	0.175	0.28	9.7						
	10-10.55	clay	69	16	0.28	0.14	0.3	6.9						
	15-15.35	sand/clay /silt	64.5	8	0.35	0.175							0.36	25
	22.45-22.9	clay + silt, sandy	76.9	24	0.17	0.085			0.09	17.1	0.07	21.4		
	25-25.35	clay + silt	90	37	0.19	0.095	0.5	9						
C-1	5.5-5.9	clay	95.2	38	0.17	0.085	0.181	9						
	10.6	silty sand	36.4		0.23	0.115								
	15-15.3	silty clay	85.8	30		0	0.3	8.1						
	19-19.25	silty clay	90.9	18	0.24	0.12	0.85	3.7						
D-1	5-5.3	silt + clay, sandy	83	18	0.15	0.075	0.47	9.1	0.33	9.8	0.14	32.3		
O-1	5-5.45	silty clay	94.4	42	0.25	0.125	0.214	9.2						
	10-10.35	silty clay	95.8	41	0.17	0.085	0.47	9.1						
B-2	proctor	clay + silt, sandy	72.9						0.34	20.6	0.4	25.4		
D-1	proctor	clay + silt, sandy	88.4						0.45	13.4	0.31	35.3		

Table 3 RESULTS OF THE CONSOLIDATION TESTS

Hole	Depth (m)	Soil	LL (%)	Wn (%)	eo (%)	Pc Kg/cm2	Cc	Cv cm2/day	OCR %
A-1	8.45-9	clay	145.4	98.07	2.697	0.64	0.874	382.9	0.91
	14.45-15	sady silt	55.3	47.44	1.409	2.2	0.35	711.0	1.2
	18.45-19	silty clay	99.6	57.93	1.555	1.7	0.4	324.8	1.1
	23.45-24	silty clay	84.2	42.79	1.089	2.2	0.2	380.9	1
	28.45-29	clay	112.4	41.14	1.116	1.8	0.25	323.9	0.87
	33.45-34	clay	129	45.44	1.089	1.7	0.31	536.8	0.62
B-1	4.45-5	sandy silt	113.1	43.16	1.001	0.67	0.58	230.3	2.2
	9.45-10	silty clay	91.1	71.52	2.334	2.7	0.62	205.1	3.5
	14.45-15	clayey silt	104.6	65.09	1.763	3.6	0.45	630.8	3.7
	17-17.5	silty clay	117.4	52.18	1.384	2.1	0.43	469.9	1.85
	21.3-21.7	silty clay	132.6	41.44	1.231	2	0.36	472.0	1.36
	28.45-29	clay/silt	94.5	23.86	0.781	1.8	0.22	541.5	0.87
B-2	4.45-5	clay	84.5	59.62	1.448	1.55	0.66	287.5	2.63
	10-10.55	clay	70.9	52.11	1.439	2.1	0.38	450.8	2.1
	15-15.35	sand/clay /silt	66.2	44.9	1.307	2.05	0.31	562.7	1.62
	22.45-22.9	clay + silt, sandy	95.4	55.56	1.454	2.1	0.49	496.3	1.3
	25-25.35	clay + silt	101	64.7	1.751	2	0.39	423.9	1.04
C-1	5.5-5.9	clay	91.1	63.08	1.592	1.9	0.32	505.6	2.6
	15-15.3	silty clay	91.7	55.15	1.416	3	0.3	476.2	2.27
	19-19.25	silty clay	108.9	59.25	1.482	2.8	0.34	557.5	1.7
D-1	5-5.3	silt + clay, sandy	72.3	78.61	1.932	2.1	0.92	584.8	5.3
O-1	5-5.45	silty clay	128	57.21	1.422	2.9	0.39	473.6	3.28
	10-10.35	silty clay	138.6	84.84	2.125	2.2	0.37	410.1	1.5
B-2	proctor	clay + silt, sandy	55.2	28.96	13.6	2.6	0.31	559.5	
D-1	proctor	clay + silt, sandy	93.6	50.2	26.19	3	0.31	505.3	

Table 4 ELEVATIONS OF BENCH MARKS AND SURVEY POINTS IN THE STUDY AREA

Code	Location	Elevation (m) 1st Survey	Elevation (m) 2nd Survey	Difference (m)
Fixed Points:				
F1	Highway interchange	1.334	1.334	0
F2	Culvert	2.502	2.503	-0.001
F3	Bridge, same as PP 745A	4.153	4.153	0
F4	Bridge	4.5	4.5	0
F4.1	Gate of Weir	3.018	3.018	0
Target Points:				
PP 701	Jalan Kamal Raya, old benchmark	1.881	1.88	0.001
PP 707	Jalan Kamal Raya, old benchmark	2.256	2.252	0.004
PP 716	Jalan Kamal Raya, old benchmark	3.132	3.119	0.013
DKI 580	Daan Mogot, old bench mark	4.333	4.333	0
CF 0	Daan Mogot, old bench mark	2.418	2.407	0.011

Codes		Elevation (m) 19981/1982	Elevation (m) 1996	Difference (m)
Other Points:				
TTG 278	Daan Mogot, old benchmark	7.532	6.853	0.679
TTG 276	Daan Mogot, old benchmark	6.133	5.165	0.968
TTG 275	Daan Mogot, old benchmark	4.399	3.53	0.869
TTG 271	Daan Mogot, old benchmark	2.874	2.174	0.7
TTG 270	Daan Mogot, old benchmark	3.788	3.454	0.334
TTG 260	Daan Mogot, old benchmark	3.105	2.558	0.547

After conversion to TTG reference:		1978/1982	1991	1996	Difference (m)
PP 701	Jalan Kamal Raya, old benchmark	2.528		1.881	0.647
PP 707	Jalan Kamal Raya, old benchmark	3.043		2.256	0.787
PP 716	Jalan Kamal Raya, old benchmark	4.196		3.132	1.064
PP 745A	Daan Mogot, old benchmark		4.738	4.1528	0.5852
PP 767	Daan Mogot, old benchmark	4.235		3.097	1.138
PP 765	Daan Mogot, old benchmark	4.078		2.484	1.594
PP 751	Jalan Kamal-Kapuk, old benchmark	1.772			
PP 753	Jalan Kamal-Kapuk, old benchmark	1.904	1.316		0.543

Table 5 FOUNDATION CHARACTERISTICS

A. Shallow foundations

Soil layer	SPT-value	Cohesion/ Angle of friction	Foundation depth	Allowable Bearing Strength
A1	1 blow	c= 1 t/m2, ϕ= 0	0 m	< 2 t/m2
A2, clayey	3-10 blows	c= 4 t/m2, ϕ= 8	2 m	12 t/m2
A2, sandy	3 blows	c= 1 t/m2, ϕ= 21	2 m	7 t/m2
B, clayey	20 blows	c= 12 t/m2, ϕ= 0		20 t/m2
Earth fill		c= 4 t/m2, ϕ= 27	1m	10 t/m2

B. Pile foundations

Soil layer at the tip of pile	Average N-value at pile tip	Type of pile	Depth	Allowable Bearing Strength
bottom of B	24 blows	friction	15 m	88 t/m2
C, clayey	15 blows	friction	9 m	41 t/m2
CS	32 blows	end bearing	8 m	85 t/m2

Table 6 RECOMMENDATIONS FOR DESIGN

A. Shallow structures

Location	Foundation bed	Foundation Depth
Kamal drainage channel	A2 or earth fill	1 - 2 m
Tanjungan drainage channel	A2, sandy	2 m
New drainage channel	A2, clayey	2 m
Gede/Bor drainage channel	B or earth fill	1- 2 m
Saluran-Cengkareng drainage channel	A2, clayey	2 m, > 2m at CSC-6

B. Pile foundations

Location	Soil bed at the tip of the pile	Type of piles	Depth	Settlement (m)
Kamal drainage channel	C, clay and sand	friction	15 m	3.60E-03
Kamal, KSC-3, 4 and 12	CS	end bearing	9- 15 m	
Kamal, KSC-8 to 10	B, clayey	wooden	5-6 m	
Tanjungan drainage channel	C, sand and thin clay levels	end bearing	15 m	
Tanjungan TSC-5 and 6	B, clayey	wooden	10-11 m	
New drainage channel	C, clay and sand	friction	12-15 m	
New channel, NSC-1and 7	CS (?)	end bearing	8 and 4 m respectively	
Gede/Bor drainage channel	B or C	friction	8 m	8.00E-03
Saluran-Cengkareng drainage channel, CSC-2 to CSC-5	CS	end bearing	7 m	
Saluran Cengkareng drainage channel, other locations	CS (?)	end bearing	>10 m	

Figures

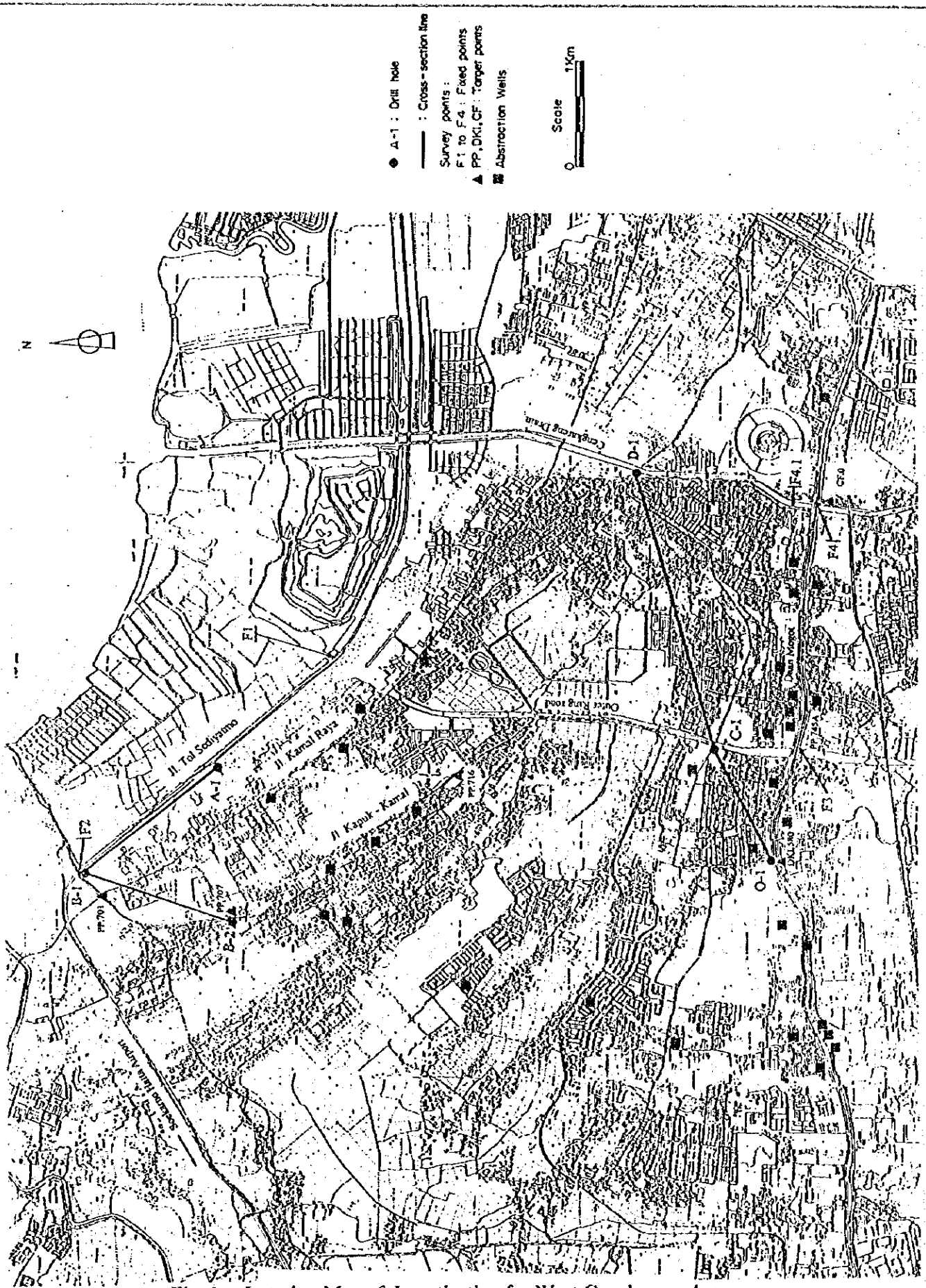


Fig. 1 Location Map of Investigation for West Cengkareng Area

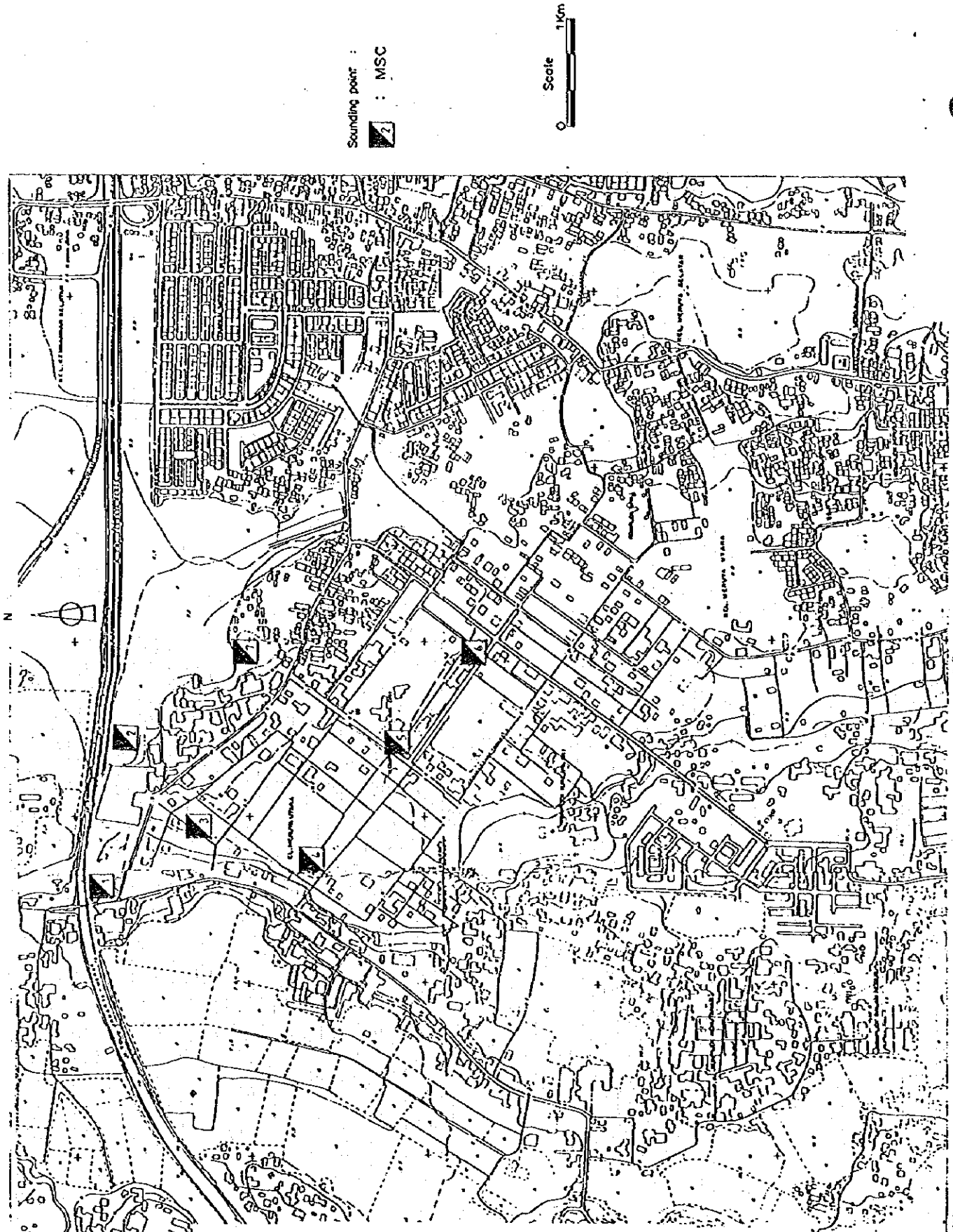


Fig. 2 Location Map for Dutch Cone Sounding in Menya Area

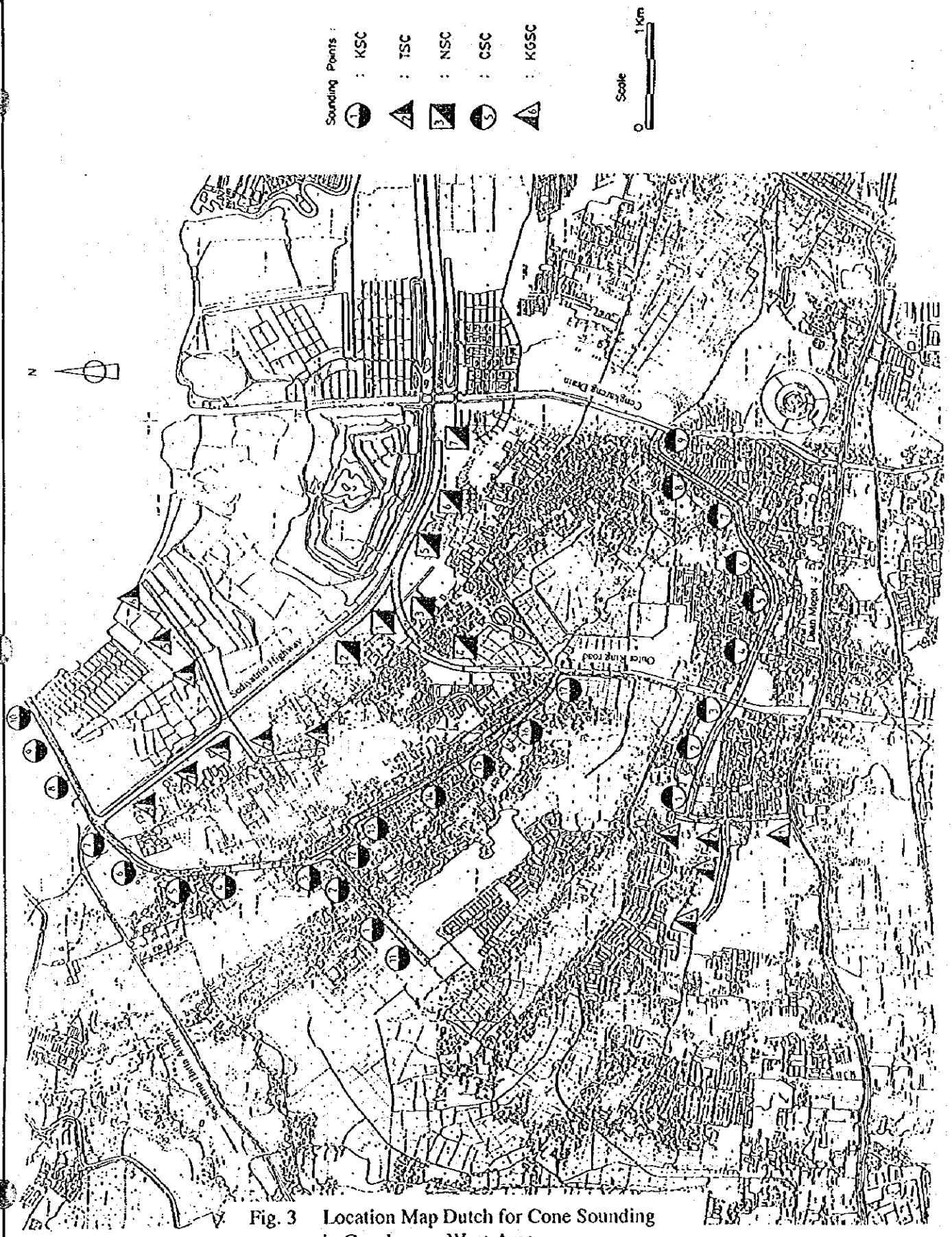


Fig. 3 Location Map Dutch for Cone Sounding in Cengkareng West Area

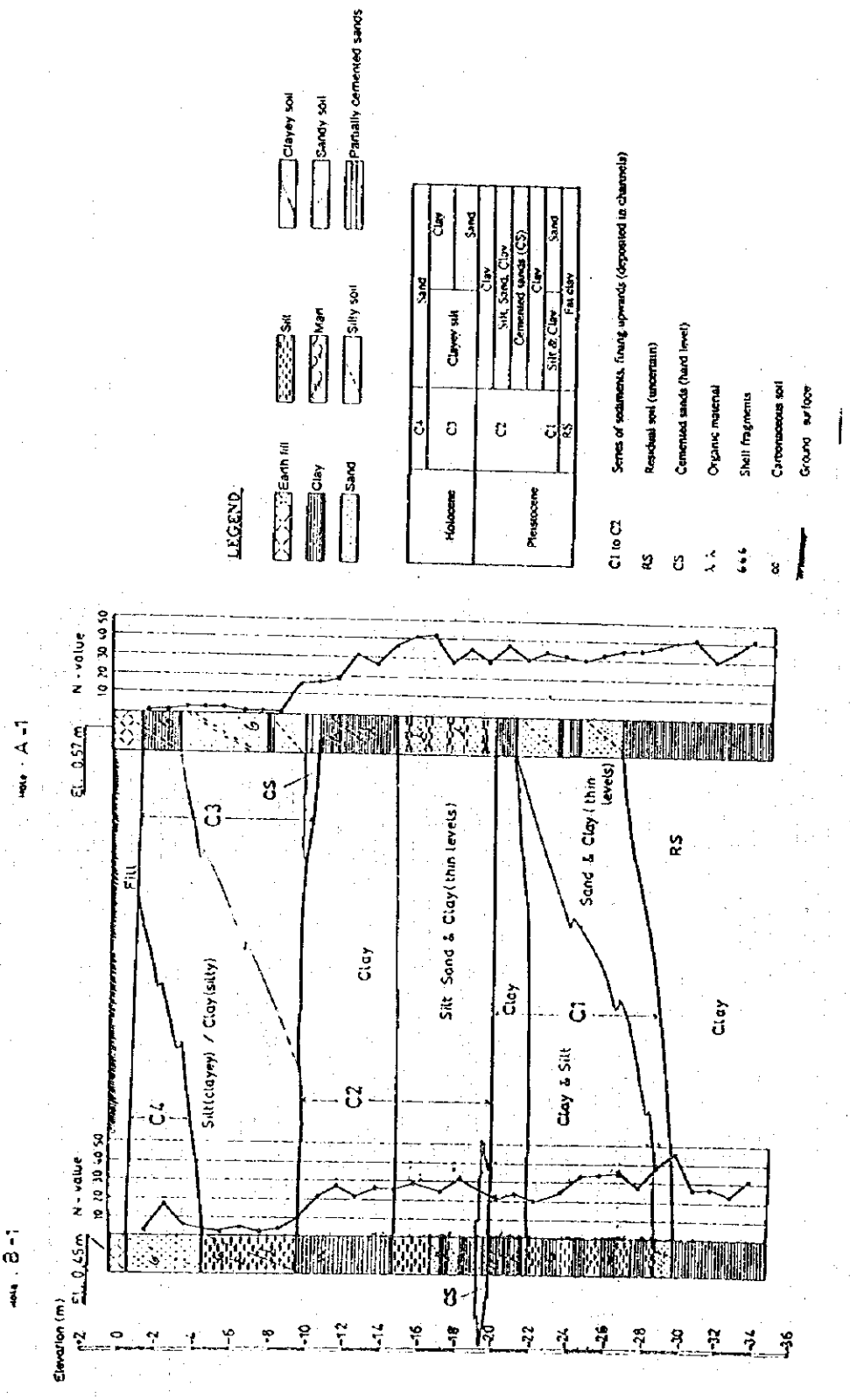


Fig. 4 Geological Cross Section A1-B1

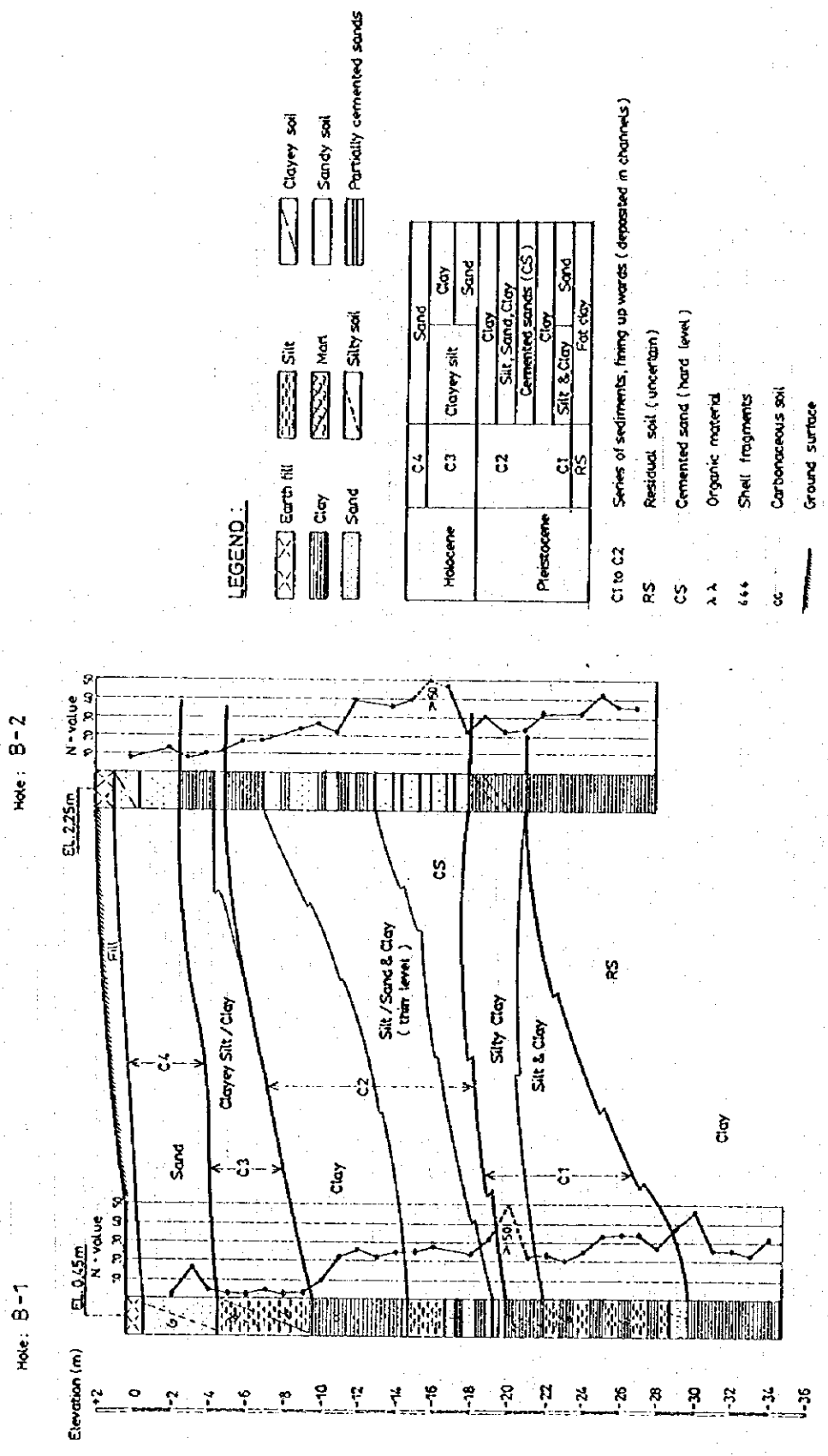


Fig. 5 Geological Cross Section B1-B2

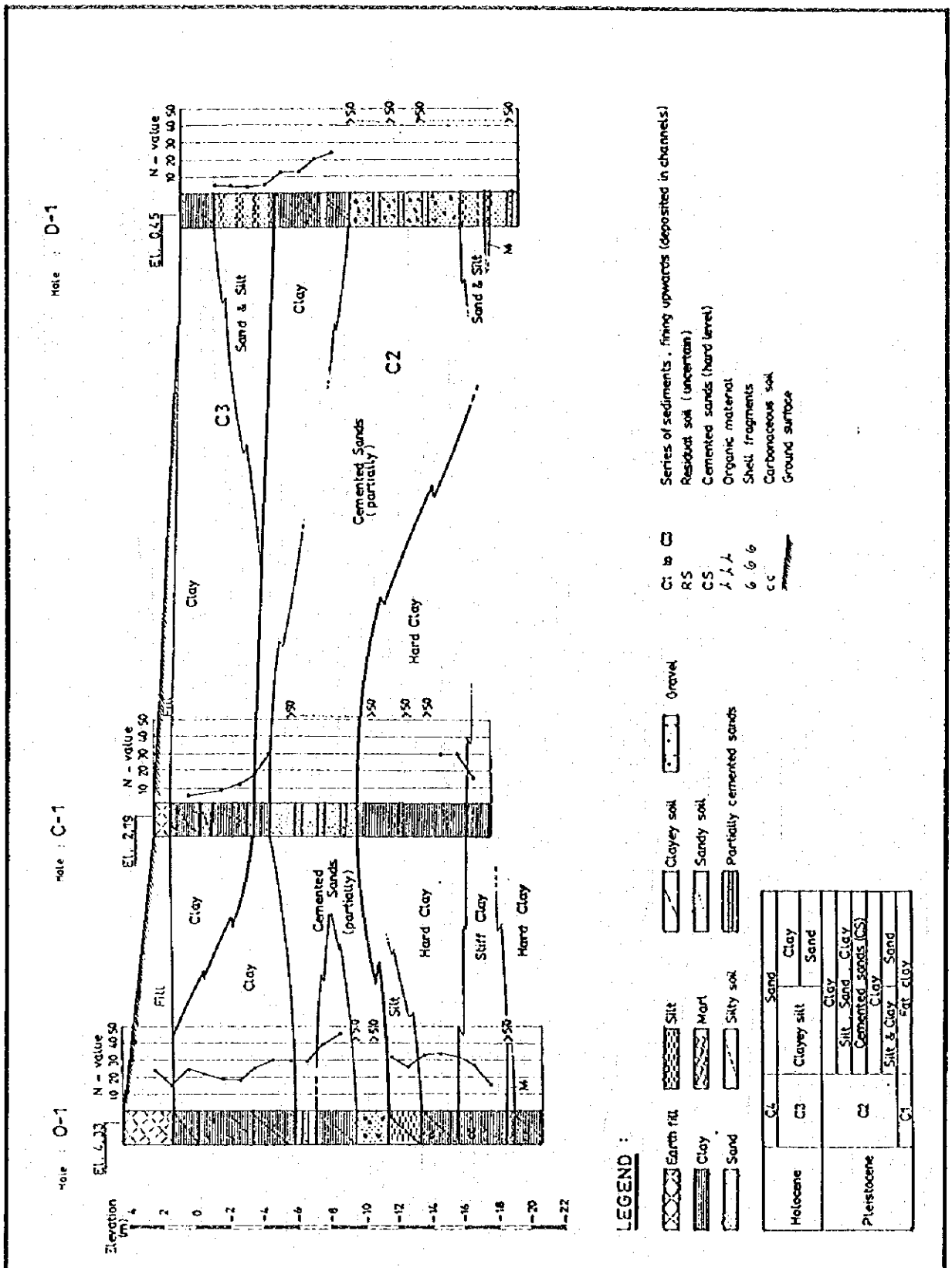


Fig. 6 Geological Cross Section O1-C1-D1

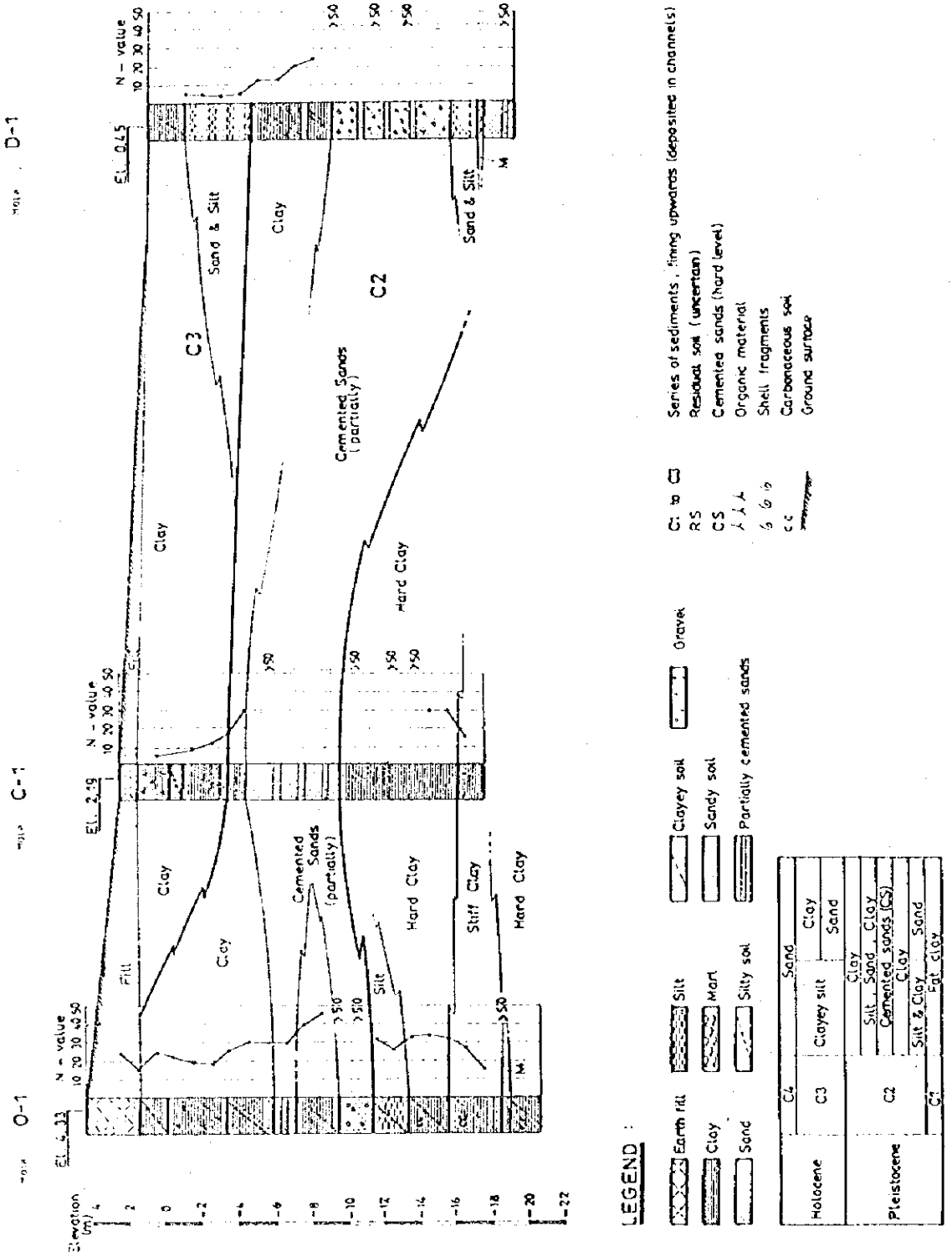


Fig. 6 Geological Cross Section O1-C1-D1

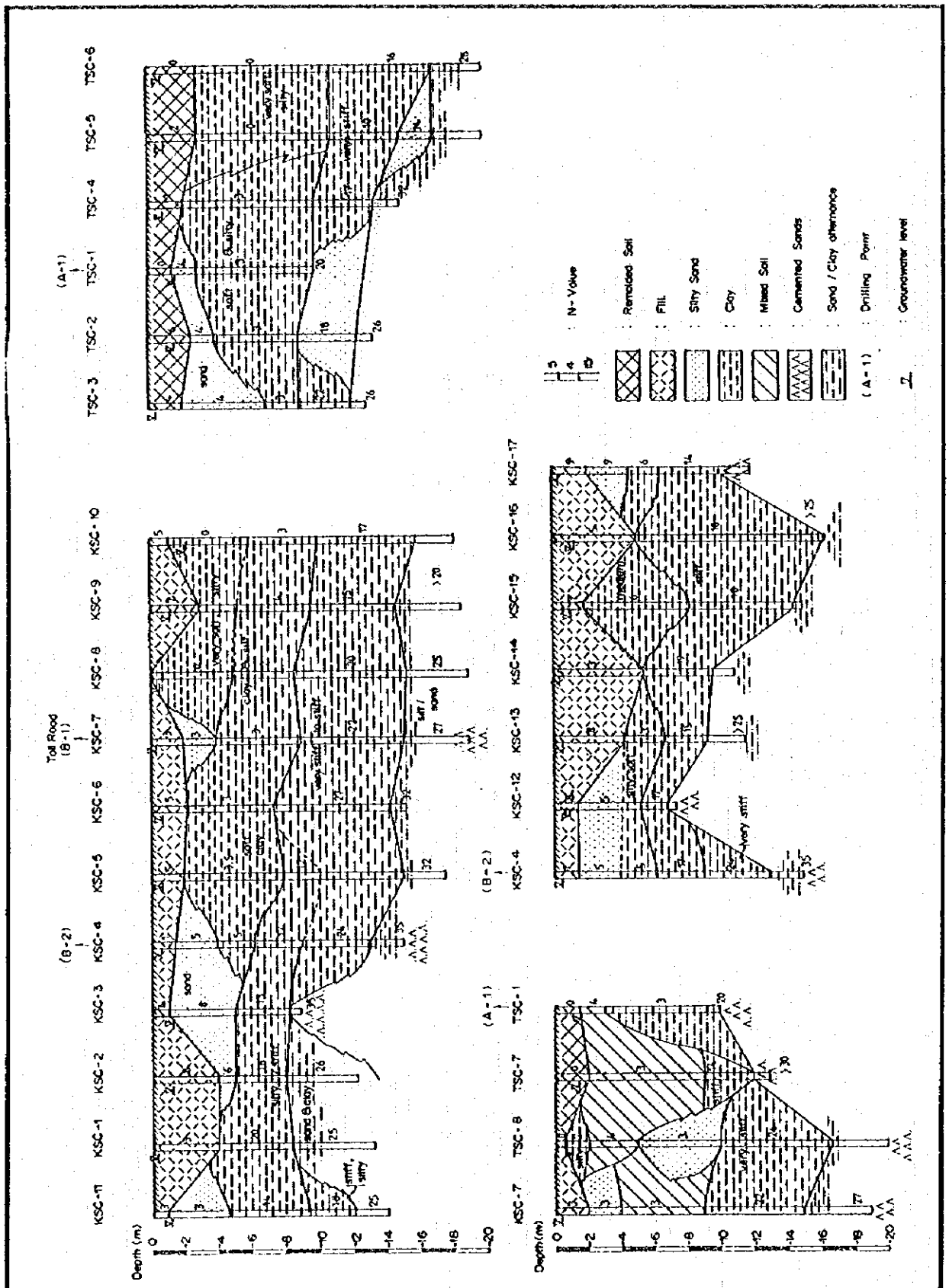


Fig. 7 Profiles of Dutch Cone Sounding (Kamal :KSC, Tanjungan:TSC)

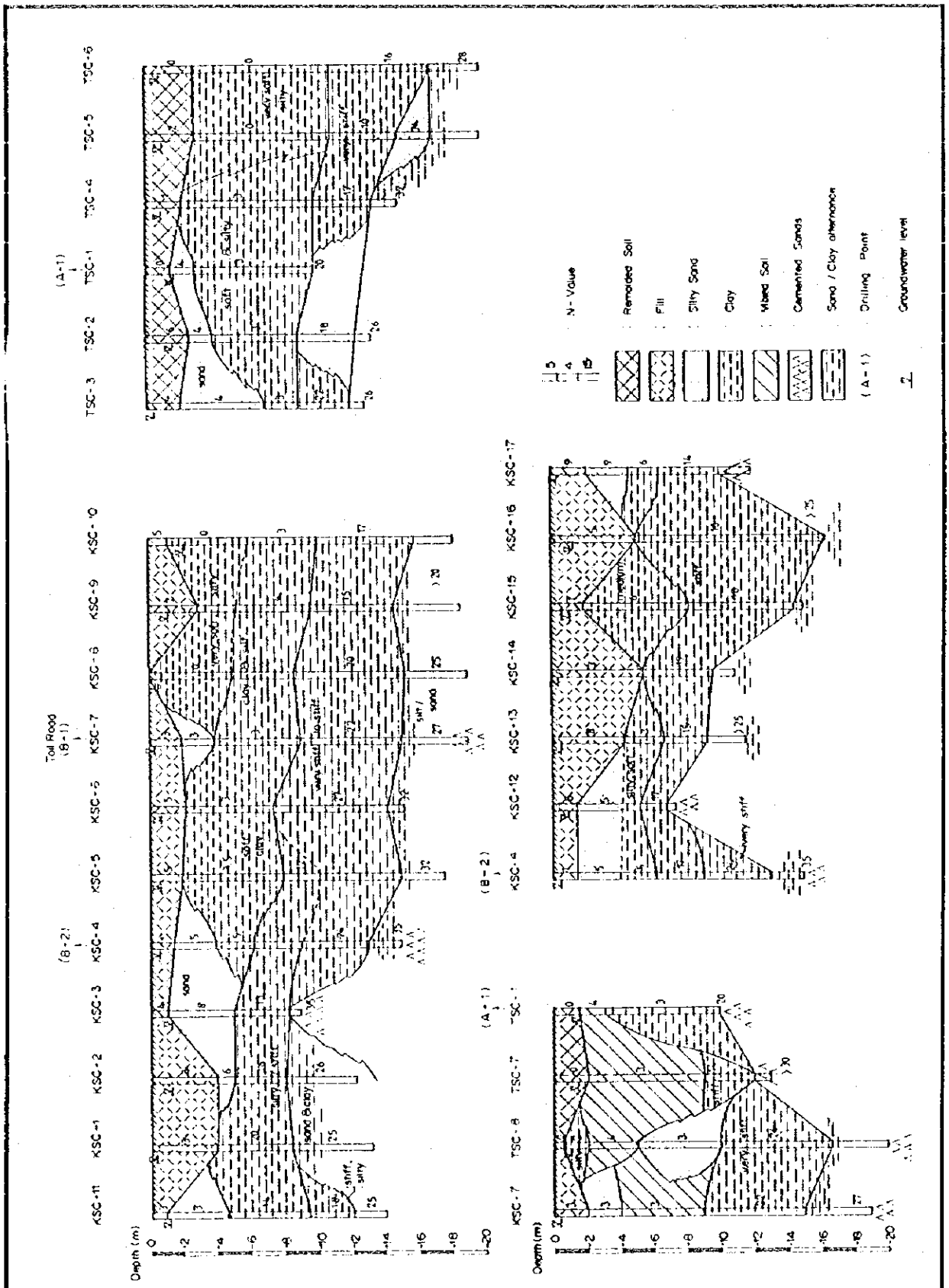


Fig. 7 Profiles of Dutch Cone Sounding (Kamal :KSC, Tanjungan:TSC)

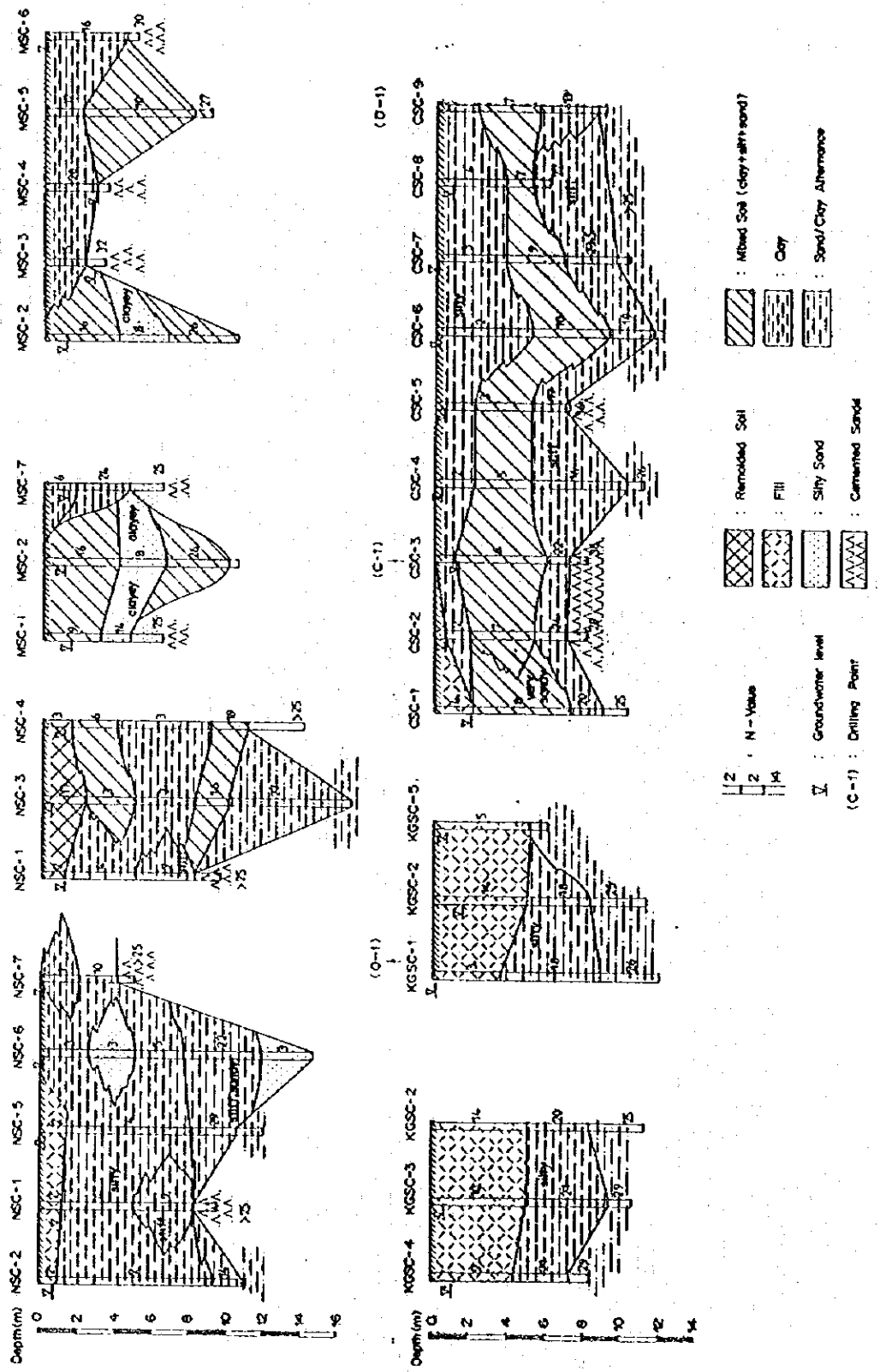


Fig. 8 Profiles Dutch Cone Sounding (New channel:NSC,Gede/Bor: KGSC, Saluran Cengkareng:CSC and Meruya:MSC)

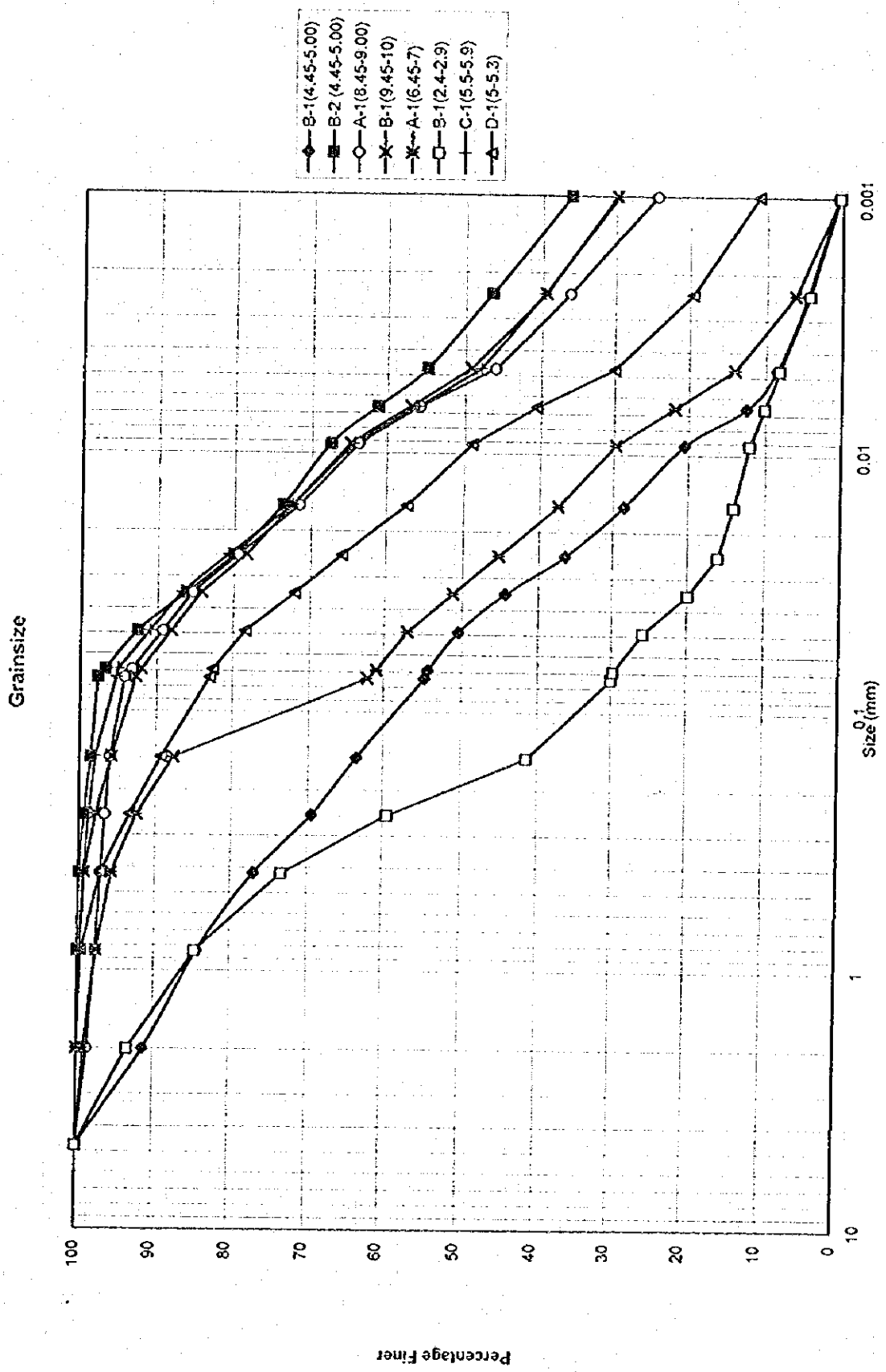


Fig. 9 Grain Size Curves, Shallow Soil

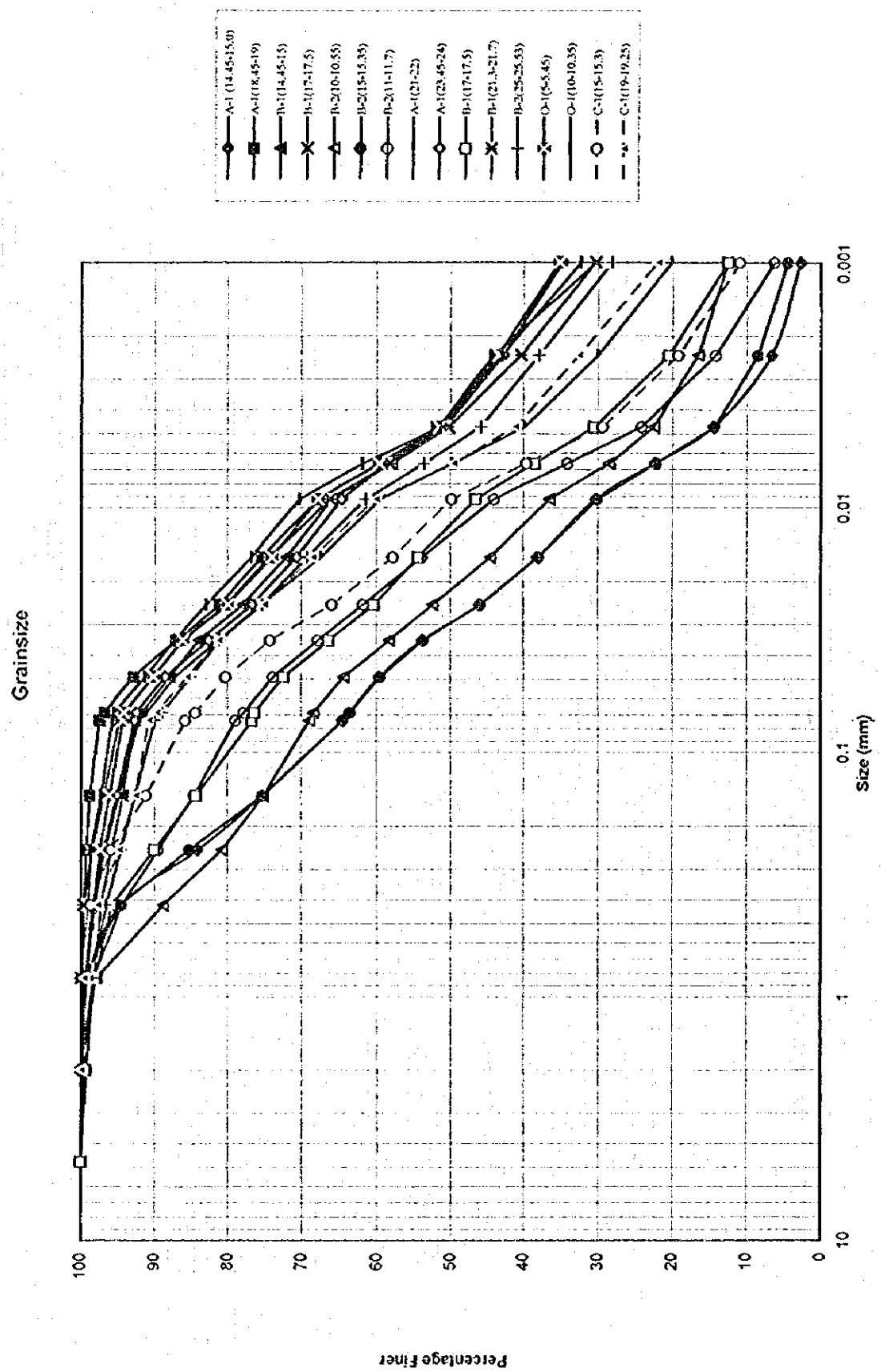


Fig. 10 Grain Size Curves, Deep Soil

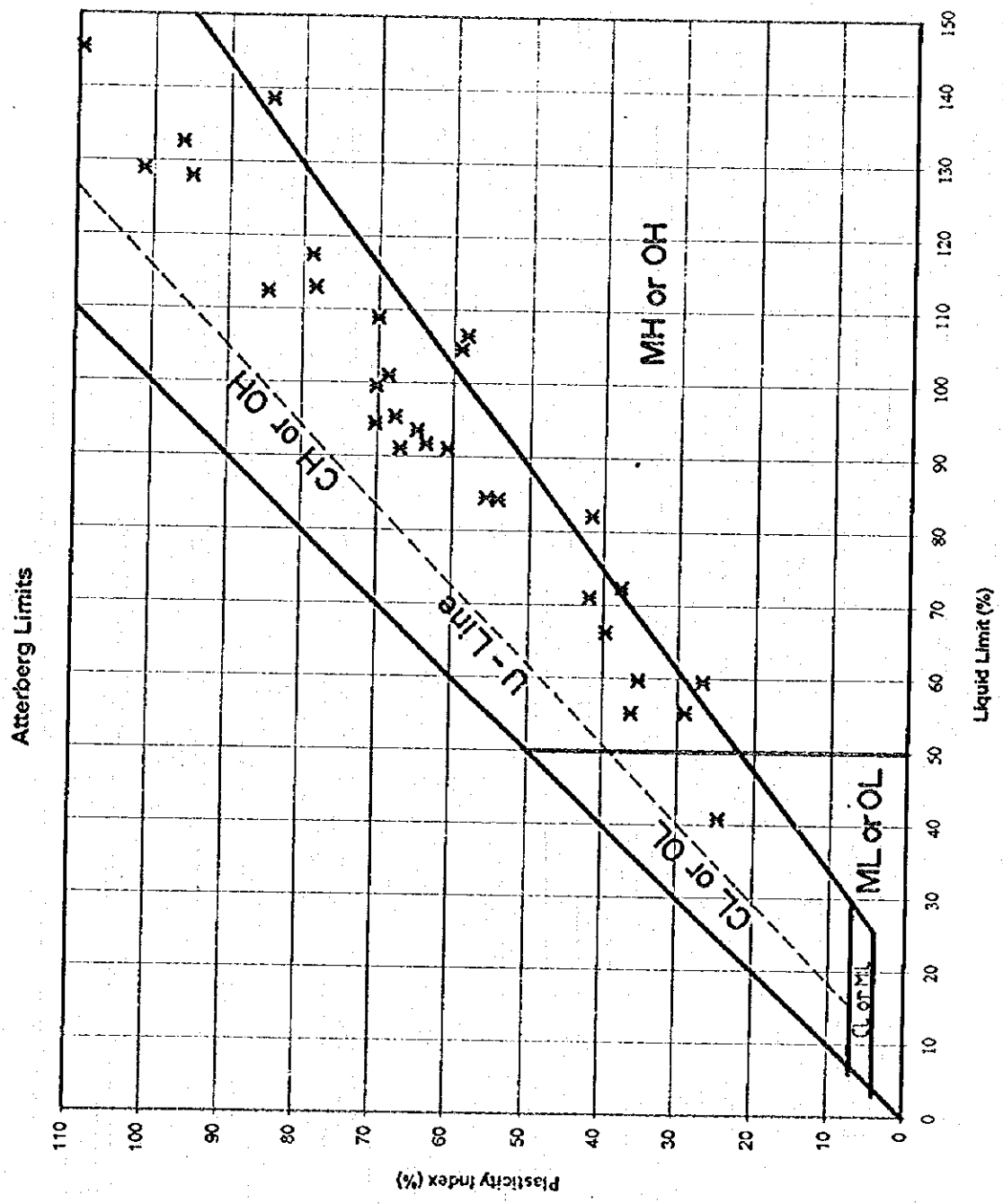


Fig. 11 Atterberg Limits for Investigated Soils

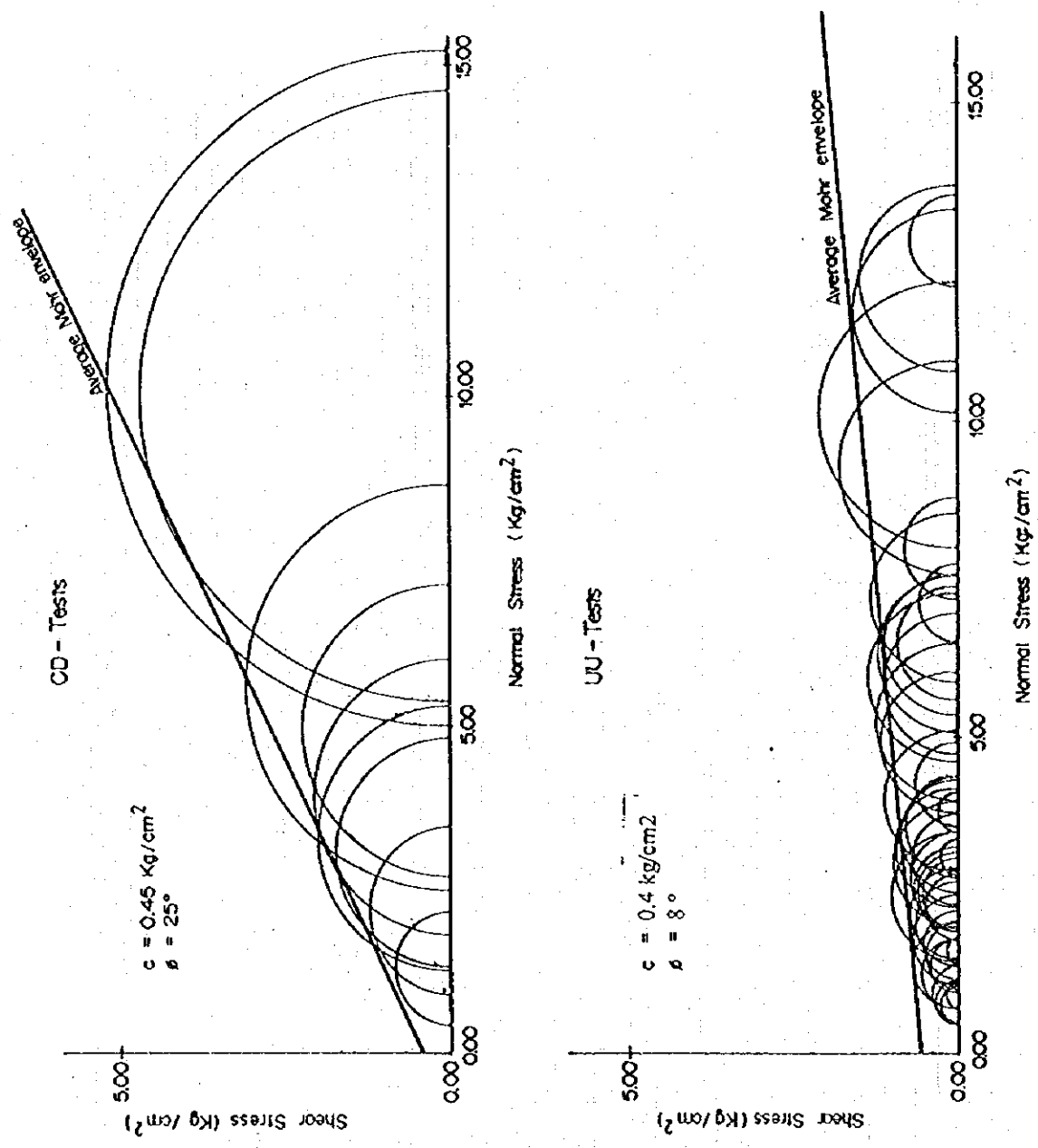


Fig. 12 Results of Triaxial CD and UU Tests

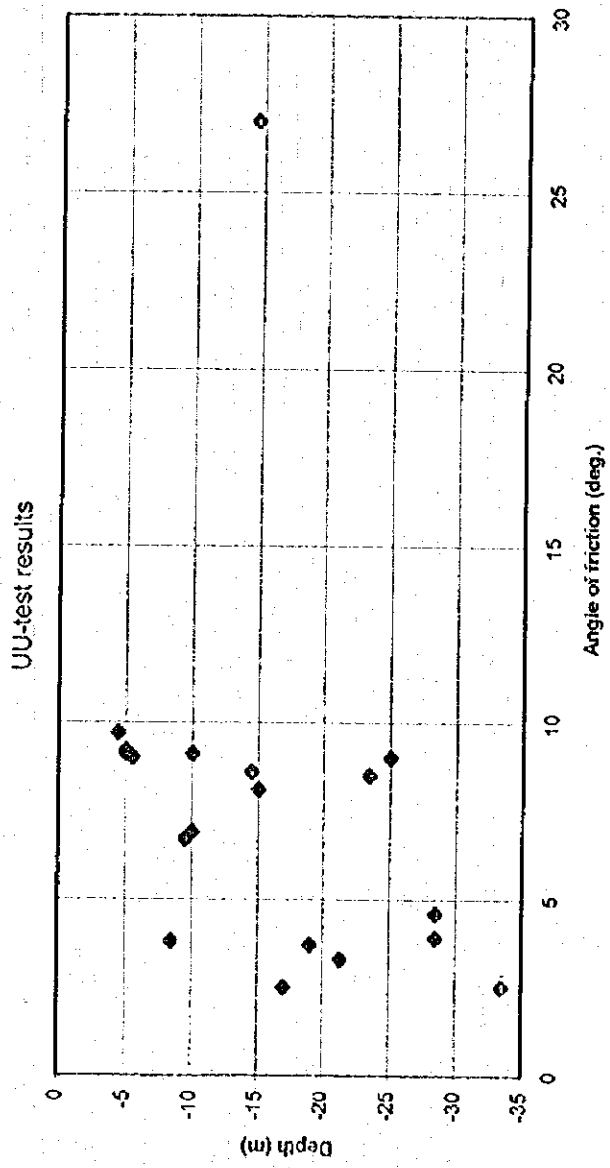
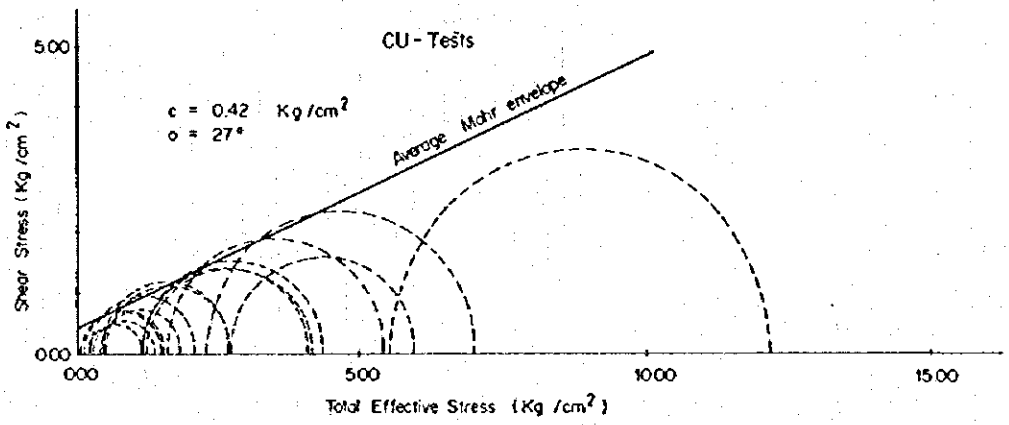


Fig. 13 Relationship between Internal Angle of Friction (UU-tests) and Depth



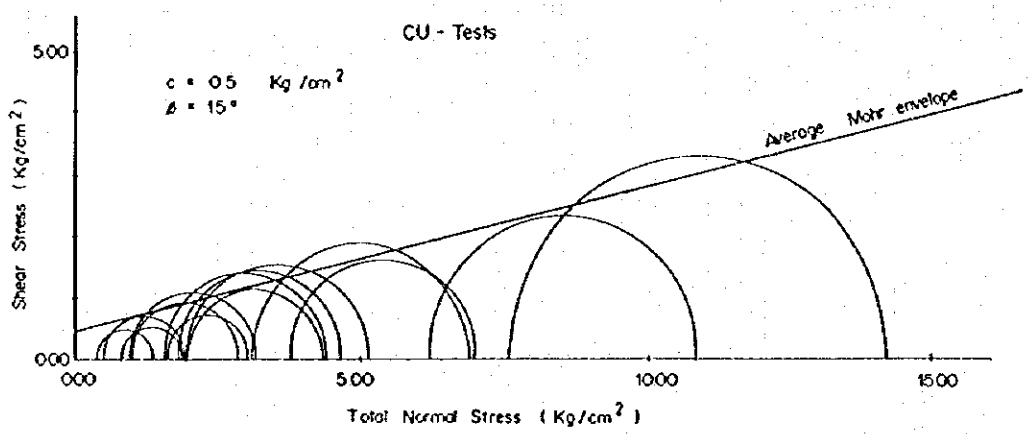


Fig. 14 Results of Triaxial CU Tests

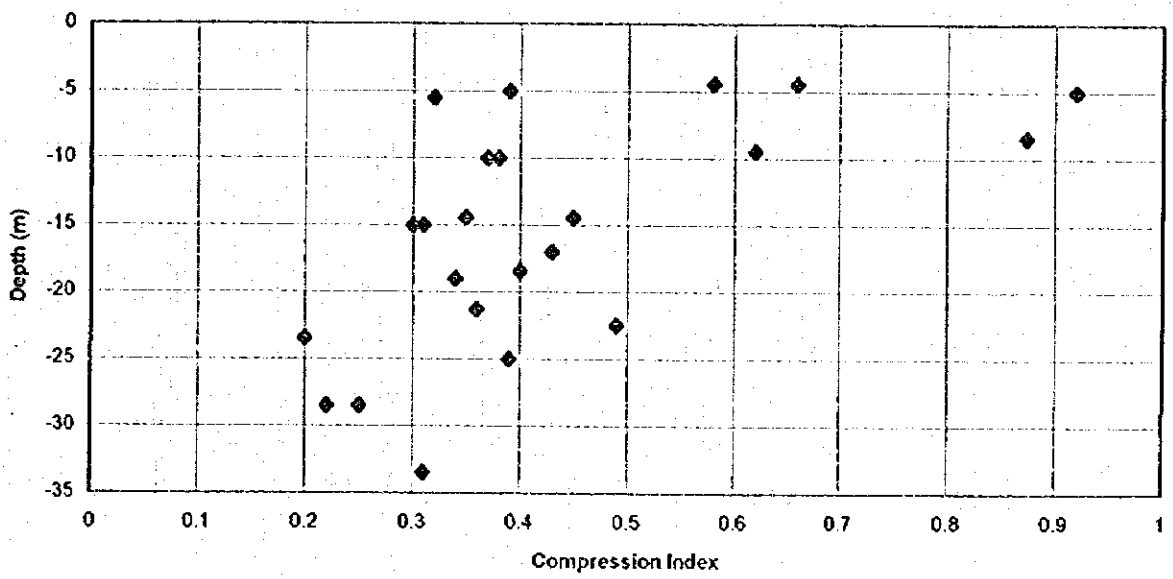


Fig. 15 Relationship between Compression Index Cc and Depth

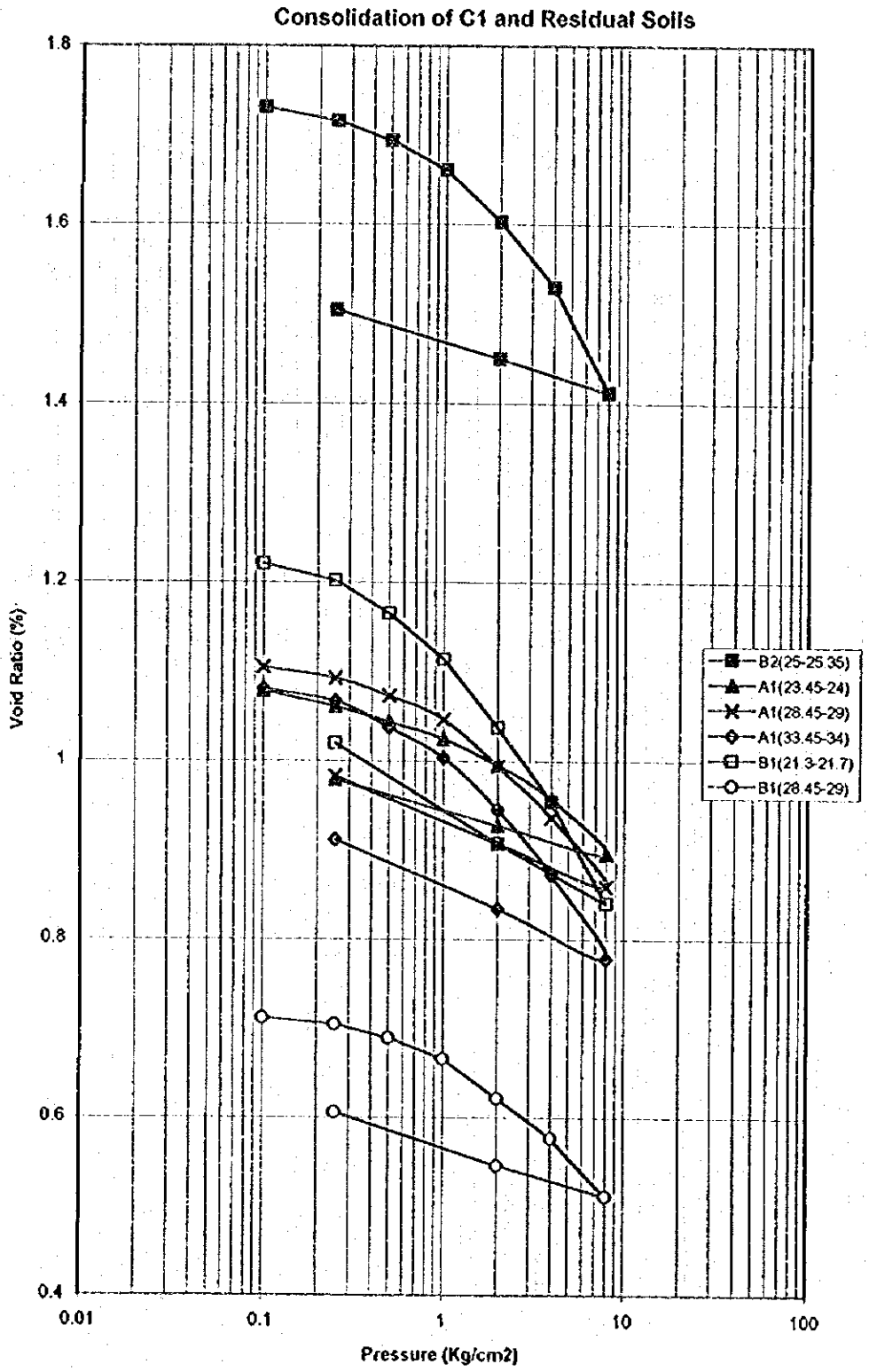


Fig. 16 Consolidation Test Results for Deeper Soils(drill holes, A1, B1 and B2)

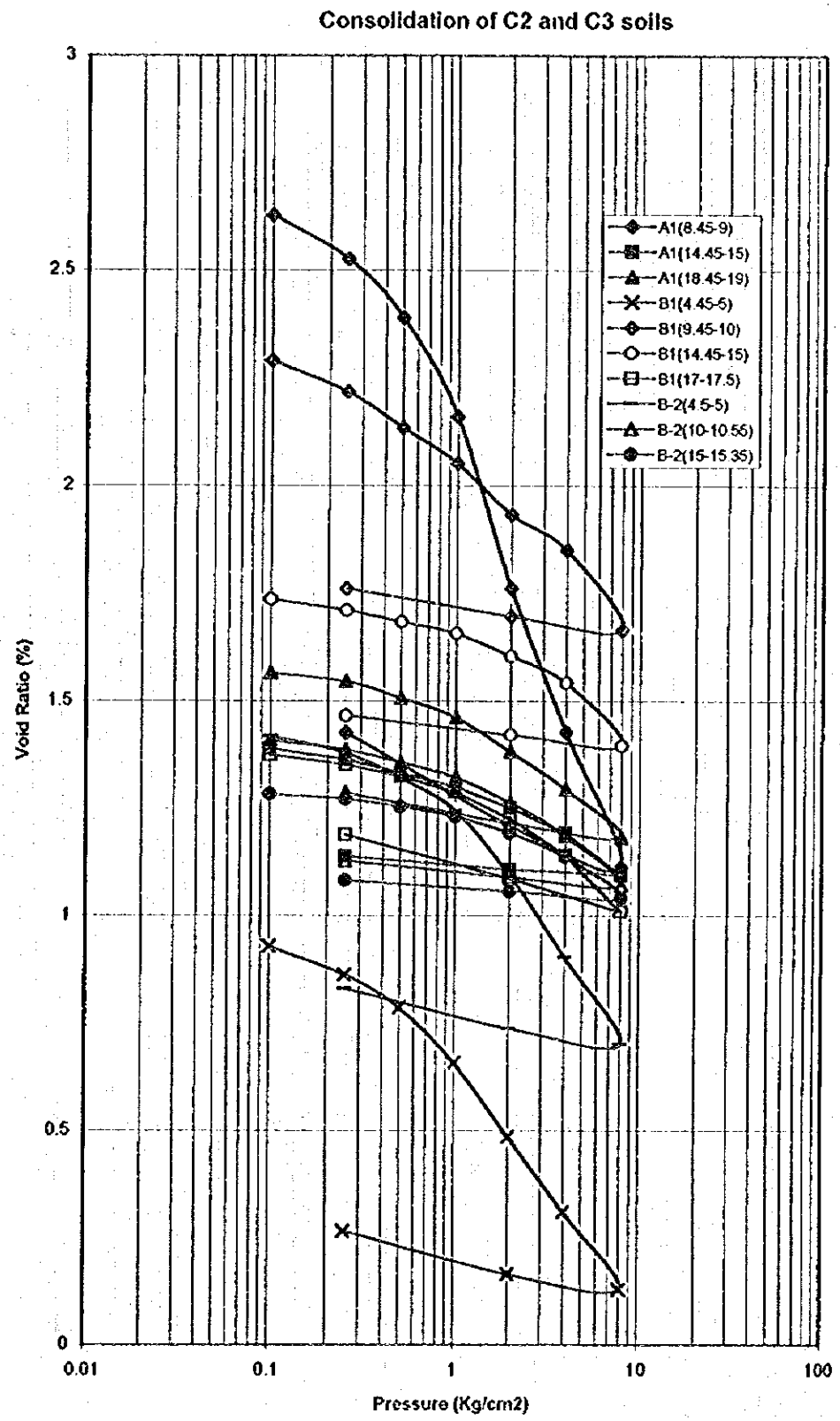


Fig. 17 Consolidation Test Results for Shallow Soils (drill holes A1, B1 and B2)

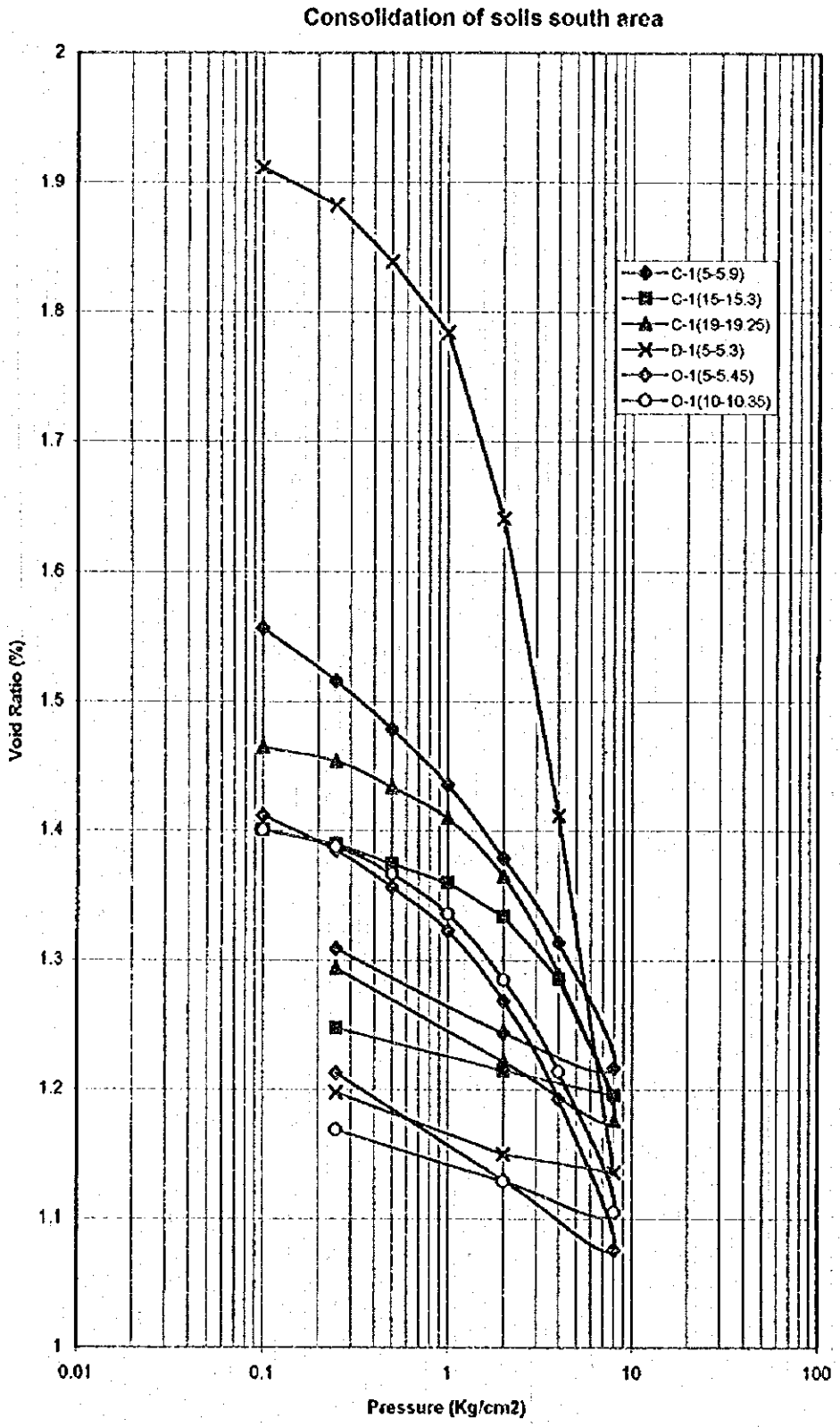


Fig. 18 Consolidation Test Results (drill holes C1, D1 and O1)

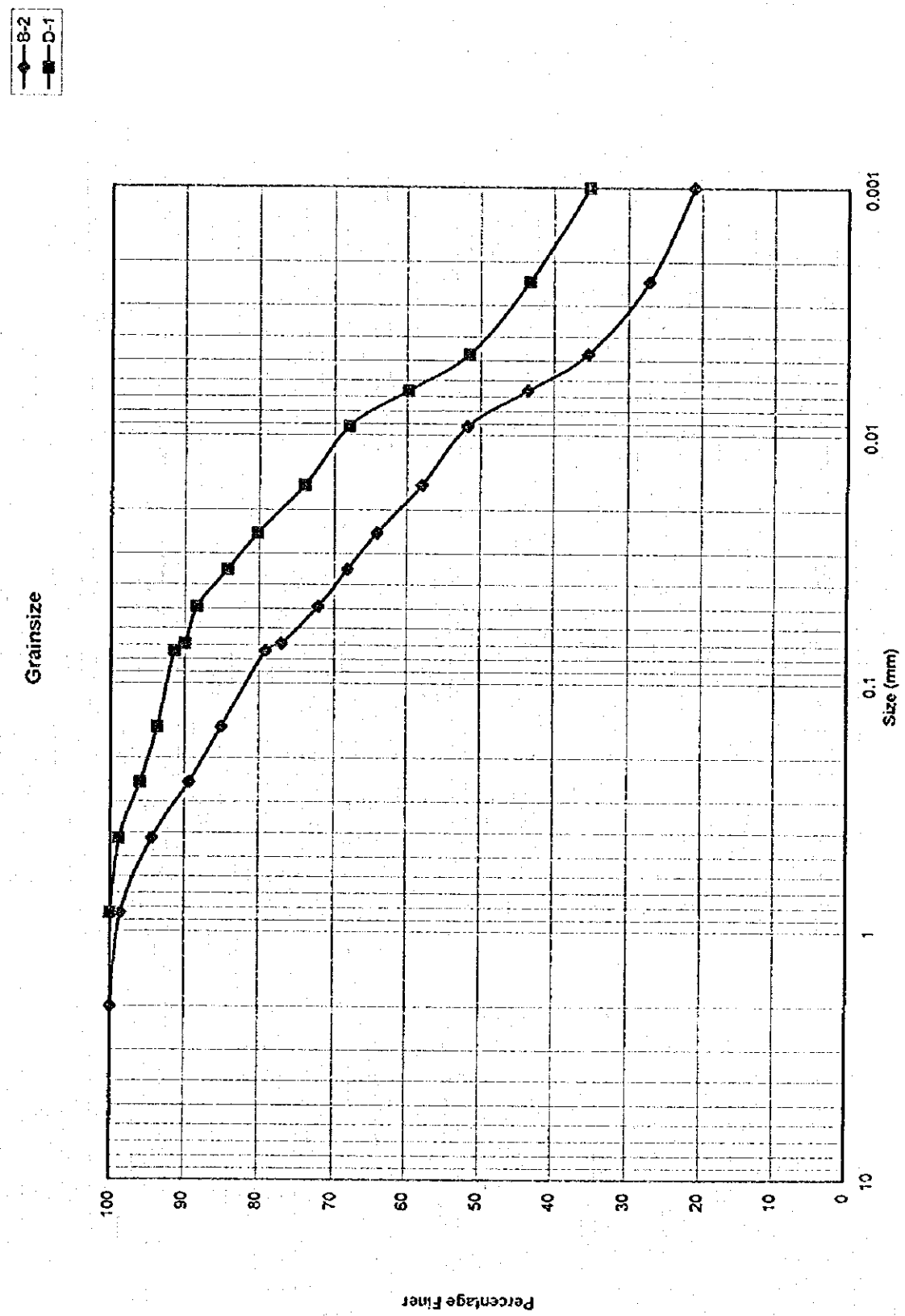


Fig. 19 Grain Size Curves for Embankment Soils

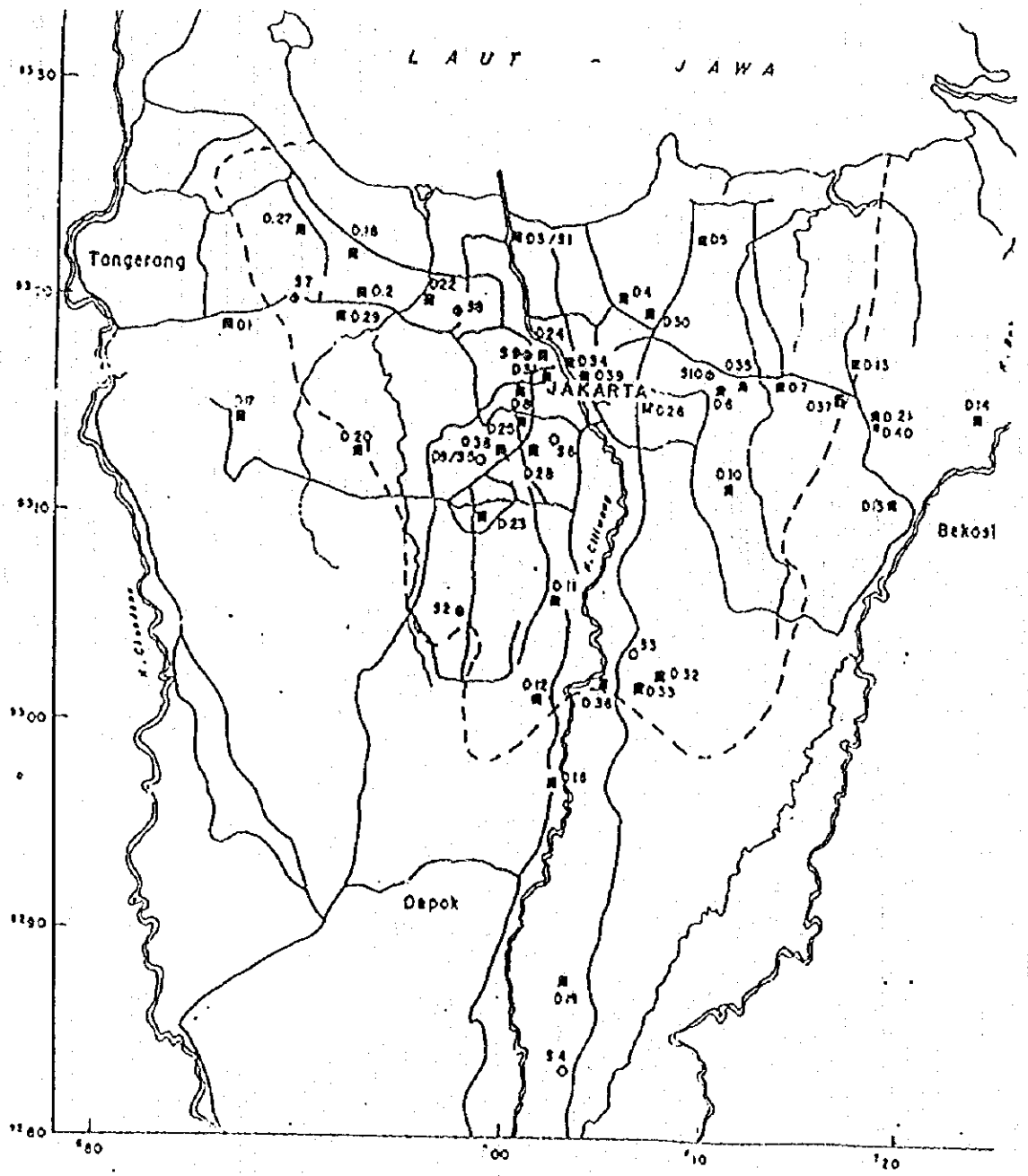


Fig. 20 Location of Monitoring for Deep Wells in the Jakarta Basin

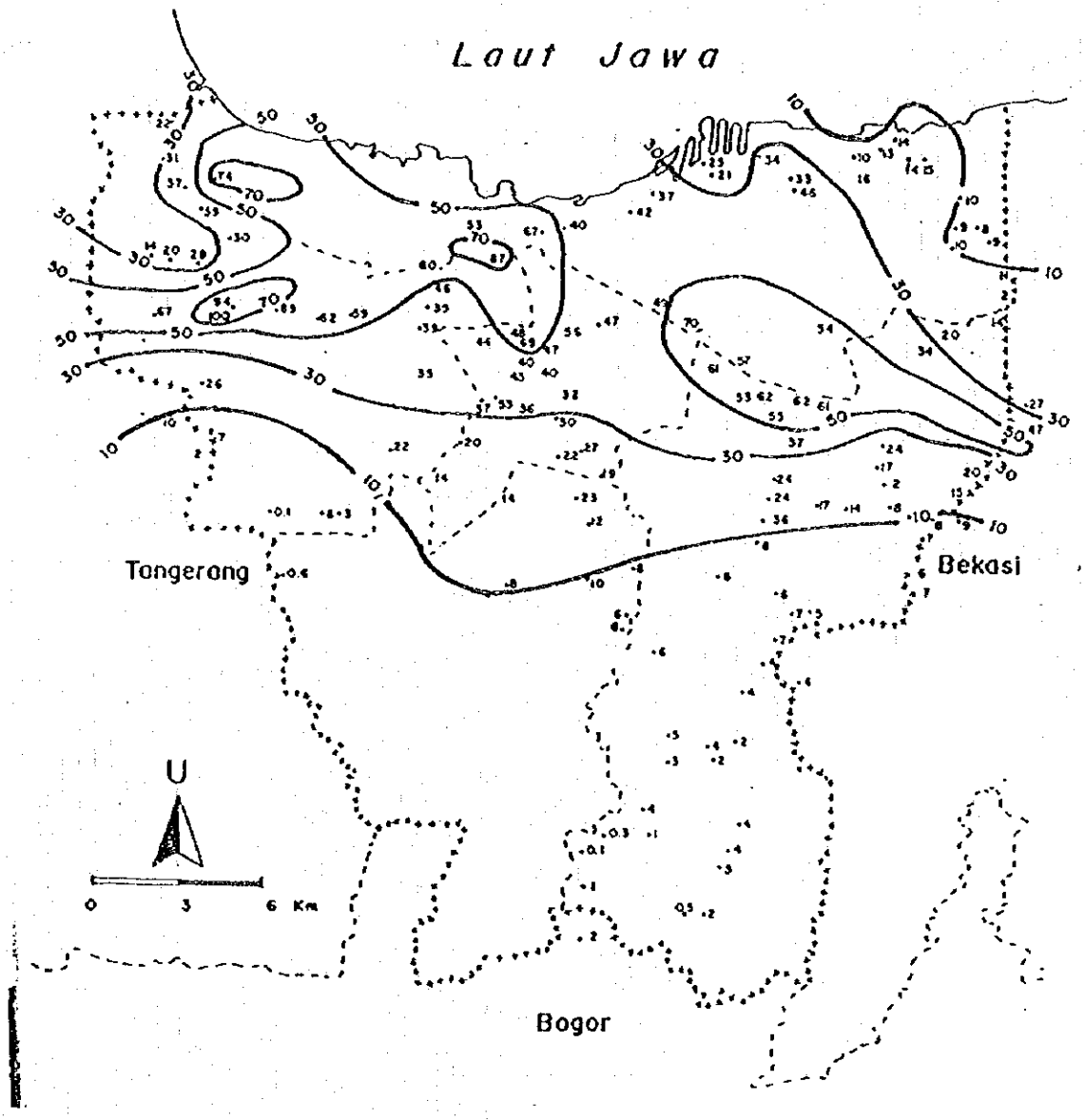


Fig. 21 Subsidence Map for the Jakarta Basin

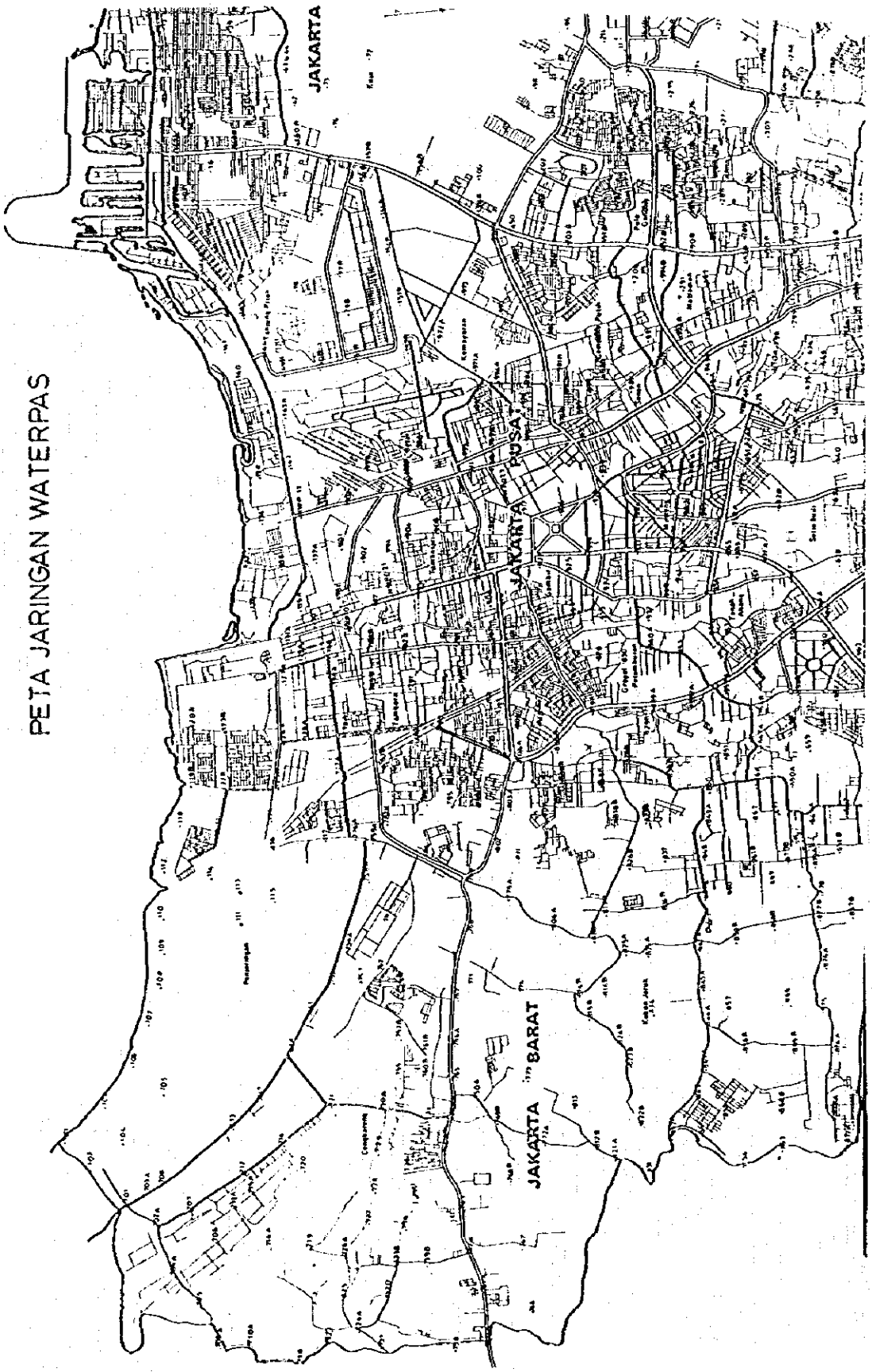


Fig. 22 Location Map of Bench Marks for PP System

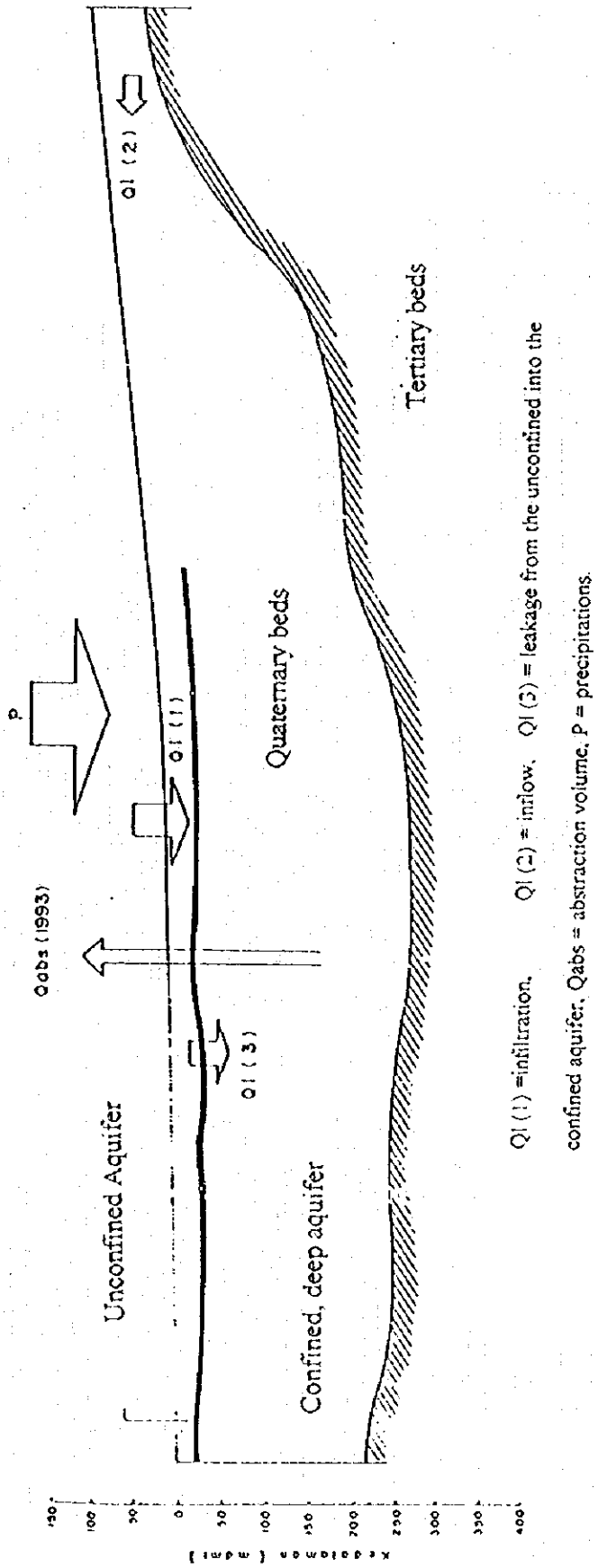


Fig. 23 Aquifer Recharge Model for the Jakarta Basin

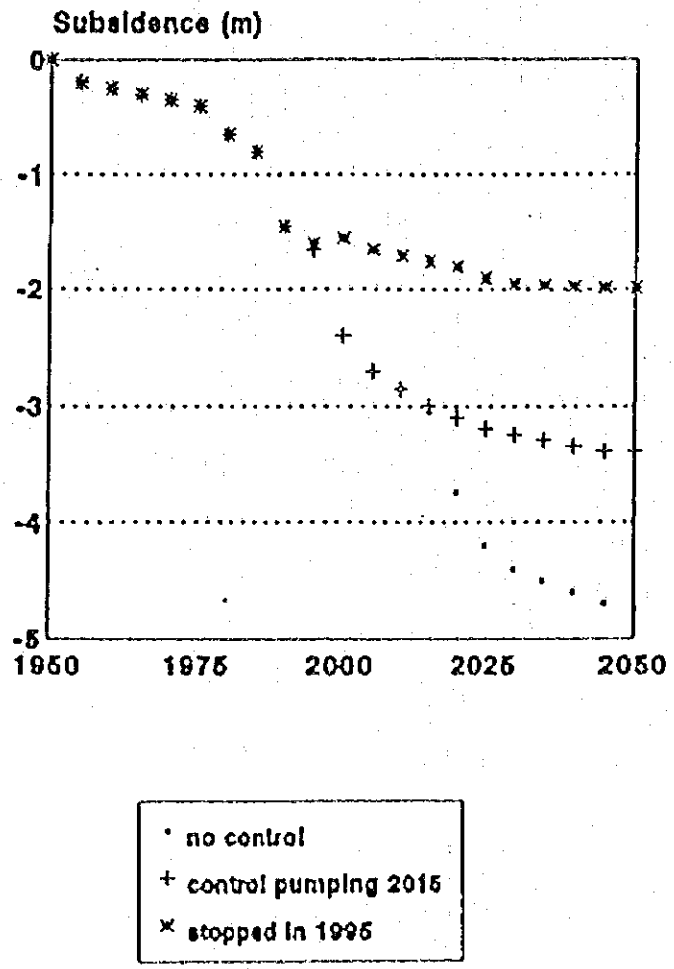


Fig. 24 Prediction of Subsidence Rates (1994)

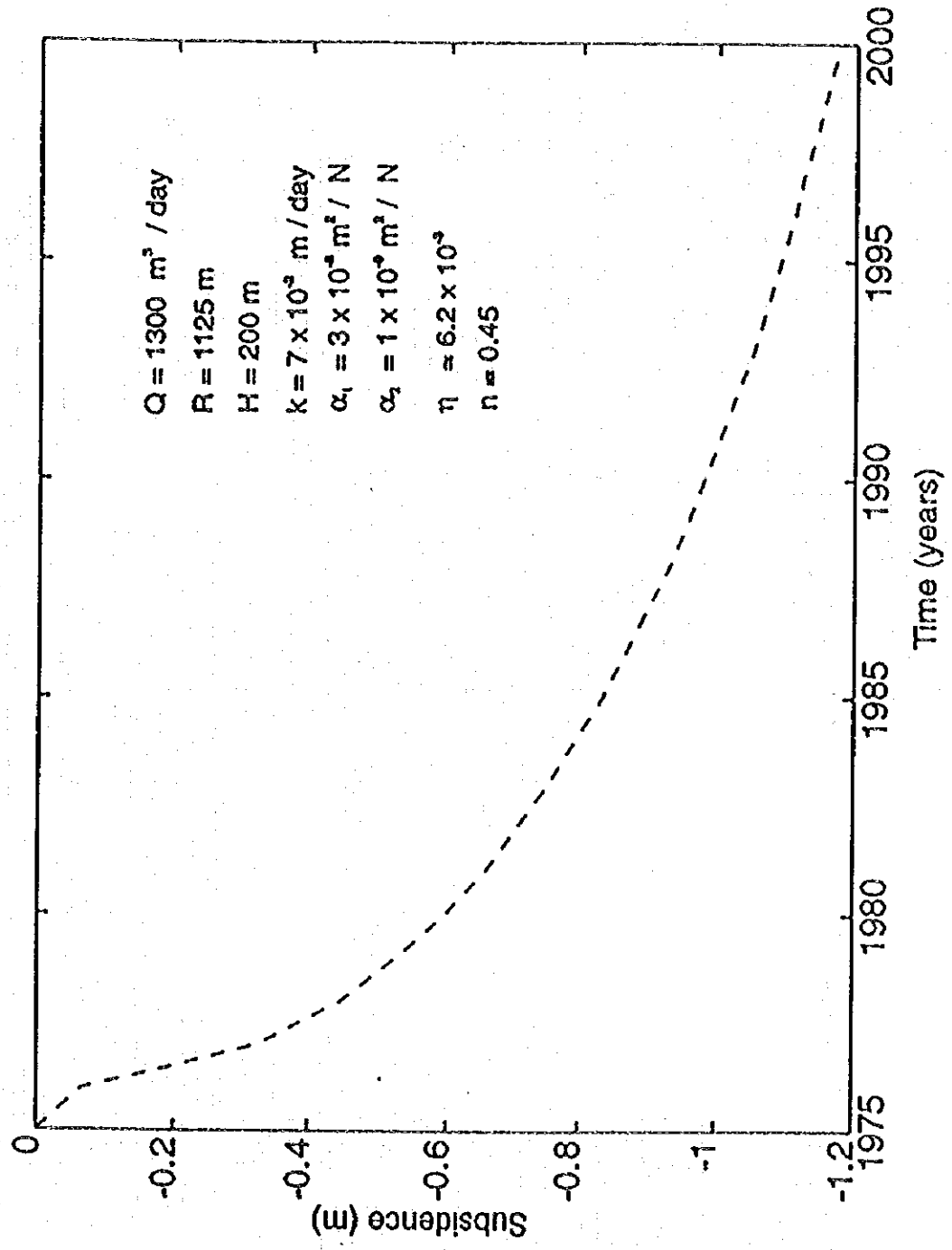


Fig. 25 Prediction of Subsidence Rates (1996)

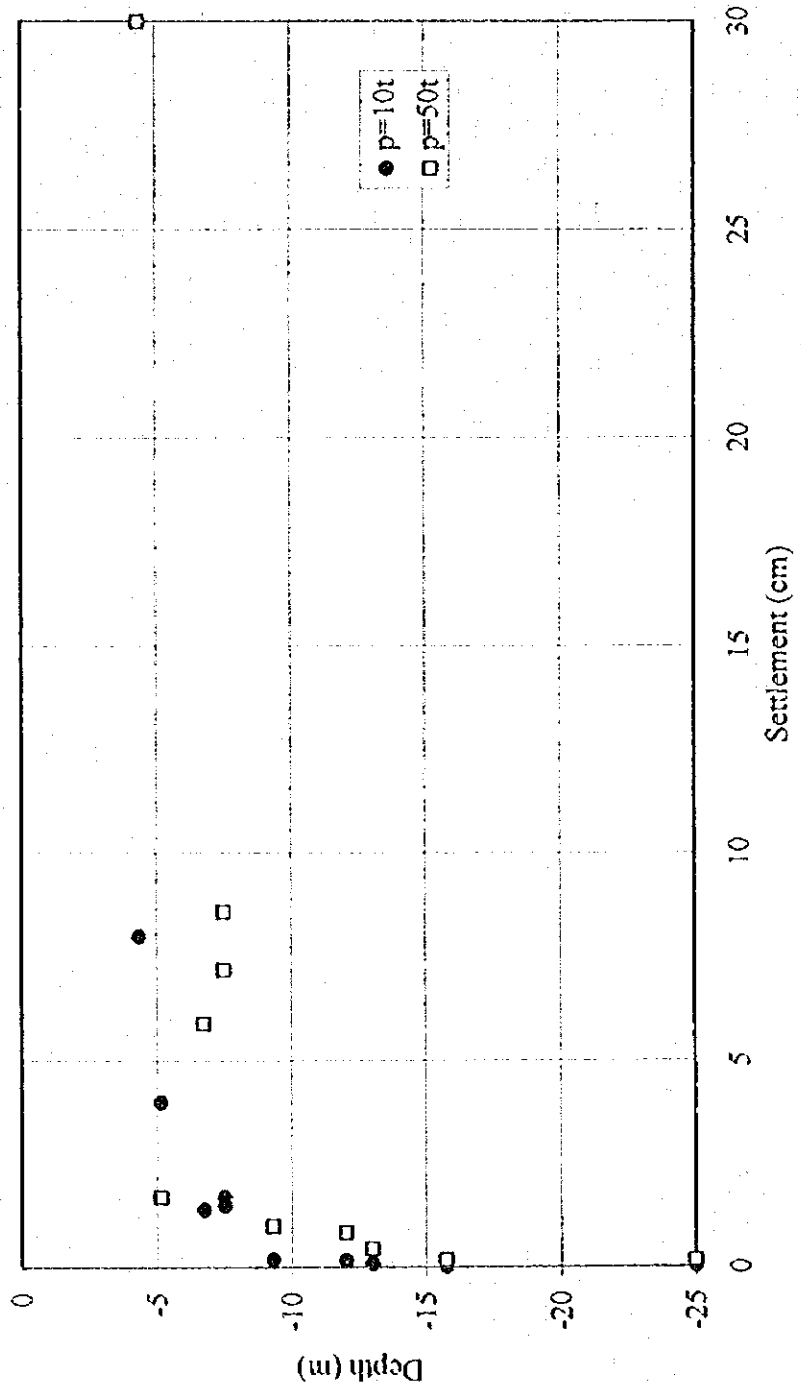


Fig. 26 Consolidation Settlement versus Depth

Appendix

APPENDIX Drill Log (1/6)

DRILL LOG HOLE No. A - 1 Sheet 1 of 1

Project	JAKARTA URBAN DRAINAGE	Depth: 35.M	Elevation: 0,57 m
	Site : Tanjungan River	Drilled: YALIA	Drill rig : KOEN OE 2L
	Date : from: 20 OCT 1996 to: 25 OCT 1996		

Depth (m)	Elevation (m)	Soil type or Formation	Column Section	DESCRIPTION	USBR	Recovery (%)	GWL (m)	N-value	Number of Blows (10 20 30 40)
1.6	-1.03	EARTH FILL		Silty CLAY, dark brown, soft		80			
3.7	-3.13	CLAY		Silty and sandy CLAY, brown to greenish-grey, red spots, soft, moist, medium plastic, rock fragments and shell fragments	CL	70, 90		4, 4	
8.3	-7.73	SAND & CLAY		SAND, dark grey-brown, very silty, fine to medium, sticky, contains roots of plants and shell fragments, becomes black at 5 m depth, soft	SC	90, 100, 100, 100, 100	0.50 / 1.63	2, 4, 4, 2, 2	
10.3	-9.73			SAND & CLAY, gradual change of color to green, low plastic, very fine, with shells and organic material, medium dense	CH	100, 100		2, 16	
11.0	-10.43	Cemented SANDS		Coarse SAND, silty, well distributed grainsize, some cemented portion, aspect of desintegrated rock, black		100		17	
15.0	-14.43	CLAY		High plastic CLAY, greenish with inclusions of coarse sand, derived from desintegrated rock, contains organic material (dark coal), some shell fragments, very stiff, - from 11.6 m to 12 m oolites of CaCO3 and iron concretions, 1.5 cm Ø - from 14 m to 14.5 m fine brown sand, silty, passes into green clay - 14.5 m to 15 m green, plastic clay	CH	100, 100, 100, 100, 100	2.56 / 1.13	19, 32, 27, 34	
20.4	-19.83	SAND & SILT		Alternation of light green- brown silty fine SAND and SILT, contains thin levels of organic material, dense, - 15.5 m to 16.45 m green, plastic clay - 18.45 m to 19.8 m color becomes dark and the sediment contains more clay	SC	100, 100, 100, 100, 100	2.28 / 1.13	36, 42, 29, 35, 29	
21.4	-20.83	CLAY		Black, fat high plastic CLAY; - 21m to 21.4 m passage from clay to greenish, silty sand	CH	100		34	
27.0	-26.43	SAND & CLAY		Brown-green intercallations of silty, fine SAND and CLAY sand is dense and the clay is hard, 21.4 m to 22 m silty fine sand or silt 22 m to 22.7 m fine to medium sand, with hard rock fragments, 3 cm Ø 22.7 m to 24.4 m silty green clay, low plastic 24.4 m to 25 m silty fine sand with brown zones (iron) and small pebbles of white rock 25 m to 27 m sand derived from desintegrated rock, fine to coarse, silty	SC/CH	100, 100, 100, 100, 100, 100	1.85 / 1.15	30, 35, 32, 30, 33, 35	
30.0	-29.43	CLAY		Greenish brown CLAY, hard brown, colored by iron oxide from 20 to 30m. From 30 to 35 m : Predominantly CLAY, brown, high plastic, very stiff to hard, thin levels or pockets of brown fine to medium sand, irregularly intercallated	CH	100, 97, 100, 100, 100, 100, 100, 100	1.85 / 1.15	35, 37, 40, 41, 31, 35, 42	
35.0	-34.43								

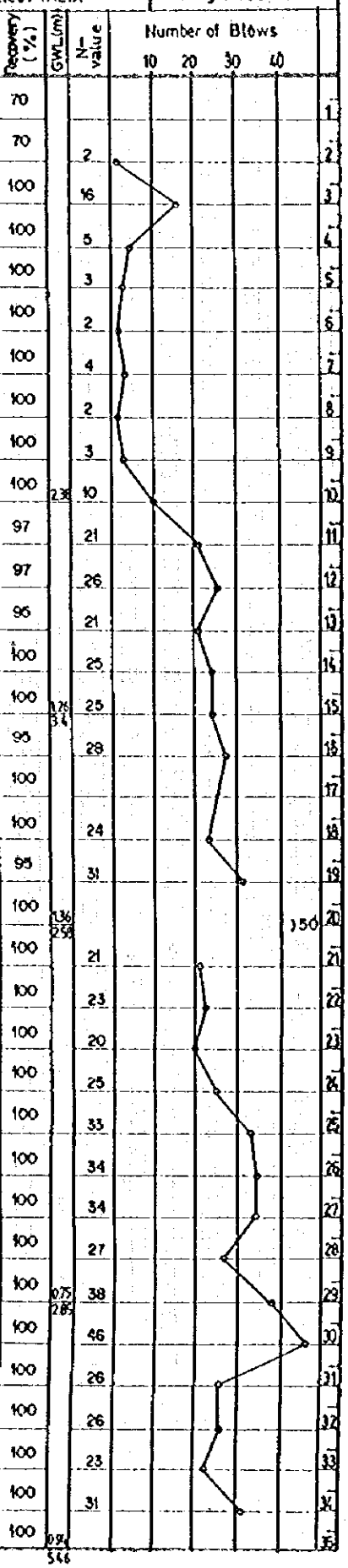
APPENDIX Drill Log (2/6)

DRILL LOG — HOLE No. B-1 — Sheet 1 of 1

Project	JAKARTA URBAN DRAINAGE	Depth: 35 M	Elevation: 0.45 M
Site	Tanjungan River	Drilled: YALIA	Drill rig: YSO-1
Date	from: 30 OCT 1996 to: 4 NOV 1996		

Depth (m)	Elevation (m)	Soil type or Formation	Column Section	DESCRIPTION	USCS	Recovery (%)	GWL (m)	N-value
0.9	-0.45	Earth Fill		Red SOIL, with black zones of organic material, sandy, silty and clayey soil		70		
4.45	-4.00	SAND		SAND, gray-black with yellow veins, fine to medium, very loose to looseslity in some portion, wet, contains many shell fragments, white, which brake down easily, fragments of wood fibers, up to 12 cm and some gravel 1-2 cm Ø, sub-angular to rounded	SM/ML	70, 100, 100		2, 16, 5
9.5	-9.05	SILT		Clayey SILT, gray, soft consistency, slightly plastic, contains shells and blck organic material, traces of fine to medium sand	ML	100, 100, 100, 100, 100		3, 2, 4, 2, 3
14.5	-14.05	CLAY		Predominantly CLAY, green-yellow and white, product of rock weathering, medium to high plastic, very stiff, contains hard fragments and pebbles 3-5 mm Ø: iron concretions, brown or yellow and carbonaceous rock	CH	100, 97, 97, 95, 100	2.38	10, 21, 26, 21, 25
17.0	-16.55	SILT		SILT, compact, yellow to green-brown and red, plastic, very stiff, contains fine sand	MH	100, 95, 100	1.26, 3.4	25, 28
19.45	-19.00			Alternation of SAND and CLAY; the sand is fine, silty or clayey, brown, medium dense, contains organic material (coal), the clay is high plastic, green, very stiff	CH/SC	100, 95, 100		24, 31
20.0	-19.55	Cemented SANDS		SANDSTONE, medium grained, dark brown, recovered as core fragments coated by silt			1.36, 2.59	>50
20.2	-19.75			Medium SAND and SILT, brown, contains iron concretions, very dense	SM	100		21
22.2	-21.75	CLAY & SILT		Silty CLAY green or grey, passing to light grey, low to medium plastic, very stiff, slightly carbonaceous, from 21 to 22.2 m it passes progressively into dark grey soil.		100, 100		23, 20
29.0	-28.55			CLAY and SILT 22.2-24 m fat, high plastic clay, dark grey, contains small pebbles of white, hard material and iron concretions 24-24.4 m sandy-silty grey clay with shell fragments 24.4-27.4 m alternation of sandy and silty clay, green, with brown zones (weathered iron oxide), low plastic and green clay, predominant from 25 m, highly plastic, very stiff, contains thin levels of organic material (grass) and 1 cm Ø iron concretions 27.4-28 m brown-grey clay, high plastic, very stiff, contains small pebbles 28-29 brown gray sandy clay, sand is derived from desintegrated carbonate rock and concentrated in pockets	CL	100, 100, 100, 100, 100, 100, 100, 100		25, 33, 34, 34, 27, 38
30.0	-29.55	SAND		Silty SAND, fine, brown, non plastic, dense, contains iron crusts, responsible for the brown color and plastic clay pockets	SM	100	0.75, 2.85	46
35.0	-34.55	CLAY		CLAY, pure or silty, brown-green with thin levels of limonite (iron oxide) - 30-30.45 m silty, sandy clay, hard - 30.45-33 m pure clay, very stiff - 33-34.45 m silty clay, very stiff - 34.45-35 m pure, dark grey clay, very stiff	CH	100, 100, 100, 100, 100	0.9	26, 26, 23, 31

Number of Blows: 10 20 30 40



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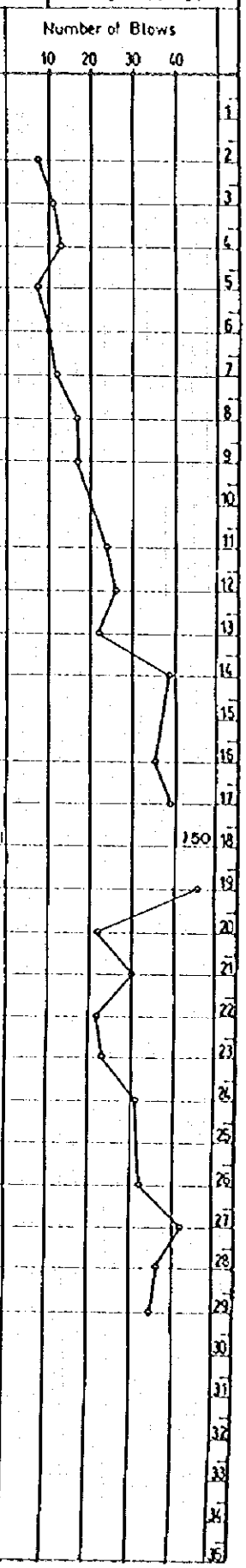
APPENDIX Drill Log (3/6)

DRILL LOG — HOLE No. B-2 — Sheet 1 of 1

Project	JAKARTA URBAN DRAINAGE	Depth: 30 M	Elevation: 2.25 M
	Site : Cengkareng Timur	Drilled: TATANG	Drill rig : YSO-01
	Date : from: 20 OCT 1996 to: 23 OCT 1996		

Depth (m)	Elevation (m)	Soil type or Formation	Column Section	DESCRIPTION	USBR	Recovery (%)	GWL (m)	N-value
0.9	+1.35	Earth Fill		CLAY silty/ sandy, organic, dark grey		100		
2.4	-0.15	SAND		SAND, loose, fine to coarse, includes dark green clay pockets, from 0.9-2.0 m dark brown; from 2.0-2.4 m yellow-brown, silty	SM	100		8
4.45	-2.20			SAND, lose to medium dense, brown-grey, very fine, contains shell fragments		100		11
						100		13
6.4	-4.15	CLAY		CLAY, stiff, pure or silty, medium plastic, contains shells and traces of organic material	CH	100		8
						100		10
7.0	-4.75	SAND		SAND, fine, gray, silty	SM	100		12
9.0	-6.75	CLAY		Sandy CLAY, stiff to very stiff, iron oxide inclusions, with sand from desintegrated rock; - 7-8 m gray-green, with red zones, colored by iron oxide; - 8-9 m green-brown, low plastic, very sandy	CH	100		17
						100		17
15.35	-13.10	SAND & CLAY		SAND, mainly derived from weathered/ desintegrated rock, CLAY in the lower levels; - 9-10.55 m gradual passage from clay to sand, low plastic material, calcareous, sand is coarse, white; - 10.55-11 m fine, clean, brown sand; - 11-11.4 m brown-green coarse sand (from weathered rock); - 11.4-12 m silty, brown-green, fine sand; - 12-13 m brown, fine, clean or silty, with black zones, colored by iron; - 13-15 m clay, light brown, low plastic, intercallated with thin levels of clean sand, becomes gradually clayey at the bottom, hard	SC/CL	100	1.55	
						100		24
						100		26
						100		22
						100		39
						100		
20.0	-17.75	Cemented SAND		SAND/ SANDSTONE; - 15-16 m partly consolidated sand- or siltstone, brown-grey, hard; - 16-18 m, brown-green silt, sand and clay, low plastic, rich in iron oxide; -10-19.7 m sand coarse to fine, brown, partly consolidated and recovered as hard, sandstone fragments; - 19.7-20 m light-brown silty sand, medium dense	SM	100		36
						100		39
						100	4.20 3.80	50/21
						100		45
						100		22
23.0	-21.75	SILT & CLAY		SILT and CLAY; - 20-21 m light brown-grey silt, non plastic; - 21-22 m fat, high plastic gray-green clay; - 22-23 m silty, light colored clay	CH	100		30
						100		22
						100		23
30.0	-27.75	CLAY		CLAY, fat, high plastic, hard with sand pockets from desintegrated rock; - 23-27.5 m dark-grey, sandy, brown zones colored by iron oxide, white calcareous pebbles and coarse sand; - 27.5-29 m reddish-green, very rich in iron oxide, silty; - 29-30 m brown-green clay intercallated with silt	CH	100		31
						100		
						100	2.45 2.27	32
						100		42
						100		36
						100		35
						100		

Number of Blows



APPENDIX Drill Log (4/6)

DRILL LOG HOLE No. C - 1 Sheet 1 of 1

Project	JAKARTA URBAN DRAINAGE	Depth: 20 M	Elevation: 2.19 M
	Site : Cengkareng Timur	Drilled: SALAMON	Drill rig : YBM - 05
	Date : from: 20 OCT 1996 to: 22 OCT 1996		

Depth (m)	Elevation (m)	Soil type or Formation	Column Section	DESCRIPTION	USBR	Recovery (%)	GWL (m)	N-value	Number of Blows (10 20 30 40)
0.9	+1.29	EARTH FILL		SAND and silty CLAY, reddish-brown, soft, moist, with round pebbles		90			
2.8	-0.61	CLAY		CLAY, dark-grey, medium consistency, little silt, medium plasticity, traces of brown, organic material	CH	100		5	
3.5	-1.31			Silty CLAY, brownish grey, moist, medium consistency, medium plastic, sand pockets, sand derived from weathered rock		100		7	
6.8	-4.61	CLAY		CLAY, light grey, stiff to very stiff, medium plastic, sandy and silty portions are irregularly distributed and low plastic		100		8	
7.8	-5.61			Sandy CLAY, green to dark grey, very stiff, contains sandy portions, yellow, fine grained, derived from weathered rock		100		12	
13.0	-10.81	Cemented SANDS		Partially cemented SANDS, aspect of a weathered sandstone, fine to medium grained, very dense, greenish-grey, - 7.8-9.7 m sharp, thin rock fragments in sandy silt, sticky (drilling sludge) - 9.7-11 m black, thin fragments of fine sandstone - 11-12 m predominantly green sandy silt with angular rock fragments - 12-13 m only rock fragments, few cm thick, black, RQD 10%	SM	82		18	
19.6	-17.41	CLAY		Predominantly CLAY, fat, high plastic, green, very stiff, irregularly distributed zones of fine sand, olive-green, resulting from weathering of rock, 19-19.6 m gradual passage to grey clay	CH	98		30	
20.0	-17.81			CLAY, pure fat, dark grey, stiff	CH	100			>50
						90	1.95		>50
						100			>50
						95			>50
						98			
						96			>50
						100		36	
						100	4.75 4.50		>50
						82			>50
						100		30	
						100		30	
						100		15	
						97	4.80		

APPENDIX Drill Log (5/6)

DRILL LOG — HOLE No. D-1 — Sheet 1 of 1

Project	JAKARTA URBAN DRAINAGE	Depth: 20 M	Elevation: 0,45 m
	Site : Cengkareng Timur	Drilled: YALIA	Drill rig : YSO - 1
	Date : from: 28 OCT 1996 to: 28 OCT 1996		

Depth (m)	Elevation (m)	Soil type or Formation	Column Section	DESCRIPTION	USBR	Recovery (%)	GWL (m)	N-value
1		CLAY		Silty CLAY, light brown and black, soft, moist, low plastic, contains organic material; becomes light-grey from 1.7 m and it contains small cristals of gypsum and trash	CL	80		
2	2.0	-1.55				100		4
3		SILT & SAND		Sandy SILT or silty SAND, grey-brown or green, contains coarse sand from desintegrated rock and small fragments of coal, from 4 m coarse, silty sand, loose	MH / SM	100		4
4						100		4
5	5.0	-4.55				100		
6		CLAY		Predominantly CLAY, greenish, low plastic - 5.6-6 m silty, sandy clay, medium - 6-6.4 m silty sand - 6.4-7 m green silty clay - 7-7.4 claycy silt - 7.4-8.2 clay, silt and sand mixture with wood fragments, 5 cm long, low plastic, stiff	CH	100		5
7						100	1.30	13
8	8.2	-7.75				100		13
	8.6	-8.15	Cemented SANDS	SILT or fine SAND, partially cemented, brown				
9		CLAY		CLAY, sandy and silty, grey-green, moist, hard, low plastic, sand is fine to coarse, derived from desintegrated rock	CH	100		21
10	10.0	-9.55				100		24
11		SAND & GRAVEL		SAND and GRAVEL, well graded, clean, medium grainsize predominates; grains of quartz, rock frag. and gypsum, gravel is 1-2 cm Ø, small pebbles, sub-angular or core fragments till 4 cm thick of consolidated sandstone, probably un irregularly consolidated deposit; - from 14.5 predominantly fine sand, clean or silty, yellow-green with iron concretions	SM - SM	100		
12						100		>50
13						100		>50
14						100		36
15						100	1.10 0.3	>50
16	16.5	-16.05				100		
17		SILT & SAND		Mix of SAND, fine, black and SILT, greenish, partly cemented to sand- or siltstone, very hard, recovered as fragments		100		
18	18.0	-17.55				100		
	18.3	-17.85	MARL	MARL, greenish- white calcareous, very hard				
19		SAND		Black or dark green SAND, fine, partly consolidated and recovered as sandstone fragments	SM	100		
20	20.0	-19.55				100		

Number of Blows: 10 20 30 40

APPENDIX Drill Log (6/6)

DRILL LOG HOLE No. O - 1 Sheet 1 of 1

Project	JAKARTA URBAN DRAINAGE	Depth: 25 M	Elevation: 4.33 M
	Site : Cengkareng Barat	Drilled: TATANG	Drill rig : YSO - 1
	Date : from: 26 OCT 1996 to: 28 OCT 1996		

Depth (m)	Elevation (m)	Soil type or Formation	Column Section	DESCRIPTION	USBR	Recovery (%)	GWL (m)	N-value
3.0	+1.33	Earth Fill		SILT, gravely and sandy, brown		100, 100, 100		24, 15
4.5	-0.17	CLAY		CLAY, silty, grey-brown, moist, low plastic with lenses of fine sand, very stiff	CH	100		25
7.7	-3.37			CLAY, brown-reddish or black, highly plastic, very stiff, very rich in organic material (roots, peat, coal), moist, weathered rock fragments in the lower part		100, 100, 100		19, 19
10.3	-6.15			CLAY, silty or sandy, green-grey, very stiff, medium plastic, moist, derived from desintegrated rock		100, 100, 100		26, 30
11.45	-7.12	Cemented SANDS		Partially cemented SANDS, rock or soil, fine to medium grained, sand is silty, medium dense, grey	SM	100	7.40	30
13.9	-9.57	CLAY		Sandy CLAY, grey to greenish-grey, very stiff, high plastic, contains weathered rock fragments	CH	100, 100, 100		40, 46
15.7	-11.37	Cemented SANDS		Gravely SAND, grey-green, very dense, fine to medium grained, poorly graded, looks like weathered sandstone, contains silty levels	SM	100, 100		>50, >50
17.7	-13.37	SILT		Clayey and sandy SILT, brown-yellow, with traces of iron	MH	100, 100, 100		32, 26, 32
20.0	-16.67	CLAY		Silty CLAY grey to greenish grey, moist, high plastic, very stiff, becomes reddish from 18.2 m because of the iron oxide, close to 20 m it contains small pebbles of calcareous rock	CH	100, 100, 100		34, 32
22.9	-18.57			Sandy CLAY, predominantly, white, stiff or very stiff, contains carbonate		100, 100	7.30, 7.40	27, 16
23.4	-19.07			Cemented fine SANDSTONE or SILTSTONE, very hard, dark grey, underlain by MARL		100		>50
25.0	-20.67			Silty CLAY grey to brownish-grey, moist very stiff, simmilar t residual soil	CH	100, 100	8.10, 8.25	38

Number of Blows: 10 20 30 40