DEPARTMENT OF
MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1973/165

PRELIMINARY GEOTECHNICAL INVESTIGATION OF THE BELCONNEN WEST INDUSTRIAL ESTATE, A.C.T., 1973

by

P.H. Vanden Broek

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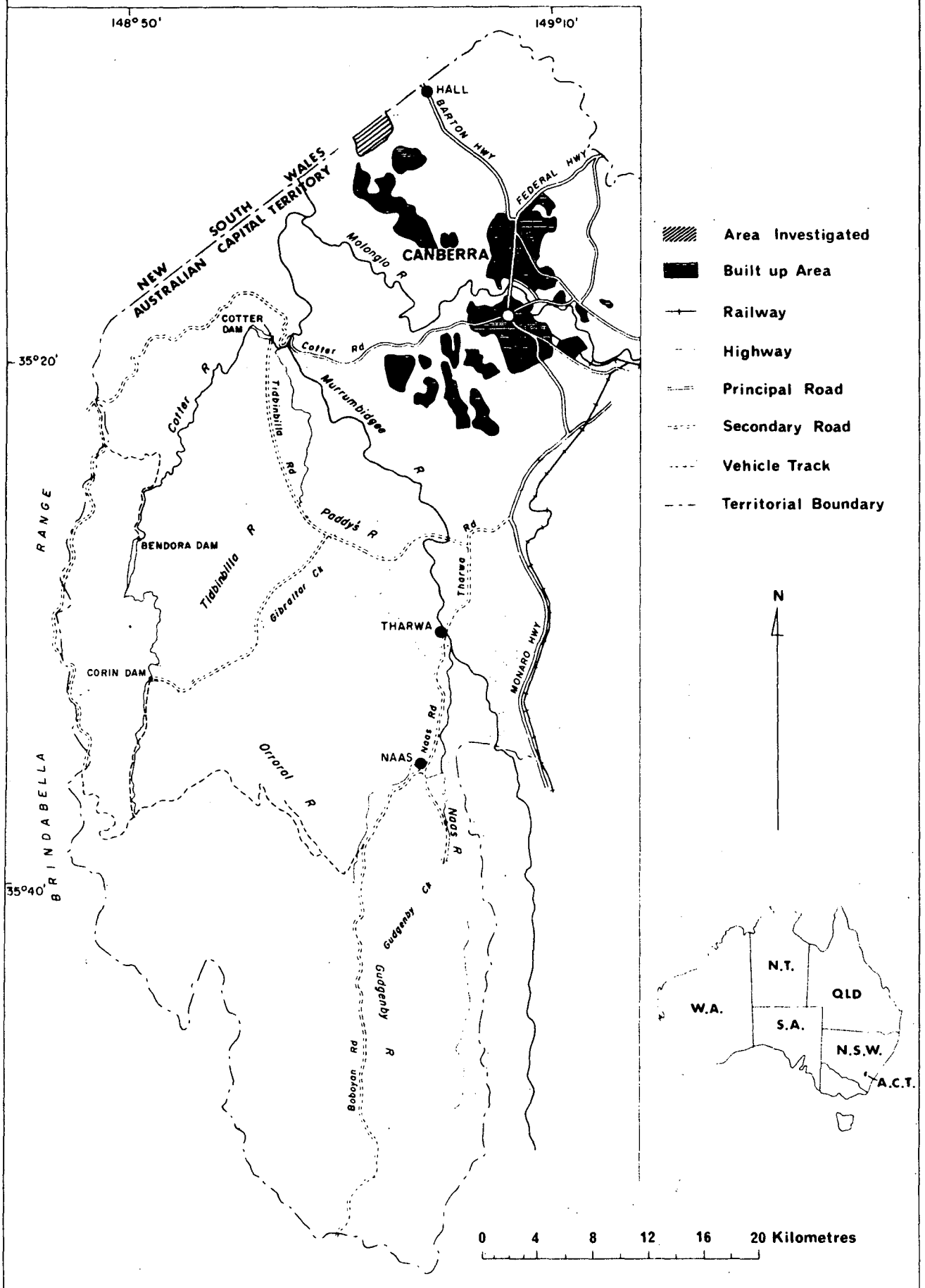
LOCALITY MAP

FIGURE 1



To accompany Record 1973/165

155/A16/995 P.B.

SUMMARY

Outcrop mapping and soils augering have been completed in the area set aside for the Belconnen West Industrial Estate. The area is mostly underlain by blue-grey rhyodacite porphyry and rhyodacite, which may be blue-grey, purple or mauve; some rhyolite is also present (Plate 1).

The thickness of soil cover has been estimated from augering, inspection of creek gullies and photo interpretation, and is shown on Plate 2. No major foundation, excavation or groundwater problems are expected in the development of the area as an industrial estate.

Excavation to a depth of three metres can be expected over most of the area before blasting becomes necessary.

INTRODUCTION

At the request of the National Capital Development Commission, the Engineering Geology Sub-section of the Bureau of Mineral Resources carried out a preliminary geotechnical study of the area set aside for the proposed Belconnen West Industrial Estate (Fig. 1). This report describes the investigations and results of the study.

All rock outcrops within the area were mapped with particular attention to the lithology and degree of weathering of outcrop and to the orientation of joints.

Soil* profiles in erosion gullies were examined and fifteen auger holes were drilled in the northern part of the area for undisturbed soil samples (Plate 2). Soil thicknesses and poorly drained areas were delineated with the assistance of aerial photographs.

GEOLOGY

Three separate geological units comprising intrusive and extrusive volcanic rocks of rhyolitic and rhyodacitic composition are separated by two major faults known as the Gooramon and Deakin Faults (Plate 1).

NORTH OF DEAKIN FAULT

Rocks in this area belong to the Deakin Volcanics (Henderson & Strusz, 1971) and where measured the strike is about 10 degrees west of north and the dip between 30 and 50 degrees west. The oldest rocks therefore are probably those that crop out in Halls Creek near Charnwood Road; these consist of fine-grained blue-grey rhyodacite (Sud_1). They are overlain by one or more interbeds of purplish rhyodacite, some of which was turned up in the back-hoe pits near Charnwood Road. The purplish rhyodacite also crops out farther to the north. The purplish rhyodacite does not crop out regularly, and its extent and continuity are not known. There are indications that other bands of purplish rhyodacite could be present within the overlying blue-grey porphyritic rhyodacite (Sud_3) which is extensive, and crops out in the remainder of the area north of the Deakin Fault.

BETWEEN DEAKIN AND GOOROMON FAULTS

Immediately south of the Deakin Fault, well dispersed low outcrops comprising rounded boulders of blue-grey rhyodacite porphyry are regarded as intrusive rock (Sp). The rock lacks the blocky jointing of the Deakin Volcanics, has a coarser texture and more homogeneous appearance.

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* The term soil is used in the general engineering sense, that is 'an aggregate of mineral grains that can be separated by such gentle mechanical means as agitation in water', under this definition, completely weathered rock is regarded as soil.

An area near the Deakin Fault and Charnwood Road is shown as containing scattered cobbles of pink porphyritic rhyodacite (Sud_2?); interpretation from aerial-photographs suggests that this area is a pendant of volcanics resting on the top of the rhyodacite porphyry.

South of 'Fassifern', an extensive area of fractured and brecciated rhyolite crops out adjacent to the Gooromon Fault, as a strip over 200 metres wide; the extent of the brecciation and ubiquitous quartz-epidote veining could be due to the proximity of the fault, and/or a brecciation effect attributable to the intrusion of the rhyodacitic porphyry.

SOUTH OF GOOROMON FAULT

The volcanics south of Gooromon Fault have been mapped as pink porphyritic rhyodacite (Sud_2); however, whilst the lithology of the rocks is similar to those further north, their position in the sequence of rocks forming the Deakin Volcanics is not known.

DEAKIN FAULT ZONE

The Deakin Fault zone is about 200 metres wide; it is closely jointed parallel to the Deakin Fault and traversed by numerous quartz veins up to 2 cm wide, also parallel to the Deakin Fault. Stress within the rock has induced the formation of chlorite, and weathering in the fault zone is expected to extend to greater depths, except where the rock is reinforced by numerous closely spaced quartz veins.

Four of the rock samples collected were submitted for thin sectioning; thin section locations and numbers are shown on Plate 1.

JOINTS

In-situ joint orientations could only be measured for the Deakin Volcanics north of the Deakin Fault. One major set of joints strikes at 115° and dips from vertical to 65° towards the north-northeast. Two minor sets strike at 030° and 160° and dip about 80° southeast and east-northeast respectively. Joint spacing varies considerably over the area and ranges from less than 15 to more than 100 cm.

ENGINEERING GEOLOGY

The effort required to excavate rock and the bearing capacity of the rock at a particular locality depend largely on the degree and uniformity of weathering; the degree and pattern of weathering is to a great extent dependent on the jointing and other rock defects such as shearing or brecciation at a particular locality. Terms used to describe weathering are set out in the Appendix.

** See Appendix for definitions of weathering terms used.

In general, the area above 561 metres consists of completely weathered rock to depths greater than three metres (Plate 2); however, rock with open jointing tends to contain boulders of partially weathered rock within the completely weathered material, and outcrops in such areas generally consist of clusters of these boulders.

Rocks at the surface have been mapped as continuous outcrop, scattered outcrop, or scattered boulders (Plate 1).

CONTINUOUS OUTCROP

Continuous rock outcrop is usually slightly to moderately weathered; if it is sheared, closely jointed or brecciated, it is likely to be highly or even completely weathered. Shear zones have only been observed close to the Deakin Fault, and brecciated rock lies between 'Fassifern' and Gooromon Fault.

SCATTERED OUTCROP

Areas with scattered rock outcrop usually include patches of slightly to moderately weathered rock on the surface and numerous cores of large, slightly weathered boulders lying within completely weathered rock below the surface.

SCATTERED BOULDERS

Areas with scattered boulders are usually associated with completely weathered rock that contain cores of less weathered rock; below the surface the depth to moderately weathered rock is usually less than in the surrounding boulder-free areas.

NO OUTCROP

Where the rock does not crop out, the stage of weathering generally decreases with increasing depth; however, the depth below the surface to rock with a particular degree of weathering may vary markedly over short distances.

SOIL

The dominant soils in the area are well developed red or yellow residual podzolic soils; they generally grade downward into completely weathered rock.

The upper 10-20 cm of the profile consists of organic topsoil (OL)*, which is usually underlain by about 20-30 cm of fine powdery silt (ML). Below this the subgrade usually comprises 20-30 cm of lean or medium plasticity clay (CL or CI) grading into a heavy clay (CH); completely weathered rock normally occurs below the clay as a sand-clay mixture or clayey sand (SC).

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* Refers to the Unified Soil Classification System (see Figure 3).

Most of the completely weathered soil material has been stripped from the Halls Creek valley near Charnwood Road and only a shallow soil cover is to be expected there; however, on the adjacent low rises, the depth to highly weathered rock exceeds 8 metres in auger holes 6, 8, and 11 (Plate 2). Low lying areas usually have a thicker heavy clay layer (CH) in the soil profile. Flat ground adjacent to Hall's Creek (Plate 2) is underlain close to the surface by a thick layer of heavy organic clay (OH) which is itself underlain by more heavy clay (see auger logs 12 and 13, fig. 2).

Soils have been mapped according to thickness as determined by the depth to highly weathered rock. Three ranges of soil thickness are shown on Plate 2; the mapping is approximate only, and its accuracy is limited. Although the soil mapping was not based on a closely spaced grid pattern of auger holes, it is nevertheless well suited to give a guide to the soil and rock conditions for general planning, but would not be adequate for, nor was it intended for, the prediction of foundation conditions at a particular site.

Column logs of auger holes drilled are presented on figure 2 and the Unified Soil Classification is presented on figure 3.

GROUNDWATER

Groundwater was intersected in auger holes 5, 6, 11, 13 and 15, where the water table was generally within 2 metres of the surface at that time (May, 1973).

The water level in the only known bore within the area was 9 metres below the surface on 13/7/73.

A perched water table develops within poorly drained soils after heavy rainfall, and the drainage of such soils during winter is slow. The most poorly drained areas are shown on plate 2; however, the construction of trenches as part of normal urban development should improve drainage of these areas without the provision of special measures.

No perennial springs are present in the area.

CONCLUSIONS

1. No major foundation or excavation problems are expected in the development of the area as an industrial estate.

2. Soils have adequate bearing strength for most types of industrial buildings, though investigations will be required, especially if heavy plant is to be installed.

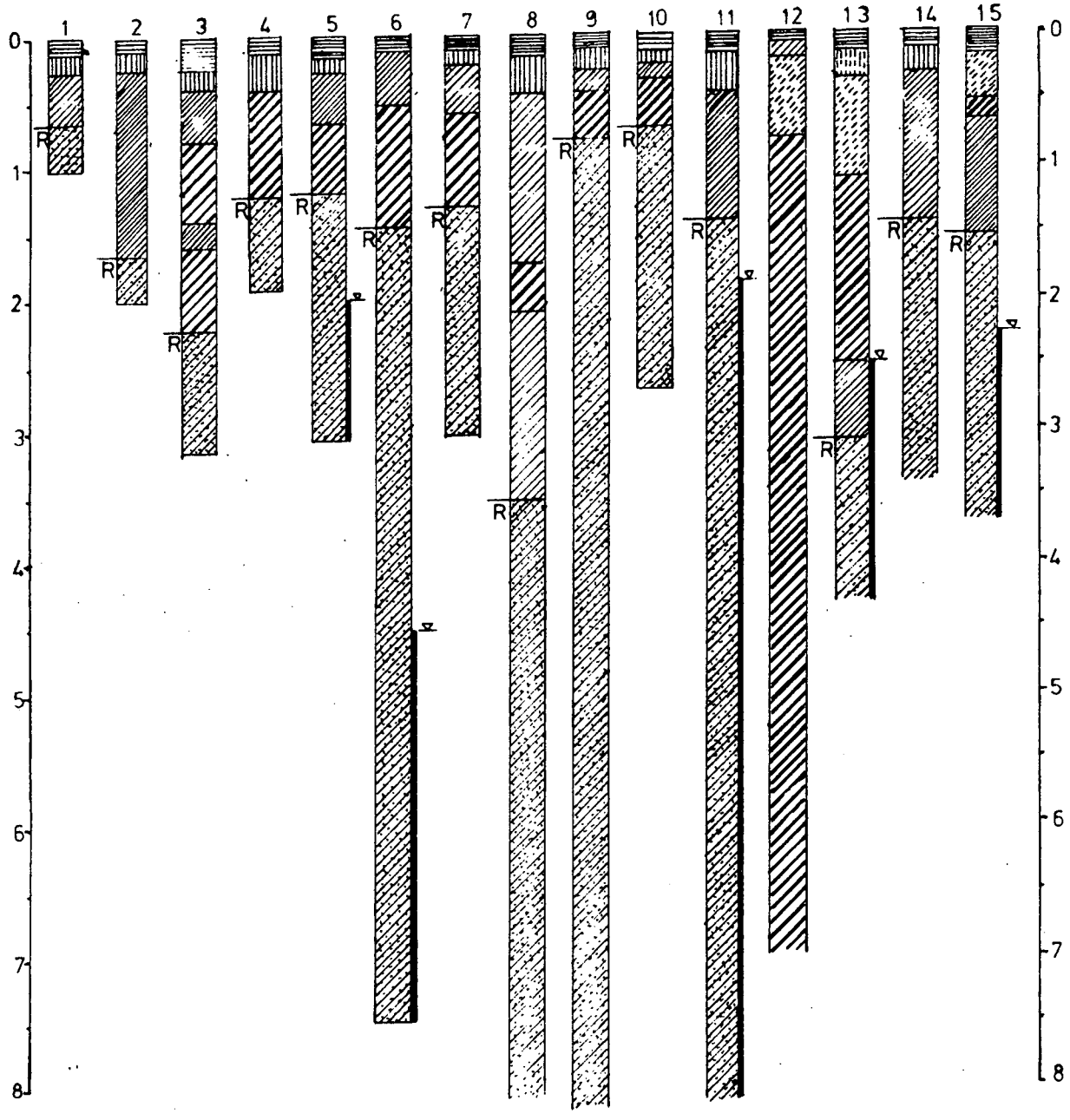
3. Groundwater problems are not expected once the area is fully serviced.

4. Excavations over about 80 percent of the area can be carried out to a depth of at least three metres before blasting becomes necessary.

COLUMN LOGS OF AUGER HOLES

FIGURE 2

(to be read in conjunction with figure 3)



SCALE 2 centimetres = 1 metre

Heavy black lines denote extent of aquifer intersected

▽ Standing water level

R Commencement of weathered rock

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UNIFIED SOIL CLASSIFICATION SYSTEM

FIGURE 3

CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than 1/2 of soil > No 200 sieve size	GRAVELS (More than 1/2 of coarse fraction > no. 4 U.S. sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines*
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixture
		GC	Clayey gravels, gravel-sand-clay mixture
	SANDS (More than 1/2 of coarse fraction > no.4 U.S. sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand silt-mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS More than 1/2 of soil < No. 200 sieve size	SILTS AND CLAYS Liquid limit > 50	ML	Inorganic silt and very fine sands, rock flour, silty or clayey fine sands or clayey silts with low plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticty
	SILTS AND CLAYS Liquid limit > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

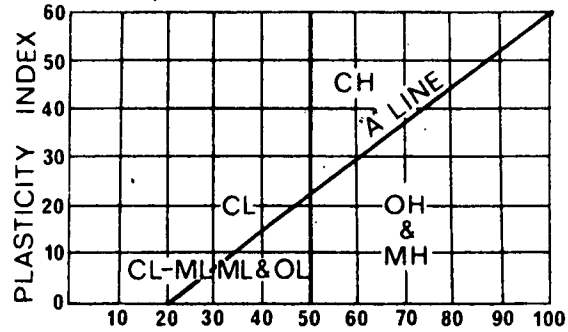
*fines - portion of a soil finer than a no. 200 sieve

GRAIN SIZE CHART

Classification	Range of grain size	
	U.S. Standard Sieve Size	Grain Size in Millimetres
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76·2
GRAVEL	3" to No. 4	76·2 to 4·76
coarse	3" to 3/4"	76·2 to 19·1
fine	3/4" to No. 4	19·1 to 4·76
SAND	No. 4 to No. 200	4·76 to 0·074
coarse	No. 4 to No. 10	4·76 to 2·00
medium	No. 10 to No. 40	2·00 to 0·420
fine	No. 40 to No. 200	0·420 to 0·074
SILT & CLAY	Below No. 200	Below 0·074

PLASTICITY CHART

(adopted from various sources)



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REFERENCES

HENDERSON, G.A.M., & STRUSZ, D.L., 1971 - 1:50 000 Geological Map, Canberra City, A.C.T. Bur. Miner. Resour. Aust. explan. Notes.

VANDENBROEK, P.H., 1971 - Geological Investigation of the proposed Belconnen Refuse Disposal area. Canberra City District, A.C.T. Bur. Miner. Resour. Aust. Rec. 1971/132 (unpubl.).

APPENDIX

WEATHERING - DEFINITION OF TERMS

FRESH:	Rock shows no discolouration or loss of strength.
SLIGHTLY WEATHERED:	Rock is slightly discoloured but not noticeably weakened; a two-inch diameter drill core cannot usually be broken by hand across the rock fabric.
MODERATELY WEATHERED:	Rock is discoloured and noticeably weakened, but a two inch drill core cannot usually be broken by hand across the rock fabric; ripping by bulldozer not possible.
HIGHLY WEATHERED:	Rock is usually discoloured and weakened to such an extent that a two-inch drill core can readily be broken by hand across the rock fabric. Wet strength generally lower than dry strength; ripping with bulldozer may be possible along joint planes.
COMPLETELY WEATHERED:	Rock is discoloured and entirely broken down to an aggregate of particles that has the mechanical property of a soil; the original fabric of the rock is mostly preserved. The properties of the soil depend on the composition of the parent rock; easily ripped by a bulldozer.

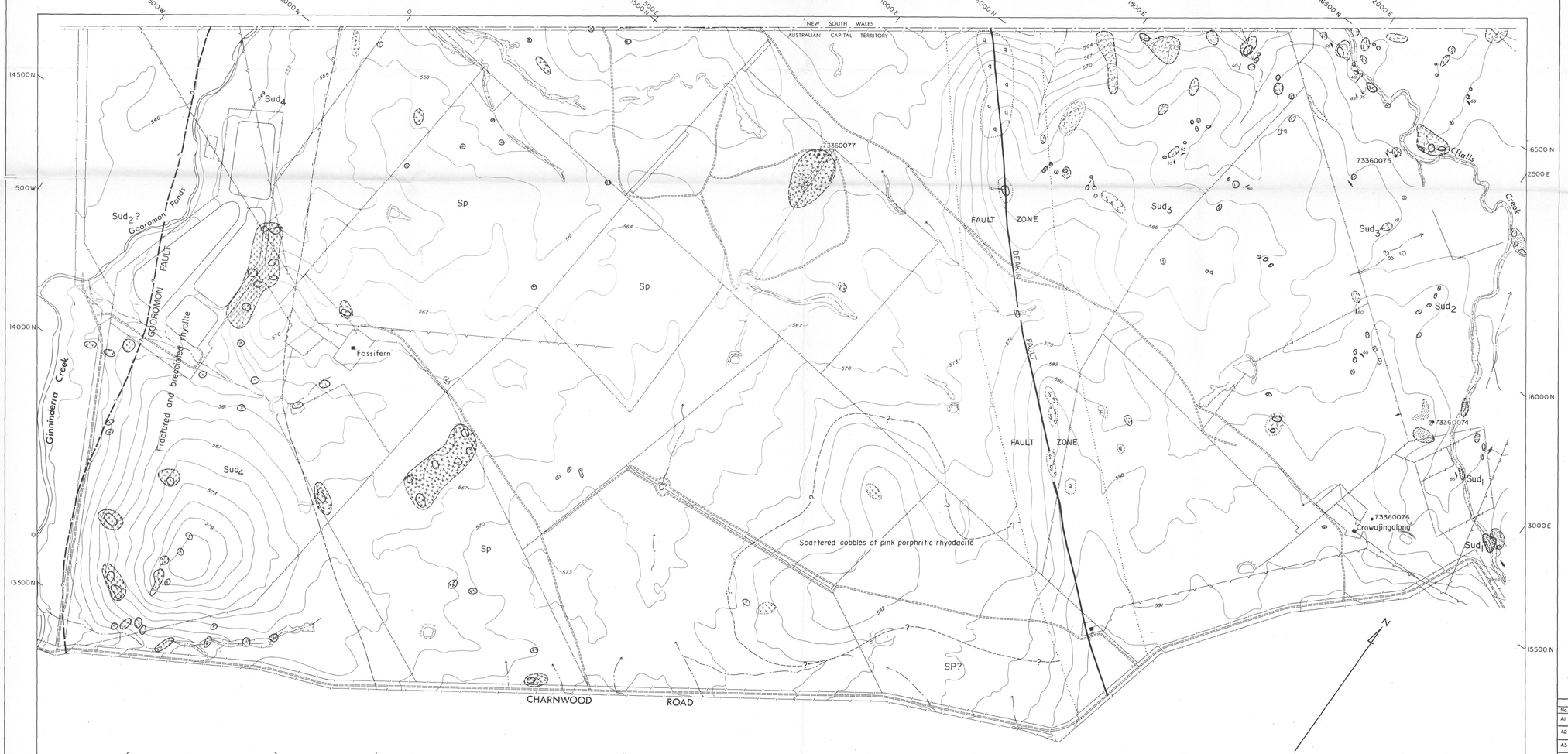
PLATE 1

BELCONNEN WEST INDUSTRIAL ESTATE

OUTCROP GEOLOGY

SCALE 1:5000

Grid co-ordinates in metres with origin at Stromlo trig station



Grid co-ordinates in metres with origin at Stromlo trig station

- Road
- Track
- Fence
- Power transmission line
- —570— Contour in metres (three metre intervals)
- Permanent creek
- Stream, intermittent showing direction of flow
- Erosion gully
- Dam

ROCK TYPE

- Sil — *Silicified and kaolinised rhyodacite of the Deakin Fault zone*
- Sp — *Blue-grey rhyodacite porphyry*
- Sud_4 — *Porphritic rhyolite*
- Sud_3 — *Blue-grey porphritic rhyodacite*
- Sud_2 — *Pink and purple porphritic rhyodacite*
- Sud_1 — *Blue-grey rhyodacite*

ROCK DISTRIBUTION

- Continuous outcrop
- Scattered outcrop
- Scattered boulders
- q Quartz
- •73360074 Thin section location
- Fault, position accurate
- —?— Fault, position approximate
- Boundary fault zone
- —?— Geological boundary, concealed
- 80 Joint, dip indicated
- Joint, dip vertical
- 40 Strike and dip of bedding

AMENDMENTS			
No.	Description	Author	Checked
A1			
A2			
A3			
A4			
A5			

SCALE 0 100 200m

Base map/survey 1:2400 detail series

Geology by P.H. VandenBroek

Compiled and checked — Project geologist

Checked and approved — Senior geologist

Supervising geologist

COMMONWEALTH OF AUSTRALIA
BUREAU OF MINERAL RESOURCES
CANBERRA, A.C.T.

TITLE: OUTCROP GEOLOGY

PROJECT: BELCONNEN WEST INDUSTRIAL ESTATE

To accompany Record: 1973/165

Drawn by: P.L. Blythe

Drawing No.: 155/A16/1030

To accompany Record 1973/165

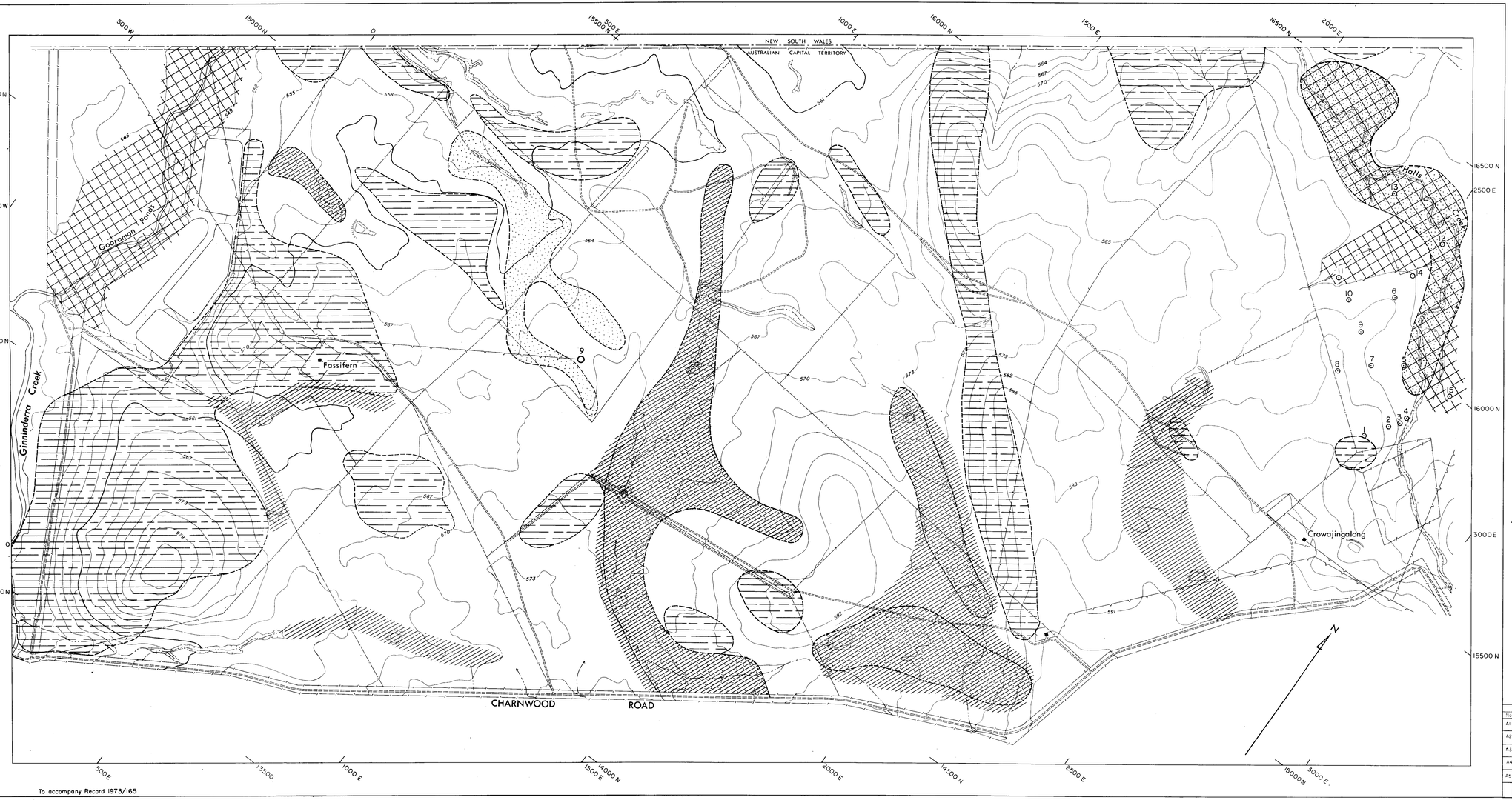
PLATE 2

BELCONNEN WEST INDUSTRIAL ESTATE

SOIL THICKNESS MAP

SCALE 1:5000

Grid co-ordinates in metres with origin at Stromlo trig station



- Road
- Track
- Fence
- Power transmisson line
- 570 Contour in metres (three metre intervals)
- Permanent creek
- Stream, intermittent showing direction of flow
- Erosion gully
- Dam

SOIL THICKNESS

- 0 – 3 metres
- 3 – 5 metres
- over 5 metres
- Approximate soil thickness boundary
- Areas of poor drainage which have a high seasonal perched water table
- Areas which normally have a water table close to the surface
- 7 Auger hole
- 9 Bore, showing depth to water table in metres

To accompany Record 1973/165

AMENDMENTS			
No.	Description	Author	Checked
A1			
A2			
A3			
A4			
A5			

SCALE 0 100 200 m

Base map/survey 1:2400 detail series

Geology by P.H. VandenBroek

Compiled and checked | Checked and approved

Project geologist | Senior geologist

Supervising geologist

COMMONWEALTH OF AUSTRALIA
BUREAU OF MINERAL RESOURCES
CANBERRA, A.C.T.

TITLE SOIL THICKNESS MAP

PROJECT BELCONNEN WEST INDUSTRIAL ESTATE

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