## DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

GEOLOGICAL SURVEY

### NOARLUNGA REGIONAL CENTRE COMMUNITY COLLEGE FOUNDATION INVESTIGATION

-PUBLIC BUILDINGS DEPARTMENT-

by .

J.C. BEAL ENGINEERING GEOLOGY SECTION

Rept.Bk.No. 79/22 G.S. No. 6141 Eng. No. 79/3 D.M. No. 652/78

CONTENTS	PAGE
ABSTRACT	1
INTRODUCTION	1
METHOD OF INVESTIGATION	1
RESULTS OF DRILLING	2
DISCUSSION	2

# APPENDIX I LOG OF FOUNDATION HOLES APPENDIX II SOILS LABORATORY REPORT

### FIGURES

Fig. No.	<u>Title</u>	Drawing No.
1	Location Plan	S13849
2	Community College-Location of Drill holes	79-38
3	Geological cross sections A'-A" to D'-D"	79-39

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#### ABSTRACT

A total of 15 auger holes drilled to a maximum depth of 10 m, has shown a gently dipping sequence of Quaternary silt and clay, passing down at about 6 m into dense Tertiary sandstone.

The highly calcareous, plastic silt which occurs immediately beneath the topsoil, would provide a suitable foundation for light structures but requires field density checks as it may be of windblown origin and have collapse potential.

Stiff mottled clay, occurring at a depth of up to 2.5 m, forms a more certain bearing horizon which should have adequate strength for large structures. Both the silt and the mottled clay are highly plastic and effective drainage particularly away from footings will be important on this site.

No groundwater was encountered.

### INTRODUCTION

Following a request from Mr. S. Warwyck, Public Buildings
Department, foundation drilling for a proposed Community
College has been carried out at the Noarlunga Regional Centre.

#### METHOD OF INVESTIGATION

Investigation was restricted to auger-coring and selected soil samples were tested by the E. & W.S. Department Soils Laboratory (Netley) for plasticity index (PI), grading curves, linear shrinkage (LS), and moisture content (Appendix II).

The first eight drill holes (CC1 to CC8) were cored using a Gemco Auger rig with hollow auger flights and taken down to a maximum of 10 metres or until drilling refusal, whichever proved the shallower.

A further six holes (CC9 - CC15) were drilled down to 2.5 m using a solid auger bit to check thickness of the upper soil layers.

Detailed geological logs of all holes are given in Appendix I, and Fig. 2 shows their location.

### RESULTS OF DRILLING

Drilling showed a horizontal to gently dipping sequence of Quaternary clay and silt, resting on partially cemented Tertiary sandstone.

TABLE I
SUMMARY OF GEOLOGICAL SEQUENCE

Thickness range (m)	<u>Unit</u>	Engineering Properties
0.2 to 0.3	Black topsoil	Organic silty clay (OL)*
1.2 to 2.2	Cream clayey silt	Strongly calcareous, variable plasticity (ML-MH); possibly of low density windblown origin; PI 20-25, LS 10-12%.
1.0 to 2.2 0.8 to 1.5	Mottled red-brown clay	<ul> <li>a) stiff to very stiff, high plasticity (CH); PI 58, LS 20%</li> <li>b) very stiff, lower plasticity (CL), becoming sandy at base; PI 10, LS 5-10%.</li> </ul>
4.0 +	Clayey sand	very stiff clayey sand (SC); PI 7, LS 5%; transitional to dense sandstone bedrock.

<sup>\*</sup>Unified soil classification symbol.

The units could be easily correlated between holes and geological sections across the site are given in Fig. 3.

No groundwater was encountered.

#### DISCUSSION

A final decision on where to place <u>shallow</u> footings on this site will depend on an assessment of whether the calcareous silt, occurring at shallow depth beneath the topsoil, is low density windblown material having collapse potential. This

will require further testing; if this proves the case, it is considered that footings for rigid light structures should be taken down to the underlying mottled plastic clay which occurs at a depth of from 1.4 to 2.5 m beneath the site. This clay would also form an adequate bearing horizon for deeper footings involving larger structures, and is considered to be the first major bearing horizon beneath the area.

Results of laboratory testing show that this mottled clay is highly plastic and is expansive. For this reason it is considered essential that drainage water be prevented from penetrating via any means to this level by careful backfilling with impervious material around excavated footings. The sloping nature of the site will facilitate natural surface runoff, and final site landscaping should ensure that runoff does not collect in pools on the surface.

John C. Beal.

JCB: ZV

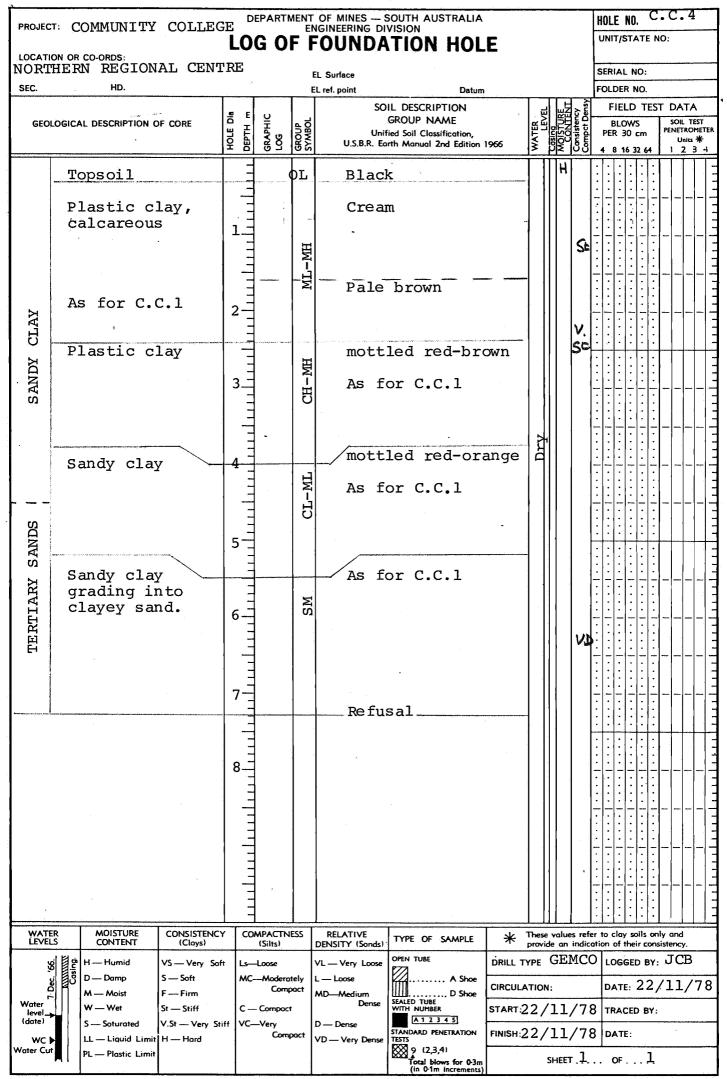
J.C. BEAL GEOLOGIST

## APPENDIX I LOG OF FOUNDATION HOLES

DEPARTMENT OF MINES — SOUTH AUSTRALIA ENGINEERING DIVISION HOLE NO. C.C.1 PROJECT: COMMUNITY LOG OF FOUNDATION HOLE UNIT/STATE NO: COLLEGE LOCATION OR CO-ORDS: SERIAL NO: NORTHERN REGIONAL CENTRE EL Surface SEC. FOLDER NO. EL ref. point Datum SOIL DESCRIPTION FIELD TEST DATA GRAPHIC LOG GROUP NAME SOIL TEST PENETROMETER BLOWS GEOLOGICAL DESCRIPTION OF CORE GROUP DEPTH Unified Soil Classification, PER 30 cm Units \* U.S.B.R. Earth Monual 2nd Edition 1966 8 16 32 64 TOPSOIL  $\mathsf{OL}$ Black Plastic clay-Cream - white high - low plastic Calcareous SŁ Clay with minor silt content. QUATERNARY CLAY 2 St Plastic clay Mottled creamred high plastic clay. Plastic clay-Mottled creamsand orange low plastic clay with silt. 5 sandy clay Medium to coarse grading into sand content TERTIARY SAND clayey sand increasing with depth Low plastic clayey sand derived from poorly cemented sandstone Refusal @ 7.70 m. 8 MOISTURE CONTENT CONSISTENCY (Clays) These values refer to clay soils only and provide an indication of their consistency. COMPACTNESS RELATIVE TYPE OF SAMPLE DENSITY (Sonds) (Silts) OPEN TUBE DRILL TYPE GEMCO LOGGED BY: JCB H -- Humid VS — Very Soft VL --- Very Loose D--- Damp S — Soft MC---Moderately Dec. DATE: 21/11/78 CIRCULATION: D Shoe SEALED TUBE WITH NUMBER Compact M — Moist F — Firm MD-Medium Water St --- Stiff C — Compact START: 21/11/78 TRACED BY: level (date) A12345 V.St - Very Stiff VC-Very D - Dense Soturated STANDARD PENETRATION DATE: Compact LL - Liquid Limit H - Hard VD - Very Dense 9 (2,3,4) PL --- Plastic Limit SHEET ... 1. OF .... 1

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Plastic clay  Plastic clay  Red clay (sand content increasing with depth)  Red orange.  Clayey sand  Clayey sand  Clayey sand  Refusal @ 8.50 m with solid auger  Plastic clay  Refusal @ 8.50 m with solid auger	Lonornamente			•		3	풀										=
Plastic clay  Plastic clay  Red clay (sand content increasing with depth)  Red orange. low plastic sand End of coring  Clayey sand  Clayey sand  Refusal @ 8.50 m with solid auger  Plastic clay  Refusal @ 8.50 m with solid auger					-	3	II-		•						- -	-  -	- =
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Refusal @ 8.50 m with solid auger   WATER MOISTURE CONSISTENCY COMPACTNESS RELATIVE Transfer to clay soils only and													<b>VD</b>				
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WATER MOISTURE CONSISTENCY COMPACTNESS RELATIVE TYPE OF SAMPLE * These values refer to clay soils only and																	]
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WATER MOISTURE CONSISTENCY COMPACTNESS RELATIVE TYPE OF SAMPLE * These values refer to clay soils only and					] :										:		1
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S — Soft MC—Moderately L — Loose CIRCULATION: DATE 23/11/78		6 %	D — Damp	S — Soft		C—Modera		L — Loose	[ ] [ ] [ ]			<del></del>					8
Water Dense SEALED TUBE	Water	111			c.		- 1		SEALED TUBE				/7				$\dashv$
(dote) S—Soturated V.St—Very Stiff VC—Very D—Dense STANDARD PENETRATION FINISH, 23/11/78 DATE			S — Soturated	V.St — Very St		—Very			A 1 2 3 4 5 STANDARD PENETRATION	<u> </u>			<del>.</del>				$\dashv$
WC ► LL — Liquid Limit H — Hard Water Cut    PL — Plastic Limit   H — Hard   PL — Plastic Limit   H — Hard   PL — Plastic Limit   H — Hard   PL — Plastic Limit   PL — Plastic L				H — Hard		- Con 14		VD Very Dense	TESTS (2,3,4)	<del></del>					1		$\dashv$

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				HOLE D	GRAPHIC LOG	GROUP SYMBOL	Unit U.S.B.R. Ed	fied Sail Classification, 11th Manual 2nd Edition	1966	WATE	WOS	Compo	PER 30 cr	" [	Units 1	*
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WA LEV	TER ÆLS	MOISTURE CONTENT	CONSISTENCY (Clays)	СО	MPACTN (Silts)	ESS	RELATIVE DENSITY (Sonds)	TYPE OF SAMPLE					r to clay soil			
		H — Humid	VS — Very Soft	Ls	Loose		VL — Very Loose	OPEN TUBE	DRILL T				1	·		
	Dec. '66. Cosing.	D — Damp	S — Saft	1	Modera		L — Loose	A Shoe	CIRCULA				DATE:2			
Wote	، [[[ن	M — Moist W — Wet	F — Firm St — Stiff	c_	Comp Compact	- 1	MD—Medium Dense	SEALED TUBE WITH NUMBER				/7	8 TRACED		-, ,	$\dashv$
leve (date		S — Saturated	V.St — Very Stif		–Very		D — Dense	A 1 2 3 4 5 STANDARD PENETRATION	-	<del></del>				٠,٠	<del></del>	<del></del>
W Water (	C D	LL — Liquid Limit PL — Plastic Limit	H — Hard		Com	pact	VD Very Dense	TESTS 9 (2,3,4)	FINISH:	<del></del>			8 DATE:			_
	Ħ.	I IOSHE EHRH		1				Total blows for 0-3m	ş]	S	HEET	‡	OF	. ∔		

LOG OF FOUNDATION HOLE NORTHERN REGIONAL CENTRE SIC. WO.  GEOLOGICAL DESCRIPTION OF CORE  Sic. WO.  TOPSOIL  TOPSOIL  TOPSOIL  Flastic, cal-  careous clay  Flastic Clay  Plastic Clay  Flastic Clay  Mottled red-brown  As for C.C.1  Silty clay  Red low plastic clay with minor silt content  Clay with minor silt content  Orange red  Clayey sand  Clayey sand  Flooring  Refusal @ 8.0 m  with solid auger  With solid auger	PROJE	ст:СО	MMUNITY (	CENTRE			E	NGINEERING DI							E NO.			8	
SEC. NO.  CLICK SOME DATA  CLICK SOME DATA  CROUP PLANT TORSOIL  TOPSOIL  Plastic, calcareous clay  Plastic Clay  Red low plastic clay with minor cl	LOCA	TION OR	CO-ORDS:	TAT CENT	LU	GO	t i	-OUNDA	TION HOL	E					·		<u></u>	<del></del>	
Topsoil  Topsoil  Topsoil  Plastic, calcareous clay  Plastic Clay  Plastic Clay  Red low plastic clay with minor silt content  Sandy clay - clayey sand  Sandy clay - clayey sand  Clayey sand  Refusal @ 8.0 m with solid auger  Refusal @ 8.0 m with solid auger		KTHE.		NAL CEN.	LKE				Datum								•	<del></del>	
Topsoil   DL Black   Plastic, calcareous clay   Plastic, calcareous clay   Plastic Clay   Plastic Clay   Plastic Clay   Plastic Clay   Mottled red-brown   As for C.C.1   Notice   Plastic Clay with minor silt content   Plastic Clay with minor silt conte	GE	OLOGICA	AL DESCRIPTION O	F CORE	HOLE Dia	GRAPHIC LOG	GROUP	1	GROUP NAME ied Soil Classification,	1966	WATER LEVEL	Casing MOISTURE	Consistency Compct Densy	E	LOWS 30 c	m	SOI PENE	L TEST TROME	TER
Plastic, calcareous clay  Plastic Clay  As for C.C.1  Red low plastic clay with minor silt content  Orange red  As for C.C. 1  As for C.C. 1  Red low plastic clay with minor silt content  Orange red  As for C.C. 1  End of coring  Poorly sorted coarse grained, clayey sand  Refusal @ 8.0 m  with solid auger		To	psoil				i -	T The second second							:[:]	: :			
Silty clay  4   W   Red low plastic clay with minor silt content  Orange red  As for C.C. 1  End of coring  Clayey sand  Poorly sorted coarse grained, clayey sand  Refusal @ 8.0 m with solid auger	WARY	Pl.	astic, ca reous cla	ay	1		-MH	Cream As fo	,	- wn									
Sandy clay - clay ey sand  Sandy clay - clayey sand  As for C.C. 1  End of coring  Poorly sorted coarse grained, clayey sand  Refusal @ 8.0 m with solid auger	QUATER			27	3		CH-MH	As fo:	r C.C.l				١.,						
Clayey sand  The work of the control	employee in grant property and the second of	Si	lty clay		4	making on a language	CI-MI	clay v	with minor	ng n		200							111111
Refusal @ 8.0 m with solid auger	RY							As fo	r c.c. 1	-	Dry		D						
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								Witch											titilini linilini
WATER MOISTURE CONSISTENCY (Clays) COMPACTNESS RELATIVE DENSITY (Sonds) TYPE OF SAMPLE These values refer to clay soils only and provide an indication of their consistency.	WA LEV	TER /ELS	MOISTURE CONTENT	CONSISTENCY (Clays)	со		ESS	RELATIVE DENSITY (Sonds)	TYPE OF SAMPLE										
WE DESCRIPTION OF THE STREET O			H — Humid	-	- 1					DRILL T	YPEG	EM	СО	LC	GGED	BY:	J	СВ	
M—Moist F—Firm Compact MD—Medium Compact CIRCULATION: DATE: 24/11//8					MC			MD—Medium	D Shoe	CIRCULA	TION	l:		DA	ATE.	24	1/1	1/	78
W—Wet St—Stiff C—Compact WITH NUMBER START: 24/11/7 \$TRACED BY:	leve	╌┸		i i			t		WITH NUMBER			·		-	<del></del>	BY:	<u> </u>		_
WC LL — Liquid Limit H — Hard VD — Very Dense	W	c 🕨	LL — Liquid Limit				pact		TESTS 9 (2,3,4)	FINISH:							<u>.                                    </u>	i	_

DEPARTMENT OF MINES — SOUTH AUSTRALIA ENGINEERING DIVISION HOLE NO. C.C.9, PROJECT: COMMUNITY COLLEGE UNIT/STATE NO: 10, LOG OF FOUNDATION HOLE LOCATION OF CO-ORDS:
NORTHERN REGIONAL CENTRE SERIAL NO: EL Surface HD. FOLDER NO. EL ref. point Datum FIELD TEST DATA SOIL DESCRIPTION GRAPHIC LOG GEOLOGICAL DESCRIPTION OF CORE GROUP NAME SOIL TEST PENETROMETER BI OWS GROUP DEPTH 권 Unified Soil Classification, PER 30 cm U.S.B.R. Earth Manual 2nd Edition 1966 8 16 32 64 C.C.9 Topsoil OI Black Plastic calcareous Cream See C.C.1 ML-MH clay CHIMH 2 Red-brown PLASTIC Clay end of hole 2.50 m Topsoil Black Plastic calcareous Cream See C.C.1 clay 2 LWH) Red-brown Plastic Clay E End of hole 2.50 m Black Topsoil Plastic calcareous Cream C.C.1 MI-MH Clay HWred-brown Plastic clay H end of hole 2.50 m MOISTURE CONTENT WATER CONSISTENCY COMPACTNESS RELATIVE These values refer to clay soils only and TYPE OF SAMPLE \* (Clays) (Silts) DENSITY (Sonds) provide an indication of their consistency. OPEN TUBE LOGGED BY: JCB H — Humid DRILL TYPE VS — Very Soft VL --- Very Loose -Loose D - Damp S --- Soft MC-Moderately ..... A Shoe L — Loose DATE: 27/11/78 CIRCULATION: Compact F --- Firm M - Moist .... D Shoe MD-Medium SEALED TUBE WITH NUMBER Dense Water START 27/11/78 TRACED BY: W --- Wet St - Stiff C - Compact A 1 2 3 4 5 V.St - Very Stiff S — Saturated D — Dense FINISH 27/11/78 DATE: TANDARD PENETRATION Compact VD --- Very Dense LL — Liquid Limit H — Hard 9 (2,3,4) PL — Plastic Limit SHEET .1... OF ..... 1

COMMUNITY COLLEGE ENGINEERING DIVISION HOLE NO.C.C.12, PROJECT: UNIT/STATE NO: 13, 14 LOG OF FOUNDATION HOLE LOCATION OR CO-ORDS: NORTHERN REGIONAL CENTRE SERIAL NO: **EL Surface** HD. SEC FOLDER NO. EL ref. point Datum SOIL DESCRIPTION FIELD TEST DATA GRAPHIC LOG GROUP NAME SOIL TEST PENETROMETER GEOLOGICAL DESCRIPTION OF CORE BLOWS GROUP SYMBOL DEPTH HOLE Unified Soil Classification, PER 30 cm Units \* U.S.B.R. Earth Manual 2nd Edition 1966 8 16 32 64 C.C.12 Topsoil  $\mathsf{OL}$ Black Cream. See C.C.1 Plastic calcareous clay CH-MH Plastic Clay red-brown end of hole 2.50 m -C.C.13 Topsoil Black Plastic calcareous clay Cream See C.C.1 DRY CH-MH Plastic clay red-brown end of hole 2,50 m 0 C.C.14 Topsoil Black Cream C.C.1 Plastic calcareous clay MI-MH 1 red-brown Plastic clay end of hole 2.50 m 3 MOISTURE These values refer to clay soils only and provide an indication of their consistency WATER CONSISTENCY (Clays) COMPACTNESS RELATIVE TYPE OF SAMPLE (Silts) DENSITY (Sonds) OPEN TUBE DRILL TYPEGEMCO LOGGED BY: JCB H - Humid VS — Very Soft Ls-Loose VL --- Very Loose D — Domp 5 — Soft MC---Moderately ...... A Shoe CIRCULATION: SEALED TUBE WITH NUMBER DATE: 27/11/78 Compact F — Firm MD---Medium Water C --- Compact START 27/11/78 TRACED BY: level. A 1 2 3 4 5 V.St - Very Stiff VC—Very D — Dense Soturated FINISH:27/11/78 DATE: TANDARD PENETRATION Compact VD — Very Dense LL — Liquid Limit H — Hard 9 (2,3,4) PL — Plastic Limi Total blows for 0-3n (in 0-1m increments

PROJECT: COMMUNITY COLLEGE DEPARTMENT OF MINES — SOUTH AUSTRALIA ENGINEERING DIVISION HOLE NO. C.C.15 LOG OF FOUNDATION HOLE UNIT/STATE NO: LOCATION OR CO-ORDS: NORTHERN REGIONAL CENTRE SERIAL NO: EL Surface SEC. FOLDER NO. EL ref. point Datum SOIL DESCRIPTION FIELD TEST DATA GRAPHIC LOG GROUP NAME SOIL TEST PENETROMETEI GEOLOGICAL DESCRIPTION OF CORE **BLOWS** GROUP DEPTH Unified Soil Classification, PER 30 cm Units \* U.S.B.R. Earth Manual 2nd Edition 1966 8 16 32 64 Topsoil  $o_{\mathbf{L}}$ Black Plastic calcareous Cream clay See C.C.1 1 Plastic clay Red-brown See C.C.1 CH-MH 2 end of hole 2.50 m MOISTURE CONTENT CONSISTENCY WATER COMPACTNESS RELATIVE DENSITY (Sonds) These values refer to clay soils only and provide an indication of their consistency TYPE OF SAMPLE (Clays) (Silts) OPEN TUBE GEMCO LOGGED BY: JCB H - Humid VS --- Very Soft DRILL TYPE VL — Very Loose Ls-Loose D - Damp S — Soft MC-Moderately L --- Loose ..... A Shoe DATE: 27/11/78 D Shoe SEALED TUBE WITH NUMBER CIRCULATION: Compact F — Firm M --- Moist MD-Medium Water Dense W - Wet St --- Stiff C — Compact START: 27/11/78 TRACED BY: level\_ A 1 2 3 4 5 V.St - Very Stiff D --- Dense TANDARD PENETRATION FINISH: 27/11/78 DATE: LL - Liquid Limit H - Hard WC b VD --- Very Dense 9 (2,3,4) **Nater Cut** PL - Plastic Limit SHEET .. 1. OF . . 1 .

## APPENDIX II SOILS LABORATORY TEST RESULTS



## Soils Laboratory SOIL TEST SUMMARY

NOARLUNGA REG. CENTRE

	·	July Meers	· .									LOCA	ATION			
Linear	Shrink %	20.5	10	7	10			5	2.5							
	₫;	65	25	10	Ξ	DI C		7	4						<del> </del>	
Atterberg Limits	W P	20	14	14	15	PLASTIC	1	15	16					<del>-</del>		
Atte	w.	85	39	24	26	NON		22	50			<b>.</b>				
:	Gravel										<del>                                     </del>					
ling	Sand										· · · · · · · · · · · · · · · · · · ·					,
Grading	Silt												1			-
	Clay			···												
Rel. Dens-	¥ <u>;</u> %		. 1				1									
s t/m³	Min.										:					
Dry Densities t/m <sup>3</sup>	Мах.			<del> </del>												
Dry De	Insitu										<b></b>				ļ	
Lime																
M.	%		:				5				19		20			
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Remarks			- 3.7	:		:										
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:		2.8	7.4	4.4	- 5.3	0.9				:						
Depth	(m)	2.6	7,57	4.2	5.0	5.7	6.2	-	٥.	:	1.6		1.6	<del></del>		
H H		8-4	00 8.5	00 8.6	8-7	8-8 8-8	၁ ဗ		cc 8-10		9 6		cc 12			



## Soils Laboratory SOIL TEST SUMMARY

NOARLUNGA REG. CENTRE COMMUNITY COLLEGE

**PROJECT** 

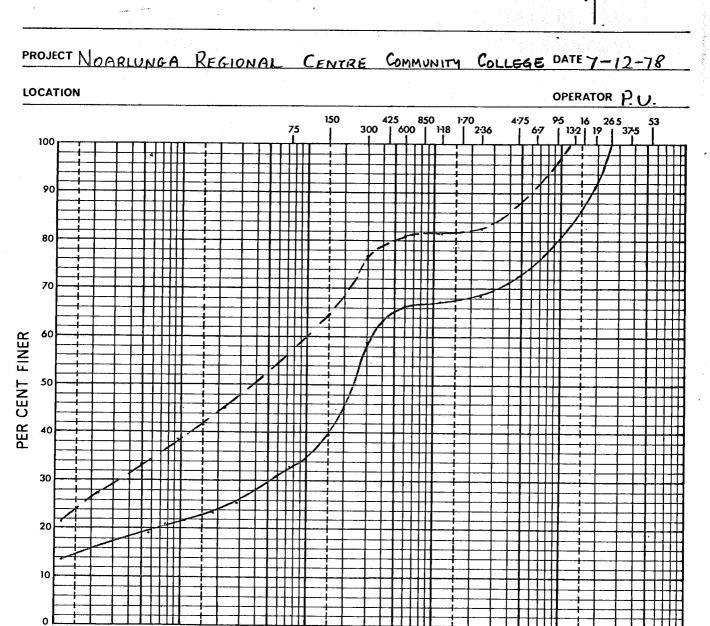
		والمنوا المسادر				···					LOCA	TION			
Linear	Shrink %		10	20.5	18	10	7		:					12.5	17.5
imits	<u>a</u> :		22	58	55	30	13					·		24	44
Atterberg Limits	WP		19	21	18	13	21							23	56
Atte	W		41	42	73	43	34	.						47	70
	Gravel	32											18		
Grading	Sand	37											27		
Gra	Silt	15											28		
	Clay	16											27		
Rel. Dens-	₹%														
s t/m³	Min.				-										
Dry Densities t/m <sup>3</sup>	Max.		···· '					:	-			1			
Dry D	Insitu					-									
Lime	%							<del> </del>							
S.		:			7			 -		19	17				
Domarke	Notigino					,									
Description		0 - 0.30	- 1.3 ML	- 2.1 MH	– 2.7 MH	- 3.6 ML	- 1.43 ML						0.25	- 1.3 ML	- 2.0 MH
Denth	(m)	0.10	1.0	1,9	2,5	3.4	4.1	5.2	<u>, i</u>	0.8	1,10		0.10	0,1	8
H		3-1	3-2	3-3	3-4	3-5	306 306	cc5	į	900	900		00 1-8	cg_2	sc 8-3 1.8 - 2.0



### Soils Laboratory MECHANICAL ANALYSIS

TRIAL HOLE

DEPTH



SIZE mm

	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY		SILT			SAND		GRAVEL

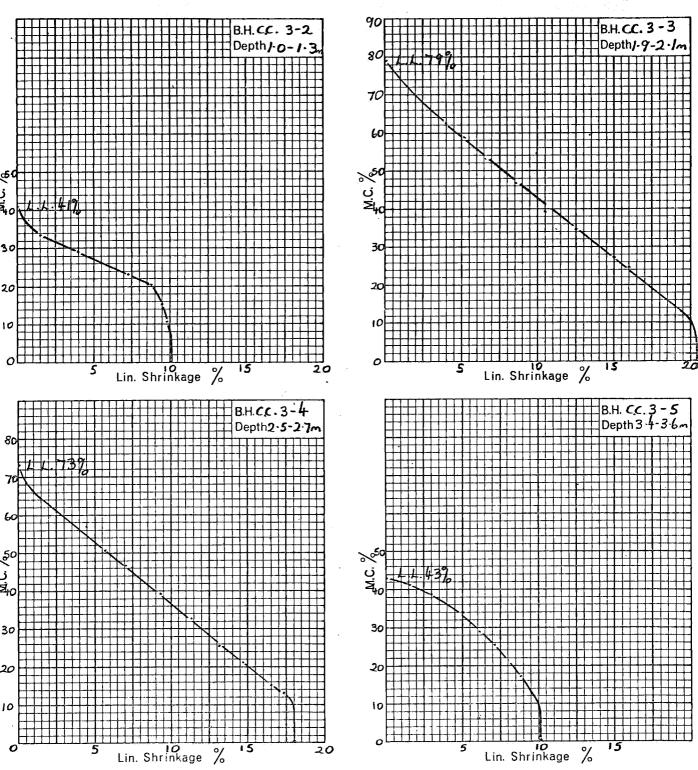
### B.S.S. & M.I.T. Classifications

	Depth metres		Line	M.C. %	Lime Cont.	Hydrometer			Sand Fraction					
						Clay	Silt	Sand	-200	Fine	Med.	Coarse	Gravel	
23-1	0-1-0-3				<del></del>	16	15	37		14	21	2	32	
cc8-1	0-1-025					27	28	27		14	12	1	18	
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NOARLUNGA REG. CENTRE. COMMUNITY PROJECT COLLEGE

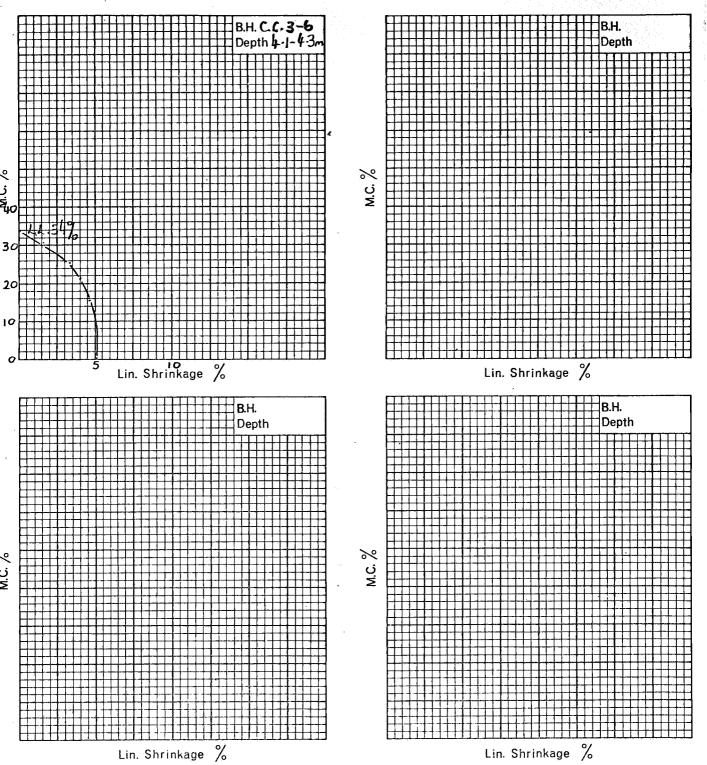
LOCATION C.C.3





NOARLUNGA REGIONAL CENTRE. COMMUNITY COLLEGE PROJECT

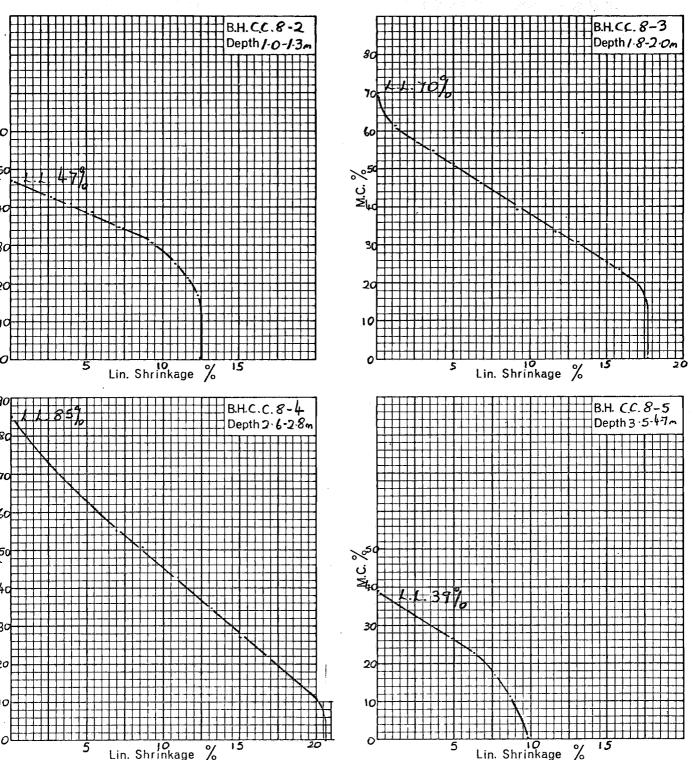
LOCATION C.C.3.





NOARLUNGA REGIONAL CENTRE. COMMUNITY COLLEGE PROJECT

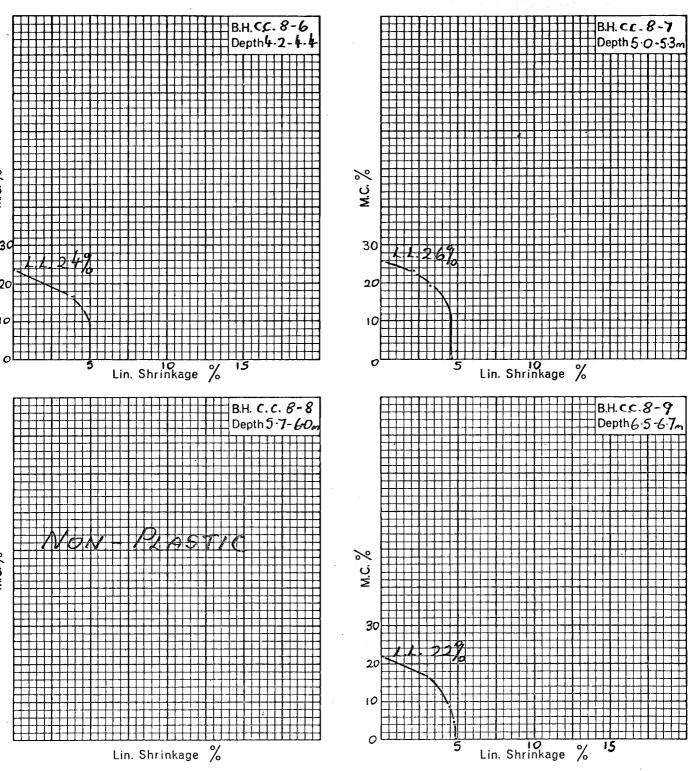
LOCATION C.C.8





NOARLUNGA REGIONAL CENTRÉ. COMMUNITY CENTRÉ PROJECT

LOCATION CC.8





NOARLUNGA REGIONAL CENTRE. COMMUNITY COLLEG PROJECT

LOCATION C.C. 8

