REPT.BK.NO. 73/15

PROPOSED SUBDIVISION - FERN HILL

Pt. Section 19, Hd. Noarlunga

REPORT ON GEOLOGICAL INVESTIGATIONS

by

S. Robertson

Department of Mines
South Australia —

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No.73/15
G.S. No. 5021
D.M. No. 1105/72
Eng.Geol.No.1972/33

GEOLOGICAL SURVEY

ENGINEERING GEOLOGY SECTION

PROPOSED SUBDIVISION - FERN HILL
Pt.Section 19, Hd.Noarlunga
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Geologist
Engineering Geology Section

16th January, 1973

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PROPOSED SUBDIVISION - FERN HILL

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REPORT ON GEOLOGICAL INVESTIGATIONS

SUMMARY AND CONCLUSIONS

A proposed subdivision at Fern Hill, Crafers, has been inspected with respect to suitability for residential development.

The area is covered by a light brown silt soil.(ML)* low plasticity with rock fragments, varying to a darker brown organic clay soil (OL) in the upper part of the subdivision. Bedrock, consisting of light coloured granite gneiss, medium strong, is shallow probably less than 1 metre.

A quarry 15 metres in diameter and with a depth of 6 metres is present in lot 3.

The subdivision is considered suitable for residential use providing the following is carried out.....

-Foundations should be excavated to bedrock.

-The quarry should be backfilled, or cleared of vegetation and the top 1-2 metres of the face cut back on a batter of 1 on 1 (45°). Buildings should be kept 25 metres uphill from the edge of the quarry.

INTRODUCTION

In a letter dated 8th November, 1972, the State Planning Office asked the Department of Mines to report on the suitability of the land for residential purposes.

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*Terms underlined and in brackets are defined in the Appendix.

The location of the proposed subdivision, showing regional geology, is given in Figure 1. A geological plan of the subdivision is given in Figure 2.

REGIONAL GEOLOGY

The subdivision is located on the Clarendon Block, one of several elongate fault blocks that make up the Mount Lofty Ranges. The site is in an area of lower Proterozoic (Carpentarian) schists and gneisses (Barossa Complex). These metamorphic rocks are the oldest exposed in the Mount Lofty Ranges and are separated from upper Proterozoic sedimentary rocks by an angular unconformity.

Near the subdivision, two inliers of Barossa Complex rocks are exposed in the cores of anticlinal folds. The western boundaries of the inliers are faulted and one of these faults (Crafers Fault) passes about 160 metres north-west of the subdivision (Sprigg and others, 1951).

SITE GEOLOGY

Topography

The subdivision is situated on the western slope of a small valley. The altitude of the site varies from 340 m to 370 m above sea level. Slopes on the site average about 15° with a flatter area at the top of the subdivision (about $5-10^{\circ}$) and a steeper area in the south-east corner (slope about 22°).

The upper part of the subdivision has been partially cultivated as an ornamental garden. The lower slopes are covered in bracken, blackberries and some trees.

Soil and Rock Types

The subdivision is composed mostly of a light brown silt soil (ML), low plasticity, containing some rock fragments. The rock fragments are weathered pebbles of granite gneiss, weak to medium strong.

In the upper part of the subdivision where cultivation has taken place the soil is a darker brown organic clay-silt soil, low plasticity (OL).

The depth to bedrock on the site is probably less than 1 metre. Numerous rock fragments are exposed in very shallow excavations. Some rock fragments are cemented in a red brown lateritic matrix. Bedrock consists of a light coloured granite gneiss, medium strong.

THE QUARRY

A quarry is situated in the eastern (downhill) end of lot 3. The uphill face is about 6 metres high and it has a diameter of about 15 metres. The quarry is completely overgrown with dense blackberries and bracken and so a close inspection was not possible.

SLOPE STABILITY

No evidence of slope instability was seen in the subdivision. Providing foundations are excavated to bedrock the area should be suitable for houses.

The quarry should be backfilled or cleared and the top 1-2 metres of the face cut back on a batter of 1 on 1 (45^{o}). Buildings on lot 3 should be kept 25 metres uphill from the edge of the quarry.

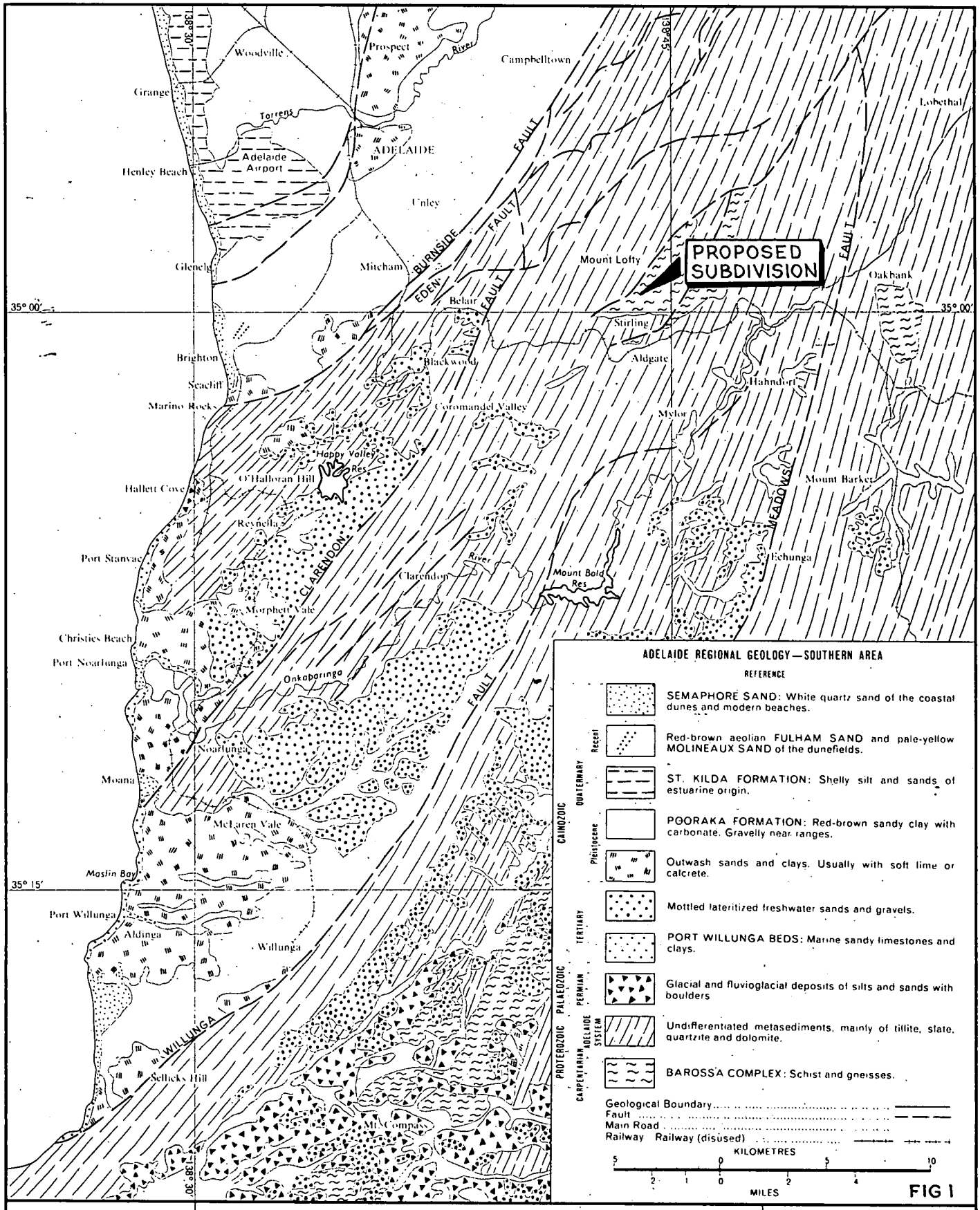
GROUNDWATER

This is not significant in the area.

R. D. Robertson

S. Robertson
Geologist
Engineering Geology Section

16.1.73
SR:CF



ENGINEERING GEOLOGY SECTION	**DEPARTMENT OF MINES—SOUTH AUSTRALIA**	Scale: 1:250.000
Compiled: R.S.R.	PROPOSED SUBDIVISION—FERN HILL	Date: 23 Jan 1973
Drn. A.F. | Ckd.	PT SEC 19 HD NOARLUNGA	Drg. No. S 10117
Geology from Adelaide and Barker 1:250.000 Geological Atlas Series	LOCATION AND REGIONAL GEOLOGY	Hg 9

PF No S9993 GH

N

THE CRESCENT

CLOSE

ANGELA

P.M.

1

2

3

4

Granite Gneiss covered by laterite

+ 1140 ft Bottom of quarry

1220

1210

1200

1190

1180

1170

1160

1150

1140

LEGEND

- Silt Soil – light brown silt soil, low plasticity, containing rock fragments. (ML)
- Organic Soil – brown organic clay–silt, low plasticity (OL)
- Geological boundary (approximate)
- 1200 Topographic contour in feet (E&W.S. datum)
- Quarry boundary

METRES

10 5 0 10 20 30

20 0 20 40 60 80

FEET

FIG 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PROPOSED SUBDIVISION — FERN HILL
PT SEC 19 HD NOARLUNGA
GEOLOGICAL PLAN

ENGINEERING GEOLOGY SECTION	R. S. Robertson. GEOLOGIST	Drn. R.S.R	SCALE: 1:330
		Tcd. A.F.	73-31
		Ckd.	Ha 9
Director of Mines	SEN GEOLOGIST	Exd.	DATE: 23 January 1973

Appendix

ENGINEERING CLASSIFICATION OF ROCK MATERIAL

1. ROCK CONDITION

TERM	ABBRN	DEFINITION
Fresh	(F)	No weathering effects visible to naked eye.
Weathered	(W)	Shows visible effects of chemical decomposition caused by air and groundwater. Can be subdivided:
Slightly weathered	(SW)	- change in appearance but no loss in strength
Moderately weathered	(MW)	- change in appearance but with significant loss in strength.
Highly weathered	(HW)	- considerable change in appearance and loss in strength. Material is still a rock but normally very weak.
Completely weathered	(CW)	- has soil properties and often shows complete change in appearance.
Altered	(A)	Shows chemical and physical alteration to rock fabric caused by temperature, pressure or injection of other material.

2. ROCK STRENGTH

Can be correlated with unconfined compressive strength tested in the laboratory.

TERM	ABBRN	$Kg\ cm^2$ (p.s.i.)	FIELD TEST
Very weak	VW	70 (1 000)	Breaks and crumbles easily in the hands.
Weak	W	70-200 (1 000-3 000)	Breaks easily with hammer tap. (Normal range of concrete
Medium strong	MS	200-700 (3 000-10 000)	Rings and breaks to firm hammer blow
Strong	S	700-1800 (10 000-25 000)	(Very difficult to break with hammer and requires sledge.
Very strong	VS	>1800 (>25 000)	

3. USE OF CLASSIFICATION

Note that Condition and Strength terms do not necessarily correspond. Strength depends on the type of rock while condition depends on external effects, e.g.

Rock Material	Condition	Strength
Granite	Fresh	Strong
Schist	Fresh	Weak

ENGINEERING CLASSIFICATION OF SOILS

The Unified Soil Classification System

COARSE-GRAINED SOILS
More than 50% of material is larger than No. 200 B.S. sieve size

FIELD INVESTIGATION PROCEDURES
Excluding particles larger than 7·5cm and basing fractions on estimated weights

			GROUP SYMBOL	GROUP NAME and typical materials
GRAVELS More than 50% of the coarse fraction is larger than 2mm. (retained on B.S.7 sieve)	**CLEAN GRAVELS** Little or no fines	Wide range in grain sizes, and substantial amounts of all intermediate particle sizes	GW	GRAVEL, well graded; gravel sand mixtures, little or no fines
		Predominantly one size or a range of sizes, with some intermediate sizes missing	GP	GRAVEL, poorly graded; gravel sand mixtures, little or no fines
	DIRTY GRAVELS Appreciable amount of fines	Non-plastic fines—for indentification see ML below	GM	GRAVEL, excess silty fines; poorly graded gravel-sand-silt mixtures
		Plastic fines—for identification see CL below	GC	GRAVEL, excess clayey fines; poorly graded gravel-sand-clay mixtures
SANDS More than 50% of the coarse fraction is smaller than 2mm. (passing B.S.7 sieve)	**CLEAN SANDS** Little or no fines	Wide range in grain sizes, and substantial amounts of all intermediate particle sizes	SW	SAND, well graded; well graded sands, gravelly sands, little or no fines
		Predominantly one size or a range of sizes, with some intermediate sizes missing	SP	SAND, poorly graded; poorly graded sands, gravelly sands, little or no fines
	DIRTY SANDS Appreciable amount of fines	Non-plastic fines—for indentification see ML below	SM	SAND, excess silty fines; poorly graded sand-silt mixtures
		Plastic fines—for identification see CL below	SC	SAND, excess clayey fines; poorly graded sand-clay mixtures

FINE-GRAINED SOILS
More than 50% of material is smaller than No. 200 B.S. sieve size

FIELD INVESTIGATION PROCEDURES
on fraction smaller than 0.4mm. (passing B.S. 36 sieve)

	SOIL CAST (soil wet)	SOIL THREAD	SHINE	DILATANCY	ODOUR	DRY STRENGTH	GROUP SYMBOL	GROUP NAME and typical materials
SILTS AND CLAYS Liquid limit less than 50	Forms fragile cast. Cracks form when kneaded while moist	Thick crumbly thread; easily broken	None to very dull	Distinct	Not significant	None to slight	ML	SILT SOIL, low plasticity; inorganic silts and very fine silty or clayey sands, rock flour
	Cast maybe handled freely without breaking. Can be kneaded moist without cracking. Material adheres to the hand	Thread can be pointed as fine as a lead pencil but is fragile	Moderate	None to slight	Not significant	Moderate	CL	CLAY SOIL, low plasticity; inorganic clays of low to medium plasticity, gravelly clay, sand, clays, silty clays, lean clays
	Cast fragile to cohesive, material will adhere somewhat to the hand	Soft, weak thread	None to very dull	Slight to distinct	Decayed organic matter	Low	OL	ORGANIC SOIL, low plasticity; organic silts and silt clays of low plasticity
SILTS AND CLAYS Liquid limit more than 50	Moderately plastic and cohesive. Material adheres somewhat to the hand	Weak to medium thread. May be crumbly	Dull	None to slight	Not significant	Moderate. Powdered soil feels floury	MH	SILT SOIL, high plasticity; inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	Very plastic and cohesive. Material very sticky to the hand. Greasy to touch	Very tough thread, can be rolled to a pin point	Very glossy	None	Strong earthy	High to very high. Cannot be powdered by finger pressure	CH	CLAY SOIL, high plasticity; inorganic clays of high plasticity, fat clays
	Plastic and cohesive. Feels slightly spongy. Greasy to touch	Weak to medium thread. Often soft and fibrous	Moderate to very glossy	None	Decayed organic matter	Moderate to high. Powdered soil may be fibrous	OH	ORGANIC SOIL, high plasticity; organic clays of medium to high plasticity
	Readily identified by colour, odour, spongy feel and frequently by fibrous texture						PT	PEATY SOIL; Peat and other highly organic soils

NOTE: BOUNDARY CLASSIFICATIONS: Soil possessing characteristics of two groups are shown as a combination of two group symbols, eg. GW-GC, well graded gravel with clay binder.

Bull.44 70—641

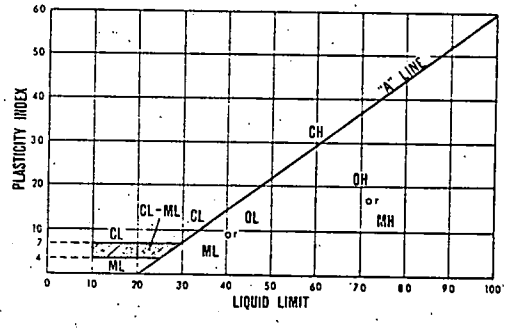
LABORATORY CLASSIFICATION CRITERIA

GRAIN SIZE CURVES to be used to identify soil fractions.

Coarse-grained soil classified on basis of percentage of fines, as follows

PERCENT OF FINES — GRAVELS: GW GP GM GC; SANDS: SW SP SM SC

- Less than 5: $Cu = \frac{D60}{D10}$ Greater than 4; $Cc = \frac{(D30)^2}{D10 \times D60}$ Between 1 and 3
- Less than 5: Not meeting all gradation requirements for GW
- More than 12: Atterberg limits below "A" line or PI less than 4
- More than 12: Atterberg limits below "A" line or PI greater than 7
- More than 12: Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
- 5 to 12 Borderline cases, use 2 symbols: $Cu = \frac{D60}{D10}$ Greater than 6; $Cc = \frac{(D30)^2}{D10 \times D60}$ Between 1 and 3
- 5 to 12 Borderline cases, use 2 symbols: Not meeting all gradation requirements for SW
- 5 to 12 Borderline cases, use 2 symbols: Atterberg limits below "A" line or PI less than 4
- 5 to 12 Borderline cases, use 2 symbols: Atterberg limits below "A" line or PI greater than 7
- 5 to 12 Borderline cases, use 2 symbols: Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE-GRAINED SOILS

Based on "The Unified Soil Classification System" United States Department of the Interior, Bureau of Reclamation "Earth Manual" First Edition, Denver COLARADO 1960.

70—641 Bull.44