



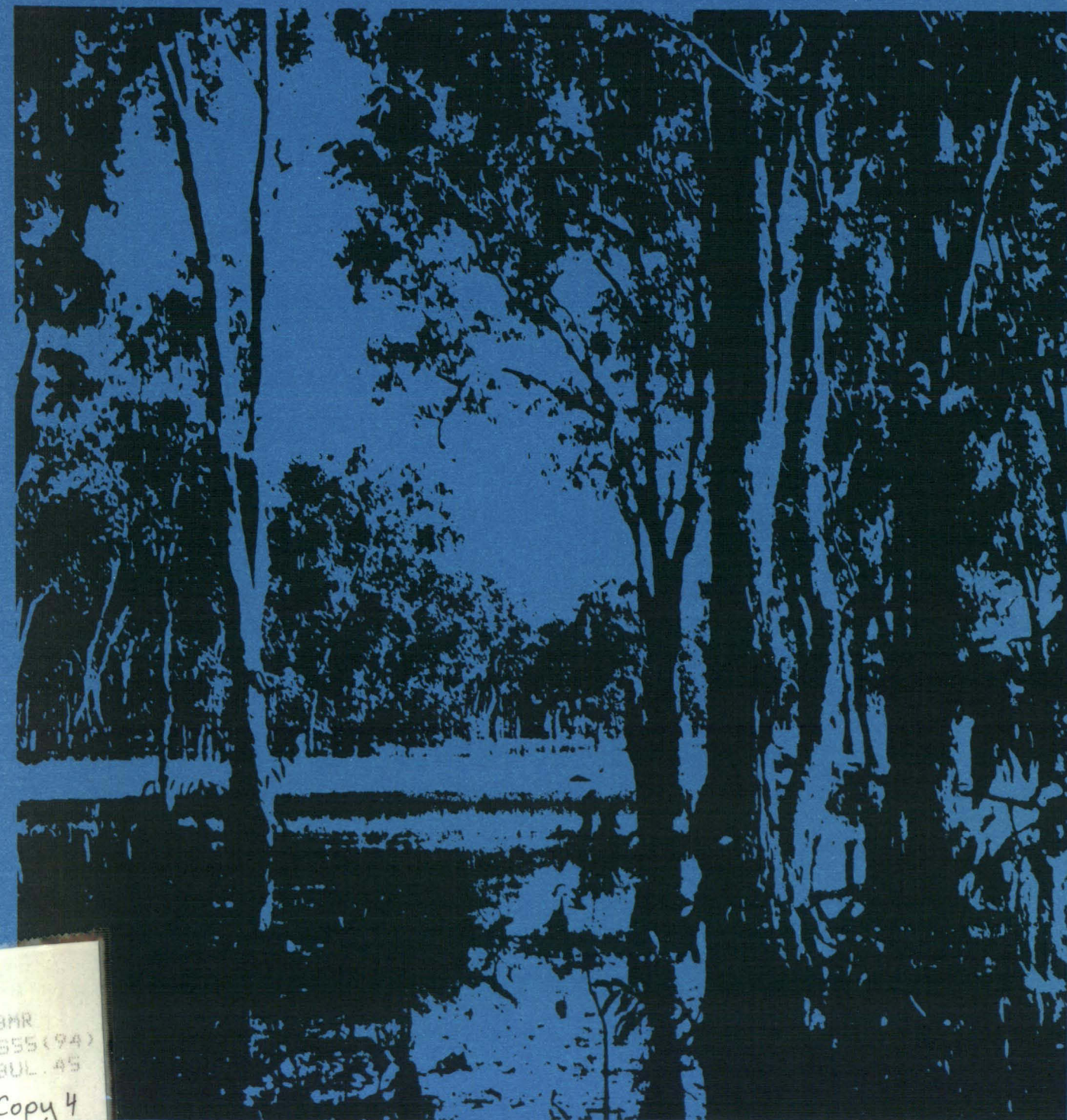
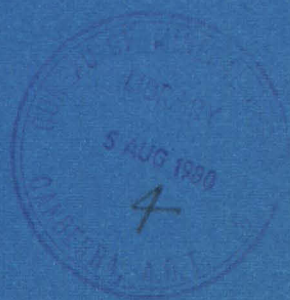
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Engineering geology of Darwin East, NT

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P.H. Vanden Broek



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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

BULLETIN 203

**Engineering geology of the proposed
Darwin East urban development area,
Northern Territory**

P.H. VANDEN BROEK

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Front cover: *Melaleuca* stands around the southern end of Marlows Lagoon — one of several perennial lagoons in the Darwin East acquisition area.

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CONTENTS

	<i>Page</i>
ABSTRACT	v
INTRODUCTION	1
Location	1
Topography	1
Climate	1
Geotechnical constraints defined or inferred from previous studies	1
Health constraint	1
Purpose of the investigation, and fieldwork	1
Acknowledgements	1
GEOLOGY	2
Regional geology	2
Local geology	3
Coomalie Dolomite	5
Golden Dyke Formation	5
Masson Formation	5
Petrel Formation	5
Darwin Member of the Bathurst Island Formation	5
GEOMORPHOLOGY AND LATERITISATION	7
Geomorphology	7
Subsidence dolines and lagoons	11
Products of lateritisation	11
Relation of geomorphology and lateritisation to the distribution of the soil types	11
SOILS	13
Lateritic soils	13
Other soils	13
GROUNDWATER	14
Groundwater occurrence	15
Springs	16
Groundwater-levels and the potentiometric surface	17
McMinns Borefield	20
DRAINAGE	20
Catchment drainage	20
Catchment drainage proposals	22
SEISMICITY	24
RESOURCES	24
CONSTRAINTS	27
Foundation conditions	27
Excavation characteristics	27
Slope stability	27
Areas deficient in soil	27
Special drainage provisions	27
PLANNING CONSIDERATIONS	28
Geological monuments	28
Refuse disposal	28
Access to East Arm	28
Alternative site for Darwin airport	28
Possible dredging of a marina	28
Location of a sewerage treatment plant	28
Use of sewerage effluent	28
CONCLUSIONS	30
Effect of geology on urban development	30
Effect of geomorphology and soil distribution on urban development	30
Effect of groundwater and natural drainage on urban development	30
Miscellaneous considerations	30
RECOMMENDATIONS	31
Geology	31
Groundwater	31
Drainage	31
Miscellaneous	31
REFERENCES	31
APPENDIX 1: Definitions of engineering geology terms	32
APPENDIX 2: Lateritisation and its products	32
APPENDIX 3: Modified Mercalli Scale	33
APPENDIX 4: Depths of water-levels (in metres) in auger and drillholes, June-December 1974	)On microfiche
APPENDIX 5: Geological logs of drill and auger holes	)in back pocket

TABLES

1. Summary descriptions of rock types	4
2. Summary descriptions of soil types	14
3. Earthquakes with magnitudes (MS) greater than 6.9 between 1900 and 1974 in the area bounded by latitudes 5-20° S and longitudes 125-135° E	24

FIGURES

1. Location map	vi
2. Topographic and locality map showing drill and auger holes	2
3. Physiographic map	3
4. Rainfall distribution for Darwin	5
5. Geological map	6
6. Map of ancient land surfaces	7
7. Geomorphological development of the Darwin East area	8
8. Formation of subsidence dolines, drainage basins, and perennial lagoons	10
9. Generalised soils map	12
10. Diagrammatic sections showing the formation of springs	16
11. Reduced water-levels and potentiometric surface contours	17
12. Potentiometric contours for August 1974 in the central part of the area	18
13. Interpretative fence diagram showing potentiometric levels and direction of groundwater flow in relation to the distribution of soil and rock types	19
14. Map of natural surface drainage	21
15. Water entering the western end of the main channel that was excavated through Churcher Lagoon	22
16. Map of drainage proposals	23
17. Earthquake epicentres in the central-north Australia/southeast Indonesia region	25
18. Resources and constraints map	26
19. Map of planning considerations	29

ABSTRACT

Field mapping, augering, and rotary core drilling have defined the main geological constraints to urban planning in the proposed Darwin East urban development area. The area is underlain by a sequence of subhorizontal Mesozoic rocks unconformably overlying a gently folded sequence of Lower Proterozoic rocks, which include cavernous dolomite. The overlying rocks have in places subsided into the cavernous dolomite to form dolines. A highly plastic clay lining the floor of these dolines has transformed some of them into perennial and ephemeral lagoons.

Geomorphological processes have developed four major land surfaces which contain the present-day physiographic features and determine the distribution of the soil types. Of the twelve soil types mapped, planosol and yellow lateritic podzolic soils are expected to be troublesome: they have poor drainage characteristics.

The establishment of a piezometer network, and subsequent water-level measurements, indicate that the groundwater catchments for the springs on the southern escarpment are likely to be more extensive than previously thought because the groundwater divide does not correspond to the topographic highs. Of the proposed alternative drainage schemes, a conventional scheme which minimises infiltration is favoured. Some supplementary subsurface drains might have to be installed to effectively drain the ephemeral lagoons and broad flat drainage depressions. Maintenance of the water-levels in the perennial lagoons is preferred to draining them.

A plot of earthquake data indicates that nearly all seismic activity originates in the Banda Sea area, north of Australia. A comparison of data recorded from earthquakes in this area since early this century with a more recent Banda Sea earthquake of known felt intensity suggests that an earthquake with a felt intensity of MM V in Darwin can be expected at least once every 50 years.

Coarse aggregate is readily available in the area, and resources of fine aggregate, fine sand, gravel, and topsoil may prove to be substantial. Extraction could be integrated with a sanitary method of garbage disposal.

Some foundation problems can be expected for large structures sited above subcropping cavernous dolomite or completely weathered mudstone and shale. Planosols in the area have low bearing strengths when they are saturated, but these should not be a problem once urban drains are installed. Excavation for services will be difficult and expensive where quartzite crops out or lies just below the surface.

Some sites are worthy of preservation as geological monuments. Rock bars, suitable for the foundation of relatively inexpensive embankments, occur adjacent to East Arm and Elizabeth River. A possible alternative site for an airport, northeast of Knuckey's Lagoon, lies partly within and adjacent to the Darwin East urban development area. Scope exists for the planning of a marina in Hudsons Creek, and for the use of sewerage effluent to irrigate part of the Mitchells Creek catchment.

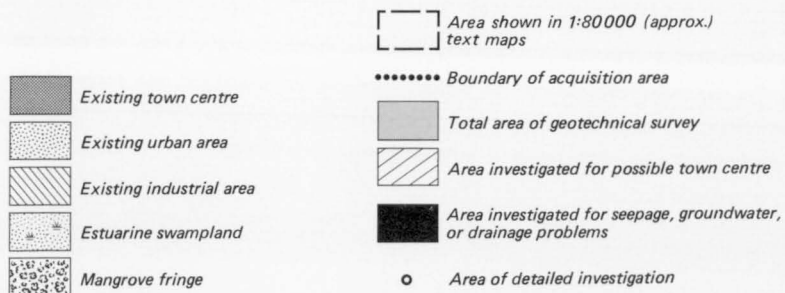
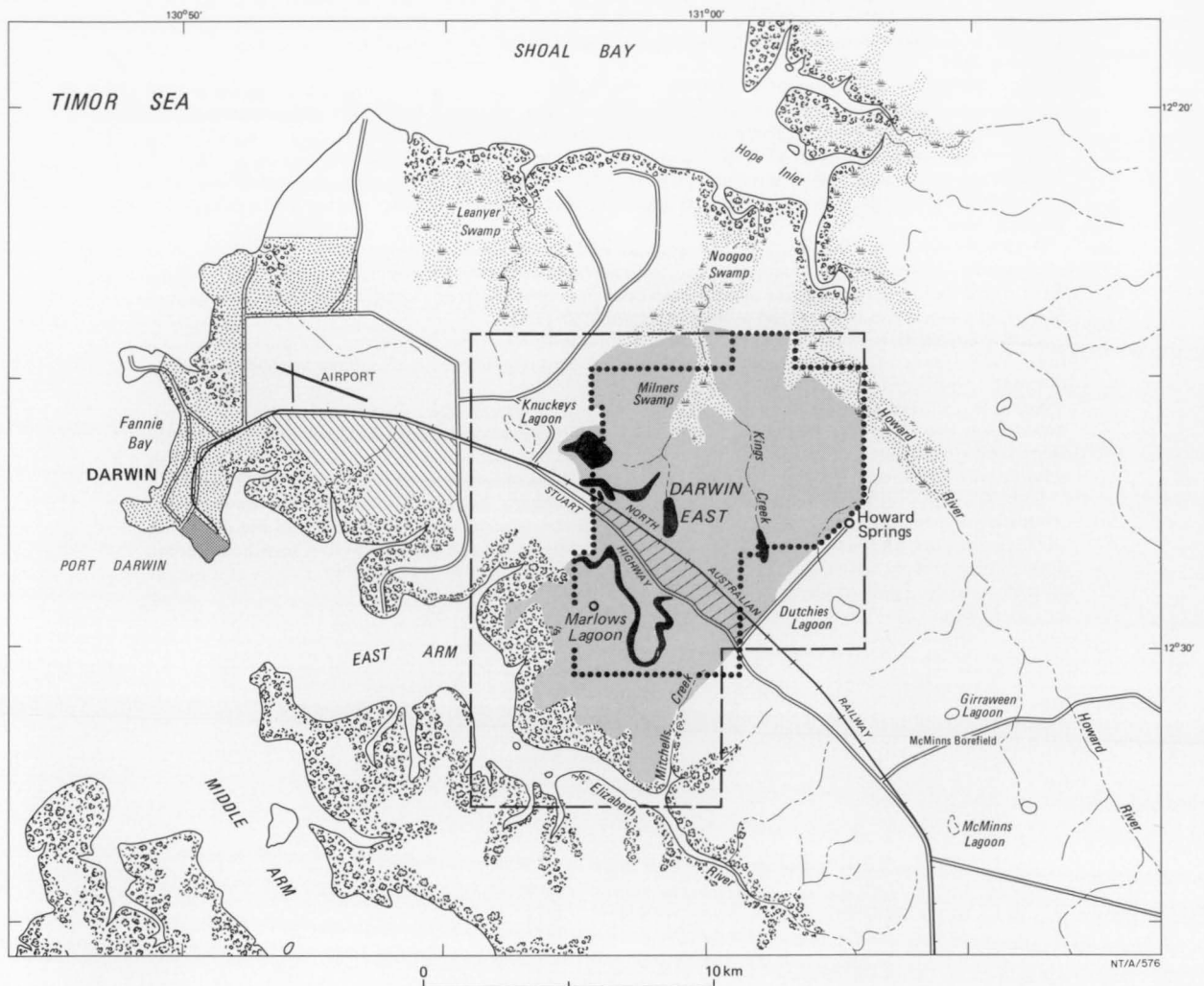


Fig. 1. Location map.

INTRODUCTION

The Darwin East area was acquired by the Australian Government in 1973 for urban development to accommodate 180 000 people. Planning was well advanced for the southern part of the area when a number of geotechnical and health constraints became apparent (Howe & Dunlop, 1973). These planning constraints made the selection of a site for initial development a complex problem: selection of a portion of either the northern or the southern part of the area would commit medium-term development in that direction.

Location

The Darwin East acquisition area occupies 83 km², and its western boundary is about 13 km east of the city of Darwin (Fig. 1). The Stuart Highway and North Australian Railway traverse the area from northwest to southeast and divide it into three parts, referred to as the northern, central, and southern parts.

For the purpose of this Bulletin the Darwin East area includes an extension to the south of the acquisition area, as far as the southern mangrove fringe.

Topography

The Darwin East area has a mature topography of low relief (Fig. 2); more than two-thirds of it has an elevation of less than 33 m (DTD)*, the highest point being only 52 m (DTD).

The natural physiographic features of the area (Fig. 3) include a central plateau; northern and southern dissected coastal plains; estuarine swamps; a mangrove fringe; ephemeral and perennial lagoons; and broad drainage channels.

The plateau is a broad divide between streams flowing north into Hope Inlet and those flowing south to the Elizabeth River and East Arm. Much of the plateau drains to the north as part of the Milners Creek catchment. Infiltration to the water-table is facilitated by the permeable underlying soil and rock. The high water-table formed during the wet season is responsible for the emergence of considerable spring flow along the plateau's northern margin and southern escarpment.

Climate

The climate of the Darwin area is monsoonal; the wet season may last for 7 months, from October to April, but most rain falls between December and March.

The mean annual rainfall is 1550 mm (measured over 86 years); its distribution throughout the year is shown in Figure 4, which also shows the monthly precipitation for the exceptionally wet 1973-74 and 1974-75 wet seasons. Total precipitation from September 1973 to April 1974 was 2105 mm, and from September 1974 to April 1975, 2240 mm (measured at Darwin Airport). The previous highest recording was 2164 mm in 1910 (Bureau of Meteorology).

The hottest month is usually November, when the mean maximum is 34°C and the mean minimum is 26°C; the coolest month is July, when the mean maximum is 30.3°C and the mean minimum is 20°C. Relative humidity exceeds 70 percent in the wet season, and the mean annual relative humidity is over 60 percent.

Geotechnical constraints defined or inferred from previous studies

The following geotechnical constraints, which were defined or inferred from previous studies, have been reviewed during the present investigation:

General

1. The risk of polluting McMinns Borefield (Fig. 1) if urban development proceeds in the Darwin East area.

* Contours on all maps are in metres above Darwin Town Datum (DTD). To convert to height above mean sea level (Australian Height Datum, AHD) subtract 3 m.

2. The extent to which cavernous dolomite, widespread beneath the area, will influence the foundation conditions for large buildings.

3. The degree of seismic risk associated with a previously mapped fault just south of the highway.

Southern part

4. The extent of known seepage areas and their persistence throughout the year.

5. The possibility that much of the seepage water is fault-transmitted artesian water.

6. The likelihood that soils with low bearing strengths reported to be thixotropic would unduly restrict development.

Northern part

7. The suggestion that if the land at present being quarried for coarse aggregate were relinquished (so that it may be developed for urban use) the future cost of production of coarse aggregate for the area would increase sharply.

Health constraint

The Department of Health requires a 1.6-km buffer zone around all major potential mosquito breeding grounds. These are considered to be bodies of ponded water that cannot be effectively sprayed or chemically treated, drained, or maintained at sufficient depth to prevent mosquitoes breeding.

Purpose of the investigation, and fieldwork

The purpose of the investigation was mainly to assess the significance of the various geotechnical constraints to urban development, but also to obtain information on the distribution and nature of the rock and soil types, and a more detailed knowledge of groundwater conditions.

The fieldwork was done between May and August 1974 in association with the Mines Branch of the former Department of the Northern Territory, on behalf of the Cities Commission. The soils and geology were mapped at the detailed scale of 1:10 000, and all known outcrops were examined by the author or by geologists of the Mines Branch. Auger, rotary core, and diamond drilling supplied subsurface information; logs of the holes are in Appendix 5 (on microfiche). A network of piezometers was established, so that fluctuations in groundwater-levels might be observed (Appendix 4, on microfiche). An airborne magnetic and radiometric survey was flown, to ascertain whether the rocks in the area have characteristic physical properties that could be mapped; owing to the extensive Lower Cretaceous siltstone cover the results did not greatly facilitate airphoto-interpretation and expedite field mapping, though areas of laterite were apparent on the radiometric contour map. Additional information was available from auger drilling by the Mines Branch (Newton, 1974).

Observations made on revisiting the area in early March 1975 (after record February rainfall, Fig. 4), supplemented by groundwater and other field observations made during the earlier fieldwork, make informed comment on the surface drainage possible.

From the information gathered it was possible to determine the general geomorphology and weathering of the area; the nature of the perennial and ephemeral lagoons; the nature of spring flow; the resources likely to be available for construction; the general foundation conditions and excavation characteristics; and the feasibility of other planning considerations. Seismicity for the area has been predicted from information supplied by the BMR Observatory Group.

Acknowledgements

I thank the staff of the Mines and Water Resources Branches of the former Department of the Northern Territory for their valuable assistance, and Mr R. Melsom of the BMR Cartography Section for drawing the figures.



Fig. 2. Topographic and locality map showing drill and auger holes.

GEOLOGY

REGIONAL GEOLOGY

Noakes (1949) and Walpole, Crohn, Dunn, & Randal (1968) reported on geological surveys of the Katherine-Darwin region, which — in its central and northern parts — includes the Darwin East area. The region is part of the Australian Precambrian shield, which has been

comparatively stable since it formed, and contains rocks of Proterozoic, Cambrian, Ordovician, Jurassic, Cretaceous, and Cainozoic ages overlying highly metamorphosed Archaean basement rocks.

The central and northern parts of the region are made up of folded, slightly metamorphosed Lower Proterozoic rocks

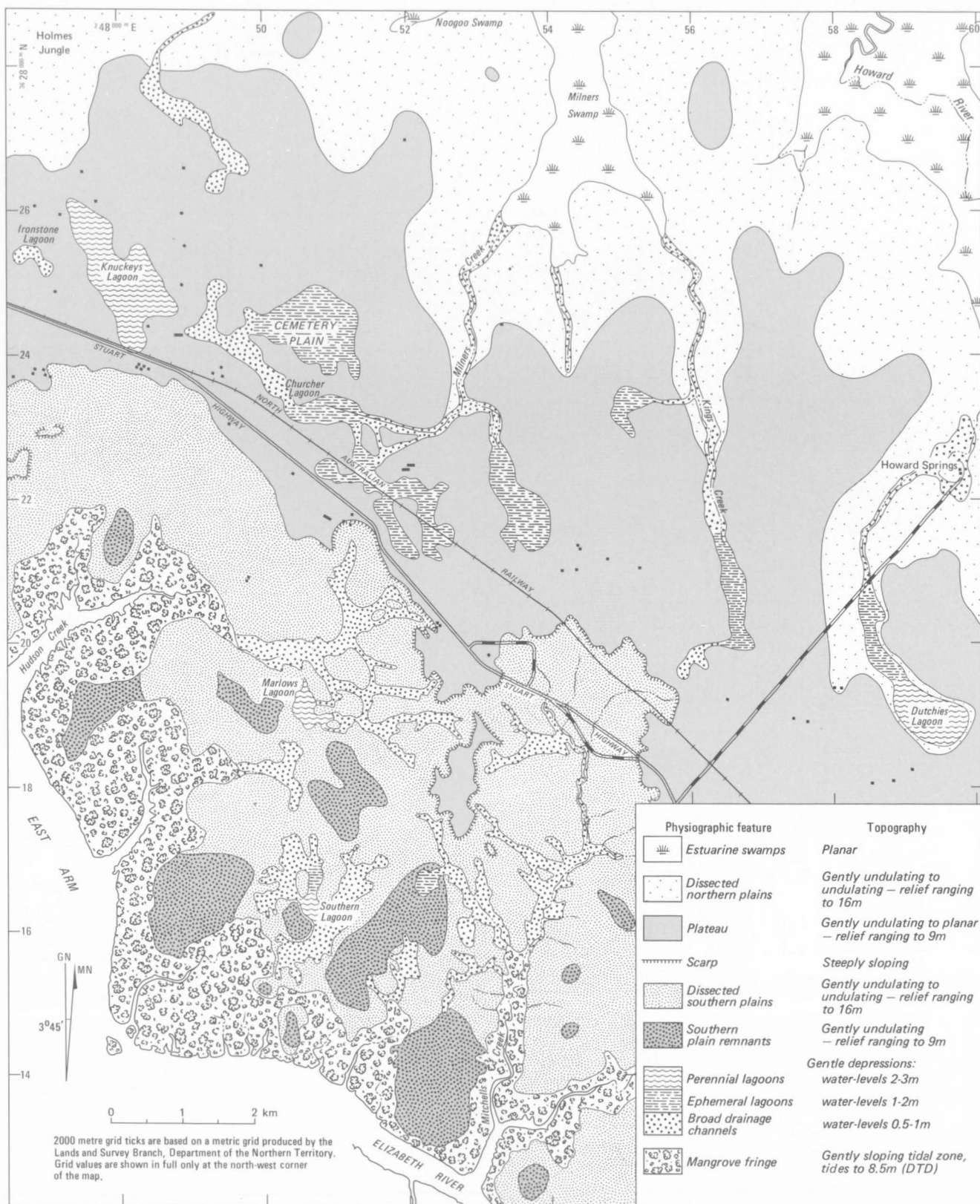


Fig. 3. Physiographic map.

of the Pine Creek Geosyncline that have been intruded by large granite bodies and basic to intermediate sills and dykes. These rocks have been mapped in great detail in the Rum Jungle/Batchelor area, where they have been subdivided into four groups – each containing a number of formations (Walpole & others, 1968).

Mesozoic sedimentary rocks unconformably overlie the

Lower Proterozoic rocks. They are residuals of a once extensive veneer of epicontinental sediments.

LOCAL GEOLOGY

Lower Proterozoic rocks within the area belong to the Batchelor and Goodparla Groups and are represented by the Coomalie Dolomite, the Golden Dyke Formation, and the Masson Formation. The Masson Formation includes a

TABLE 1. SUMMARY DESCRIPTIONS OF ROCK TYPES

Age	Stratigraphic unit			Rock type	Colour	Distribution	Description	Exposure	Weathering and alteration	Strength and hardness	Foundation conditions	Excavation characteristics	Defects	Possible uses
Early Cretaceous	Bathurst Island Formation	Darwin Member	Upper unit	Mainly siltstone	White, usually with red-brown staining	Extensive in the central part of the area; up to 40 m thick (drillhole 1)	Radiolarian siltstone, some basal conglomerate	Mostly as horizontal sheets	Strongly lateritised, developing the standard lateritic profile	Strong, hard	Good, but may be underlain by less competent rocks	Moderate blasting required below soil cover	Irregular spheroidal fracture surfaces	Fill, riprap, etc.
			Lower unit	Mainly sandstone	Yellow	Generally restricted to the lower-lying areas; probably about 5-10 m thick	Fine to medium sandstone, some siltstone	Mostly as low continuous platform sandstone	Not very susceptible	Moderately strong, moderately hard	Good, but may be underlain by less competent rocks	Moderate blasting required at the surface and at depth	Closely jointed in places	None
Late Jurassic?		Petrel Formation		Coarse sandstone	Dark red-brown or pale yellow	Confined; a few isolated outcrops about 10-15 m thick	Gently folded medium to coarse friable quartz sandstone, ferruginised in outcrop, kaolinitic matrix at depth	Prominent, continuous outcrop well-exposed above ground level	Usually strongly lateritised (ferruginous); becomes friable below 1-2 m depth	Moderately strong moderately hard at the surface; soft at depth	Irregular conditions to be expected; rock quality may deteriorate rapidly with depth	Difficult at the surface, but rippable below 2-3 m	Thickly bedded; one joint set observed	Could be an economic source of coarse sand
Early Proterozoic	Good-paria Group	Acacia Gap Tongue (Masson Formation)		Quartzite	Blue-grey to dark grey	Extensive in the northern part of the area; probably about 800 m thick	Beds of massive folded silicified quartz greywacke with some thinly interbedded phyllite	Mostly low, scattered	Not very susceptible; usually develops about 1 m of sand as a weathering profile	Very strong, very hard	Excellent where occurrence is massive but upper surface of unit has up to 15 m of relief	Very difficult for service trenches; extensive heavy blasting would be required in places	No bedding visible in outcrop; 2 or 3 sets moderately close-jointed	For aggregate production
			Golden	Siltstone, shale and mudstone	Mauve, buff or yellow	Widespread in the central and southern parts of the area	Thinly bedded siltstone, massive mudstone, and highly cleaved shale	Mostly low, shaly, scattered	Often highly to moderately weathered, may weather completely where rock is extensively fractured	Moderately strong to weak, soft	Generally good, though rock quality may deteriorate with depth	Not difficult normally; light blasting would be sufficient	Siltstone often thinly bedded; shale often laminated; mudstone jointed	Shale used for brick manufacture
				Carbonaceous siltstone	Dark grey	Extensive to the south, close to the mangrove fringe	Moderately to steeply dipping, folded pyritic carbonaceous siltstone	Exhumed planar surface	Weathers to a bright brick-red ferruginous siltstone that flakes excessively	Weak, soft	Generally good	Not difficult normally; only light blasting would be required	Thinly bedded, closely fractured	None
			Formation	Silicified slump breccia	Blue-grey mottled white; or black	Irregular; mostly in the southern part of the area	Silicified brecciated shale, slate, siltstone; in places containing bands and nodules of chert and silicified dolomite	Scattered boulders in situ	Not very susceptible	Moderately strong, hard	Generally good but could be irregular in places because of contained dolomite beds	Probably has harder siliceous bands that would be difficult to excavate	No bedding or jointing apparent; conchoidal fracture	None
	Batchelor Group	Coomalie Dolomite		Silicified dolomite comprising saccharoidal quartz rock	White	In the southwestern part of the area, at the surface to a depth of about 30 m	Massive silicified brecciated algal? dolomite; no bedding visible	Low, rounded, scattered outcrop, and scattered boulders	Weathers to fine quartz sand. Essentially a saccharoidal quartz rock	Strong to very strong, very hard	Irregular, usually not massive	Very difficult and irregular in some localities	Widely jointed	None
				Dolomite	Pale yellow to pale grey	Extensive at depth beneath silicified dolomite and Mesozoic rocks	Massive dolomite		Usually fresh; gypsum present in places	Moderately strong, moderately hard	Generally unpredictable, often cavernous at depth	Requires moderate blasting to excavate	Widely jointed to massive; no bedding visible	Agricultural lime

number of rock types, but only the western tongue of the formation — called the Acacia Gap Tongue, consisting mostly of quartzite — is present in the area.

The Mesozoic rocks have previously been grouped together and called the Mullaman Beds, a composite unit which includes a range of rock types. More recent regional geological mapping indicates that the Mullaman Beds may be divided into three distinct lithological units: a coarse sandstone, a fine sandstone, and a radiolarian siltstone. These units may be correlated with the Petrel Formation, and the lower and upper units of the Darwin Member, which is part of the Bathurst Island Formation (Hughes, 1978).

The distribution of the rocks making up the formations, and the stratigraphic relations of the units, are shown in Figure 5. Table 1 presents a summary of the rock types and their engineering characteristics. A detailed description of each rock formation follows.

Coomalie Dolomite

The Coomalie Dolomite consists of algal dolomite and dolomitic slump breccia, which are about 300 m thick in the Rum Jungle area. Exposures have been silicified to a depth of about 30 m, and consist of large scattered boulders of white fine-grained sugary quartz-rock which weathers to fine-grained quartz sand.

At depth, silicification gradually becomes less intense, and the rock changes to a white honeycombed vesicular quartz-dolomitic rock and then to a massive, hard, strong, pale grey or cream dolomite which is cavernous in places. Not all drillholes that have intersected dolomite beneath Mesozoic rocks have encountered the upper silicified zone (see drill logs for holes 2 and 13). Where a thick section of poorly consolidated sand forms part of the Mesozoic sequence, silicification is generally absent, suggesting that this silicification is a weathering phenomenon restricted to dolomite that was exposed in topographic highs in the pre-Late Jurassic land surface.

Dolomite extends under much of the southwestern part of the area and at greater depths to the north beneath the Cemetery Plain/Knuckeyes Lagoon area.

Golden Dyke Formation

The Golden Dyke Formation has a maximum thickness of about 3000 m and consists of a lower unit of silicified slump breccia, a middle unit of pyritic carbonaceous siltstone, and an upper unit of quartz siltstone, shale, and mudstone.

The lower part of the formation — the silicified slump breccia — includes a lower unit of brecciated, silicified, carbonaceous, dolomitic siltstone and chert that is commonly nodular or banded, and grey, or black and white; it forms angular, irregular outcrops. At the top of the lower unit, brecciated dark grey silicified carbonaceous shale is widespread and forms low rubbly exposures.

The middle part of the formation — the pyritic carbonaceous siltstone — is relatively soft, weak rock where exposed. It occurs extensively adjacent to the southern mangrove fringe, where it forms low continuous pale grey rock platforms. It is moderately folded and closely fractured, and weathers to a brick-red shaly ferruginous siltstone.

The upper part of the formation is the most widespread, and consists of thinly bedded quartz siltstone, shale, and mudstone, which generally form inconspicuous low exposures. These rocks are commonly pale brown or pale mauve where slightly to moderately weathered, and yellow or pale grey where highly or completely weathered or decomposed to clay. At depth they are commonly massive, moderately hard, and strong; however, where they have been extensively fractured, completely weathered rock occurs at considerable depth (see drillholes 1, 3, 4, and 5).

Masson Formation

The Masson Formation is represented by the Acacia Gap

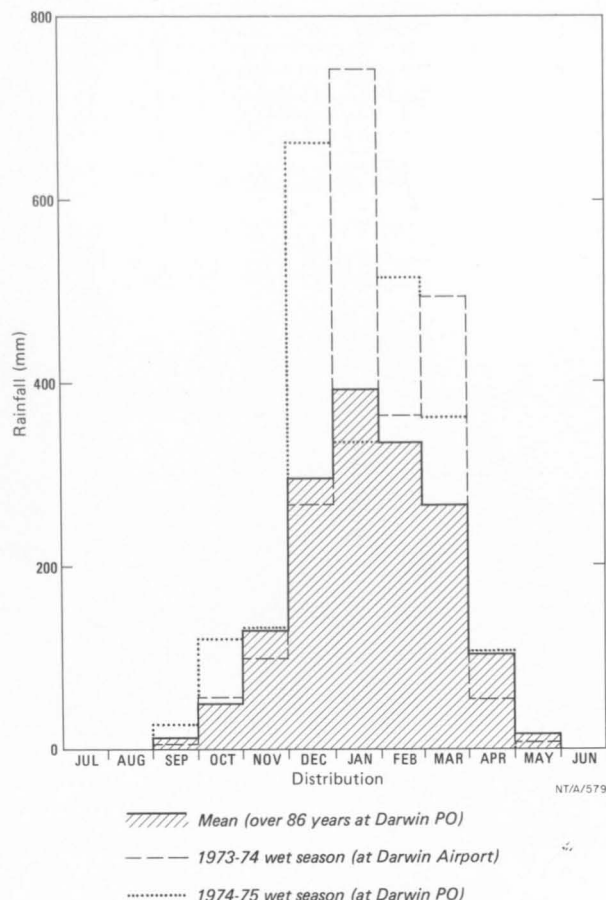


Fig. 4. Rainfall distribution for Darwin (from figures supplied by the Bureau of Meteorology, Northern Territory).

Tongue, which is 1200 m thick in the Manton Dam area (Walpole & others, 1968). It consists mostly of quartzite (silicified quartz greywacke), but contains some interbedded phyllite. Beds of quartzite are commonly 2-7 m thick; graded bedding, and cast and load structures, are common, and the rock is made up of silicified, poorly sorted, subrounded quartz grains. Extensive areas of scattered or continuous low-lying hard strong blue-grey quartzite are common at the surface.

The interbedded phyllite is carbonaceous in places but is more commonly bleached; it is not well exposed.

The Acacia Gap Tongue is contemporaneous with the Golden Dyke Formation, and interfingers with it to the east and northeast of the area mapped.

Petrel Formation

The Petrel Formation is probably Late Jurassic, and is generally not more than 15 m thick; it is exposed at a few isolated localities as continuous prominent outcrops of dark red-brown, moderately hard, moderately strong, coarse-grained, well-rounded ferruginous quartz sandstone. The rock is cemented by iron oxides at the surface — a weathering feature, possibly associated with lateritisation (see Appendix 2). A few metres below the surface the rock is a friable, weak, soft, kaolinitic sandstone. In outcrop the sandstone is gently folded, and at some localities appears to be locally unconformable below the Darwin Member of the Bathurst Island Formation.

Darwin Member of the Bathurst Island Formation

The Darwin Member comprises two distinct units of Lower Cretaceous rocks: a lower nearshore marine unit of yellow fine to medium quartz sandstone; and an upper, offshore marine unit of white siliceous siltstone made up predominantly of radiolarian skeletons.

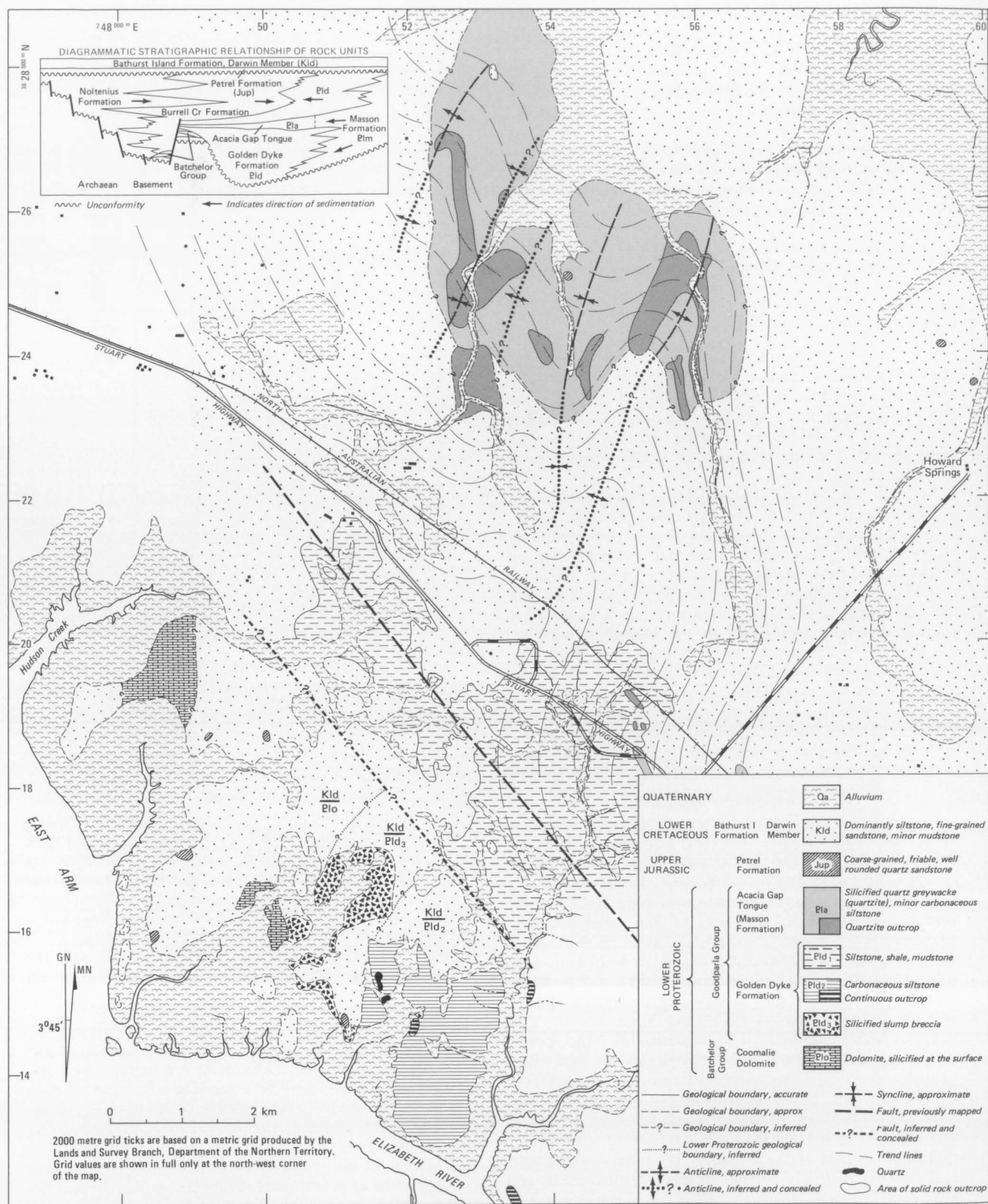


Fig. 5. Geological map.

The sandstone unit is more extensive in topographically low-lying areas, where it forms extensive moderately hard, moderately strong, low-lying exposures little affected by weathering.

The siltstone unit is extensive throughout the Darwin region, where it forms scarps and cliffs. It is commonly a hard strong white fine-grained siltstone that has orange-brown limonite-stained irregular spheroidal fracture surfaces. These spheroidal fracture surfaces may be related

to the irregular jointing the rock has in some places. At the base of the unit, rounded pebbles of quartz are commonly incorporated in the siltstone; elsewhere a layer of grit above the unconformity between the siltstone and the underlying Lower Proterozoic rocks is probably the lateral equivalent of the lower fine sandstone unit.

The upper unit was lateritised during the formation of the Tennant Creek land surface, and has developed the standard lateritic profile (see p.11).

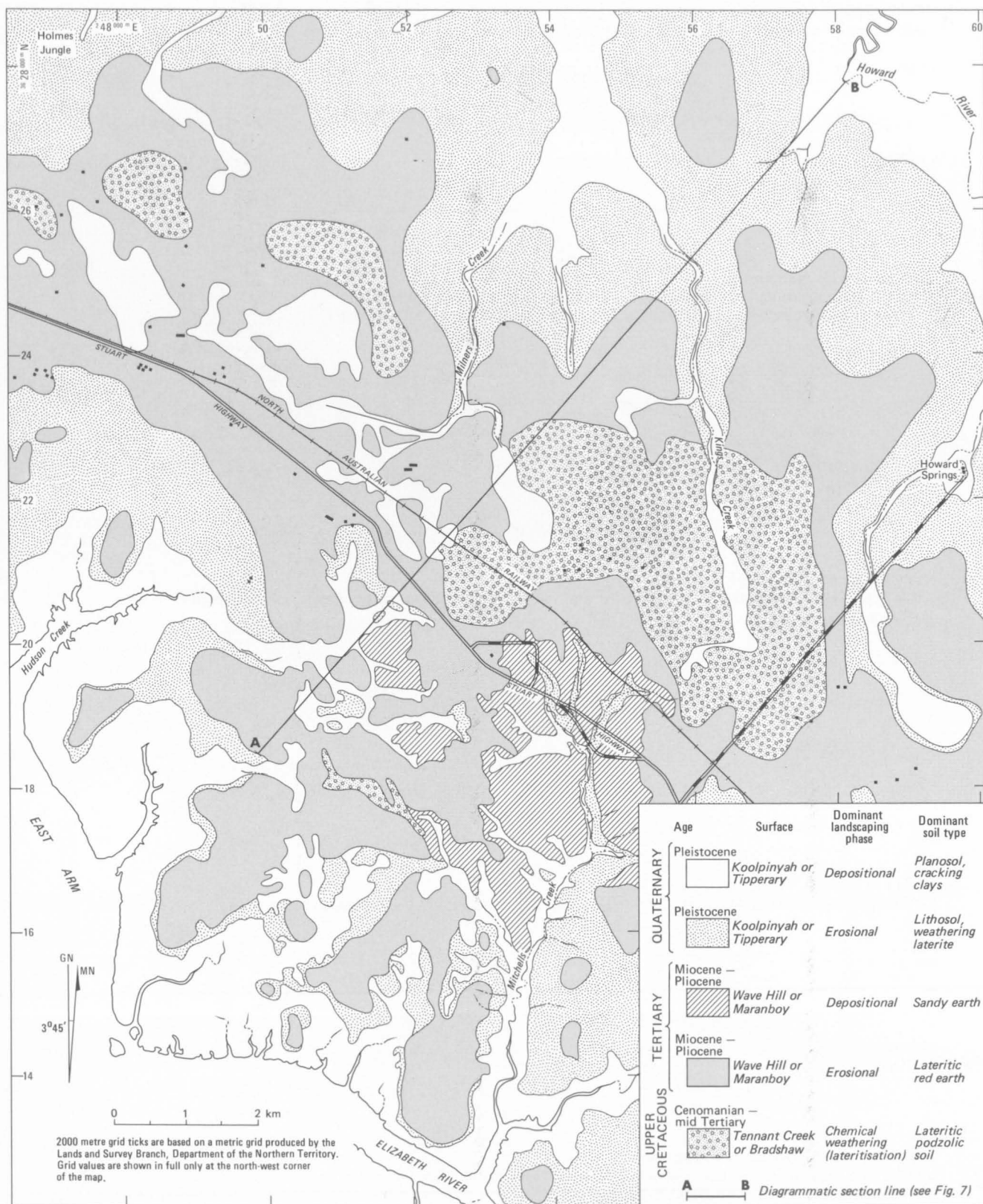


Fig. 6. Map of ancient land surfaces.

GEOMORPHOLOGY AND LATERITISATION

GEOMORPHOLOGY

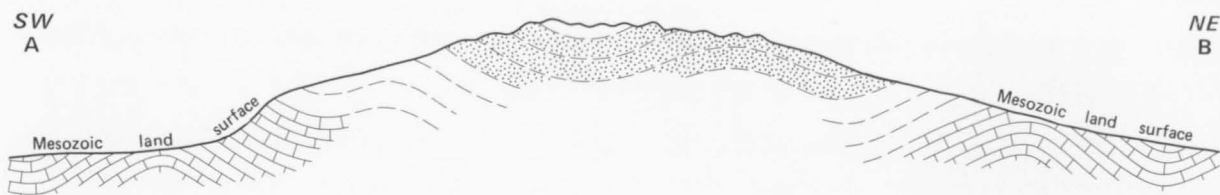
Low relief has retarded the processes of erosion to such an extent that large remnants of ancient land surfaces have been preserved within the area. The distribution of these remnants is shown in Figure 6.

The Darwin East area contains evidence of

geomorphological development which can be traced back as far as Middle Jurassic time. At that time the form of the landscape was probably similar to that of today, with quartzite and siltstone forming the high ground, siltstone and shale underlying the dissected plains, and dolomite beneath the low-lying areas (Fig. 7-1).

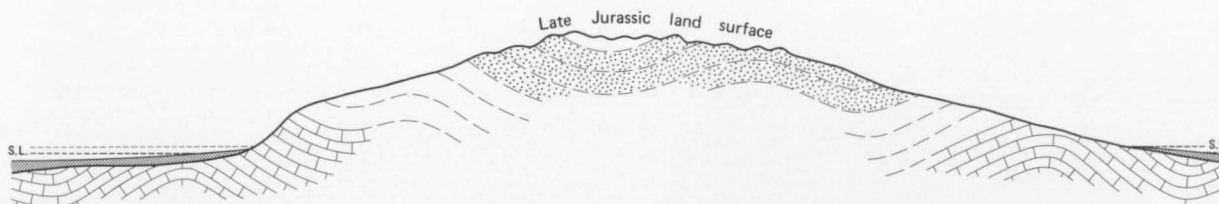
1. Middle Jurassic land surface

Land area — folded and eroded Lower Proterozoic rocks; mature landscape



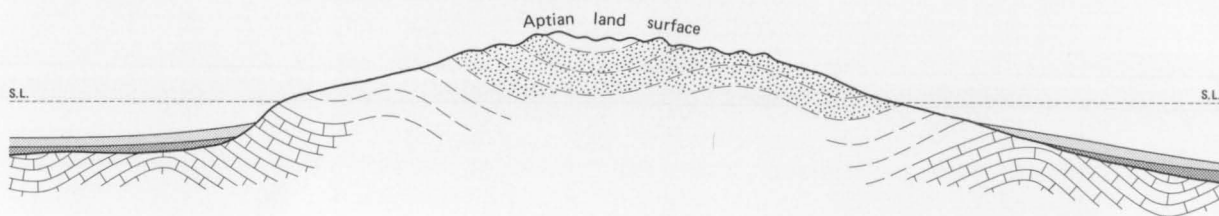
2. Late Jurassic — Neocomian

Unconformable deposition of coarse-grained, friable, quartz sand (Petrel Formation).
High-energy environment, transgressive sea; shoreline, marine, and fluvial conditions



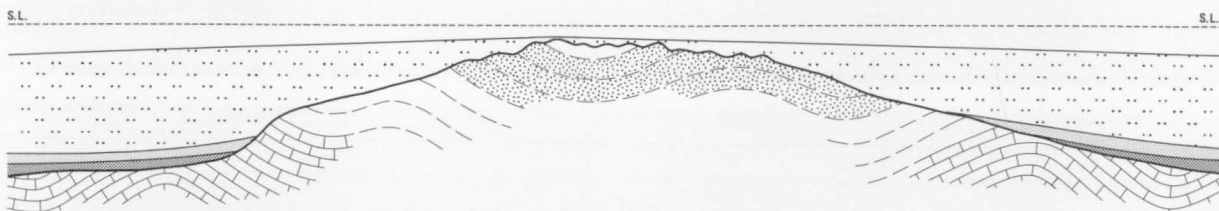
3. Early Cretaceous (Aptian)

After a brief regression, locally unconformable deposition of fine-grained quartz sand (lower unit of Darwin Member).
Medium-energy environment, transgressive sea; near-shore marine



4. Early Cretaceous (Aptian)

Conformable deposition of radiolarian silt (upper unit of Darwin Member). Low-energy environment; offshore marine



5. Early Cretaceous (Albian) land surface

Uplift, and erosion by pediplanation. Major landscape-forming event; minor internal drainage;
formation of subsidence dolines and basin-like depressions

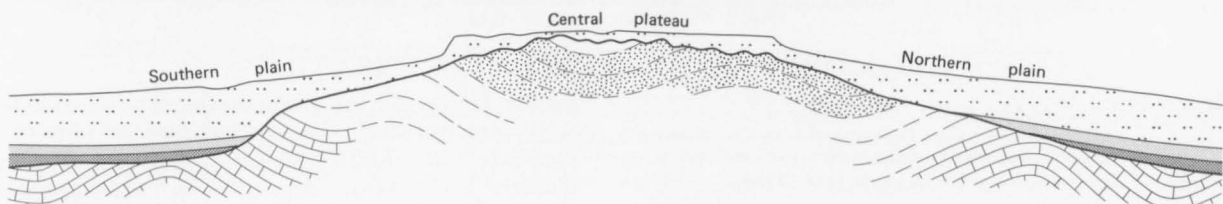
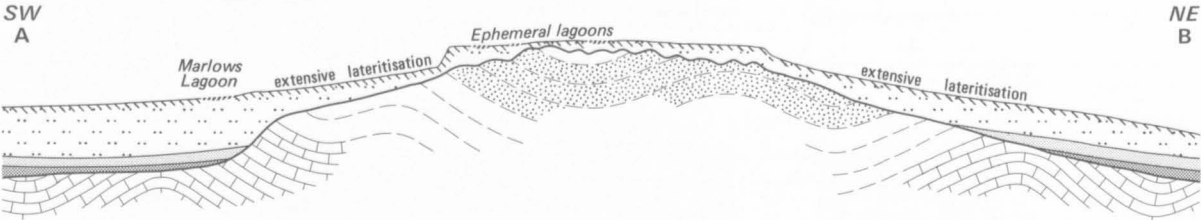
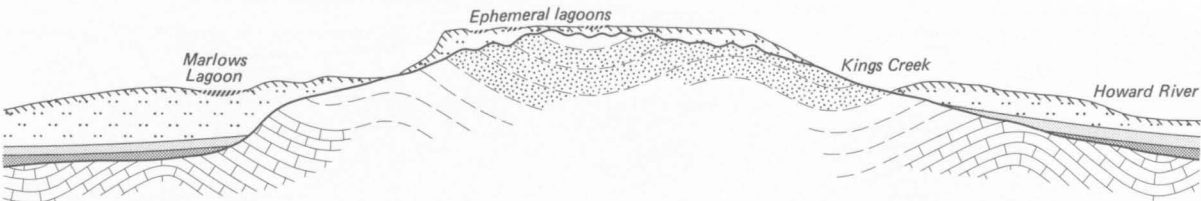


Fig. 7. Geomorphological development of the Darwin East area

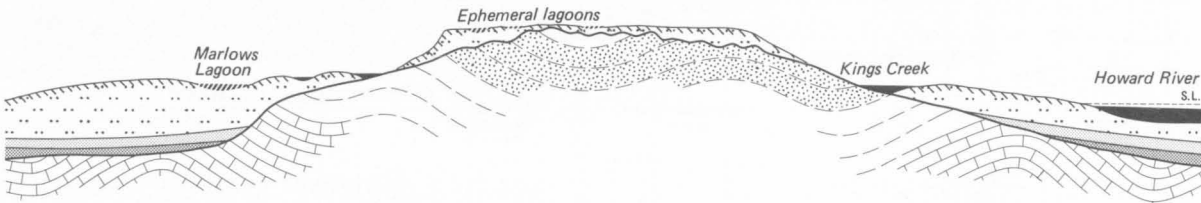
6. Late Cretaceous (Cenomanian) to middle Tertiary (Miocene) land surface
 Lateritisation, major chemical weathering event; minor landscape-forming event; formation of the standard lateritic profile; filling of dolines with lateritic clay; formation of lagoons



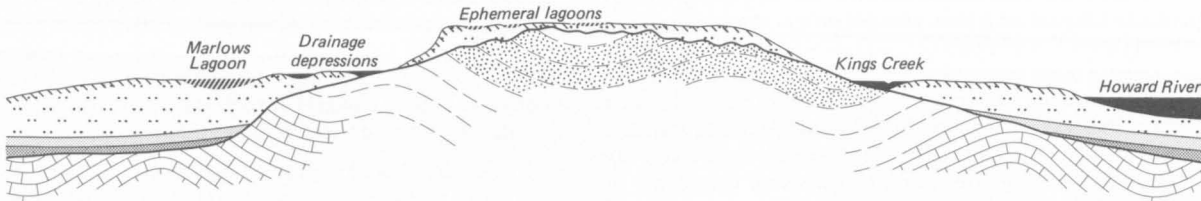
7. Middle to Late Tertiary (Miocene to Pliocene) land surface
 Erosion by fluvial processes; major landscape etching; lowering of base (sea) level; cooler climate; formation of broad drainage channels



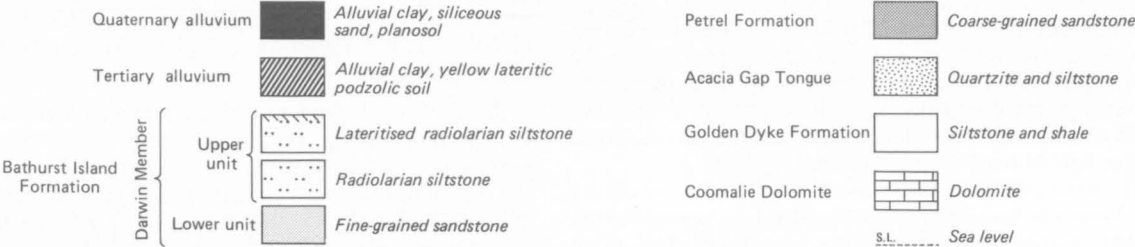
8. Quaternary (Pleistocene) land surface
 Deposition by fluvial, colluvial, and aeolian processes; major rise in sea level; formation of laterite in seasonally flooded areas; drowning of river mouths; deposition in estuaries and broad drainage channels



9. Quaternary (Recent)
 Minor erosion by fluvial processes; minor fall in sea level; slight cooling of climate; formation of estuarine swamps

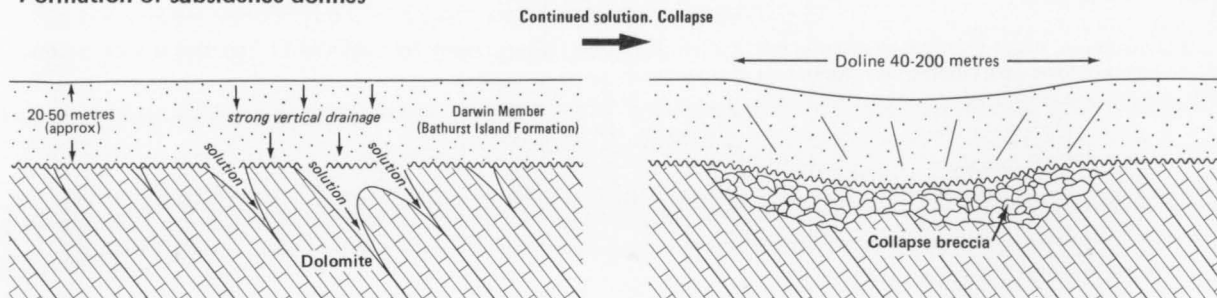


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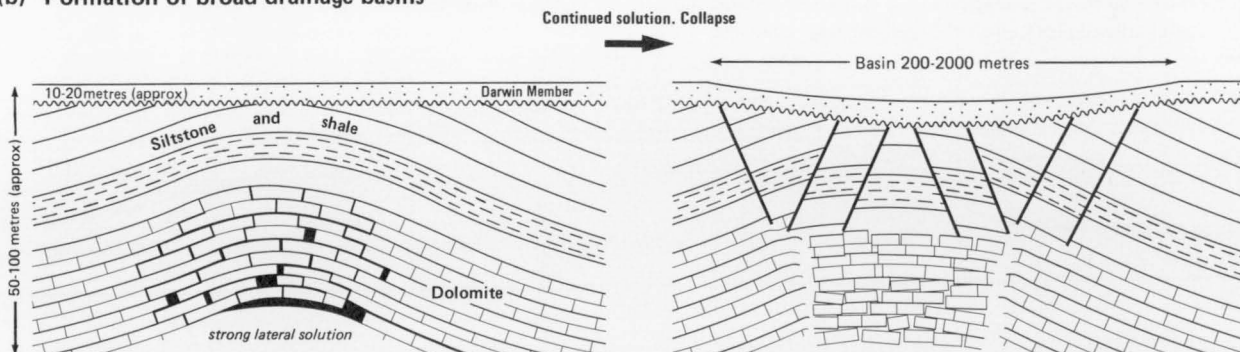


based on a diagrammatic section through line A-B in Figure 6.

(a) Formation of subsidence dolines



(b) Formation of broad drainage basins



(c) Formation of perennial lagoons

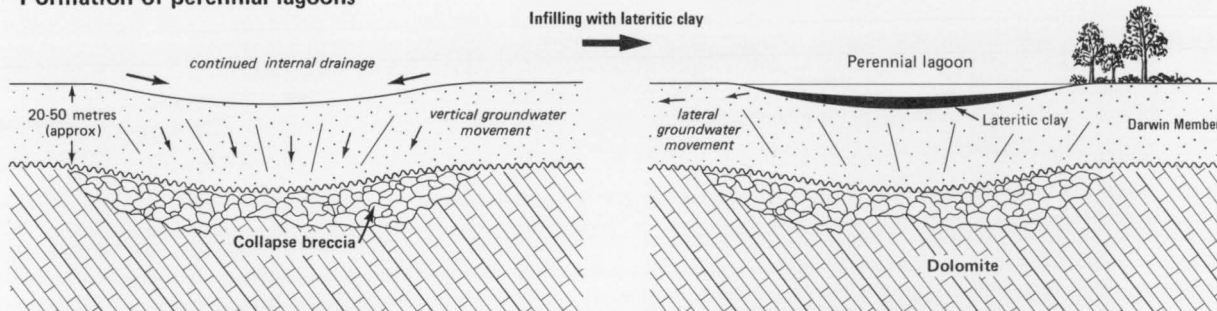


Fig. 8. Formation of subsidence dolines, drainage basins, and perennial lagoons.

The Late Jurassic sea inundated the low-lying coastal plains and deposited a transgressive unit of nearshore coarse sands (Petrel Formation; Fig. 7-2). Drilling and mapping in the Darwin East area indicates that the distribution of the Petrel Formation is limited to what appear to have been surface depressions in the Middle Jurassic land surface. Consequently, this formation is generally underlain by poorly consolidated soil, sand, or clay, and commonly at greater depths by dolomite (Coomalie Dolomite).

After a brief regression, the sea level rose again during the Aptian and further inundated the Middle Jurassic land surface, resulting in the deposition of deeper-water fine sand over much of the lower and intermediate ground (lower unit of the Darwin Member, Fig. 7-3). By the late Aptian the entire Middle Jurassic land surface was submerged beneath a low-energy epicontinental sea which deposited silts and muds composed predominantly of radiolarian skeletons (upper unit of the Darwin Member, Fig. 7-4).

The once extensive veneer of sediments deposited during the Mesozoic was uplifted, and eroded by pediplanation during Early Cretaceous time to form the main physiographic features of today (Fig. 7-5).

Lateritisation from Late Cretaceous to middle Tertiary time produced a weathering land surface characterised by the development of the standard lateritic profile (Whitehouse, 1940; Fig. 7-6). This weathering land surface has been referred to as the Tennant Creek Surface by Hays (1967), and the Bradshaw Surface by Wright (1963).

Erosion by fluvial processes during the middle to Late Tertiary etched the older land surface, modified the major physiographic features, and removed all or part of the thick lateritic profile from many areas (Fig. 7-7). This largely erosional land surface has been referred to as the Wave Hill Surface by Hays (1967), the Maranboy Surface by Wright (1963), and the Koolpinyah Surface by Williams (in Story & others, 1969).

A depositional land surface further modified the older land surfaces during the Quaternary (Fig. 7-8); it has been correlated with higher sea levels and has been referred to as the Koolpinyah Surface (by Hays, 1967) and the Tipperary Surface (by Wright, 1963). A Recent land surface, correlated with a minor fall in sea level, has exposed extensive areas of Pleistocene deposits (Fig. 7-9).

Subsidence dolines and lagoons

Subsidence dolines are collapse structures caused by the downward settlement and collapse of material into solution cavities and channels. This process is shown diagrammatically in Figure 8a. Dolines are karst features (internal drainage sinks), and are widespread within the area because cavernous dolomite is extensive at depth. Drilling has intersected solution cavities in this dolomite up to 1.5 m high (drillhole 2, 62–63.5 m); however, the poor core recovery in hole 7 (from 65–73 m) suggests that larger cavities may be present.

Drilling results indicate that the structure of the dolomite and the thickness of the beds overlying the dolomite influence the size and shape of the doline. Where dolomite is overlain by thin beds of the Darwin Member — say 20 m thick — small (about 40 m across) individual dolines form. Where these beds are thicker — say 50 m — the dolines formed are larger and usually composite, consisting of two or more adjacent dolines. The composite doline structures forming Marlows and Knuckeyes Lagoons consist of two and five dolines, which are about 500 m and 2000 m across respectively.

Where dolomite is at still greater depths — say 100 m — beneath Lower Proterozoic siltstone and shale, broad shallow basin-like depressions of irregular shape have formed. The mechanism for the formation of these shallow basins is shown diagrammatically in Figure 8b. Cemetery Plain is a good example of such a basin-like depression and is about 2000 m across.

Subsidence dolines within this area were internal groundwater drains during initial pediplanation in Early Cretaceous time (see p.10). The thickness and impermeable nature of the highly plastic clay intersected by drilling into the floor of several of these dolines (more than 13 m in auger holes 24 and 25) suggests that downward drainage through them is no longer possible.

The clay at the bottom of the dolines is alluvial in origin; it was probably deposited just before the major period of lateritisation, when a yellow lateritic podzolic soil profile developed on it. It has provided an impermeable seal, which has transformed a number of dolines into perennial and ephemeral lagoons. This process is illustrated in Figure 8c.

The water-levels in these lagoons are thought to reflect the level of the potentiometric surface throughout the wet season and for much of the dry season; this is because water can still move laterally through the sides of the lagoons. However, the clay lining the lagoons retards leakage to the lowered groundwater-level during the latter part of the dry season. Depressions with minimal or no clay lining — such as Churcher Lagoon, Cemetery Plain, and a number of other basin-like depressions — are ephemeral lagoons only during and for a short time after the wet season.

Both perennial and ephemeral lagoons store large amounts of water during the wet season; where they occur within an open drainage system they tend to regulate runoff to a certain extent. Lateral leakage from these lagoons charges the groundwater aquifers throughout the periods of high water-levels.

PRODUCTS OF LATERITISATION

Lateritisation has been the dominant weathering process in the area, and was most intense during the development of the Late Cretaceous to middle Tertiary land surface. The term lateritisation, and the products resulting from this process, are defined in Appendix 2.

Standard lateritic profile

The standard lateritic profile is widely distributed throughout the area and comprises three distinct zones: an uppermost ferruginous zone, an intermediate mottled zone, and a lowermost pallid zone.

The ferruginous zone is made up of orange to red-brown,

partly pisolitic, partly vesicular or nodular, earthy (massive, porous) soil, and may be up to 5 m thick; it shows no trace of the structure or fabric of the parent rock from which it was derived, and it grades downwards over about 1 m into the mottled zone. The mottled zone comprises a red-brown and white, ferruginised and leached, highly weathered siltstone or sandy siltstone layer, which typically develops a honeycomb structure and may be up to 3 m thick. This zone usually merges into a pallid zone, which comprises a bleached white, pale yellowish white, or pale greenish white kaolinitic highly to completely weathered siltstone or sandy siltstone layer. An exception is where the mottled zone is unconformably underlain by older rocks; these are not usually as susceptible to lateritisation, probably because they do not have the initial required permeability.

Within the area mapped, this standard lateritic profile has been observed only on the upper unit of the Darwin Member, and is preserved only in places that have undergone relatively minor erosion since the time of its development. This is probably because the upper unit of the Darwin Member is the only unit within the area that has the porosity, permeability, and thickness required for the formation of the standard lateritic profile (Stewart, 1956). However, a weak mottled zone which bears little resemblance to the standard lateritic profile has developed on completely decomposed Lower Proterozoic siltstone and shale in some places.

Erosion, exposure, and weathering of the standard lateritic profile has given rise to four distinct derivative products. These are known locally as 'laterite', 'weathering laterite', 'porcellanite', and 'conglomeratic laterite'.

Laterite

Laterite is sedentary concretionary ironstone that forms where poor drainage and seasonal flooding has rendered the ferruginous zone of the standard lateritic profile susceptible to secondary iron enrichment. Groundwater transfer of iron probably plays an important role in the formation process. Laterite has also been called 'groundwater laterite' and 'hardpan'; it is probably still forming in places at the present day.

Weathering laterite

Weathering laterite is the hardened mottled zone which forms where the ferruginous zone has been removed by erosion. This zone varies in hardness depending on the extent to which it is indurated by silica and iron. Some weathering laterites are very hard in the dry season, but softer when continuously saturated during the wet season.

Porcellanite

Porcellanite is the hardened pallid zone which has become intensely silicified on exposure. Porcellanite has a tendency to develop vertical cracks similar to columnar jointing. It forms where both the overlying ferruginous and mottled zones of the standard lateritic profile have been removed by erosion.

Conglomeratic laterite

Conglomeratic laterite is an iron-cemented conglomerate made up of redeposited laterite and rock fragments. The ferruginous cement was probably formed by groundwater transfer of iron within the profile as a result of fluctuations in the water-table. It is found in the southern part of the area among the mangroves and is thought to be of Pleistocene age.

RELATION OF GEOMORPHOLOGY AND LATERITISATION TO THE DISTRIBUTION OF THE SOIL TYPES

Geomorphology and lateritisation have strongly influenced the distribution of the various soil types. This is because, in addition to initial lateritisation, each subsequent, predominantly erosional or depositional land surface since

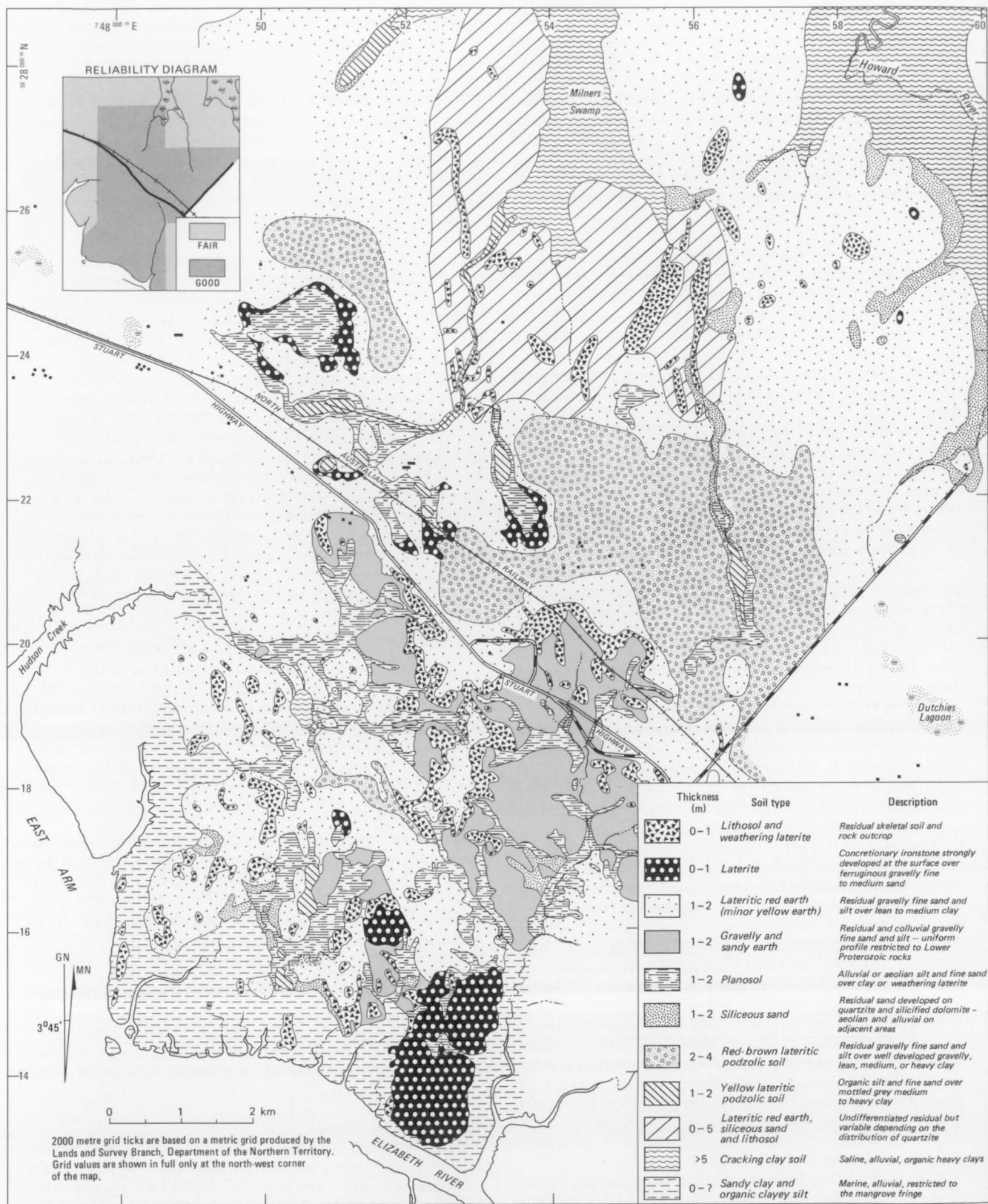


Fig. 9. Generalised soils map.

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that time has had an associated minor local complementary depositional or erosional phase. The dominant landscaping and main soil type associated with each land surface are shown in Figure 6.

The two dominant soil types within the area — the red-brown lateritic podzolic soil and the lateritic red earth — represent the ferruginous zone and the partly truncated and weathered ferruginous zone of the standard lateritic profile

respectively. Gravelly and sandy earths represent locally deposited colluvial soils associated with fluvial erosional processes operating during the middle to Late Tertiary. Lithosol and weathering laterite are the soils associated with the erosional phases of the Pleistocene land surface. Planosol, eolian and alluvial siliceous sand, and cracking clay represent the soils associated with the depositional phases of the Pleistocene land surface.

SOILS

CSIRO mapped the soils in the Katherine-Darwin region for the North Australian Development Committee (Stewart, 1956), and land units in the adjacent Adelaide-Alligator rivers region (Story & others, 1969). Land units, partly based on soil type, were mapped in the Darwin East area for the Land Conservation unit, Animal Industries and Agriculture Branch of the former Department of the Northern Territory, by Howe & Dunlop (1973).

Twelve distinct soil types, each with characteristic engineering properties, are recognised on essentially pedological criteria; most of these have been described in the 'Handbook of Australian Soils' by Stace & others (1968). They were mapped individually in most places, but were mapped together for expediency where several soil types are closely associated. The distribution of individual soil types or associations is shown in Figure 9. Table 2 summarises the various engineering, pedological, and geomorphological characteristics of each soil type or association.

Soils within the area can be grouped into two broad categories: soils directly related to the processes of lateritisation, and other soils.

LATERITIC SOILS

Red-brown lateritic podzolic soil

The essential feature of this soil is the strong texture contrast between the A and B horizons. The upper A horizon consists of pale grey gravelly sand or silt, generally 30-60 cm thick, that may be underlain by a nodular pisolitic or concretionary ironstone layer. Beneath this the B horizon consists of a red-brown ferruginous, low to medium plasticity, friable, porous clay layer, up to 5 m thick, which may have greater plasticity with increasing depth; it contains roughly equal amounts of kaolinite and illite (Stewart, 1956). Below the B horizon, a mottled weathering laterite or silty clay overlies kaolinised highly to completely weathered bedrock. This soil represents the upper ferruginous zone of the complete, uneroded standard lateritic profile.

Yellow lateritic podzolic soil

This soil type is distinguished by the strong texture contrast between the A and B horizons. The upper part of the A horizon is a highly organic silt or sandy silt, dark grey to black, that merges into a pale grey to white sandy lower A horizon. Beneath this the B horizon comprises a mottled yellow and grey, red and grey, or red and yellow medium to high plasticity clay layer. The clay layer is commonly underlain by completely weathered rock with the composition of sandy clay. This soil typically occurs in poorly drained, seasonally flooded areas, and is the hydromorphic equivalent of the red-brown lateritic podzolic soil.

Lateritic red earth

This soil type is distinguished by its massive red-brown earthy appearance — that is, a dull mat or dusty porous appearance on the face of freshly broken soil. It exhibits only weak profile differentiation with gradual or diffuse boundaries. In the typical profile a darker organic A horizon of gravelly, silty fine sand overlies a more clayey, predominantly kaolinitic B horizon of gravelly, silty, or sandy clay or clayey fine sand. Iron pisolites are common throughout the profile.

Lateritic red earth commonly represents a partly eroded standard lateritic profile, and therefore is normally underlain by a mottled and pallid zone that weathers to clayey sand (see p.11). It is widely distributed through the area and is generally confined to areas underlain by the upper unit of the Darwin Member.

Laterite

Laterite forms a hard crust (hardpan) on the surface, but is normally underlain by softer, pisolitic ferruginous sand (see p.11).

Weathering laterite

Weathering laterite is the exposed mottled zone of the standard lateritic profile (see p.11). It commonly occurs in association with skeletal soil and rock outcrop at the margins of the plateau. Mottled zone material (ferruginised siltstone) is a soil only in the sense that it can be readily excavated mechanically where it is in contact with water for some time; in places it has hardened on drying from a gravelly, clayey sand or gravelly, clayey silt to a hard rock-like material.

OTHER SOILS

Lithosol

Lithosol is a stony or gravelly residual skeletal soil lacking horizon development other than minor organic matter that has accumulated at the surface. It generally forms in association with weathering laterite at the plateau margins, or on the sheet-eroded coastal plain remnants in association with rock outcrop.

Planosol

Planosol is a two-layered soil that comprises an upper fine sandy silt or silty fine sand layer of alluvial or eolian origin which overlies a clay pan, weathering laterite pan, or laterite hardpan. It forms in the broad drainage channels in association with siliceous sand, and at the margins of the ephemeral lagoons in association with laterite or yellow lateritic podzolic soil.

Siliceous sand

This soil type is characterised by its quartzose composition, uniform texture, and absence of horizon differentiation, except for a darker upper layer due to the accumulation of organic matter where the surface layer has been stabilised by vegetation. Siliceous sand is white or pale grey, has a fine to medium sand texture, and occurs as a residual soil over silicified dolomite or quartzite; elsewhere it is alluvial or eolian.

Gravelly and sandy earth

This soil is characterised by its uniform grey-brown earthy profile of gravelly sand. It is the coarser, uniform-textured equivalent of the red earth, but is younger and mostly underlain by Lower Proterozoic siltstone, mudstone, or shale.

Cracking clay soil

This soil comprises a dark grey organic high-plasticity clay layer overlying a light grey rusty mottled layer with various textures. The high-plasticity clay layer has very high shrinkage characteristics and is dominated mainly by montmorillonite with lesser amounts of illite and kaolinite. It is saline and alluvial in origin.

The soil occurs on the gently sloping to flat, broad, low-lying estuarine swamplands such as Milners Swamp, Noogoo Swamp, and those swamplands associated with the Howard River (Fig. 9). These swamps are regularly flooded during the wet season; during the dry season they develop shrinkage cracks at the surface which may extend down to the depth of waterlogging, about 80 cm.

Sandy clay

This pale yellow sandy clay soil was examined only at the

surface. It occupies a considerable part of the southern mangrove fringe, adjacent to the Elizabeth River and East Arm in the tidal zone. The distribution of this sandy clay is related to the occurrence of silicified dolomite on the adjacent land areas. This soil drains readily between tides and does not restrict access.

Organic clayey silt

Organic clayey silt was sampled to a depth of only 50 cm. It has a uniform texture, is pale grey, and occupies the southern mangrove fringe in association with sandy clay soil. It has poor internal drainage characteristics and tends to pond water at the surface in local depressions between tides. In places, the low bearing strength of this soil restricts access on foot.

GROUNDWATER

A groundwater study of the area was completed by the Water Resources Branch of the former Department of the

Northern Territory in May 1974 (Kingwell & others, 1974). BMR made further investigations and established a network

TABLE 2. SUMMARY

Soil group	Soil type	Normal thickness (m)	Typical soil profile (length classification)	Description*	Mode of occurrence	Topography	Geomorphology	Internal soil drainage	Normal drainage	Association
SKELETAL SOILS	Lithosol	0-1	GM-SP	Gravel-sand-silt	Residual in areas undergoing extensive sheet erosion	Edge of scarp; stripped plain remnants	Koolpinyah land surface	Poor	Good	With rock outcrop and laterite
	Laterite	0-1		Concretionary ironstone	Secondary reconstituted ferruginous zone material	Margins of lagoons; coastal plains	Koolpinyah land surface	Poor	Poor to good	With laterite red earth
	Weathering Laterite	0-1		Mottled ferruginised siltstone	Exposed hardened laterised siltstone	Stripped plain remnants; edge of scarp	Koolpinyah erosional land surface	Good to fair	Good	With rock outcrop
AZONAL SOILS	Planozol	1-2	ML/CH/SC	Silt and fine sand; clay; weathering laterite or highly weathered shale	Alluvial, overlying residual, weathered, or lateritised rock	Drainage depressions, ephemeral lagoons	Koolpinyah depositional land surface	Poor	Poor; seasonally inundated	With groundwater; laterite, podzolic and siliceous sand
	Siliceous sand	1-2	SP	Poorly graded, fine to medium quartz sand	Residual on silicified dolomite	Low-lying southern plains	Exposed pre-Tennant Creek land surface	Good	Fair	With rock outcrop
					Folien as sheet deposits	Northern plains	Koolpinyah land surface	Good	Good	
EARTHES					Alluvial in drainage depressions	In and adjacent to drainage lines	Koolpinyah land surface	Good	Poor	With planozol
	Laterite red earth	1-2	GM/GW-CL/SC	Gravelly, silty fine sand; gravelly, silty, or sandy clay or gravelly, clayey fine sand; clayey sand	Residual on L. Cretaceous siltstone	Eroded plateau and plains	Wave Hill erosional land surface	Good	Good	With yellow earth and laterite
	Gravelly and sandy earth	1-2	GW-GM	Gravel-sand-silt	Residual on L. Proterozoic mudstone, siltstone, or sandstone	Mainly on dissected plain slopes	Wave Hill depositional land surface	Very good	Good	With lithosol
PODZOLICS	Red-brown laterite podzolic	2-4	GM/CL/CH/CL	Gravelly silt or gravelly fine sand; sandy or silty clay; median clay; silty clay or weathering laterite	Residual, upper ferruginous layer of the standard laterite profile	Plateau and southern plain	Tennant Creek land surface	Fair	Good	With laterite red earth
	Yellow laterite podzolic	2-4	OL/SW/CH/SC	Highly organic silt or sandy silt; pale grey to white sand; mottled clay; sandy clay	Residual in drainage depressions and lagoons	Perennial and ephemeral lagoons	Tennant Creek land surface	Very poor	Pooded; poor; saturated most of the year	With planozol
UNDIFFERENTIATED	Red earth	1-5	GM/CL/SC	As for laterite red earth	On L. Cretaceous siltstone	Plateau and plain remnants	Koolpinyah erosional land surface	Good	Good	With L. Cretaceous remnants
	Siliceous sand	1-5	SP	As for siliceous sand (above)	On L. Proterozoic quartzite	Plateau and plain remnants	Koolpinyah land surface	Good	Good to poor	With quartzite
	Lithosol	0-1	GM-SP	As for lithosol (above) but including numerous quartzite outcrops	Between scattered quartzite outcrops	Plateau and plain remnants	Koolpinyah erosional land surface	Good to poor	Fair	With quartzite outcrops
MARINE SOILS	Cracking clay	5	OH	Organic heavy clay, very plastic when wet, contains montmorillonite	Marine estuarine alluvia	Estuarine swampy plains	Koolpinyah depositional land surface	Very poor or none; lower horizons permanently saturated	Pooded; saturated most of the year	With siliceous sand
	Organic clayey silt and sandy clay	1-2	CL-OL	Organic clayey silt and sandy clay	Marine alluvia	Mangrove fringe	Koolpinyah depositional land surface	Poor to good	Poor to good	With sandstone and laterite conglomerate outcrops

*The diagonal strokes (/) printed in this column mean 'overlying'.

of open, slotted-casing piezometers. Monthly groundwater observations were made from May to December 1974 by the Mines and Water Resources Branches of the former Department of the Northern Territory; readings for individual piezometers are given in Appendix 4 (on microfiche). Rainfall for the 1973-74 and 1974-75 wet seasons is shown in Figure 4.

GROUNDWATER OCCURRENCE

Groundwater occurrence through the Darwin East area is largely controlled by the distribution and aquifer characteristics of the soil and rock types.

The Lower Proterozoic siltstone and shale are relatively impermeable and only transmit small quantities of groundwater. Quartzite is slightly more permeable owing to fractures within the rock mass. Dolomite commonly provides a good aquifer for groundwater.

The Lower Cretaceous siltstone is generally porous and permeable; its mottled zone, as a result of a pervading honeycomb structure formed during lateritisation, behaves as a highly permeable aquifer. The siltstone is underlain in places by clean coarse-grained sand, grit, or weakly consolidated friable sandstone which is permeable. In much of the central part of the area, groundwater infiltrating the

DESCRIPTIONS OF SOIL TYPES

General excavation characteristics		General foundation conditions		Soil fertility (after Stewart, 1956)				Soil suitability for garden use	Urban planning constraints
1-2 m	>2 m	For single and two storey residential buildings	For large buildings, office blocks, etc.	Acidity pH	Organic carbon content %	Carbon to nitrogen ratio	Total soluble salts %		
Backhoe and hand tool to 1 m then jackpuck	Moderate blasting	Good	Good close to surface, but may deteriorate with depth					Requires topsoil	Difficult excavation conditions. Good foundations close to the surface
Blasting to loosen	Blasting may be required	Good	Generally good at depth					Poor, requires topsoil	Difficult excavation of services close to surface
Blasting to loosen	Extensive blasting may be required	Good to fair	Generally good at depth					Poor, requires topsoil	Difficult excavation of services
Backhoe and hand tool	Ripping and dozing commonly possible. Sites would need dewatering and support	Reasonable below 0.5-1 m	Requires detailed investigations	Strong to medium acid, 5.4-5.7	1.7-3.8	About 15:1	Soluble salts and chlorides very low	Variable when drained	Requires extensive drainage works, possibly some agricultural drainage
Backhoe and hand-tool excavation generally possible. Side support may be necessary	Side support probably required	Reasonable if drainage is adequate	Poor	Mildly acid			Very low, strongly leached	Needs organic matter and fertiliser	A potential resource at some locations
Backhoe and hand-tool excavation generally possible	Some blasting	Good below 0.3 m	Often good below 2 m	5.3-6.2	1.6-3.7	About 20:1	Very low, 0.01	Very suitable	A possible source of gravel parent material in some places
Backhoe and hand-tool excavation generally possible	Back excavating and ripping should be possible, some blasting to loosen	Good	Generally good except where underlying rock is deeply weathered					Needs organic matter and fertiliser	Could be difficult for excavation of deeper services in some places
Backhoe and hand-tool excavation possible	Dozing to 1-5 m; ripping below this. Back excavating to 5 m in places	Good below 0.3 m	Poor	Medium acid to neutral, 5.8-6.8	About 1	About 20:1	Very low, hydrogen dominant, chlorides low	Very suitable	Useful for topsoil
Backhoe and hand-tool excavation possible. Side support required	Dozing and back excavation possible; sites would need dewatering and support	Poor	Poor	Medium acid in upper layer, strongly acid in lower layers, 6.1-4.4	7 at surface, decreasing to 2 at depth	About 9:1	0.05 at the surface, increasing to 0.1 at depth, hydrogen dominant	Good topsoil	Usually occurs beneath paper-bark and tropical rainforest stands
As for lateritic red earth	Very difficult in places	Good	Variable; requires detailed investigations					Good	Difficult and costly excavation for services. Quartzite a resource for aggregate
As for siliceous sand (arenosol)	Very difficult in places	Reasonable	Variable; requires detailed investigations					Requires fertiliser and organic matter	
Difficult; heavy blasting to fracture in some places	Very difficult in places	Good	Good					Requires topsoil	
Backhoe and hand-tool excavation possible	Backhoe and dozing possible in dry season; requires support	Very poor	Very poor	Acid to neutral upper layer; very acid lower layer, 4.1-3.9	1.5-3.3	12:1	Chloride 0.4, Total 0.6-2.1		Not suitable for urban development
Hand-tool excavation possible	Difficult	Very poor	Very poor						Of, not suitable for embankments

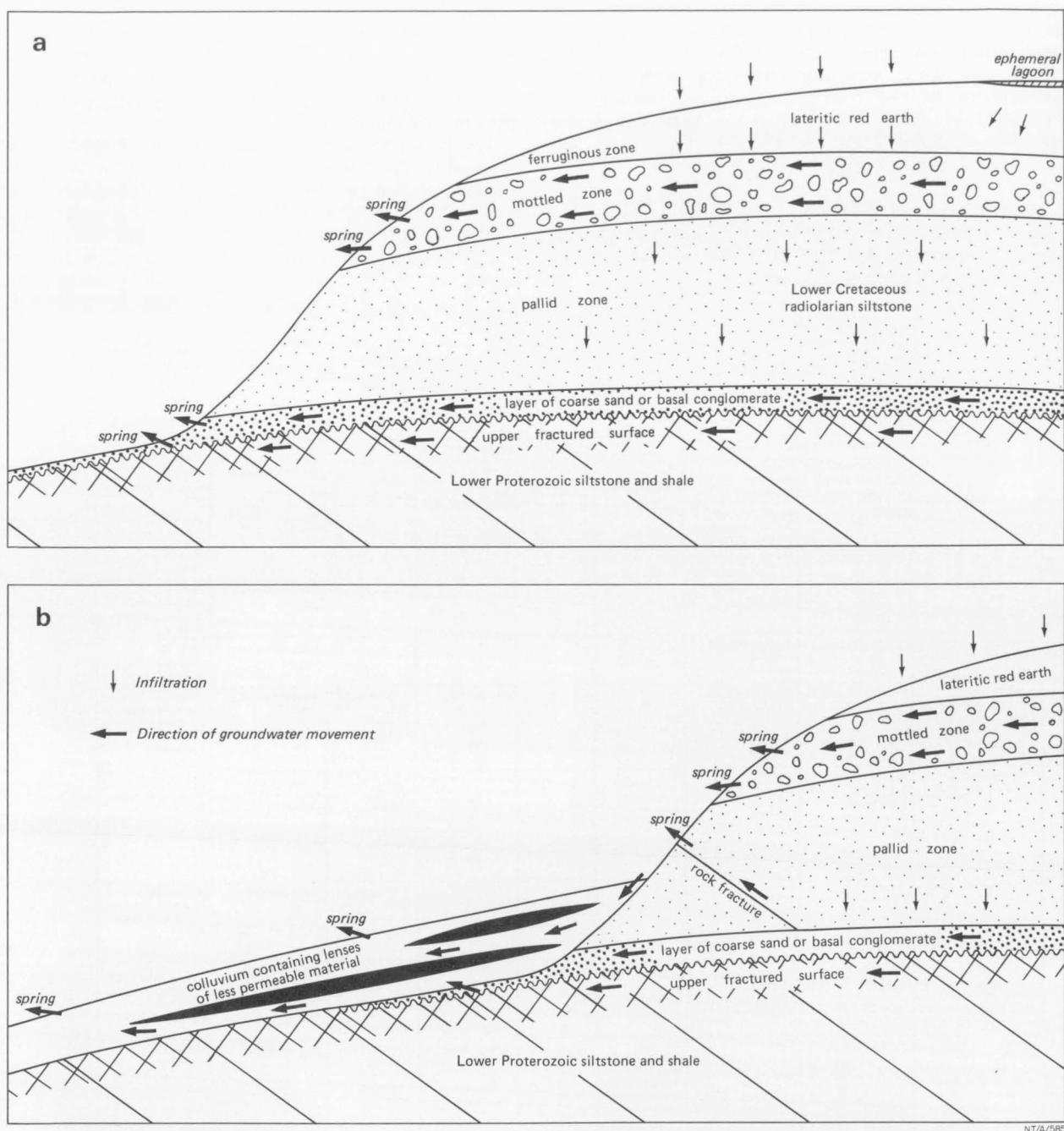


Fig. 10. Diagrammatic sections showing the formation of springs: (A) at the southern escarpment; (B) where a thick colluvial mantle abuts the escarpment.

siltstone is prevented from flowing to greater depths by the underlying, relatively impermeable Lower Proterozoic siltstone and shale. Thus groundwater moves laterally either along the unconformity within a sand, grit, or sandstone layer, or in the mottled zone of the overlying siltstone (Fig. 10).

There is good infiltration of rainfall into the lateritic soils throughout the area; the sandy and earthy soils are very permeable; the silty soils have only moderate permeability; and the clayey soils have a low permeability or are practically impermeable.

SPRINGS

During the wet season, numerous springs appear along the plateau escarpment immediately to the south of the Stuart Highway. These springs convert adjacent broad drainage channels into swamps during, and for some months after, the end of the wet season. The flow of springs is maintained by

groundwater that moves laterally through, and along the base of, the upper siltstone unit of the Darwin Member. Groundwater emerges at the escarpment through the most permeable path (Fig. 10a): either the honeycomb structure of the mottled zone, the basal conglomeratic layer in the upper unit of the Darwin Member, or, less commonly, the upper fractured surface of the highly to moderately weathered Lower Proterozoic rocks.

Surface water infiltrates colluvium on the pediment adjacent to the escarpment, and springs issuing from the base of the slope also charge the colluvium. Within the colluvium, water moves along the more permeable layers until these intersect the surface, and water issues from the ground as a spring (Fig. 10b).

A large number of springs were located in March 1975; some had been observed previously by the Water Resources Branch. All known springs in the area are shown in Figure 11.

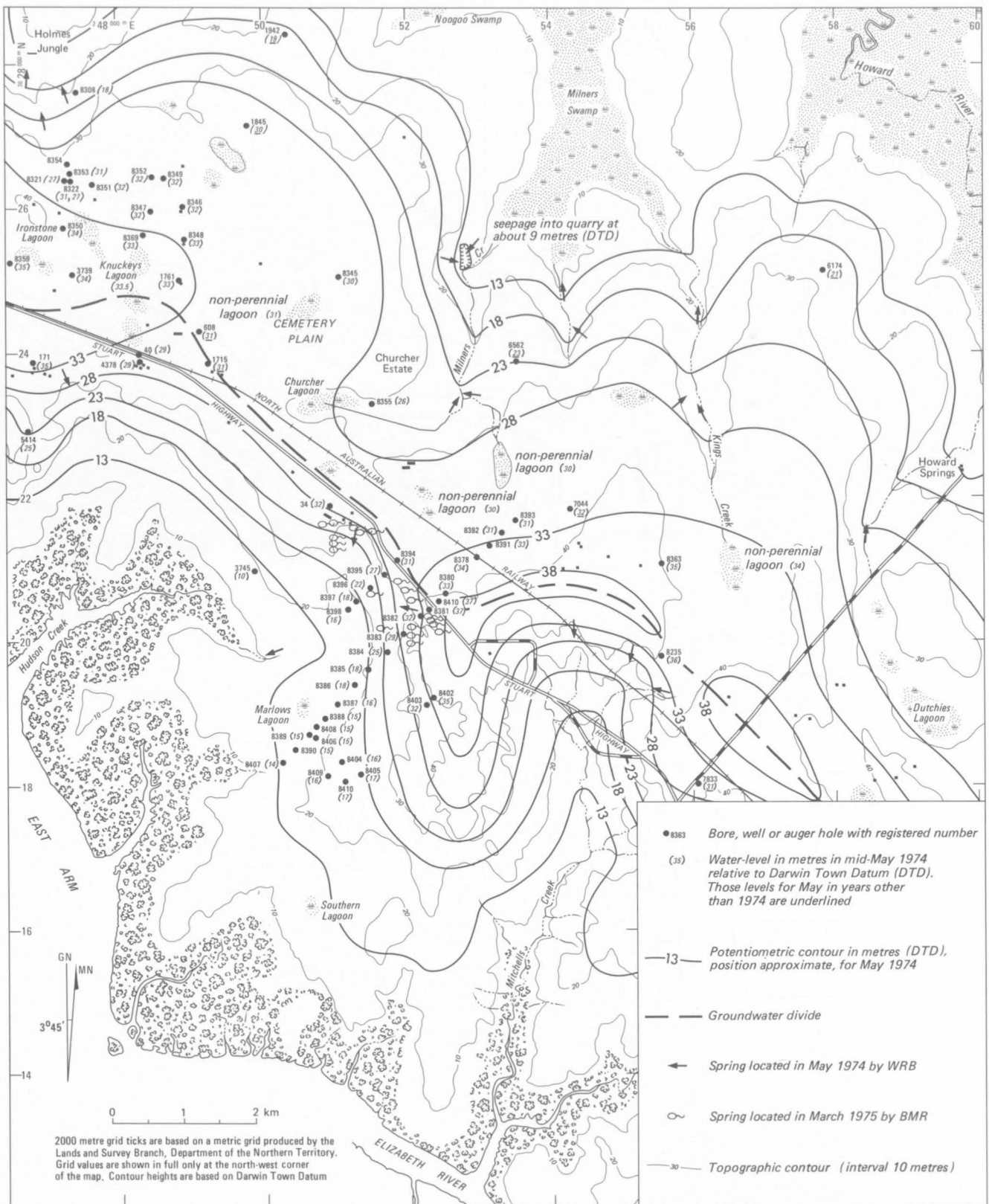


Fig. 11. Reduced water-levels and potentiometric surface contours (after Kingwell & others, 1974).

GROUNDWATER-LEVELS AND THE POTENTIOMETRIC SURFACE

A potentiometric surface contour map was drawn up from groundwater-levels for May 1974 by the Water Resources Branch (Fig. 11); from these contours the hydraulic gradients prevailing at that time (based on available data) can be calculated. The combined Mines and Water Resources

Branches' piezometer measurements made between June and December 1974 are listed in Appendix 4. They show that fluctuations of water-levels are greatest beneath high ground, and that beneath low ground the potentiometric surface is either just below or at the ground surface throughout the year. Beneath most of the area the depth to the potentiometric surface in the wet season is about 1.5-2.5 m; near the end of the dry season this surface subsides

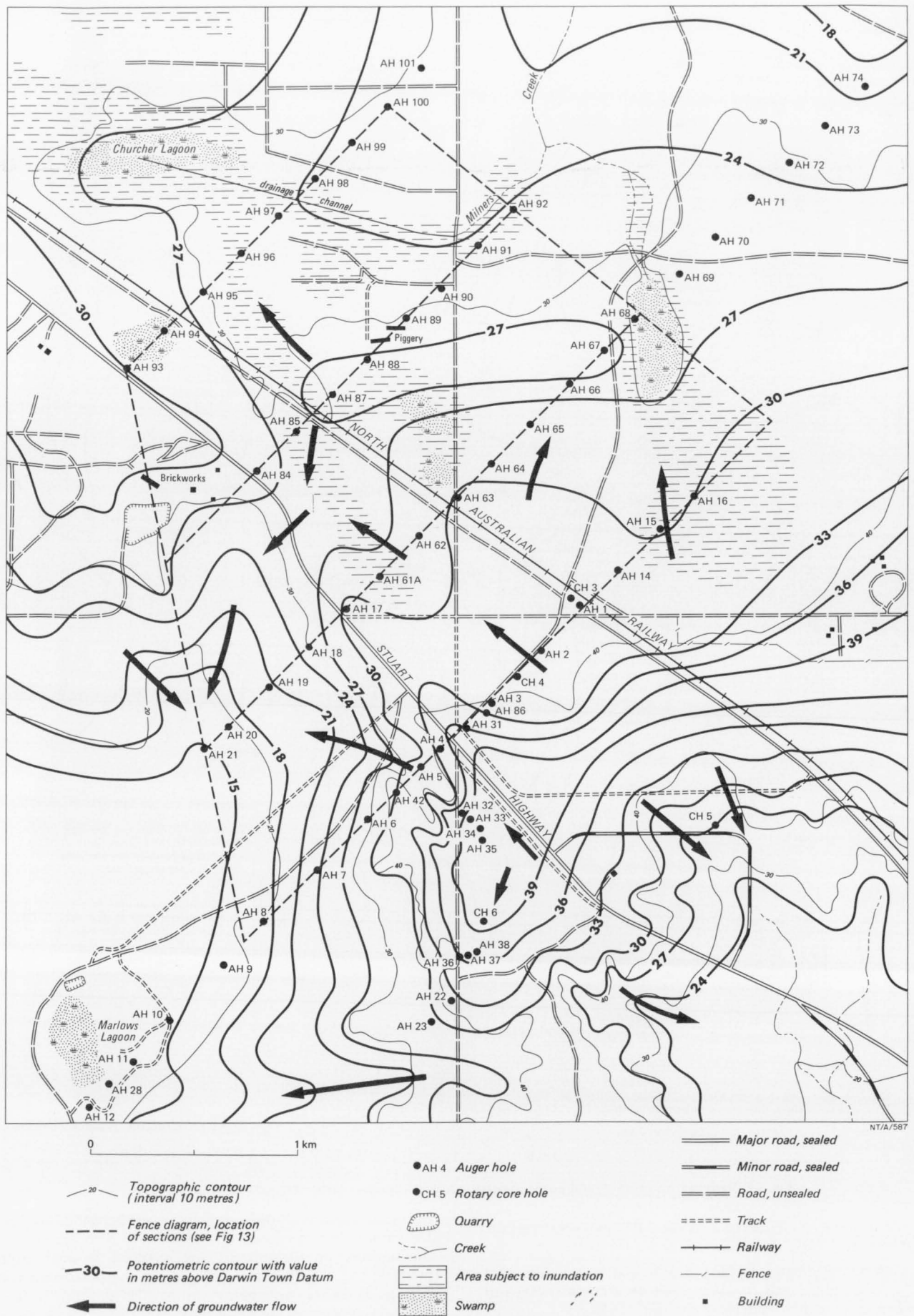


Fig. 12. Potentiometric contours for August 1974 in the central part of the area.

to 6-7 m at an average rate of about 0.5 m per month. The potentiometric surface is thought to reach its maximum in February or March of most years, depending on the rainfall distribution. The greatest depth to the potentiometric surface is beneath the higher ground at the end of the dry season.

Groundwater readings from the piezometer network have enabled a more detailed potentiometric surface map to be drawn up for the central part of the area (Fig. 12), where spring activity during the wet season is most pronounced. From this map the groundwater catchments can be defined, and the origin of the springs determined. Figure 13, a diagrammatical three-dimensional representation of the central part of the area (Fig. 12), shows a potentiometric surface for December 1974 and water-levels in the lagoons for March 1975. It illustrates likely groundwater conditions for much of the wet season, and the arrows indicate the direction of groundwater flow.

Figures 12 and 13 show that the groundwater catchments of some springs on the southern escarpment may be very extensive; the catchments include some of the ephemeral lagoons close to the Stuart Highway, and leakage from the lagoons at times of high water-level probably recharges the groundwater catchments of the springs. Leakage from lagoons when they are close to their maximum levels will significantly change the potentiometric surface; this will have a marked effect on the size of the groundwater catchment for the various springs because the groundwater divide is not pronounced until the lagoons reach their maximum levels.

To establish beyond all doubt that some lagoons do recharge groundwater supplies to the springs on the southern escarpment during the wet season, the following measures would be required:

- (1) an accurate survey of the piezometer network;

- (2) the establishment of height datum posts at all perennial and ephemeral lagoons; and
- (3) the recording of water-levels every month for a year — particularly between January and April, when levels are at a maximum — even though access might make the measurement of water-levels difficult and time-consuming.

The hypothesis that springs are fed by fault-transmitted artesian water was assessed, but the potentiometric surface shows no configuration that could be ascribed to water emanating from fault zones in the area.

MCMINNS BOREFIELD

McMinns Borefield, 7 km east-southeast of the acquisition area's southeastern corner (Fig. 1), is in the Lower Proterozoic dolomite (Coomalie Dolomite); it has provided a small proportion of Darwin's water supply in the past.

Urban development of the Darwin East area has been considered likely to cause pollution of the McMinns underground water supply. Although potentiometric contours within the acquisition area (Fig. 11) show that there is no significant hydraulic gradient towards McMinns Borefield, large drawdowns in the McMinns area could create such gradients if hydraulic continuity were to exist between the aquifers of the two areas. However, geological mapping indicates that folded, relatively impermeable, interbedded quartzite and siltstone occur at or near the surface — and extend to considerable depth — between the McMinns Borefield and Darwin East areas; these are regarded as a permeability barrier to groundwater movement between the two areas. Recharge of the borefield is more likely to come from the adjacent rocks of higher permeability such as dolomite, rather than from the Darwin East area. So urban development at Darwin East is unlikely to cause pollution in McMinns Borefield.

DRAINAGE

A surface hydrology and drainage study is included in a report prepared by the Water Resources Branch (Kingwell & others, 1974). In addition, a preliminary regional stormwater drainage report was prepared for the Department of Housing and Construction by the consultants Willing, English, and Devin (Aitken, 1974). A brief description of the natural drainage within the various surface water catchments is included here.

CATCHMENT DRAINAGE

Kingwell & others (1974) divided the Darwin East area into a number of surface water catchments. A modified version of their figure (Fig. 14) shows that the extent of surface water and flooding in the wet season under natural drainage conditions closely approximates the distribution of the azonal planosol soil (Fig. 9).

Milners Creek catchment

Milners Creek has the most extensive catchment, which includes much of the central plateau. A number of interconnecting, open, unlined drains have been excavated in this catchment at Churcher Estate, and these have modified the natural drainage to some extent.

The catchment includes the Knuckeys-Ironstone Lagoons system. Once the storage capacity of this system has been exceeded, water flows eastward through a culvert beneath Thorak Road to Cemetery Plain — a broad shallow basin or ephemeral lagoon which in the wet season covers an extensive area to an average depth of about one metre. Once the storage capacity of this plain is exceeded, water flows overland in a southerly direction into Churcher Lagoon (Fig.

15) and into drainage channels in Churcher Estate. The channels increase surface drainage during the wet season, but have little effect on some adjacent soils — e.g., yellow lateritic podzolic soil. The main drainage channel in Churcher lagoon has a marked effect on the potentiometric surface of the surrounding area while water continues to flow in it during the dry season (Fig. 11). Water from Churcher Lagoon continues in an easterly direction and is joined by water flowing from the small ephemeral lagoons to the southeast, between the railway and the Stuart Highway, to form Milners Creek, which flows northwards to Milners Swamp.

Hudson Creek catchment

The Hudson Creek catchment comprises an extensive network of broad drainage channels and a perennial lagoon, Marlows Lagoon. During the wet season and for some months afterwards, many of these drainage channels receive seepage from the southern edge of the escarpment; Marlows Lagoon receives some seepage from a source to the south. These broad channels are naturally swampy during the wet season, and the underlying silty soils (planosols) have very low shear strengths when saturated. The position is aggravated by the poor internal drainage of these soils, and so they tend to remain boggy in the dry season for as long as springs are providing seepage water.

Other catchments

Though other catchments within the area also contain broad ill-defined drainage channels, seepage problems do not occur to the same extent; however, these channels remain

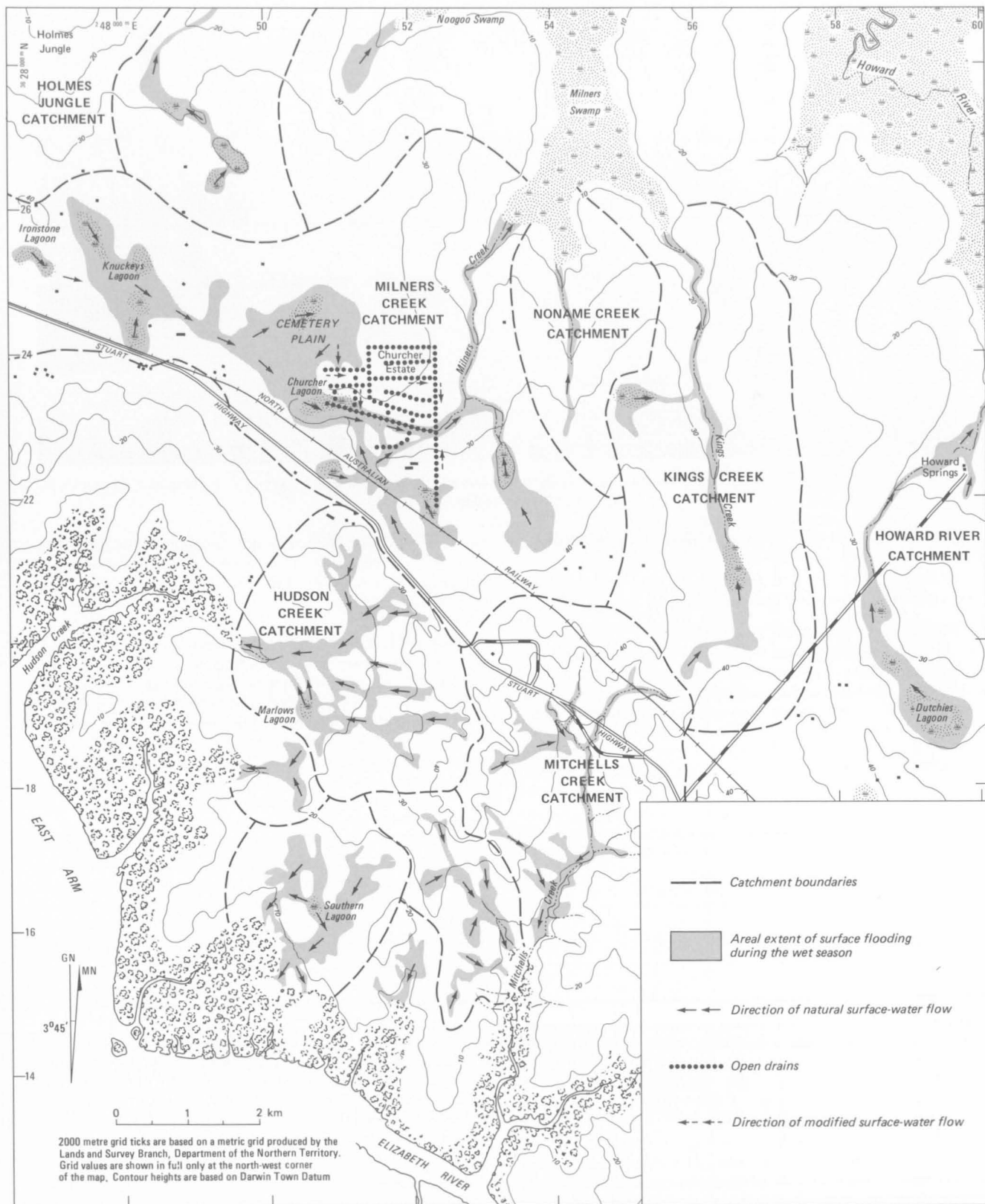


Fig. 14. Map of natural surface drainage.

wet and boggy during the wet season under natural drainage conditions because of the low gradients and the large amount of water that is to be drained.

Mangrove fringe

The portion of the southern mangrove fringe underlain by sandy clay soil is well drained between tides; however,

drainage of the areas underlain by organic clayey silt is often not as effective, and water may pond between tides.

Estuarine swamps

The estuarine swamps are covered with extensive sheets of brackish or fresh water for much of the year. They have a poor natural drainage, because of the prevailing low



Fig. 15. Water entering the western end of the main channel that was excavated through Churcher Lagoon — looking east, March 1975 (250825E, 623375N in Fig. 9). (GB/505)

gradients and the poor internal drainage characteristics of the underlying heavy clay soils.

CATCHMENT DRAINAGE PROPOSALS

Milners Creek catchment proposals

Two proposals to drain the Milners Creek catchment have been put forward by consultants: a conventional stormwater system of channels and buried pipes to maximise runoff and groundwater interception; and a less conventional scheme incorporating retardation basins that would store water temporarily after heavy rainfall (Fig. 16). The latter scheme is a modification of the existing natural drainage, in which a high degree of groundwater recharge contributes to the extensive seepage on the southern escarpment — in the adjoining Hudson Creek catchment. Because the groundwater divide lies to the south of Cemetery Plain and Churcher Lagoon, both these lagoons could be used as retardation basins without affecting the southern seepage areas.

Much of the water flooding Cemetery Plain during the 1973-74 and 1974-75 wet seasons overflowed from the Knuckeyes-Ironstone Lagoons system; however, this overflow could readily be diverted to the north towards Holmes Jungle. The remaining surface water flow from Cemetery Plain could effectively be drained south to Churcher Lagoon along natural drainage paths. There may be some advantage in using Churcher Lagoon as a retardation basin, for a large volume of water flows through it. The proposed retardation basin to the east, in Churcher Estate, does not fall within a natural waterway, and would appear to serve little purpose. The retardation basins proposed to the southeast of Churcher Lagoon are likely to aggravate the seepage problems on the escarpment; a temporary storage in this area is thought to be impracticable.

Hudson Creek catchment proposals

Seepage from the southern edge of the escarpment is a major contributor to the drainage problems within this catchment. Seepage could be greatly reduced by minimising infiltration in the central part of the Darwin East area, and by draining the ephemeral lagoons on the plateau which are closest to the seepage areas. Methods of reducing infiltration are given by Kingwell & others (1974) and Aitken (1974), and

are associated with the urban development of the area. The effect of such measures on the southern escarpment seepages would not be known until the central part of the area were completely developed.

One possible way of dealing with the seepage problem would be to install specially located cut-off drains along the base of the escarpment to intercept seepage flow; the preferred locations of the proposed cut-off drains are shown in Figure 16. Such drains would be expensive and possibly a constraint to planning. Another alternative would be to align a narrow road along the base of the escarpment and to position the associated road drains to intercept seepage flow. Such a road would be an effective scenic route, particularly as consideration might be given to reserving the escarpment area for botanical gardens, similar to those at Darwin.

The general wet, boggy conditions that exist in the broad drainage channels should be largely eliminated when drains to hasten surface runoff are installed. It is assumed that a considerable proportion of each of these broad channels will be incorporated into the drainage design as grassed floodways; however, such grassed areas would have to be watered during the dry season to control wind erosion.

Other catchments proposals

Other catchments are similar to the Hudson Creek catchment in that they consist of a number of broad natural drainage channels which have low gradients, but seepage problems generally do not occur. Normal drainage installations that hasten runoff should suffice to drain the catchments during the wet season; again, broad open grassed areas should be retained to cope with excessive water.

Perennial lagoons

Attractive natural features such as the perennial lagoons (Marlows and Knuckeyes Lagoons) ought to be preserved in their undisturbed state, if possible, and not incorporated in a stormwater drainage scheme. However, because of the mosquito breeding potential of these lagoons, the Department of Health will be obliged to treat them if urban development is to take place nearby. Treatment may be physical or chemical: physical treatment may include formalisation of the lagoonal margins and deepening of shallow-water areas; chemical treatment involves spreading small amounts of chemical on the water surface at regular

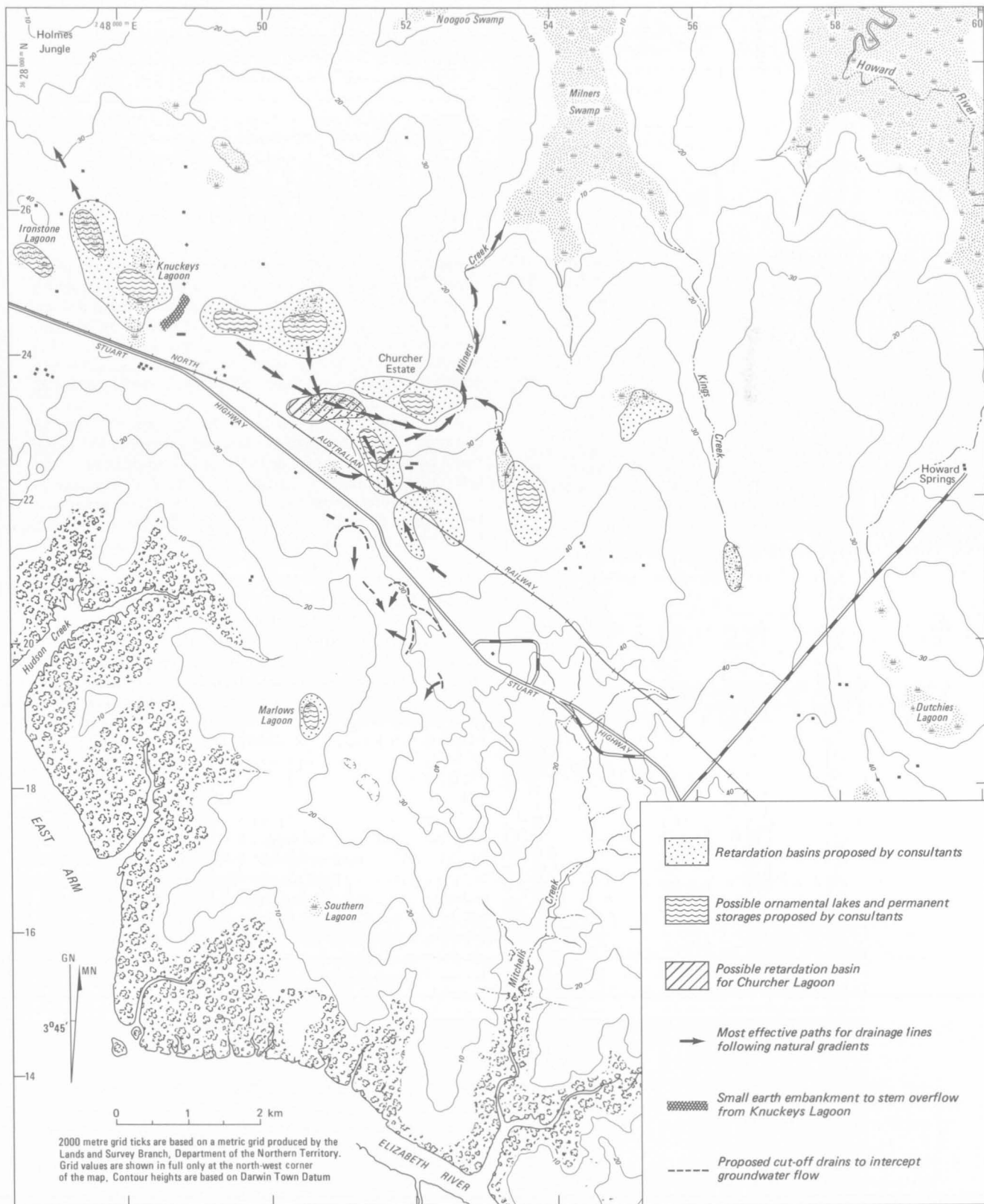


Fig. 16. Map of drainage proposals.

intervals. Physical treatment would considerably upset the natural ecology of these areas, particularly aquatic weed growth and the *Melaleuca* stands in Marlows Lagoon; it could promote leakage if the impermeable soil underlying these lagoons were displaced.

Drains installed as urbanisation proceeds are expected to increase runoff and reduce infiltration, which will lower the

potentiometric surface throughout the area; this may increase natural seepage from the perennial lagoons, particularly if these are formalised by physical treatment. To maintain the lagoons at an acceptable level during the dry season, water would have to be added to them to replace that lost by evaporation and seepage. To divert water from the town supply may not be economical; a cheaper groundwater

supply may be available from aquifers in the underlying dolomite. Potential aquifers should be pump-tested to determine their yields. Water quality should be tested by chemical analyses to ascertain the concentration of total dissolved solids in the groundwater, and to assess its effect on the natural vegetation (i.e., the *Melaleuca* stands, etc.).

If seepage from the lagoons during the dry season proved to be excessive, consideration could be given to sealing their sides with a clay lining.

Mangrove fringe and estuarine swamps

A large part of the southern mangrove fringe is free-draining between tides. Those parts of it with ponds that are not free-draining could probably be filled with suitable material to eliminate them as potential mosquito breeding areas, but the feasibility of doing this would require a special geotechnical study. Draining the estuarine swamps, if considered desirable, would be a costly undertaking.

SEISMICITY

A map of earthquake epicentres recorded between 1900 and 1974 in the region bounded by latitudes 5°S and 20°S and longitudes 125°E and 135°E (Fig. 17) — simplified from an earthquake-data printout supplied by the BMR Observatory Group — shows that nearly all recorded seismic activity has originated in the Banda Sea, north of Australia, and that the northern part of Australia is comparatively stable. The larger-magnitude earthquakes recorded in this region are listed in Table 3.

TABLE 3. EARTHQUAKES WITH MAGNITUDES (MS) GREATER THAN 6.9 BETWEEN 1900 AND 1974 IN THE AREA BOUNDED BY LATITUDES 5-20°S AND LONGITUDES 125-135°E

Date (UT)			Geographical location		Depth	Magnitude	Distance from
Yr	Mo	Day	Lat.(° S)	Long.(° E)	(km)	(MS)	Darwin (km)
1909	05	30	8.00	131.00	100	7.2	500
1914	07	04	5.50	129.00	200	7.0	810
1917	08	30	7.50	128.00	100	7.8	636
1918	11	18	8.00	127.50	190	7.8	615
1918	11	23	8.00	127.50	190	7.2	615
1927	06	03	7.00	131.00	150	7.4	615
1930	03	26	7.50	125.50	40	7.2	810
1931	03	28	7.00	129.50	80	7.3	626
1938	02	01	5.00	131.50	33	8.2	850
1943	11	06	5.70	134.00	33	7.6	850
1944	03	31	5.60	131.00	60	7.0	770
1950	11	02	7.50	129.00	220	7.5	590
1950	02	14	8.00	126.60	33	7.2	690
1956	07	18	5.07	130.26	130	7.5	820
1957	03	23	5.54	130.97	147	7.3	770
1960	10	07	7.72	130.81	16	7.3	530
1962	05	15	7.44	128.30	66	7.2	630
1963	11	04	6.94	129.50	122	8.2	635
(1974	10	29	6.88	129.46	117	6.4	650)

The intensity with which an earthquake is felt at the surface is measured on the modified Mercalli (MM) scale (Eiby, 1966; Appendix 3); intensity decreases with increasing

distance from the epicentre and with increasing depth of the focus. The greatest felt intensity at Darwin was probably from the MS 7.3 earthquake at a depth of 16 km 530 km north of the city on 7 October 1960 (Table 3). Because intensity data for this earthquake are not available, its felt intensity can only be estimated by comparison with the more recent Banda Sea earthquake of 29 October 1974, for which data are available.

The Banda Sea earthquake of 29 October 1974 had an epicentre 650 km north of Darwin and a depth of 117 km; it had a body-wave magnitude (MB) of 6.5, equivalent to MS 6.4, and a felt intensity at Darwin of MM V. Damage to concrete fixtures, toilet fixtures, and walls was reported, and the earthquake was felt as far afield as Derby in the west, Groote Eylandt in the east, and Dunmarra in the south. The maximum felt intensity in Australia for this earthquake was a single report of MM VI on Bathurst Island. No reports of intensity were received from Indonesia, although the United States Geological Survey in its *Preliminary Determination of Epicentres Sheet* listed the earthquake as felt on Timor.

The 1960 earthquake was about 120 km closer to Darwin than the Banda Sea earthquake, and its focus was shallower; its estimated maximum intensity at Darwin was about MM V — possibly MM VI. According to A. McEwin (BMR, personal communication) an earthquake with a felt intensity of MM V in the Darwin area can be expected at least once every 50 years.

Buildings underlain by soft alluvial foundations or a thick soil mantle are generally more severely shaken than those sited on sound rock, but large buildings are not expected to be founded on unconsolidated material in the Darwin East area. Earthquake effects could also be accentuated where a building is founded on competent rock which is underlain by less competent highly or completely weathered rock — for example, moderately weathered Lower Cretaceous siltstone unconformable underlain by highly to completely weathered Lower Proterozoic shale or mudstone in the Darwin East area.

RESOURCES

Locations of the various resources within the area are shown in Figure 18, and the suitabilities of rock and soil units for use as resources are listed in Tables 1 and 2.

Coarse aggregate

Quartzite (silicified greywacke) is the only suitable rock in the area for coarse aggregate quarrying; most production for Darwin comes from deposits in the Darwin East area. Between 1967 and 1974, an estimated less than 35 percent of available reserves had been extracted, but a detailed geological mapping and drilling program would have to be undertaken in order to substantiate available reserves; such work might extend resources farther north.

Alternative sources of coarse aggregate (quartzite) are available outside the area, but farther away from Darwin. One deposit is 30 km southeast of the city but has lower

reserves than the deposits within the Darwin East area. A small amount is brought in by rail from a quarry near Manton Dam about 45 km south-southeast of Darwin. Therefore, quartzite deposits within the area constitute a valuable resource, and the proposed closure of existing quarries does not appear to be warranted at this time, even though future, longer-term development may make this necessary.

Fine aggregate

Darwin's fine aggregate supply is coarse river sand which is hauled from the Mary River 65 km to the southeast. Until recently a deposit of coarse sand was worked near the Howard River, where the sand lies beneath the upper unit of the Darwin Member and probably forms part of the Petrel Formation.

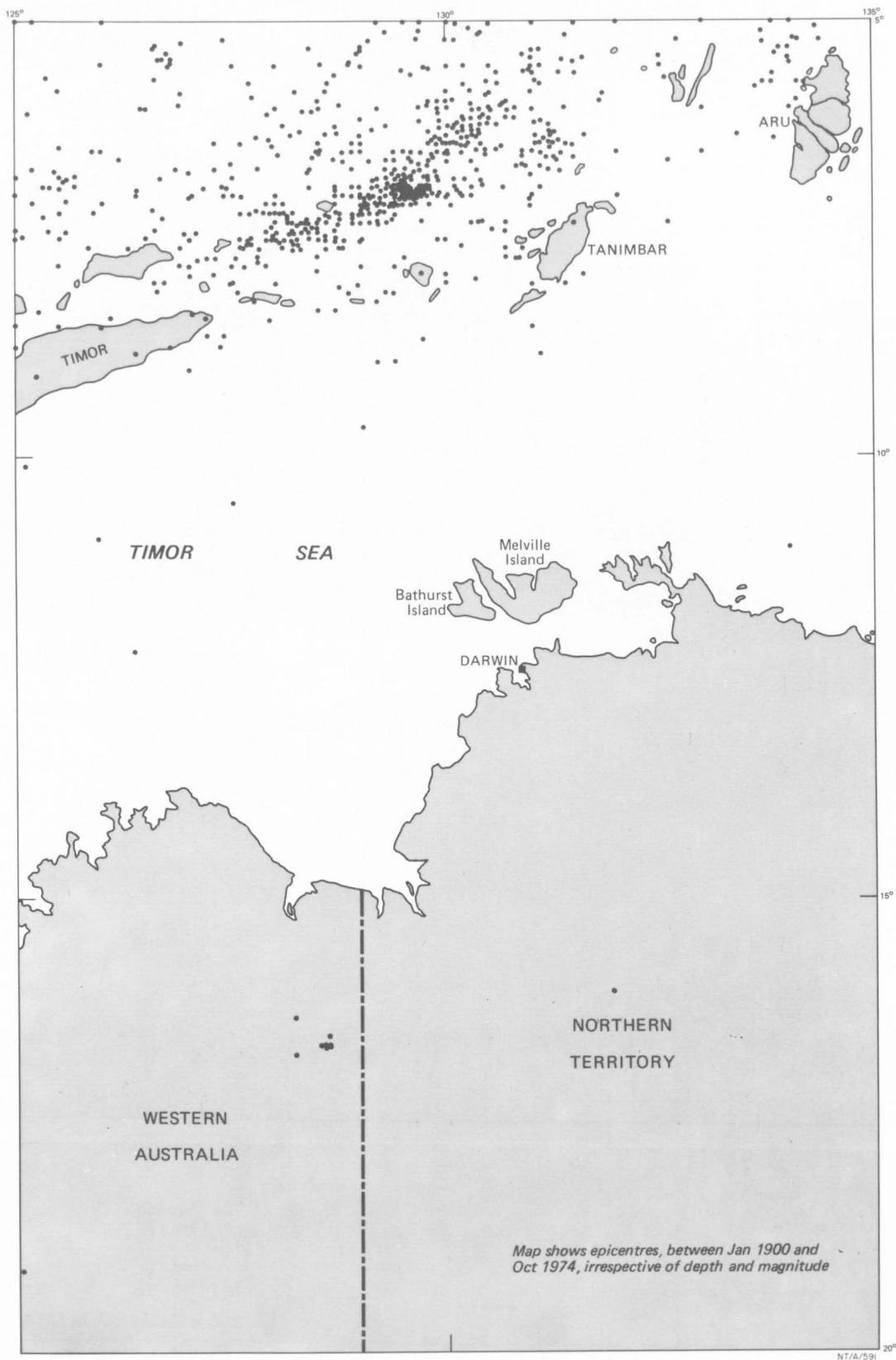


Fig. 17. Earthquake epicentres in the central-north Australia/ southeast Indonesia region.

Deposits similar to that occurring near the Howard River may be present in the Darwin East area; an auger drilling programme would be required to prove their existence. One area that is considered likely to contain such deposits is southwest of Marlow's Lagoon (Fig. 18).

Fine sand

Considerable quantities of fine sand (siliceous sand, Fig. 9)

suitable for use in bricklayers' and plasterers' mortar are being extracted from the northern part of the Darwin East area; probably more than 60 percent of the known reserves have so far been extracted. Fine quartz sand is a weathering product of quartzite and silicified dolomite, and has been concentrated by eolian or alluvial processes, or both, into workable deposits.

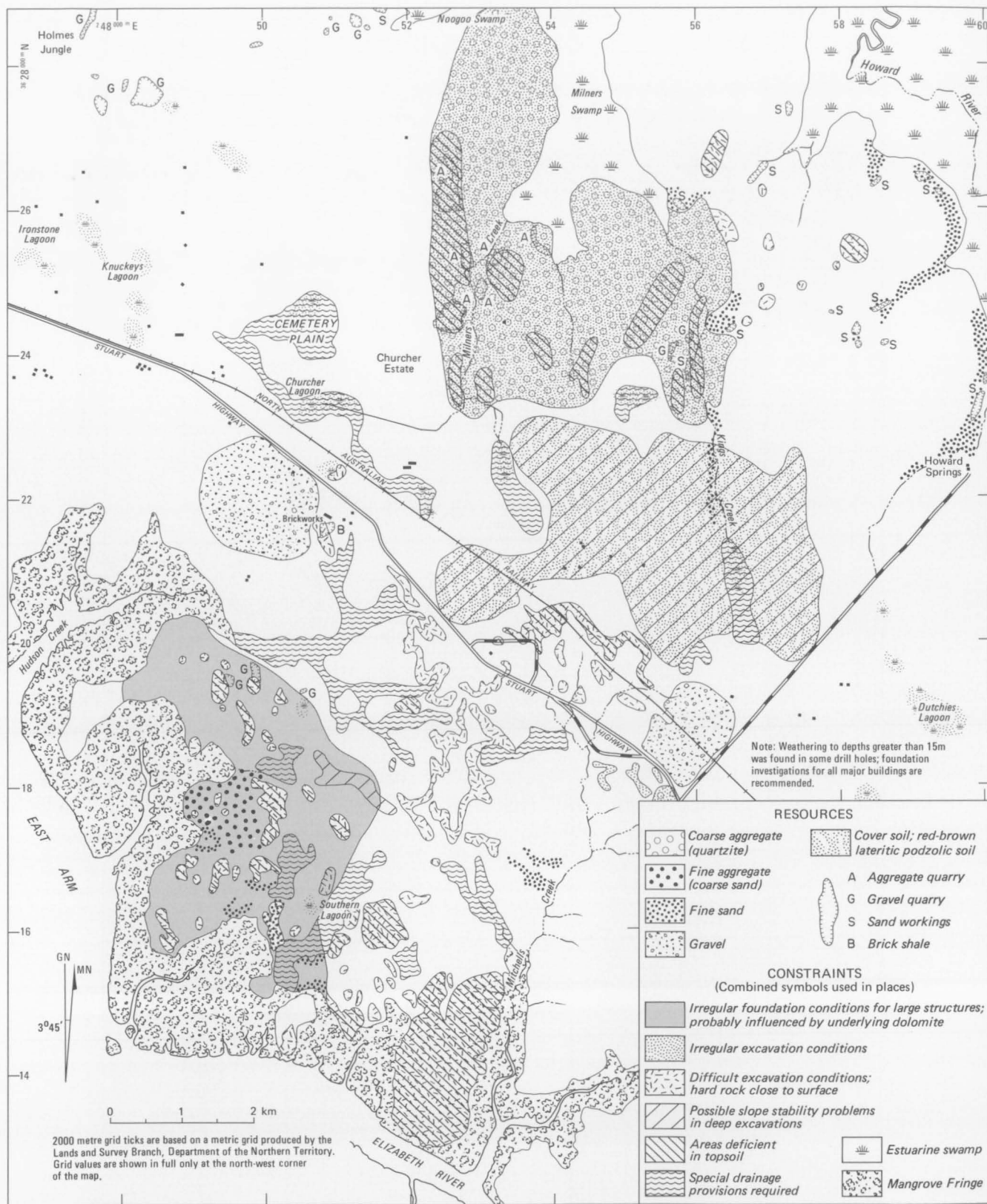


Fig. 18. Resources and constraints map.

Sand has not been won from deposits in the southern part of the area, where it is residual and overlies silicified dolomite; a number of these deposits may be suitable for exploitation.

Gravel

Gravel forms in situ by the lateritisation of the Lower

Cretaceous siltstone. Gravel suitable for pavement construction is essentially the mottled zone of the standard lateritic profile; however, upper ferruginous zone material is sometimes mixed with the mottled zone to increase the quantity of gravel available. Most areas being worked have a lateritic red earth profile; the A horizon of this profile (normally about 25 cm thick) is pushed aside, and the

underlying material is removed to the limit of rippability. Mixing of the mottled zone (B horizon) with the ferruginous zone during borrowing, loading, and placing operations produces a sandy ferruginous gravel that has been used under many sealed surfaces in Darwin.

Gravel suitable for sealed pavement construction has been removed from many places in the northern part of the area; a smaller quantity has been removed from the southern part of the area. Most known deposits have now been fully exploited. The restoration of areas previously worked for gravel has not been attempted, and at present such areas are devoid of soil cover and vegetation. Future operations should make some provision for the rehabilitation of the areas worked, including the replacement of some soil cover and planting of vegetation.

Some areas from which future gravel supplies might be readily won are shown in Figure 18; however, urban planning considerations may preclude these areas from exploitation.

Topsoil

Topsoil is generally regarded as a dark grey to black

organic sandy silt or silty sand that is suitable for topdressing lawns, etc. The natural distribution of this type of soil is not widespread in the Darwin region; it occurs as the upper layer (A horizon) of yellow lateritic podzolic soil in the perennial and ephemeral lagoons, and in some drainage channels. Its distribution approximates to those areas requiring special drainage provisions (Fig. 18).

Much topsoil will be needed to rehabilitate those parts of the Darwin East area lacking soil. In Darwin, the upper layers of the red-brown lateritic podzolic soil are now being used for topsoil; this practice could be the solution for those parts deficient in soil at Darwin East, as large amounts of this soil are expected to be available from the central part of the area (see Fig. 18).

Brick shale

A brick shale deposit being worked in the Darwin East area supplies Darwin's total requirements. Similar deposits of weathered shale exist to the southeast of the proposed urban development area, and, subject to satisfactory tests, the brickmaking facility could be relocated if necessary.

CONSTRAINTS

FOUNDATION CONDITIONS

General foundation conditions for the various rock and soil types that occur within the area are listed in Tables 1 and 2. Figure 18 shows areas that are expected to have foundation constraints.

Geological factors affecting the construction of large buildings

Cavernous dolomite underlies much of the area at depth. One deep hole (about 50 m) should be drilled on each proposed site to determine whether dolomite is present, and, if so, at what depth. Foundations for large buildings underlain by dolomite may require additional expenditure.

Lower Proterozoic mudstone, siltstone, and shale are generally sound and only moderately to highly weathered close to the surface, though in places they are completely weathered at depth beneath the Darwin Member (see drillholes 1, 3, 4, and 5, Appendix 5).

Weakly cemented grit or conglomerate layers rest on the unconformity between the Darwin Member and the underlying Lower Proterozoic rocks (see drillhole 6). These layers may not provide suitable foundations and are likely to contain large amounts of groundwater during the wet season. Therefore a detailed geological investigation of foundation conditions at the unconformity will have to be made at each proposed construction site in the Darwin Member.

Soils affecting the construction of roads and small buildings

Planosols have very little shear strength when saturated; however they rarely exceed 75 cm in thickness, and better foundation conditions for small structures generally underlie this layer. They will have to be removed and replaced before roads are constructed across them.

Estuarine marine cracking clay soils, and the organic clayey silts of the mangrove fringe, have poor bearing strengths. Cracking clays should have sufficient strength to support road embankments, but the organic clayey silts would probably have to be replaced.

EXCAVATION CHARACTERISTICS

General excavation characteristics for the rock and soil

types are given in Tables 1 and 2. Figure 18 shows areas where excavation is likely to be difficult.

Geological factors affecting the excavation of building sites, service trenches, and road-cuts.

Quartzite and, to a lesser extent, the sandstone and siltstone of the extensive Darwin Member will be expensive to excavate, because explosives will have to be used to loosen them. Laterite (concretionary ironstone) can be hard at the surface and, consequently, difficult to excavate, but it is commonly underlain by softer, weathered (mottled zone) material. Mottled and pallid zones of the lateritic profile can be very hard where exposed at the surface; they are generally not underlain by softer material and can be difficult to excavate.

SLOPE STABILITY

Slope stability problems may arise when steep road-cuts or deep service trenches are excavated; trenches excavated in red-brown and yellow lateritic podzolic soils may have to be supported and dewatered. Other soils are generally thin. The mottled and pallid zones of the standard lateritic profile stand up well in existing cuttings.

AREAS DEFICIENT IN SOIL

Areas deficient in soil (Fig. 18) are generally where rock, laterite, or weathering laterite are exposed at the surface. The quantity of soil necessary to form an adequate cover varies from place to place, but generally a thickness of 25-30 cm should be enough. The required soil could be borrowed from places that contain thick red-brown lateritic soil profiles (see Fig. 18).

SPECIAL DRAINAGE PROVISIONS

Specially designed surface or subsurface drains will probably be necessary to effectively drain the broad flat drainage depressions, ephemeral lagoons, and areas of seepage along the southern escarpment. Drains associated with normal urban development — though expected to increase runoff and reduce infiltration — are unlikely to lower the potentiometric surface to the extent that areas with seepage problems show any marked improvement under very wet conditions (see p.22).

PLANNING CONSIDERATIONS

GEOLOGICAL MONUMENTS

Five sites which should be preserved as geological monuments are indicated in Figure 19.

Sites 1 and 2 are the perennial lagoons, Knuckeys and Marlows Lagoons, which are clay-lined, composite subsidence dolines. These are karstic features formed by the collapse of Lower Cretaceous siltstone into underlying cavernous Lower Proterozoic dolomite. Site 3 is a small subsidence doline southeast of Marlows Lagoon.

Site 4 is an interesting exposure of Lower Cretaceous and Upper Jurassic? rocks. At this site the possibly unconformable contact between these rocks is apparent. Drillholes 2 and 12 were sunk at this site; hole 2 intersected Lower Proterozoic dolomite (Coomalie Dolomite) at 40 m.

Site 5 is a road-cut exposure along the old Stuart Highway where the ferruginous, mottled, and pallid zones of the standard lateritic profile are exposed.

REFUSE DISPOSAL

Although rubbish (general non-putrefying waste) is suitable fill for reclaiming mangrove fringe and estuarine swamp areas, garbage (putrefying material) is not; the latter could create long-term water pollution problems. The number of suitable sites for landfill garbage disposal is extremely limited; however, areas underlain by thick profiles of red-brown lateritic podzolic soil should be suitable if appropriate steps are taken to isolate the leachate from the groundwater regime.

A multiple land-use program is proposed for areas underlain by deep profiles of red-brown lateritic podzolic soil: (1) trenching methods would be used to remove selectively the upper ferruginous soil layers for use as topsoil elsewhere in the area; (2) clay layers within the profile would be removed and stockpiled; (3) the lowermost gravel layer (mottled zone) would be extracted, and, if it met required specifications, could be used for gravel pavement construction; and (4) the stockpiled clay would be placed on the bottom and sloping sides of the trenches to seal them from groundwater movement. Such an operation would create a number of parallel, clay-lined trenches suitable for sanitary landfill operations. Long-term pollution risks would be kept to a minimum if runoff and groundwater could be controlled during wet-season operations.

Areas most suited to this type of operation could be delineated only by a detailed augering and testing program. Such an approach would have long-term benefits, and, once such landfill areas were designated and appropriate compaction and cover procedures adopted, future re-use of the area could be planned.

ACCESS TO EAST ARM

Rock crops out in several places along the southwestern and southern mangrove fringes — adjacent to East Arm and the Elizabeth River. Low rock embankments founded on some of these outcrops would provide relatively cheap, easy access to the water's edge for fishing, boating, etc. (Fig. 19). Rock borrow areas are suitably located nearby.

ALTERNATIVE SITE FOR DARWIN AIRPORT

The geological and soils mapping has indicated a geotechnically suitable site for an airport to the northeast of Knuckeys Lagoon, adjacent to and partly within the western boundary of the acquisition area (Fig. 19). Special features of the site are:

1. The area is topographically planar: there is less than 1 m height variation over a length of 4.3 km; and the proposed main runway is suitably oriented in a northwest-southeast direction.
2. Approaches to possible runways are largely free from high ground, and noise-expectancy forecast (NEF) zones associated with the approaches would be over areas with non-geological constraints that exclude them from urban development.
3. The site has soils that could be ripped and recompacted to make a strong sub-base at minimum expense for the various runways.
4. The quarries to the east of the site could provide high-grade fine crushed rock and aggregate suitable for base and surface course construction. Haulage distances would be only 2-3 km on average.
5. The existing quarries and quartzite reserves would lie within the NEF zones of the airport, and therefore could continue operations.
6. The airport would act as a buffer zone between the ecologically balanced coastal plains to the northeast and northwest and the urban development at Darwin and Darwin East.

If a decision is made to relocate Darwin airport, then a site at Darwin East should be considered as a possible alternative. A further, detailed investigation of the site would have to be made as part of a feasibility study.

POSSIBLE DREDGING OF A MARINA

The tidal mangrove flats in the Hudson Creek estuary could be dredged, and a marina constructed (Fig. 19). The sand and silt dredged from the harbour could be used as fill behind the suggested rock embankment flanking East Arm (see above). As the emplacement of fill would destroy a considerable part of the mangrove fringe flanking the Darwin East area, it would have to be the subject of a separate study to assess the feasibility and environmental impact of the scheme.

LOCATION OF A SEWERAGE TREATMENT PLANT

An extensive area of sand and Lower Cretaceous siltstone within the mangrove fringe flanking the Elizabeth River (Fig. 19) may be suitable for locating a sewerage treatment plant.

USE OF SEWERAGE EFFLUENT

Construction of a tidal bund across the mouth of Mitchells Creek may facilitate the desalination of the enclosed mangrove tidal areas, which could perhaps be farmed; treated sewerage effluent could be used for irrigation (Fig. 19). A more detailed study would have to be made in order to determine the feasibility of such a scheme.

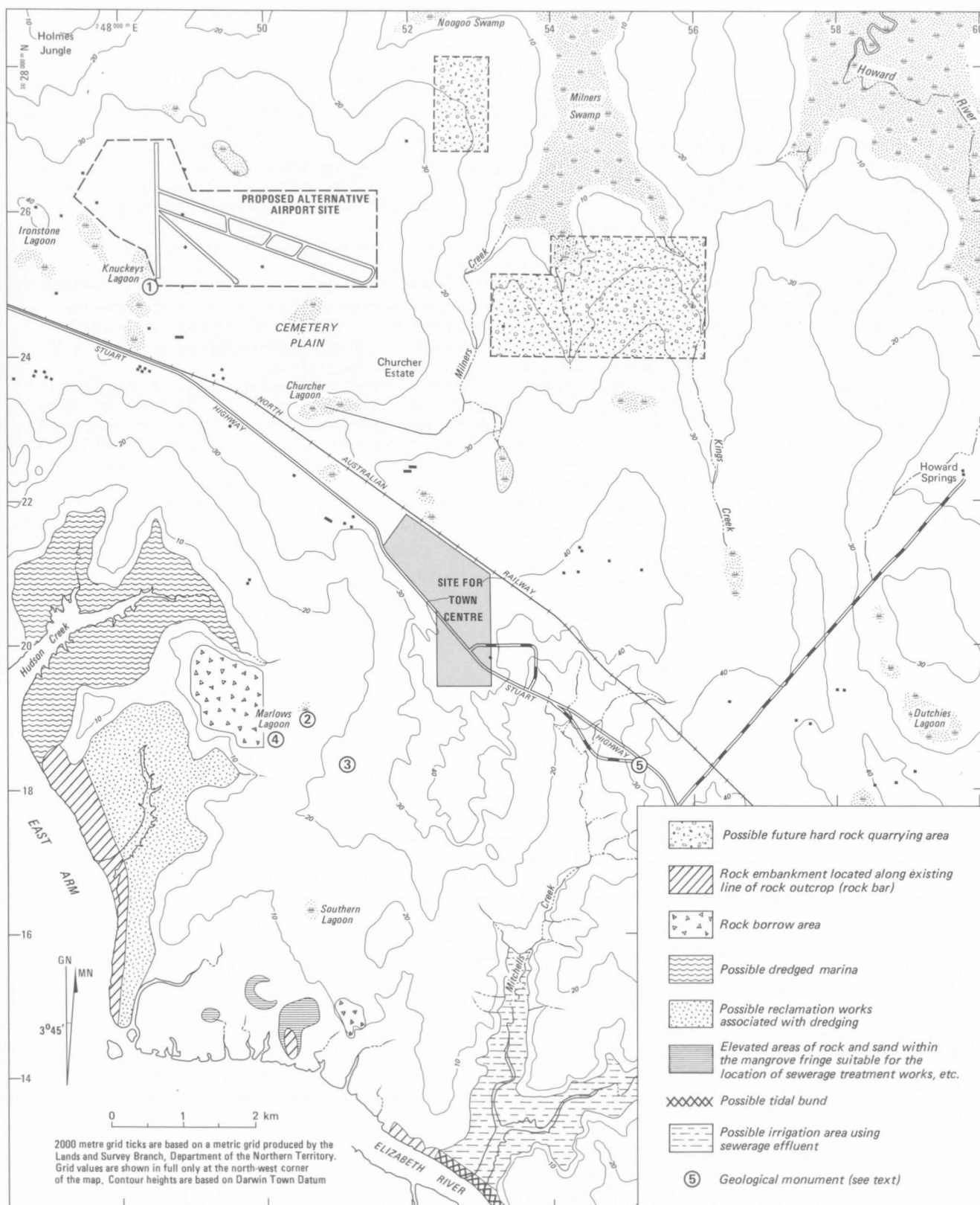


Fig. 19. Map of planning considerations.

NT/A/593

CONCLUSIONS

There are no major engineering geological constraints that would preclude the Darwin East area from urban development.

EFFECT OF GEOLOGY ON URBAN DEVELOPMENT

- (1) Rocks within the area are of Lower Proterozoic and Mesozoic age. The older rocks are folded and unconformably overlain by subhorizontal younger rocks.
- (2) Cavernous dolomite underlies much of the southwestern part of the area at relatively shallow depths and extends at greater depths to the north beneath the Cemetery Plain/Knuckeyes Lagoon system; its presence may cause foundation problems for large structures.
- (3) Completely weathered Lower Proterozoic shale and mudstone underlying the upper siltstone unit of the Darwin Member were recovered in cores from drillholes on the site of the proposed town centre; they may cause foundation problems for large structures.
- (4) Although cavernous dolomite is unlikely to occur at depth beneath the proposed town centre, other rock types may cause foundation problems there: possible layers of weakly cemented grit or conglomerate at the unconformity between the Darwin Member and the underlying Lower Proterozoic rock, and completely weathered Lower Proterozoic rock, may necessitate the relocation of some large structures to more suitable sites nearby.
- (5) Rock bars adjacent to East Arm are suitable for founding embankments that would give easy access to the water's edge, but this scheme would have to be investigated in more detail.
- (6) A rock and sand platform that crops out in the southern mangrove fringe may be a suitable site for a sewerage treatment plant.
- (7) Alternative quartzite quarry sites are available outside the area, but at a greater distance from proposed urban development. Large quartzite reserves still exist in the Darwin East area, and these should be set aside for future use. Relocation of quarries out of the Darwin East area does not appear to be warranted.
- (8) Excavation for services in areas where quartzite crops out or occurs just below the surface is likely to be difficult and expensive.
- (9) There is some scope for the selective extraction of fine aggregate, fine sand, and gravel from the area. However, the major resource activity may well be the redistribution of topsoil and the extraction of gravel in conjunction with future landfill refuse disposal operations.
- (10) Some features of geological interest are worthy of preservation as geological monuments.

EFFECT OF GEOMORPHOLOGY AND SOIL DISTRIBUTION ON URBAN DEVELOPMENT

- (11) At least eight distinct geomorphological events have occurred in the area since the Middle Jurassic. One of the most significant events was the major period of lateritisation that developed the standard lateritic profile during Late Cretaceous to middle Tertiary time.
- (12) Areas deficient in topsoil — that is, those areas underlain by lithosol, laterite, and weathering laterite — will be difficult to excavate.
- (13) Areas underlain by red-brown lateritic podzolic soil could provide the quantities of topsoil required for the area.

- (14) There are no areas of thixotropic soil. Planosol has a low bearing strength when saturated, but should not be troublesome because it is a relatively thin soil which is usually underlain — 0.5-1 m below the surface — by material having a higher bearing capacity. The period of saturation should be considerably reduced when urban drainage is installed; however, a large percentage of areas underlain by planosol would probably continue to act as floodways and would not be available for recreation during the wet season.
- (15) Slope stability is not expected to be a major problem, but deep trenches through red-brown and yellow lateritic podzolic soils, cracking clay soils, sandy clay, and organic clayey silt soils may have to be supported and dewatered.

EFFECT OF GROUNDWATER AND NATURAL DRAINAGE ON URBAN DEVELOPMENT

- (16) The level of the potentiometric surface varies markedly throughout the year; the high level that develops during the wet season falls away during the following months with a loss of water to a large number of springs along the edge of the plateau escarpment.
- (17) Groundwater catchments for the various lines of springs are probably extensive. Recharge of these groundwater catchments is partly attributed to many of the lagoons in the area when the water-levels are high. No evidence was found of springs being fed by fault-transmitted artesian water.
- (18) Spring flow may not persist for long after the wet season when drains are installed, and infiltration is reduced in the central part of the area; however, there are indications that some additional drains will be required to control the effects of seepage.
- (19) Sufficient groundwater may be available from aquifers underlying perennial lagoons to provide water for topping up the lagoon levels during the dry season.
- (20) Urban development at Darwin East is unlikely to cause pollution of McMinns Borefield.
- (21) A conventional drainage system is favoured as being the most appropriate for the area; a system incorporating retardation basins could increase spring flow along the southern escarpment.
- (22) Drains will reduce the time that standing water remains in depressions in the urban development area, and so will make a major contribution to mosquito control. Pockets in which water is ponded between tides in the southern mangrove fringe could be filled; the selection of a suitable fill material, and its stability when placed, would have to be investigated.

MISCELLANEOUS CONSIDERATIONS

- (23) Very little seismic activity has been recorded in the northern part of Australia. Most earthquakes felt at Darwin originate in the Banda Sea area. An earthquake with an intensity of MM V in Darwin can be expected on average at least once every 50 years.
- (24) A geotechnically suitable airport site lies partly within, and adjacent to, the western boundary of the Darwin East area northeast of Knuckeyes Lagoon.
- (25) The tidal mangrove flats in the Hudson Creek estuary could be dredged, and a marina constructed.
- (26) Sewerage effluent could perhaps be used to irrigate part of the Mitchells Creek catchment.

RECOMMENDATIONS

The following recommendations are made:

GEOLOGY

- (1) That foundation investigations of a site reserved for a large building include at least one deep drillhole, to help the civil engineers assess the suitability of the site for founding a large building on it.
- (2) That the present quarrying operations be allowed to remain within the area, and reserves of quartzite be set aside for future exploitation.
- (3) That future landfill refuse disposal operations be planned in conjunction with selective resource extraction.
- (4) That investigations to locate reserves of fine aggregate (coarse sand) be undertaken.
- (5) That the feasibility of constructing embankments adjacent to East Arm and the Elizabeth River be investigated.
- (6) That sites considered worthy of preservation as geological monuments be preserved in their natural state.

GROUNDWATER

- (7) That the piezometer network in the central part of the area be accurately levelled, and bench-marks established at

the nearby lagoons. Water-levels in the piezometer network and adjacent lagoons should be recorded monthly for 12 months.

- (8) That the use of groundwater for maintaining water-levels in the perennial lagoons during the dry season be investigated.

DRAINAGE

- (9) That a conventional drainage scheme which maximises runoff be adopted.
- (10) That investigations be made to determine whether ponds during low tide in the southern mangrove fringe are extensive, and whether they could be readily filled.

MISCELLANEOUS

- (11) That the proposed alternative airport site be considered if a decision is made to relocate the existing airport.
- (12) That the possibility of dredging a small-boat harbour in Hudson Creek be examined.
- (13) That use of sewerage effluent in part of the Mitchells Creek catchment be examined.

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APPENDIX 1

DEFINITIONS OF ENGINEERING GEOLOGY TERMS

Weathering of rock

Fresh	: No discolouration or loss in strength
Fresh stained	: Limonitic staining along fractures; rock is otherwise fresh and shows no loss of strength
Slightly weathered	: Rock is slightly discoloured, but not noticeably lower in strength than the fresh rock
Moderately weathered	: Rock is discoloured and noticeably weakened; N-size drill core (54 mm diameter) generally cannot be broken by hand across the rock fabric
Highly weathered	: Rock is discoloured and weakened: N-size drill core can generally be broken by hand across the rock fabric
Completely weathered	: Rock is decomposed to a soil, but the original rock fabric is mostly preserved

Percussive strength of rock

Strong to very strong	: Cannot be broken by repeated blows with a hammer
Moderately strong	: Rock broken by three or four blows
Weak	: Rock broken by one blow

Hardness of rock

Hard to very hard	: Impossible to scratch with knife blade
Moderately hard	: Shallow scratches with knife blade
Soft	: Deep scratches with knife blade

Bedding

Laminated	: Less than 10 mm thick
Thinly bedded	: 10 to 100 mm thick
Thickly bedded	: Greater than 100 mm thick

APPENDIX 2

LATERITISATION AND ITS PRODUCTS

(Modified after Whitehouse, 1940; and Hays, 1967)

The term lateritisation, as used here, refers to all weathering and alteration processes, pedological or otherwise, that result in the concentration of iron oxides in a subsurface layer. If the resultant weathering profile impressed upon the parent rock can be subdivided into an upper 'ferruginous zone', a middle 'mottled zone', and a lower 'pallid zone', after the classification used by Whitehouse (1940), it is termed the standard lateritic profile. Where the ferruginous zone is easily recognisable as a separate sedentary deposit of vesicular and concretionary ironstone, the term laterite is used. Conglomerate consisting wholly or partly of fragments of reworked laterite are here referred to as conglomeratic laterite.

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APPENDIX 3 MODIFIED MERCALLI SCALE

MM I:	Not felt by humans, except in especially favourable circumstances, but birds and animals may be disturbed. Reported mainly from the upper floors of buildings more than 10 storeys high. Dizziness or nausea may be experienced. Branches of trees, chandeliers, doors, and other suspended systems of long natural period may be seen to move slowly. Water in ponds, lakes, reservoirs, etc., may be set into seiche oscillation.		
MM II:	Felt by a few persons at rest indoors, especially by those on upper floors or otherwise favourably placed. The long-period effects listed under MM I may be more noticeable.	MM IX:	General panic Masonry D destroyed. Masonry C heavily damaged, and may collapse completely. Masonry B seriously damaged. Frame structures racked and distorted. Damage to foundations general. Frame houses not secured to foundations shift. Brick veneers fall and expose frames. Cracking of the ground conspicuous. Minor damage to paths and roadways.
MM III:	Felt indoors, but not identified as an earthquake by everyone. Vibration may be likened to the passing of 'light traffic'. It may be possible to estimate the duration, but not the direction. Hanging objects may swing slightly. Standing motor-cars may rock slightly.		In alluviated areas, ejected sand and mud form earthquake fountains and sand craters. Underground pipes broken. Serious damage to reservoirs.
MM IV:	Generally noticed indoors, but not outside. Very light sleepers may be awakened. Vibration may be likened to the passing of heavy traffic, or to the jolt of a heavy object falling or striking the building. Walls and frames of buildings are heard to creak. Doors and windows rattle. Glassware and crockery rattle. Liquids in open vessels may be slightly disturbed. Standing motor-cars may rock, and the shock can be felt by their occupants.	MM X:	Most masonry structures destroyed, together with their foundations. Some well-built wooden buildings and bridges seriously damaged. Dams, dykes, and embankments seriously damaged. Railway lines slightly bent. Cement and asphalt roads and pavements badly cracked or thrown into waves. Large landslides on river banks and steep coasts. Sand and mud on beaches and flat land move horizontally. Large and spectacular sand and mud fountains. Water from rivers, lakes, and canals thrown up on to the banks.
MM V:	Generally felt outside, and by almost everyone indoors. Most sleepers awakened. A few people frightened. Direction of motion can be estimated. Small unstable objects are displaced or upset. Some glassware and crockery may be broken. Some windows cracked. A few earthenware toilet fixtures cracked. Hanging pictures move. Doors and shutters may swing. Pendulum clocks stop, start, or change rate.	MM XI:	Wooden frame structures destroyed. Great damage to railway lines and underground pipes.
MM VI:	Felt by all. People and animals alarmed. Many run outside. Difficulty experienced in walking steadily. Small church and school bells ring. Windows, glassware, and crockery broken. Objects fall from shelves, and pictures from walls. Heavy furniture moved. Unstable furniture overturned. Slight damage to Masonry D*. Some plaster cracks or falls. Isolated cases of chimney damage. Trees and bushes shake, or are heard to rustle. Loose material may be dislodged from existing slips, talus slopes, or shingle slides.	MM XII:	Damage virtually total. Practically all works of construction destroyed or greatly damaged. Large rock masses displaced. Lines of sight and level distorted. Visible wave-motion of the ground surface reported. Objects thrown upwards into the air.
MM VII:	General alarm. Difficulty experienced in standing. Noticed by drivers of motor-cars. Large bells ring. Masonry D cracked and damaged. A few instances of damage to Masonry C. Loose bricks and tiles dislodged. Unbraced parapets and architectural ornaments may fall. Stone walls cracked. Weak chimneys broken, usually at the roof-line. Domestic water tanks burst. Concrete irrigation ditches damaged. Trees and bushes strongly shaken. Waves evident on ponds and lakes. Water made turbid by stirred-up mud. Small slips, and caving-in of sand and gravel banks.	<i>Categories of non-wooden construction</i>	
MM VIII:	Alarm may approach panic. Steering of motor-cars affected. Masonry C damaged, and partly collapses. Masonry B may be damaged. Masonry A undamaged. Chimneys, factory stacks, monuments, towers, and elevated tanks twisted or brought down. Panel walls thrown out of frame structures. Some brick veneers damaged. Decayed wooden piles broken. Frame houses not secured to the foundation may move.	Masonry A:	Structures designed to resist lateral forces of about 0.1 g, such as those satisfying the New Zealand Model Building By-Law, 1955. Typical buildings of this kind are well reinforced by means of steel or ferroconcrete bands, or are wholly of ferroconcrete construction. All mortar is of good quality and the design and workmanship is good. Few buildings erected before 1935 can be regarded as in category A.
		Masonry B:	Reinforced buildings of good workmanship and with sound mortar, but not designed in detail to resist lateral forces.
		Masonry C:	Buildings of ordinary workmanship, with mortar of average quality. No extreme weakness, such as inadequate bonding of the corners, but not designed nor reinforced to resist lateral forces.
		Masonry D:	Building with low standards of workmanship, poor mortar, or weak materials such as mud-brick and rammed earth. Weak horizontally.
		<i>Windows</i>	
		Window breakage depends greatly upon the nature of the frame and its orientation with respect to the earthquake source. Windows cracked at MM V are usually either large display windows, or windows tightly fitted to metal frames.	
		<i>Chimneys</i>	
		The 'weak chimneys' listed under MM VII are unreinforced domestic chimneys of brick, concrete block, or poured concrete.	
		<i>Water tanks</i>	
		The 'domestic water tanks' listed under MM VII are of the cylindrical-iron type common in New Zealand rural areas. If these are only partly full, movement of the water may burst soldered and riveted seams.	
		<i>Reference</i>	
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* See *Categories of non-wooden construction* at the end of this Appendix.

APPENDIX 4

DEPTHS (IN METRES BELOW GROUND LEVEL, DARWIN TOWN DATUM)
OF WATER-LEVELS IN AUGER AND DRILL HOLES,
JUNE-DECEMBER 1974

Auger holes

<u>Auger Hole No.</u>	<u>Date (1974)</u>							
	4/6	26 27/6	24/7	26/8	1/10	28/10	25/11	16/12
1	3.30	3.80	4.23	4.67	5.17	DRY	DRY	2.46
2	4.47	5.12	5.42	5.79				
3	7.30	7.60	7.88	8.16	8.26	8.41	8.24	5.32
4	4.37	5.16	5.91	6.81	7.75	8.40	8.35	2.77
5	0.45	0.61	0.87	1.68	3.02	3.99	0.74	0.48
6	1.30	1.46	1.94	2.56	3.45	4.11	3.93	1.21
7	0.85	0.98	1.23	1.72	2.18	2.60	2.18	0.61
8	2.80	2.51	2.99	3.65	4.46	4.99	4.99	1.36
9	0.60	0.82	1.03	1.50	2.17	DRY	1.25	0.12
10	1.30	1.90	3.05	5.10	6.10	DRY	DRY	0.57
11	2.00	2.62	3.69	4.98	6.22	6.86	7.22	1.95
12	2.42	3.10	3.83	4.81	5.19	6.65	7.28	3.99
13	1.82	2.50	3.27	4.40	DRY	DRY	DRY	
14	4.15	4.62	5.23					
15	3.00	3.66	4.34	5.10	6.28	7.51	6.56	
16	1.52	1.61	2.05	2.44	2.99	3.63	0.91	
17	1.82	2.08	2.32	2.55	2.77	2.96	2.16	1.17
18		4.85	5.70	6.93	DRY	DRY	DRY	
19		3.29	3.78	4.41	5.08	5.65	4.95	
20		1.16	1.41	1.83	2.43	2.86	2.58	
21		0.99	1.37	1.98	2.42	DRY	DRY	
22		10.38	11.61	12.89	DRY	DRY	DRY	
23		2.32	3.32	4.88	DRY	DRY	DRY	
24		6.18	7.28	8.43	9.54	DRY	DRY	
25		5.47	6.73	7.90	9.07	9.87	10.35	
26		2.09	2.98	4.05	5.10	5.85	5.75	
27		1.09	1.61	2.89	4.25	4.98	5.35	
28		0.49	0.93	DRY?	DRY	DRY	DRY	1.00
29		5.54	6.63	7.77	8.88	9.95	10.45	
30		6.44	7.66	8.86	9.99	10.82	DRY	
31A		4.62	5.14	5.68	6.22	6.58	6.81	2.57
31B			DRY	DRY	DRY	DRY	DRY	
31C				DRY	DRY	DRY	DRY	
32			1.22	2.19	DRY	DRY	3.02	
33			1.88	3.15	DRY	DRY	DRY	
34			3.99	4.13			DRY	
35			5.94	7.00	8.27	9.16	9.01	
36			1.88	DRY	DRY	DRY	0.60	
37			3.89	DRY	DRY	DRY	DRY	
38			DRY (UNCASED)					
39			2.28	2.96	3.87	4.43	4.61	
40			3.76	4.69	5.44	5.96	6.08	
41								
42			11.43		DRY	DRY	DRY	
43			1.63	2.29	3.05	3.10	3.98	
44			2.01	2.73	3.64	4.27	4.35	
45			1.17	1.85	2.72	3.36	3.65	
46			DRY (UNCASED)					
47			5.18	6.00	6.83	7.48	7.72	
48			DRY (UNCASED)					
49			DRY (UNCASED)					
50			4.55	5.26	6.19	6.75	6.95	
51			4.03	4.62	5.37	5.90	6.09	
52			DRY (UNCASED)					
53			3.05	3.70	4.37	4.75	4.78	
54			3.30	3.37	3.64	3.79	3.57	
55			5.94	7.01	8.12	9.04	9.53	
56			5.89	7.31	8.54	9.49	DRY	

Auger Hole No.	4/6	26 27/6	24/7	26/8	Date (1974)				
					1/10	28/10	25/11	16/12	
57			DRY (UNCASED)						
58			7.77	8.58	DRY	DRY	DRY		
59			9.39		DRY	DRY	DRY		
60			5.25	DRY	DRY	DRY	DRY		
61			3.31	3.82	4.33	5.01	4.70		
61A			2.08	2.24	2.48	2.65	0.87	0.00	
62			2.85	3.04	3.49	3.77	3.40	1.70	
63			1.71	1.98	2.33	2.76	2.82	0.50	
64			4.02	4.54	5.29	5.82	5.76	2.20	
65			3.22	3.68	4.34	4.96	5.38	1.25	
66			5.97	6.41	6.87	DRY	DRY	2.08	
67			5.28	DRY	DRY	DRY	DRY	1.72	
68			4.27	DRY	DRY	DRY	DRY	UNDER WATER	
69			5.52	6.00	6.90	7.89	7.82	2.84	
70			DRY (UNCASED)						
71			DRY (UNCASED)						
72			DRY (UNCASED)						
73			4.5	4.8	DRY	DRY	DRY		
74			DRY (UNCASED)						
75			6.10	6.38	DRY	DRY	DRY		
76				DRY	DRY	DRY	DRY		
77			5.47	5.92	DRY	DRY	DRY		
78			4.98	6.44	DRY	DRY	DRY		
79		HOLE FILLED IN							
80				DRY	DRY	DRY	DRY		
81			9.80	DRY	DRY	DRY	DRY		
82			4.32	5.33	6.68	7.73	8.45	3.27	
83			2.28	2.66	3.58	4.52	4.50	2.26	
84				4.78	5.84	6.92	6.50	2.68	
85				2.47	3.18	3.73	3.90	0.00	
86				5.46	5.99	6.40	6.53	2.63	
87			2.74	3.08	3.63	3.94	3.60	0.74	
88				4.29	4.99	5.42	5.40	0.51	
89				4.92	5.33	DRY	5.80	2.77	
90				4.86	5.30	5.68	5.80	3.02	
91				2.19	2.68	3.15	2.90	0.39	
92				3.52	4.33	4.96	4.50	UNDER WATER	
93				3.58	3.88	4.24	4.00	0.42	
94				4.44	DRY	DRY	5.99	UNDER WATER	
95				4.39		DRY	DRY	1.43	
96				3.55		5.15	5.70	0.82	
97				3.58		4.49	5.05	1.72	
98				4.14	4.62	5.07	5.20	2.65	
99				5.02			6.00	3.62	
100				5.54			6.60	4.18	
101				5.93			7.10	4.50	

Drill holes

<u>Drill</u> <u>Hole</u> <u>No.</u>	<u>Date (1974)</u>						
	26/6 27	24/7	26/8	1/10	18/10	25/11	16/12
DD1			6.76	7.38	7.82	7.90	3.98
DD2	DRILLED AT 50° - NO READING						
CH3		4.37	4.69	5.20	FILLED IN		
CH4		6.10	6.39	BLOCKED AT 6.52			3.68
CH5			9.80	10.55	11.21	10.80	7.28
CH6			9.37	10.72	11.80	12.49	
CH7			4.05	5.10	5.85	5.89	
DD8			4.62	5.48	5.83	5.83	
DD9			12.55	13.51	14.07	14.44	
CH10			1.74	2.72	3.76	4.30	
DD11							
DD12				7.50	8.08	8.02	
DD13				2.70	2.75	1.92	
DD14							

APPENDIX 5

GEOLOGICAL LOGS OF DRILL AND AUGER HOLES

Note: Since these logs were recorded, the strata in the Darwin East area have been further subdivided: the Mullaman Beds, referred to in several of the logs, have been renamed the Darwin Member of the Bathurst Island Formation.

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 255630 E 3620080NDIRECTION
RT OF COLLAR 39.65m

SHEET 1 OF 5

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Scale Log	L and % core recovered	Depth of core	Fracture Log	RQD	Defect Frequency Intercept Angle				Structures joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							50	60	80	90			
Red earth.	Sandy clay profile bright red-brown, soft.			N									
				1m									
				2									
				3									
Ferruginous mottled siltstone.	Lateritised Mullaman Beds. NC			4							Honeycombing or latticework structure. Small vesicles throughout.		
				5	25								
				6									
				7									
				8									
	Ferruginous band			30									
Siltstone HW-CW	Light grey, mod. strong to weak. NC			55							Core broken into 6cm pieces.		
				10									
				75									
				11									
Sand	Quartz sand			75							Medium-grained.		
				12									
				13	60								
				14									
				15	25								
Siltstone HW-CW	Light grey to pale yellow, soft, weak. NC			16							Core typically broken to 10cm pieces.		
				17									
				18	100								
				19									
				20	100								

2/8/74

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines.N.T.
Commenced
Completed
Logged by P.V.B.
Vertical scale 1:100
Checked by G. Jacobson

Notes
Fracture Log - Number of fractures per 25cm of core. Zones of core loss blocked in Bedding and Joint Planes - Angles are measured relative to a plane normal to the core axis.
Defect Frequency - Number of natural defects (shears, joints, fractures) per 25cm of core occurring at specified intercept angle range.
Water Level Measurements - 1. Level when hole in progress at specified depth.
2. Level in completed hole on specified date.

HW Highly Weathered.
CW Completely Weathered.
NC NO CORE.

Water Pressure Tests
* Values in Lugeons should be read in conjunction with computation sheets. Test sections are indicated by blocked in strips.
Core Photograph Negative No.
Depth (m) Black & White Colour

M.P. 146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 255630 E 3620080 NDIRECTION
R. OF COLLAR 3965 m

SHEET 2 OF 5

Rock Type and Degree of Weathering	Description Thickness, colour, strength, etc.	Core Loss Grain Size Fracture Log R.O.D.	Defect Frequency Intercept Angle No. per 25 cm	Structures Veins, veins, seams, faults, etc.	Water Pressure Test Losses (Lugeons) *
Siltstone HW-CW.	Light grey, slight pale brown mottling, weak, soft. NIC	100 21m-		Broken into 4cm pieces.	
Siltstone HW	Mullaman Beds. Strongly mottled, light yellow-brown, to pale grey NIC	25 22 - 23 - 60 24 - 25 - 100 26 -		Extensively broken into 2cm pieces.	
Siltstone MW	Mullaman Beds. Weakly mottled, pale grey to white, hard, mod. strong.	100 27 - 28 - 100 29 - 100 30 - 31 - 30 32 -		Core broken into 10 cm pieces.	
	NIC	33 -		Unconformity.	
	Small quartz pieces. Sand washed out of hole.	2 34 - 35 - 36 -		Medium to coarse.	
	NIC	37 -			
Mudstone HW-CW. Golden Dyke Formation	Light grey, lower Proterozoic, soft & weak. NIC Vitreous quartz	10 38 - 39 - 40 -			

Drill type Longyear
Hydraulic
Core barrel type Wireline
Mines N.T.
Coring
Commenced
Completed
Logged by P.V.B.
Vertical scale 1:100
Checked by G. Jacobson

Notes

Fracture Log - Number of fractures per 25 cm of core. Zones of core loss blocked in
Bedding and Joint Planes - Angles are measured relative to the line normal to the core axis
Defect Frequency - Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range
Water Level Measurements -  Level when hole in progress at specified depth
 Level when completed hole at specified depth

NIC. NO CORE.
MW. Moderately Weathered.
HW. Highly Weathered.
CW. Completely Weathered.

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blocked-in strips.

Core photograph negative No.
Depth (m) Black & White Colour

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 255630E 3620080 NDIRECTION
R.L. OF COLLAR 39.65m

SHEET 3 OF 5

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	L ₁ and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency					Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							Intercept Angle							
							0	30	60	80	90			
Mudstone HW-CW.	Pale grey, soft, weak, lower Proterozoic.			N										
			100	41m										
		N/C	40	42										
			43											
			100	44										
		N/C		45										
			40	46										
		N/C		47										
			25	48										
			60	49										
Siltstone MW	Pale grey to medium grey, mod. hard, mod. weak.	N/C	25	50										
				51										
			50	52										
		N/C		53										
			60	54										
		N/C		55										
			75	56										
			100	57										
			50	58										
		N/C		59										
	60	60												
	75													

Core broken into
1cm pieces.Core broken into 6
cm pieces.

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines N.T.
Commenced
Completed
Logged by PVB
Vertical scale 1:100
Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range.
Water Level Measurements — Level when hole in progress at specified depth
 Level in completed hole on specified date

HW Highly Weathered.
CW Completely Weathered.
N/C NO CORE.
MW Moderately Weathered

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blacked in strips

Core Photograph Negative No
Depth (m) Black & White Colour

HOLE NO. 1

DIRECTION
R L OF COLLAR 39.65 m

SHEET 4 OF 5

[illegible]

Drill type	Longyear	Notes	Water Pressure Tests
Feed	Hydraulic		
Core barrel type	Wireline	Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in	* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.
Driller	Mines N.T.	Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis	
Commenced		Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range	
Completed		Water Level Measurements — ∇ Level when hole in progress at specified depth	Core Photograph Negative No.
Logged by	P.V.B	∇ Level in completed hole on specified date	Depth (m) Black & White Colour
Vertical scale	1:100		
Checked by	G. Jacobson	MW Moderately Weathered.	
		HW Highly Weathered	
		CW Completely Weathered	
		NC NO CORE.	
			M(Pf)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT
LOCATION

DARWIN EAST
Taylor Road

HOLE NO 1

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical.
COORDINATES 255630 E 3620080 N

DIRECTION

R.L. OF COLLAR 39.65m

SHEET 5 OF 5

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Log	Graphic Log	L ¹ and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency				Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
								Intercept Angle						
								0	30	60	80	90		
Siltstone MW.	Light grey, mod.hard, weak.			50	81m									
Mudstone HW-CW	Light grey, weak, mod.hard to soft.			30	82									
				90	83									
				40	84									
				86	85									
				30	86									
				60	87									
				80	88									
				80	89									
				75	90									
					91									
					92									
END OF HOLE 92.5m.					93									
					94									
					95									
					96									
					97									
					98									
					99									
					100									

Core broken into
2cm pieces. Small
crush zone.

Drill type Longyear
Feed Hydraulic

Core barrel type

Wireline

Driller Mines N.T.

Commenced

Completed

Logged by P.V.B.

Vertical scale 1:100

Checked by G. Jacobsen

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blocked in

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range

Water Level Measurements — ∇ Level when hole in progress at specified depth
 ∇ Level in completed hole on specified date

MW Moderately Weathered.

HW Highly Weathered.

CW Completely Weathered

N/C NO CORE

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blacked in strips

Core Photograph Negative No

Depth (m) Black & White Colour

M(Pf)146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) 50°
COORDINATES 250120E 3618790N
DIRECTION 180°
REL OF COLLAR 18.3m

SHEET 1 of 4

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc.	Core Losses (Lugons)	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures joints, veins, seams, faults, etc.	Water Pressure Tests Losses (Lugons)
Siltstone HW	Mullaman beds white, mottled brown, limonitic staining on fractures	75 50 100 90	1 2			Rock extensively fractured.	
Siltstone SW	Mullaman beds white some limonitic staining on fracture surfaces, hard.	100 100 30 100 100 100 100 66 N/C 70 100 90	3 4 5 6 7 8 9 10 11 12			Extensively fractured	14/8/74
Siltstone MW-HW	Mullaman beds white	50 50 60 N/C	13 14 15			Very intensely fractured	
Siltstone HW-CW	Mullaman beds pale yellow, soft	100 100 90	16 17 18			Intensely fractured	
Sandy clay	Soft earthy sandy clay, pale yellow to yellow-brown.	80 N/C	19 20				

Drill type Longyear
Feed Hydraulic
Core barrel type WirelineDriller Mines N.T.
Commenced 27/6/74
Completed 7/7/74
Logged by P.V.B.
Vertical scale 1:100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range

Water Level Measurements —  Level when hole in progress at specified depth
 Level in completed hole on specified dateSW Slightly Weathered.
MW Moderately Weathered.
HW Highly Weathered.
CW Completely Weathered.
NC NO CORE

Water Pressure Tests

* Values in lugons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips

Core Photograph Negative No.
Depth (m) Black & White Colour

M(Pf)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT
LOCATION

DARWIN EAST
West of Marlow's Lagoon.

HOLE NO 2

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) 50°
COORDINATES 250120 E 3618790 N

DIRECTION 180°
R.L. OF COLLAR 18.3m

SHEET 2 of 4

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Core Recovery	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Pressure Test Losses (Lugeons) *
Soil	Sandy clay		80	N				
NO	CORE		0	21-				
Soil	Black earthy material.		100	22-				
Soil	Sandy yellow-brown clay.		100	23-				
NO	CORE		0	24-				
Soil	Yellow-brown silty clay.		2	25-				
NO	CORE		0	26-				
Soil ?	Medium sand light grey.		8	27-				
NO	CORE		0	28-				
Sand	Dark brown ferruginous, fine.		8	29-				
NO	CORE		0	30-				
Silt	Yellow-brown earthy ferruginous and micaceous.		0	31-				
			0	32-				
			0	33-				
			0	34-				
			0	35-				
			0	36-				
			0	37-				
			0	38-				
			0	39-				
			0	40-				

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines N.T.
Commenced 27/6/74
Completed 7/7/74
Logged by P.V.B.
Vertical scale 1:100

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range
Water Level Measurements — ☒ Level when hole in progress at specified depth
☒ Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No
Depth (m) Black & White Colour

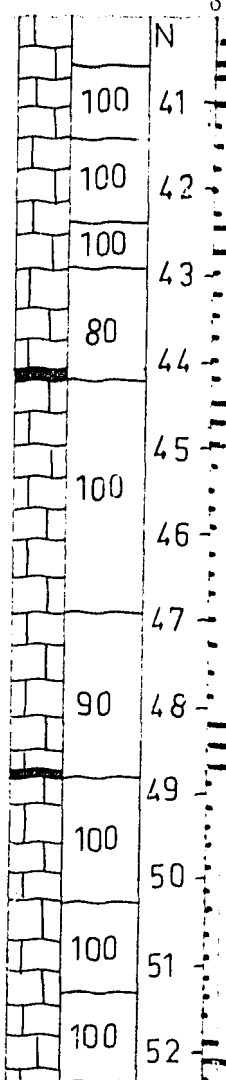
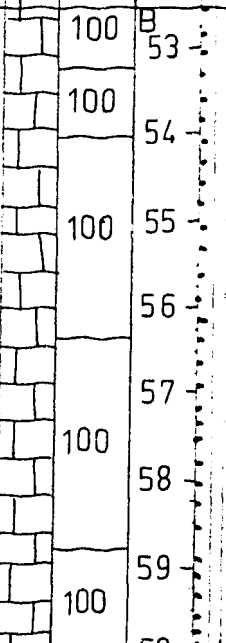
Checked by G. Jacobson

M(Pf)146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) 50° DIRECTION 180°
COORDINATES 250120E 3618790N RE OF COLLAR 18.3m

SHEET 3 OF 4

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Graphic Log	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
Dolomite SW	Pale white, creamy on fresh faces, massive, strong.		41 42 43 44 45 46 47 48 49 50 51 52						
Dolomite SW	Pale white, creamy on fresh faces, massive, strong.		53 54 55 56 57 58 59 60						

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines N.T.
Commenced 27/6/74
Completed 7/7/74
Logged by P.V.B.
Vertical scale 1:100

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.
Water Level Measurements —  Level when hole in progress at specified depth
 Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No.

Depth (m) Black & White Colour

Checked by C. Jacobsen

SW Slightly Weathered.

M(Pf)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT LOCATION **DARWIN EAST**
West of Marlow's Lagoon

HOLE NO **2**

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) **50°**
COORDINATES **25°12'0"E**

DIRECTION **180°**
REL. OF COLLAR **18.3m**

SHEET **14** OF **4**

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc.	Core Losses (m)	Fracture Log	R.O.D.	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc.	Water Pressure Test Losses (Lugons) *
Dolomite SW	Pale white, cream on fresh faces, strong.		B 61 -			Massive	
Cavity	1.5m loss of water circulation.		62 -				
			63 -				
Dolomite SW	Pale white, cream on fresh faces, strong. N/C		64 -			Small fracture zone	
			65 -				
			66 -				
			67 -				
			68 -				
			69 -				
			70 -				
			71 -				
END OF HOLE	71.8m		72 -				
			73 -				
			74 -				
			75 -				
			76 -				
			77 -				
			78 -				
			79 -				
			80 -				

Drill type **Longyear**
Feed **Hydraulic**
Core barrel type **Wireline**
Driller **Mines N.T.**
Commenced **27/6/74**
Completed **7/7/74**
Logged by **P.V.B**
Vertical scale **1:100**
Checked by **G. Jacobsen**

Notes
Fracture Log - Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes - Angles are measured relative to a plane normal to the core axis.
Defect Frequency - Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.
Water Level Measurements - ☒ Level when hole in progress at specified depth.
☐ Level in completed hole on specified date.
SW Slightly Weathered.
N/C NO CORE.

Water Pressure Tests
* Values in Lugons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.
Core Photograph Negative No.
Depth (m) Black & White Colour

M(P1)146

HOLE NO 3

DIRECTION
R L OF COLLAR 37m

SHEET 1 OF 2

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
NO CORE				H 1m 2 3 4						
Mudstone CW Mullaman Beds.	Pale grey, weak yellow brown mottling, weak, soft.		40	5 6 7				Core extensively broken to 1cm pieces.		
Mudstone MW-HW Golden Dyke Formation	White, pale yellow, and buff, moderately hard to weak.		100	8				Unconformity. ~~~ Core extensively broken into 10cm pieces.		
			100	9						
			100	10						
			100	11						
			100	12						
			100	13						
				14						
Mudstone HW	White, buff, and pale yellow.		90	15				Core typically broken to 4cm pieces.		
				16						
			100	17						
				18						
			80	19						
				20						

Drill type Mayhew
Feed Cable
Core barrel type Triple
Tube
Driller B.M.P.
Commenced 26/6/74
Completed 27/6/74
Logged by P.V.B.
Vertical scale 1:100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range

Water Level Measurements — I Level when hole in progress at specified depth.
II Level in completed hole on specified date

MW	Moderately Weathered
HW	Highly Weathered
CW	Completely Weathered
N/C	NO CORE

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blocked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour
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M(PF)146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 252950E 3621100NDIRECTION
R. OF COLLAR 37m

SHEET 2 OF 2

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Logging Graphic Log	L. and C. to core recovery	Depth m	Fracture Log	R.Q.D.	Defect Frequency				Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							Intercept	Angle					
Mudstone HW - CW	Pale greenish white, buff, weak, soft.	---	---	21 -	H								
				22 -									
	Quartz veining; very hard drilling. N/C	9	25	23 -									
END OF HOLE 24m.				24 -									
				25 -									
				26 -									
				27 -									
				28 -									
				29 -									
				30 -									
				31 -									
				32 -									
				33 -									
				34 -									
				35 -									
				36 -									
				37 -									
				38 -									
				39 -									
				40 -									

Drill type Mayhew
Feed Cable
Core barrel type Triple
Tube
Driller B.M.R.
Commenced 26/6/74
Completed 27/6/74
Logged by P.V.B.
Vertical scale 1:100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range.
Water Level Measurements — ∇ Level when hole in progress at specified depth
 ∇ Level in completed hole on specified date

HW Highly Weathered
CW Completely Weathered
N/C NO CORE.

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blacked in strips.

Core Photograph Negative No
Depth (m) Black & White Colour

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							Intercept Angle 0 30 60 80 90			
NO	CORE			H						
				1						
				2						
				3						
				4						
Mudstone HW - C W Mullaman Beds.	White with some yellow-brown mottling, sandy towards 8m, mod. hard, soft.		100	5						
			100	6						
			100	7						
			100	8						
Mudstone HW Golden Dyke Formation	Pale greenish grey, moderately hard, moderately strong, sandy to 11m.		100	9						
			100	10						
Mudstone HW	Buff, soft, weak.		100	11						
			100	12						
			100	13						
Mudstone HW	Pale green and mauve, soft to moderately hard & weak.	N/C	50	14						
			100	15						
				16						
				17						
			100	18						
				19						
				20						

Drill type Mayhew
Feed Cable
Core barrel type Triple
Tube
Driller B.M.P.
Commenced 27/6/74
Completed 28/6/74
Logged by P.V.B.
Vertical scale 1: 100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blocked in Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis. Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements —  Level when hole in progress at specified depth
 Level in completed hole on specified date

HW Highly Weathered.
CW Completely Weathered.
N/C NO CORE.

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blocked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour
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M(Pf)146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 252680E 362790NDIRECTION
R.L. OF COLLAR 38.1m

SHEET 2 OF 2

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lith. and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle					Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							0	30	60	80	90			
Mudstone HW-CW	Buff, weak, soft	▲ -	100	H								Brecciated and sheared.		
Mudstone MW-HW	Yellow-brown, mod. strong, mod. hard.	- -	100	21 -								Core typically broken into 10-20 cm. pieces.		
		- -		22 -										
		- -		23 -										
		- -		24 -										
END OF	HOLE 24m.			25 -										
				26 -										
				27 -										
				28 -										
				29 -										
				30 -										
				31 -										
				32 -										
				33 -										
				34 -										
				35 -										
				36 -										
				37 -										
				38 -										
				39 -										
				40 -										

Drill type Mayhew
Feed Cable
Core barrel type Triple
Tube
Driller B.M.R.
Commenced 27/6/74
Completed 28/6/74
Logged by P.V.B.
Vertical scale 1:100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range.
Water Level Measurements — ☒ Level when hole in progress at specified depth
☒ Level in completed hole on specified date

CW Completely Weathered.
HW Highly Weathered.
MW Moderately Weathered.

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blacked in strips

Core Photograph Negative No.

Depth (m) Black & White Colour

M(Pf)146

DIRECTION
R.L. OF COLLAR 36.6m

SHEET 1 OF 2

Drill type	Mayhew	Notes	Water Pressure Tests		
Feed	Cable		* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blocked in strips.		
Core barrel type	Triple Tube	Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blocked in.	Core Photograph Negative No.		
Driller	B.M.R.	Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.			
Commenced	1/7/74	Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range	Depth (m)	Black & White	Colour
Completed	2/7/74	Water Level Measurements — ∇ Level when hole in progress at specified depth.	.....	.....	.....
Logged by	P.V.B.	∇ Level in completed hole on specified date	.....	.....	.....
Vertical scale	1:100	SW Slightly Weathered.	.....	.....	.....
		MW Moderately Weathered.	.....	.....	.....
		HW Highly Weathered.	.....	.....	.....
		CW Completely Weathered.	.....	.....	.....
Checked by	G. Jacobson	NC NO CORE	.....	.....	.....
			M(Pf)146		

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS		PROJECT <u>DARWIN EAST</u> LOCATION <u>Behind Drillers Hut.</u>		HOLE NO. <u>5</u>						
GEOLOGICAL LOG OF DRILL HOLE		ANGLE FROM HORIZONTAL (°) <u>Vertical</u> COORDINATES <u>253640E 3620100N</u>		DIRECTION <u></u> R.L. OF COLLAR <u>36.6m</u>						
SHEET <u>2</u> OF <u>2</u>										
Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							0 30 60 80 90			
Mudstone HW-CW	Yellow-brown, firm to soft.			90 21m 100 22 100 23 100 24 100 25				No structure visible.		
END OF HOLE	25.5m			26 27 28 29 30						
Drill type <u>Mayhew</u> Feed <u>Cable</u> Core barrel type <u>Triple</u> <u>Tube</u> Driller <u>B.M.P.</u> Commenced <u>1/7/74</u> Completed <u>2/7/74</u> Logged by <u>P.V.B.</u> Vertical scale <u>1:100</u>		Notes <i>Fracture Log</i> — Number of fractures per 25 cm of core. Zones of core loss blacked in <i>Bedding and Joint Planes</i> — Angles are measured relative to a plane normal to the core axis <i>Defect Frequency</i> — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range <i>Water Level Measurements</i> — <u> </u> Level when hole in progress at specified depth. <u> </u> Level in completed hole on specified date. HW Highly Weathered CW Completely Weathered					Water Pressure Tests * Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips. Core Photograph Negative No. Depth (m) Black & White Colour			
Checked by <u>G. Jacobson</u>							M(Pf)146			

HOLE NO. 6

DIRECTION
R.L. OF COLLAR: 48.8 m

SHEET 1 OF 2

Drill type Mayhew	Notes	Water Pressure Tests
Feed Cable	<i>Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in</i>	* Values in logs should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.
Core barrel type Triple Tube	<i>Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis</i>	
Driller BMP	<i>Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range</i>	Core Photograph Negative No.
Commenced 3/7/74	<i>Water Level Measurements — ☒ Level when hole in progress at specified depth</i>	Depth (m) Black & White Colour
Completed 4/7/74	<i>☒ Level in completed hole on specified date</i>	
Logged by P.V.B.	SW Slightly Weathered.	
Vertical scale 1:100	MW Moderately Weathered.	
	HW Highly Weathered.	
Checked by G. Jacobsen		M(Pf)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT
LOCATION

DARWIN EAST
Town Centre Area.

HOLE NO 6

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 252540E 3619625N DIRECTION
R/L OF COLLAR 48.8 m.

SHEET 2 OF 2

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lith and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle					Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							0	30	60	80	90			
Mudstone MW	Pale buff to pale purple, hard & strong.		100	21										
				22										
				23										
				24										
				25										
END OF HOLE 24.85 m				25										
				26										
				27										
				28										
				29										
				30										
				31										
				32										
				33										
				34										
				35										
				36										
				37										
				38										
				39										
				40										

Small crush zone
m

Drill type Mayhew
Feed Cable
Core barrel type Triple
Tube
Driller B.M.P.
Commenced 3/7/74
Completed
Logged by P.V.B.
Vertical scale 1:100

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blocked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range.

Water Level Measurements — Level when hole in progress at specified depth
 Level in completed hole on specified date

MW Moderately Weathered

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blocked in strips.

Core Photograph Negative No
Depth (m) Black & White Colour

Checked by G. Jacobson

M.F.1146

1
HOLE NO 7

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (9) Vertical
COORDINATES 250700E 3618610N

DIRECTION
R.L. OF COLLAR 18 m

PAGE 1 OF 5

[illegible]

Line type Mayhew
 Cable
 Core barrel type Triple
 Tube
 B.M.R.

Drawn and 4/7/74
 Completed 17/7/74
 Logged by P.V.B.
 Date of scale 1:100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blocked in.

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements — ☐ Level when hole in progress at specified depth.
☐ Level in completed hole on specified date.

HW Highly weathered.
CW Completely weathered.

Water Pressure Tests

* Values in parentheses should be read in conjunction with computation sheets. Test sections are indicated by blocked in strips.

Core Photograph Negative No.		
Depth (m)	Black & White	Colour

M(PF)146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 250 700E 3618610NDIRECTION
R.L. OF COLLAR 18m

SHEET 2 of 5

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Loss and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
Mudstone HW - C W	White to pale green, mottled yellow - brown, soft weak. Mullaman Beds			100	H					
				21	m					
				100						
				22						
				100						
				23						
				24						
				25						
				26						
				100						
				27						
				28						
				29						
				100						
				30						
				31						
				32						
				100						
				33						
				34						
				35						
				100						
				36						
				37						
				100						
				38						
NO	CORE			39						
	Mullaman Beds			10	40					

Drill type Mayhew
Feed Cable
Core barrel type Triple
Tube
Driller B.M.R.
Commenced 4/7/74
Completed 17/7/74
Logged by P.V.B.
Vertical scale 1:100

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blocked in
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range

Water Level Measurements — Level when hole in progress at specified depth
 Level in completed hole on specified date

HW Highly weathered.
CW Completely weathered.

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blocked in strips

Core Photograph Negative No.
Depth (m) Black & White Colour

Checked by G. Jacobson

M(Pf)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT **DARWIN EAST**
LOCATION **Near Marlow's Lagoon.**

HOLE NO **7**

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) **Vertical**
COORDINATES **250700E 3618610N**

DIRECTION
R.L. OF COLLAR **18m**

SHEET **3** OF **5**

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Pressure Test Losses (Lugeons) *
				0 6 12 18*			30 60 80 90		
NO CORE				H					
				41 m					
				42					
Mudstone	Mullaman Beds, white, mottled pale yellow, moderately hard.		35	43					
				44					
				45					
				46					
				47					
				48					
				49					
				50					
				51					
NO CORE				52					
	Mostly pieces of fractured quartz & medium to fine sand.			53					
				54					
				55					
				56					
				57					
				58					
				59					
				60					

Drill type **Mayhew**
Feed **Cable**
Core barrel type **Triple**
Tube
Driller **B.M.R.**
Commenced **4/7/74**
Completed **17/7/74**
Logged by **P.V.B.**
Vertical scale **1:100**

Checked by **G. Jacobsen**

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.
Water Level Measurements —  Level when hole in progress at specified depth
 Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No
Depth (m) Black & White Colour

M(Pf)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT DARWIN EAST
LOCATION Near Marlow's Lagoon.

HOLE NO. 7

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 250700E 3618410N

DIRECTION
RL OF COLLAR 18m

SHEET 4 OF 5

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Depth and size of core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
			0	6	12	18			
NO	CORE		61						
			62						
			63						
Silicified dolomite	Dull yellow, cavernous, honey- combed, some clay infilling.		64				Vesicular porous structure		
			65						
			66						
NO	CORE		67						
			68						
Soil	Dark earthy material		69				Probably filling in cavernous dolomite.		
			70						
			71						
			72						
			73						
Vitreous quartz & silicified dolomite	White, cavernous & honeycombed.		74				Vesicular, porous.		
			75						
			76						
			77						
NO	CORE		78						
			79						
			80						

Drill type Mayhew
Feed Cable
Core barrel type Triple
Tube
Casing B.M.R.
Commenced 4/7/74
Completed 17/7/74
Logged by P.V.B.
Vertical scale 1:100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range.
Water Level Measurements — — Level when hole in progress at specified depth
— Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blacked in strips.

Core Photograph Negative No.
Depth (m) Black & White Colour

M/P/1146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) **Vertical**
COORDINATES **250700E 3618610N**DIRECTION
R.L. OF COLLAR **18m**SHEET **5** OF **5**

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency					Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							Intercept Angle							
							0	30	60	80	90			
NO CORE				81										
				m										
				82										
NO CORE				83										
				84										
				85										
NO CORE				86										
				87										
				88										
NO CORE				89										
				90										
				91										
NO CORE				92										
				93										
				94										
NO CORE				95										
				96										
				97										
NO CORE				98										
				99										
				100										

Drill type **Mayhew**
Feed **Cable**
Core barrel type **Triple**
Tube
Driller **B.M.R.**
Commenced **4/7/74**
Completed **17/7/74**
Logged by **P.V.B.**
Vertical scale **1:100**

Checked by **G. Jacobsen**

Notes

Fracture Log -- Number of fractures per 25 cm of core. Zones of core loss blocked in Bedding and Joint Planes -- Angles are measured relative to a plane normal to the core axis.
Defect Frequency -- Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements --  Level when hole in progress at specified depth
 Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blocked in strips.

Core Photograph Negative No.
Depth (m) Black & White Colour

M(Pf)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICSPROJECT
LOCATIONDARWIN EAST
Near Southern Lagoon

HOLE NO. 8

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) Vertical
COORDINATES 25 119 0 E 36 182 60 NDIRECTION
R.L. OF COLLAR 24.4 m

SHEET 1 OF 5

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
				0 6 12 18			0 30 60 90			
Sandy - silt	Soil, light grey, soft.		100	N						
				1m						
Silty clay	Soil, bright red, soft		100	2						
Lateritised siltstone.	Mottled red-brown & white, mod. hard,		90	3				Ferruginous lattice-work structure.		
Mullaman Beds.	hardens on exposure, honeycombed.		70	4						
	N/C			5						
			80	6						
Weakly lateritised Siltstone.	White, red-brown to yellow-brown mottling, hard,		100	7				Core broken into 4cm pieces		
Mullaman Beds.	porous.			8						
	N/C		30	9						
Ferruginous fine sandstone	Yellow-brown, mod. hard, mod. strong,			10				Core broken into 6 cm pieces.		
Mullaman Beds.			60	11						
				12						
Mudstone	Pale greenish grey, soft, weak.			13						
HW-CW Mullaman Beds.				14						
				15				Core extensively broken into 1cm pieces.		
			50	16						
				17						
				18						
	N/C			19						
				20						

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines N.T.
Commenced 9/7/74
Completed 23/7/74
Logged by P.V.B.
Vertical scale 1:100

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements — ∇ Level when hole in progress at specified depth
 ∇ Level in completed hole on specified date

HW Highly Weathered
CW Completely Weathered
N/C NO CORE

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No
Depth (m) Black & White Colour

M(PF)146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical.
COORDINATES 25 11 90 E 3 01 82 60 NDIRECTION
R. OF COLLAR

10 m

SHEET 2 OF 5

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc.	Casing Graphic Log	and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 30 60 80 90	Structures Joints, veins, seams, faults, etc.	Water Level	Water Pressure Test Losses (Lugeons) *
Siltstone HW Mullaman Beds.	Yellow-brown to pale grey, mod. hard, mod. strong.	NIC		50	N					
		NIC		80						
				100						
Mudstone HW - CW Mullaman Beds.	Pale grey, soft to mod. hard, weak to mod. strong.	NIC		50						
		NIC		80						
				100						
				150						
				200						
				250						
				300						
				350						
				400						
				450						
				500						
				550						
				600						
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				9700						
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				9900						
				9950						
				10000						

Core broken into 6
cm pieces.Core broken into
15cm pieces.

Longyear
Hydraulic
Wireline
Mines N.T.
9/7/74
23/7/74
P.V.B.
1:100

Notes
Fracture Log - Number of fractures per 25 cm of core. Zones of core loss placed in
Heading and Joint Planes - Angles are measured relative to a plane normal to the core axis
Defect Frequency - Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range
Water Level Measurements -  Level when hole in progress at specified depth
 Level in completed hole at specified date
HW Highly Weathered
CW Completely Weathered
NC NO CORE

Water Pressure Tests
* Values in Lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by block letters
Core Photograph Negative No.
Depth (m) Black & White Colour
M/P/146

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS		PROJECT DARWIN EAST LOCATION Near Southern Lagoon				HOLE NO 8	
GEOLOGICAL LOG OF DRILL HOLE		ANGLE FROM HORIZONTAL (°) Vertical		DIRECTION 3418260N		SHEET 3 of 5	
		COORDINATES 251190E 3418260N		RL OF COLLAR 10m.			

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *	
						0 30 60 80 90					
Mudstone.CW Mullaman Beds.	Pale grey, very soft, very weak. NIC			50	N						
				41	m						
				42							
				30							
				43							
				44							
				50							
				45							
				46							
				47							
Siltstone MW-HW. Mullaman Beds.	Mod. strong, mod. hard. NIC			65							
				48							
				85							
				49							
				50							
				30							
				51							
				52							
				40							
				53							
Mudstone CW	White to pale yellow, soft, weak. NIC			54							
				55							
				56							
				57							
				58							
				59							
				60							

Drill type **Longyear Hydraulic**

Feed **Wireline**

Core barrel type **Mines N.T.**

Driller **9/7/74**

Commenced **23/7/74**

Completed **P.V.B**

Logged by **1:100**

Vertical scale

Checked by **G. Jamieson**

Notes

Fracture Log -- Number of fractures per 25 cm of core. Zones of core loss blocked in.

Bedding and Joint Planes -- Angles are measured relative to a plane normal to the core axis.

Defect Frequency -- Number of natural defects (shears, joints, fractures), per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements -- Level when hole in progress at specified depth.

Level in completed hole on specified date.

MW Medium Weathered.
HW Highly Weathered.
CW Completely Weathered.
NC NO CORE

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blocked in strips.

Core Photograph Negative No.

Depth (m) Black & White Colour

M.F. 1146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT LOCATION **DARWIN EAST**
Near Southern Lagoon.

HOLE NO. **8**

EOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) **Vertical** DIRECTION
COORDINATES **251190 E 3613260 N** R.L. OF COLLAR **10 m**

SHEET **4** OF **5**

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Li ⁺ and % core recovery	Depth and size of core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
				0 6 12 18			0 30 60 80 90			
Mudstone HW	Pale yellow, mod. strong, mod. hard.		40	61 m				Completely broken core.		
				62						
Sand unconsolidated.	Coarse to very coarse sand, very well rounded.		0	63						
Petrel Formation	Similar to lateritised sand in hole 2 ie			64						
	rounded beach sand washed out of hole.		0	65						
				66						
				67						
				68						
				69						
	Large rounded pebbles 2-3cm.		10	70						
				71						
			0	72						
				73						
				74						
				75						
	Medium quartz sand.		25	76						
				77						
				78						
	Very fine sand.			79						
				80						

Drill Type **Longyear Hydraulic**
Casing Type **Wireline**
Drill Bit **Mines N.T.**
Commenced **9/7/74**
Completed **23/7/74**
Logged by **P.V.B.**
Scale **1:100**

Notes
Fracture Log - Number of fractures per 25 cm of core. Zones of core loss blocked in drilling and lost of pieces - Angles are measured relative to a plane normal to the core axis.
Defect Frequency - Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.
Water Level Measurements - Level when hole in progress at specified depth.
- Level when completed hole on specified date.

Water Pressure Tests
* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blocked in strips.
Core Photograph Negative No.
Depth (m) Black & White Colour

HW Highly Weathered

NC NO CORE

Checked by **G. Jacobson**

M(PF)146

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS						PROJECT DARWIN EAST								HOLE NO 8			
						LOCATION Near Southern Lagoon											
GEOLOGICAL LOG OF DRILL HOLE						ANGLE FROM HORIZONTAL (°) Vertical.								DIRECTION			
						COORDINATES 251190 E 3618260 N								RL OF COLLAR 10 m.			
Rock Type and Degree of Weathering		Description Lithology, colour, strength, etc		Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90				Structures Joints, veins, seams, faults, etc		Water Level	Water Pressure Test Losses (Lugeons) *	
Quartz		Similar conditions to holes 7,9,11. Loose quartz in hole.			2	N											
						81m											
		NIC				82											
						83											
						84											
						85											
						86											
						87											
		NIC				88											
						89											
						90											
						91											
END OF HOLE 91m.						92											
						93											
						94											
						95											
						96											
						97											
						98											
						99											
						100											
Drill type Longyear Hydraulic		Notes										Water Pressure Tests					
Feed Wireline		Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in. Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis. Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range. Water Level Measurements — ☒ Level when hole in progress at specified depth. ☒ Level in completed hole on specified date.										* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.					
Core barrel type Mines N.T.												Core Photograph Negative No					
Driller P.V.B		Depth (m)				Black & White		Colour									
Commenced 9/7/74																	
Completed 23/7/74																	
Logged by P.V.B																	
Vertical scale 1:100																	
Checked by G. Jacobson		NIC NO CORE										M(Pf)146					

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT
LOCATION

DARWIN EAST
Between Sinkholes

HOLE NO

9

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ)

Vertical

DIRECTION

COORDINATES

131450E 3618260 N

R L OF COLLAR

24 m

SHEET

1

OF 2

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	R Q D	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							0 30 60 80 90			
	Straight drilling through Mullaman Beds.			0 6 12 18						
				1m						
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						
				11						
				12						
				13						
				14						
				15						
Siltstone HW	Mullaman Beds, white with ferruginous stainings on N/C fracture surfaces, mod hard, mod strong.		100	16						
			25	17						
			100	18						
			70	19						
			N/C	20						
Extensively broken core 1-2cm pieces.										

Drill type
Feed
Core barrel type

Longyear
Hydraulic
Wireline

Driller
Commenced
Completed
Logged by
Vertical scale

Mines N.T.
24/7/74
31/7/74
P.V.B
1:100

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range

Water Level Measurements — ▾ Level when hole in progress at specified depth
▾ Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No.

Depth (m) Black & White Colour

HW HIGHLY WEATHERED.

N/C NO CORE

M(Pf)146

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS		PROJECT DARWIN EAST LOCATION Town Centre L.Proterozoic..		HOLE NO 10					
GEOLOGICAL LOG OF DRILL HOLE		ANGLE FROM HORIZONTAL (°) Vertical COORDINATES 254750E 3619300N		DIRECTION R.L. OF COLLAR 25 m					
SHEET 1 OF 2									
Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Depth and size of Core	Fracture Log	R.Q.D.	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
NO CORE		H 1m 2 3 4						14/8/74	
Mudstone MW - HW Golden Dyke Formation	Pale mauve, pink, and buff.	100 100	5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			Possible bedding at 50°. Core broken extensively.			
Drill type Mayhew Feed Cable Core barrel type Triple Tube B.M.R. Driller P.V.B. Commenced 17/7/74 Completed 19/7/74 Logged by P.V.B. Vertical scale 1:100		Notes Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in. Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis. Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range. Water Level Measurements — ☒ Level when hole in progress at specified depth ☐ Level in completed hole on specified date				Water Pressure Tests * Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips. Core Photograph Negative No. Depth (m) Black & White Colour			
MW Moderately Weathered HW Highly Weathered						M(Pf)146			

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT LOCATION DARWIN EAST
Town Centre L. Proterozoic

HOLE NO 10

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (to Vertical) DIRECTION
COORDINATES 254750 E 3619300 N R/L OF COLLAR 25 m

SHEET 2 OF 2

Rock Type and Degree of Weathering	Description Colour, texture, strength, etc.	Core Recovery % 1st and 2nd core	Depth m 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26	Fracture Log R.Q.D.	Defect Frequency Intercept Angle 5 10 20 30 40 50 60 70 80 90	Structures Joints, veins, seams, faults, etc.	Water Level	Water Pressure Test Losses (Lugeons) *
Mudstone HW-MW	Pale mauve, pink, and buff, mod. hard to weak.					Possible bedding dip 50°.		

END OF HOLE 26.5m

27 -

28 -

29 -

30 -

31 -

32 -

33 -

34 -

35 -

36 -

37 -

38 -

39 -

40 -

Drill type Mayhew
Feed Cable
Core barrel type Triple
Tube
Bit B.M.R.
Commenced 17/7/74
Completed 19/7/74
Logged by P.V.B.
Vertical scale 1:100

Notes
Fracture Log - Number of fractures per 25 cm of core. Zones of core loss blocked in.
Bedding and Joint Planes - Angles are measured relative to a plane normal to the core axis.
Defect Frequency - Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range.
Water Level Measurements - ☒ Level when hole in progress at specified depth
☐ Level in completed hole at specified date

MW Medium Weathered.
HW Highly Weathered.

Water Pressure Tests
* Values in Lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blocked in strips.
Core Photograph Negative No.
Depth (m) Black & White Colour

Checked by G. Jacobson

M(Pf)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT
LOCATION

DARWIN EAST
Silicified Dolomite Outcrops.

HOLE NO 11

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) Vertical
COORDINATES 250180 E 3616020 N

DIRECTION
R/L OF COLLAR 10 m.

SHEET 1 OF 4

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Depth and size of core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
Quartz.	Pale white sugary quartz, strong. Lateritic gravel, several small quartz pieces. N/C	q q	100	N			Very hard drilling.		
	Broken quartz pieces. N/C	q q	12						
	Broken quartz pieces. N/C	q q	15						
	Broken quartz pieces. N/C	q q	15						
	Broken quartz pieces some yellow-brown clay. N/C	q q	15				Minor limonitic gravels.		
	Broken quartz pieces. One 10cm length of sugary quartz. N/C	q q	20						
	Loose quartz grains in clay matrix. N/C	q q	30						
	Silicified sugary quartz, white, pale yellow. Quartz pieces. N/C	q q	30				Quartz crystals in openings of vughs and cavities. Some honeycombing.		
	N/C		10						
Silicified Dolomite	Pale yellow-brown. N/C	s s	70	B					
	N/C		30						

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines N.T.
Commenced 1/8/74
Completed 17/8/74
Logged by P.V.B
Vertical scale 1:100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis. Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements — ☒ Level when hole in progress at specified depth
☒ Level in completed hole on specified date

N/C NO CORE.

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No
Depth (m) Black & White Colour

M(Pf)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT
LOCATION

DARWIN EAST
Silicified Dolomite Outcrops.

HOLE NO 11

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) Vertical
COORDINATES 250180E 3616020N

DIRECTION
R/L OF COLLAR 10m.

SHEET 3 OF 4

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle				Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
							30	60	80	90			
				0 6 12 18									
Dolomite	Vesicular, white , honeycombed. N/C		100	B									
			30	41m-									
				42 -									
			30	43 -									
				44 -									
Dolomite	Pale grey, hard , strong, massive . Pale yellow-grey.			45 -									
			100	46 -									
				47 -									
				48 -									
			100	49 -									
				50 -									
			100	51 -									
			100	52 -									
			100	53 -									
				54 -									
			100	55 -									
	56 -												
	57 -												
	58 -												
	59 -												
	60 -												

Drill type Longyear
Fluid Hydraulic
Core barrel type Wireline
Driller Mines N.T.
Commenced 1/8/74
Completed 17/8/74
Logged by PVB
Vertical scale 1:100

Notes

Fracture Log — Number of fractures per 25cm of core. Zones of core loss blocked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25cm of
core occurring at specified intercept angle range.
Water Level Measurements —  Level when hole in progress at specified depth
 Level in completed hole on specified date

N/C NO CORE

Water Pressure Tests

* Values in Lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blocked in strips.

Core Photograph Negative No
Depth (m) Black & White Colour

Checked by G. Jacobsen

M/P/146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT
LOCATION

DARWIN EAST
Silicified Dolomite Outcrops..

HOLE NO 11

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical.
COORDINATES 250180E 3616020N

DIRECTION
R.L. OF COLLAR 10 m

SHEET 4 OF 4

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	L* and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency					Structures Joints, veins, seams, faults, etc	Water level	Water Pressure Test Losses (Lugeons) *
							Intercept	Angle						
							0	30	60	80	90			
Dolomite	Pale yellow-grey, hard strong massive			B										
				61m										
				100										
				62										
				63										
				60										
		N/C		64										
				65										
				100										
				66										
				67										
				100										
				68										
				69										
				70										
				71										
				72										
				73										
				74										
				75										
				76										
				77										
				78										
				79										
				80										

Cavities.

Broken core at 72.5 to 73m.

Massive

END OF HOLE 76m.

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines. N.T.
Commenced 1/8/74
Completed 17/8/74
Logged by P.V.B
Vertical scale 1:100

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.
Water Level Measurements — ☒ Level when hole in progress at specified depth
☒ Level in completed hole on specified date

N/C NO CORE

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph negative No.
Depth (m) Black & White Colour

Checked by G. Jacobson

M(PF)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT
LOCATION

DARWIN EAST
Ferruginous Sandstone Outcrop.

HOLE NO 12

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 250070E 3618730N

DIRECTION
R.L. OF COLLAR 17.7m.

SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
				0 6 12 18			0 30 60 80 90			
Ferruginous Sandstone	A few rounded quartz pebbles. N/C Fine sand N/C		50	N				Massive, bedding visible in outcrop		
			25	1 m						
Ferruginous Sandstone	Very well rounded coarse quartz grains, mauve, lateritised.		90	2						
	mod. strong.		10	3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						
Sand and clay Petrel Formation	Washed up out of hole. Pale yellow, medium-grained.			11						
HOLE ABANDONED				12						
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline

Driller Mines . N.T.
Commenced 18/8/74
Completed 20/8/74
Logged by P.V.B.
Vertical scale 1:100

Checked by G. Jacobson

Notes
Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.
Water Level Measurements —  Level when hole in progress at specified depth
 Level in completed hole on specified date

Water Pressure Tests
* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No
Depth (m) Black & White Colour

M(PF)146

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

PROJECT
LOCATION

DARWIN EAST
Ferruginous Sandstone Outcrop.

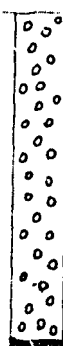
HOLE NO 13

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical.
COORDINATES 248920E 3617100N

DIRECTION
R.L. OF COLLAR 7m

SHEET 1 OF 4

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
Ferruginous Sandstone. Petrel Formation	Lateritised, deep mauve to purple, hard, mod. strong.		N 100 1m 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20						
Sand	Clean medium quartz washed out of hole. N/C Medium to coarse. N/C Yellow, very fine sand and silt. N/C Light grey, fine sand N/C Light grey, fine sand.								

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline.
Driller Mines. N.T.
Commenced 19/8/74
Completed 26/8/74
Logged by P.V.B.
Vertical scale 1:100

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blocked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range.
Water Level Measurements — Level when hole in progress at specified depth
 Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blocked in strips.

Core Photograph Negative for
Depth (m) Black & White Colour

Checked by G. Jacobson

NC NO CORE

M(PF) 146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical
COORDINATES 248920 E 3617100 N

DIRECTION

R.L. OF COLLAR 7m

SHEET 2 OF 4

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
				0 6 12 18+			0 30 60 80 90			
Sand	Yellow-brown, fine sand washed out of hole. NC		0	21m						
				22-						
				23-						
	Yellow-brown, fine sand. NC		0	24-						
				25-						
				26-						
				27-						
	Light grey, fine to medium sand. NC		0	28-						
				29-						
				30-						
	Light grey, fine sand. NC		0	31-						
				32-						
				33-						
	Yellow-brown clayey sand. NC		0	34-						
				35-						
				36-						
	Yellow-brown medium to fine sand. NC		0	37-						
				38-						
	Yellow-brown, medium sand.			39-						
				40-						

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines N.T.
Commenced 19/8/74
Completed 26/8/74
Logged by P.V.B.
Vertical scale 1:100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Budding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range

Water Level Measurements —  Level when hole in progress at specified depth
 Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blacked in strips.

Core Photograph Negative No.
Depth (m) Black & White Colour

NC NO CORE

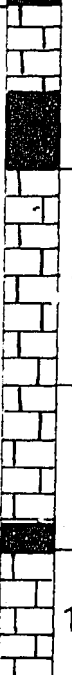
M(Pf)146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical.
COORDINATES 248920E 3617100NDIRECTION
R.L. OF COLLAR

7m

SHEET 3 OF 4

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Gr. and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
				0 6 12 18			0 30 60 80 90			
Sand	Fine yellow-brown sand washed out of hole.		N/C	0	41m					
					42-					
				0	43-					
					44-					
					45-					
				0	46-					
					47-					
					48-					
				0	49-					
					50-					
Dolomite ? Or Limestone.	Light grey, crystalline, hard, strong.		N/C	30	52-					
					53-					
					54-					
				100	55-					
					56-					
					57-					
				80	58-					
					59-					
				100	60-					

Some pyrite in
small joint faces.

Small crush zone.

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines N.T.
Commenced 19/8/74
Completed 26/8/74
Logged by P.V.B.
Vertical scale 1:100

Checked by G. Jacobsen

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range

Water Level Measurements —  Level when hole in progress at specified depth
 Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blacked in strips

Core Photograph Negative No
Depth (m) Black & White Colour

N/C NO CORE

M(Pf)146

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS	PROJECT	DARWIN EAST		HOLE NO. 13
	LOCATION	Ferruginous Sandstone Outcrop		
GEOLOGICAL LOG OF DRILL HOLE	ANGLE FROM HORIZONTAL (°)	Vertical		SHEET 4 OF 4
	COORDINATES	248920E 3617100N		
	DIRECTION	7m		
	R.L. OF COLLAR			

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
				0 6 12 18+			0 30 60 80 90			
Dolomite? Or Limestone	Pale grey, crystalline, massive, hard, strong.		100	61m						
			100	62						
				63						
			100	64				Small light green epidote veins.		
	Medium grey to pale grey, hard, strong.			65						
				66				Core breaks into 1m pieces, massive.		
			100	67						
				68						
				69						
			70	70						
		N/C		71				Small cavity.		
				72						
			100	73						
				74						
END OF HOLE 74.25 m				75						
				76						
				77						
				78						
				79						
				80						

Drill type	Longyear
Feed	Hydraulic
Core barrel type	Wireline
Driller	Mines N.T.
Commenced	19/8/74
Completed	26/8/74
Logged by	P.V.B.
Vertical scale	1:100

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements — ∇ Level when hole in progress at specified depth.
 ∇ Level in completed hole on specified date.

Water Pressure Tests		
* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.		
Core Photograph Negative No.		
Depth (m)	Black & White	Colour

Checked by G. Jackson

N/C NO CORE

M(Pf)146

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) **Vertical** DIRECTION
COORDINATES **259.330E 3624.075N** R.L. OF COLLAR **13.8 masl**SHEET **1** OF **2**

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of core	Fracture Log	RQD	Defect Frequency Intercept Angle 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
Sandstone MW	Limonitic, brown, mod. strong, hard.		85	1m				Close fractures		
	N/C		75							
			35	2						
Petrel Formation	Light brown, mod. strong, hard to very hard.			3						
	N/C		45	4						
				5						
				6						
	Quartzite fragments							~ Slight Unconformity		
Mudstone SW	Light brown, soft, and weak. Limonitic coatings on joints.		40	7						
				8						
				9						
Golden Dyke Formation	N/C			10						
			25	11						
				12						
Siltstone SW.	Grey-brown, mod. strong to weak, soft.		30	13						
Mudstone MW.	Light brown, mod. strong to weak, soft.		40	14				Thin siltstone interbeds.		
				15						
Siltstone SW-MW.	Light brown to light grey, weak, soft.		85	17						
				18						
Mudstone SW-MW.	Light brown, weak, soft.		55	19						
				20						

Drill type **Longyear
Hydraulic**

Feed

Core barrel type **Wireline**Driller **Mines N.T.**Commenced **27/8/74**

Completed

Logged by **G. LAU.**Vertical scale **1:100**Checked by **G. Jacobson**

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures, per 25 cm of
core occurring at specified intercept angle range.

Water Level Measurements —  Level when hole in progress at specified depth.
 Level in completed hole on specified date.

SW Slightly Weathered.
MW Moderately Weathered.
NC NO CORE.

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blacked in strips.

* Core Photograph Negative No
Depth (m) Black & White Colour

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (°) Vertical.
COORDINATES 259330E 3624075NDIRECTION
RL OF COLLAR 13.8 masl

SHEET 2 OF 2

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency				Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *		
							Intercept Angle								
							0	30	60	80				90	
0 6 12 18+															
Mudstone MW	Pink, weak, soft.			75	21m							Irregular fractures			
Siltstone SW	Grey, calcareous.				22										
	Grey-brown, mod. strong to weak, soft.	N/C		25	23										
Mudstone	Light grey- calcareous?	N/C		15	24										
					25										
					26										
Siltstone SW	Brown, mod. strong to weak, soft.			45	26							Very close fractures			
					75										
					75										
				85	27										
					28										
					28										
Mudstones & Siltstones.	Graded beds.	N/C		55	28							Very close fractures.			
END OF HOLE 29 m.					29										
					30										
					31										
					32										
					33										
					34										
					35										
					36										
					37										
					38										
					39										
					40										

Drill type Longyear
Feed Hydraulic
Core barrel type Wireline
Driller Mines N.T.
Commenced 27/8/74
Completed
Logged by G.LAU
Vertical scale 1:100

Checked by G. Jacobson

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blocked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of
core occurring at specified intercept angle range.

Water Level Measurements —  Level when hole in progress at specified depth
 Level in completed hole on specified date

SW Slightly Weathered.
MW Moderately Weathered.
N/C NO CORE.

Water Pressure Tests

* Values in lugeons should be read
in conjunction with computation
sheets. Test sections are indicated
by blocked in strips.

Core Photograph Negative No
Depth (m) Black & White Colour

M.P. 1146

**BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS**

Geological Log of Auger Hole

Project: Darwin East

Hole: 1

Date: 22/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, STH.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Sandy silt.	ML	light brown	D	L		S	P	D		Residual topsoil.
		Sandy silt	ML	Red brown				S	P	D		
		Gravelly sand	GW									
2		Gravelly sand.	GW	Deep red brown.	D	L						Lateritic gravelly sand, up to 2cm across.
		High plasticity clay	CH	Pale yellow grey	M			ST	M	D		Residual clay.
3		Sandy clay	CL- CH	Pale yellow grey	D	L			M	D		Residual sandy plastic clay, some rock fragments.
		UNCONFORMITY.										31/5/74.
4		Pulverised siltstone (heavy medium silty clay)	CH	Yellow brown	M		?	F	M			Lower Proterozoic
5			CL- CH									17/7/74
6												26/8/74
7		Pulverised mudstone. (medium silty clay)	CL- CH	Pale brown	M			S	?	D		Lower Proterozoic
8												
9												
10												
11												
12												
13												
14		Pulverised mudstone (medium silty clay)	CL- CH	Pale brown	M			S	?	D		lower Proterozoic
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. D. D. S. S.

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 2

Date: 22/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		organic silt.	OL	Dark grey	D	VL	G			D		Topsoil
		Inorganic silt.	MH	Brown grey	D	L	G			D		
1		Silty lean clay	CL	Orange red	M<			S	C	D		Residual subsoil.
												(lean clay, some pellets of iron oxide.
2		Gravelly silty clay	CL	Red brown	M		G	F	?	D		Buckshot mixed with clay.
3		Gravelly silty clay (pulverised siltstone)	GC CH	Dark red brown.	M		G	ST	M	D		Lateritic gravels Weakly lateritised Mullaman Beds.
		Silty gravelly clay	CL	Dark red Brown	M		G	F	M?	D		
4		Hard gravel band. Pulverised siltstone. HW. (clayey sand)	CH	Pale green grey	D	D	S		M	D		Basal conglomerate Weakly lateritised
5		UNCONFORMITY Pulverised cw mudstone.		Pale green grey.							3/6/74	Lower Proterozoic
6												17/7/74
												26/8/74
7												
8												
9												
10		Pulverised siltstone HW.	CH	Pale green grey	D	D	S		M	D		Lower Proterozoic
11												
12		END OF HOLE 12.0 M. Auger Refusal.										
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 3

Date: 22/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS SF ST V ST H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Inorganic silt.	ML	Orange brown	D	VL	G		1	D		Residual topsoil.
		Gravelly silty lean clay.	CL	Bright orange brown.	D	L	G		2	D		Subsoil, residual
		Clayey gravel	GC	Deep red brown	M < MD					D		lateritic gravels.
2		Gravelly silty clay	Ch	Deep red brown	M		G	ST	3	D		Lateritic gravels.
3		"		"								
4		Pulverised HW mudstone (gravelly)	GP	Yellow gravels			S					Basal Conglomerate. Mullaman Beds.
5		"		"								"
6		"		"								"
7		UNCONFORMITY? Pulverised mudstone.		Yellow brown.			"					3/6/74 lower Proterozoic
8												19/7/74 12/8/74 24/8/74
9												
10												
11												
12												
13												
14		Pulverised HW mudstone	Ch	yellow brown	M	D	S		M? D			lower Proterozoic
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 4

Date: 23/5/74

Logged by: PV B

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast. OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS SF, ST, V, ST, H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly silty clay	CH	Chocolate brown.	D		S?		P	D		Residual lateritic soil.
		Gravelly clay	CH-CH	Yellow brown	D				M			Marginal.
1		Silty gravel	GM	Yellow brown	D				M	D		Conglomerate?
		Gravelly silty clay (pulverised siltstone)	CH	Orange brown	D		S?					HW, lateritised weakly, pulverised Mullaman
2				Pale green grey	D		S?					Beds.
		UNCONFORMITY?										
3		Pulverised HW siltstone		Pale green grey.								Lower Proterozoic
4												
											3/6/74	
5											13/6/74	
6		Pulverised HW-CW mudstone.		Pale green grey							23/7/74	Lower Proterozoic
											12/8/74	
7											27/8/74	
8												
9												
10												
11												
12		Pulverised HW mudstone		Pale green grey								Lower Proterozoic
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

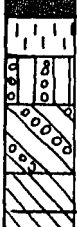
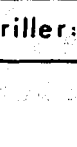
Geological Log of Auger Hole

Project: Darwin East

Hole: 6

Date: 24/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/cm ² VS, SF, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		organic silt Gravel, silt mixture. Gravel clay mixture. Gravelly clay	OL GM GC CL	Pale green grey Yellow grey Orange red. light brown	D D M D		S G G G		P P? M? D	D D D D		Topsoil containing angular gtz & rock fragments.
2		Gravel sand clay mixture	GC	Pale yellow brown.	M		G			D		31/5/74 Pulverised lower Proterozoic
3		Pulverised HW mudstone.		light brown.								23/7/74 27/8/74 lower Proterozoic (alternating hard and soft layers)
4												
5												
6												
7		Pulverised HW mudstone.		light brown.								(alternating hard and soft layers)
8												
9												
10												
11												
12												
13		End of Hole 12.5 m. Auger refusal.										
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 7

Date: 24/5/74

Logged by: PV B

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS SF ST V ST H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Silty gravel	GM	Yellow brown	D	L	S		P	D		Residual
		Clayey gravel.	GC	Orange red	M<		S	F	M?	D		Residual 31/5/74
1												19/6/74
												23/7/74
2		Pulverised soft (HW) mudstone.		light green, brown.								27/8/74
3												Lower Proterozoic Brown Rock fragments.
4												
5		Pulverised HW mudstone.		Dark chocolate brown.								On completion of drilling.
6												Lower Proterozoic
7												Water struck whilst drilling.
8		Pulverised HW mudstone		light brown.								
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco



Not sampled

Checked by: G. Jacobsen

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Geological Log of Auger Hole

Project: Darwin East

Hole: 8

Date: 27/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (G) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, SI, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic silty clay (Low PI) Silty gravel. Gravelly silty clay. Clayey gravel.	OL GM GL GC	Pale yellow grey Light brown Mottled orange red-yellow Pale grey	D D D D	L L G G	G S G G	 F 	 M 	D D D D		Residual topsoil. Qtz gravel silty matrix. Residual clay. Completely weathered Mullaman Beds.
2		Pulverised HW-CW mudstone.		Yellow brown	D					D		Mullaman Beds
3												31/5/74. 18/6/74 23/7/74 27/8/74
4												
5		Pulverised HW mudstone.		Yellow brown						D		
6												
7		Hole discontinued at 7m very easy augering.										
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 9

Date: 27/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Silty gravel	GM	light grey	M		S	S		D		Residual lateritic gravel.
1		Clayey gravel.	GC	Red-orange	MK					31/5/74	▽	completion of drilling
										D	▽	water struck.
										15/7/74	▽	Residual lateritic clay.
2		Gravelly clay	CL	Orange-red	MZ					27/8/74	▽	"
3		Pulverised HW mudstone.		Mottled yellow orange and grey green.								Mullerian Beds?
4		End of hole 4.0 m Easy augering.										
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 10

Date: 27/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Organic clayey silt.	OL	Grey	M	L	S		P	D		Topsoil.
		Gravelly clay	CL	Yellow grey mottled.	M>		S	S-F	M	D		Buckshot Gravelly clay.
1		Medium plasticity clay.	CL-CH	Orange red some pale grey mottling.	M>		G		M	D		31/5/74 Residual red clay
2												19/6/74
3		Pulverised, lateritised, HW Mudstone (sandy clay).	CL	Orange red	M		G	F	C?	D		20/7/74 Pulverised, Weakly lateritised Mullaman Beds.
4												WATER AT TIME OF DRILLING.
5		Pulverised, lateritised, HW Mudstone. (gravelly & sandy) clay		Pallid mauve orange and grey mottled	M			S-F				6/8/74 27/8/74 Mod lateritised Mullaman Beds.
6												
7												
8		Pulverised HW mudstone. (sandy clay)	CL	Pallid mauve orange and grey mottled.	M			VST	M?	D		Weathered Mullaman Beds
9												
10												
11												
12												
13												
14		Pulverised HW mudstone.		Grey mottled	M					D		Mullaman Beds
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 11

Date: 28/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gr. Cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS. SF. ST. V. ST. H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Organic sandy silt.	OL	Dark grey	M	L	G	S	P	D		Topsoil, residual.
1		Fine sand.	SP	White	D	L	G		P?	D		Subsoil, residual.
2		Pulverised HW mudstone. (clayey sand)	SC	Pale mauve	D	MD	G		P	D		CW Mullaman Beds. 31/5/74
3		Pulverised HW mudstone sand clay mixture.	SC- CH	Pale grey to pale mauve.	M	D	G		P	D		CW Mullaman Beds. 16/7/74
4					W							LEVEL STRUCK. WHILE DRILLING
5												6/8/74
6												27/8/74
7		Pulverised HW mudstone.		Yellow brown	W					D		Mullaman Beds.
8												
9												
10												
11												
12												
13												
14		Pulverised HW mudstone		Yellow brown to white.	M.					D		CW Mullaman Beds.
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 12

Date: 29/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, < PL, W	Relative density (G) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS SF ST V ST H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian; Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0.1		Gravelly organic silt.	OL	Brown grey.	D	L	G		P	D		Residual topsoil. Some buckshot gravel.
0.2		Silty clay	CL	Orange brown	D		G	S	P?	D		Subsoil residual clay.
1.0		Pulverised HW siltstone. (sandy clay)	CL	Orange brown	M		S?	ST	M	D		Mottled weathering zone HW Mullaman Beds.
2.0												
3.0												
4.0												
5.0		Pulverised HW mudstone. (silty clay)	CL	Pale mauve	W		G	VS		D		HW Mullam. Beds.
6.0												
7.0												
8.0												
9.0												
10.0												
11.0		Pulverised HW mudstone. (sandy clay)	CL	Yellow brown								Mullaman Beds
12.0												
13.0												
14.0												
15.0												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 13

Date: 29/5/75

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic sandy silt.	OL	Dark grey	D	VL	S?		P	D		Topsoil residual.
		Fine poorly sorted sand.	SP	Pale yellow	D	L	S		P	D		Residual subsoil clean sand.
		Gravel clay mixture.	CL- GC	Orange red	M<		G	ST	M	D		Residual clayey gravel.
		sandy clay	CL	Orange red	M<		G		M	D		
		clayey sand (pulverised mudstone)	SC	Orange red	M<		S		M	D		HW Mullaman Beds.
2		Pulverised mudstone, HW. (sandy clay)		Pale grey	W			ST	M	D		CW Mullaman Beds
3		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
4		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
5		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
6		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
7		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
8		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
9		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
10		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
11		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
12		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
13		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
14		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.
15		Pulverised HW mudstone.	CL	Pale grey	M	MD			P	D		CW Mullaman Beds.

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 14

Date: 3/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravel-sand-silt mixture	GM	Grey	D	L	G		P	D		Residual topsoil.
		Silty gravel.	GM	Brown grey	D	L	G		P	D		Residual lateritic subsoil.
1		Gravelly sandy clay	CL	Orange brown	D		G			D		Residual clay.
2		Pulverised porcelainite		white.								
3												
4		UNCONFORMITY.										
5		Pulverised mudstone HW.		Yellow-brown.								3/6/74 21/5/74 lower Proterozoic. 23/7/74
6				mauve								
7		Pulverised mudstone HW.		Pale green								lower Proterozoic
8												
9												
10		Pulverised yellow brown CW mudstone.		Pale green.								
11												WHILST DRILLING.
12												
13												
14		Pulverised mudstone.		Mauve-purple								
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 15

Date: 31/5/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M >< PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gor S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Sandy clayey silt.	ML	Pale yellow brown.	D	VL	G		P	D		Residual topsoil.
		Clayey sand.	SC	Yellow brown	D	L	G		P	D		Residual subsoil.
1												
		Silty clay	CL	Mottled orange and grey	D			H	M	D		Residual clay.
2				Mottled brown and white.	M		G	H	M	D		
3		Pulverised HW mudstone (highly plastic clay)		Mottled yellow and white.	M		G	VST	M	D		3/6/74 CW Mullaman Beds.
4												
5												17/7/74 6/8/74 26/8/74
6		Pulverised CW mudstone		light grey to pale greenish white.	D		S			D		Mullaman Beds
7												AFTER DRILLING
8												
9												
10												
11		UNCONFORMITY?										WHILST DRILLING.
12												
13												
14		Pulverised, CW mudstone.		Deep mauve purple.	W							lower Proterozoic?
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 16

Date: 3/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M >< PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gr S cement	Consistency Ton/Sq. ft. Q 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly sandy silt.	GM	Deep red brown.	D	L	S		P	D		Residual lateritic red earth.
1		Hard thin ironstone layer										
2		Plastic clay	CH	Pale greenish white mottled yellow orange.	M		G	F?	M	D	▼	4/6/74 Residual clay developed on Mullaman Beds.
3		Pulverised HW mudstone (silty clay)		Pale greenish white.							▼ ▼	19/7/74 26/8/74 HW-CW Mullaman Beds.
4		UNCONFORMITY?										
5		Pulverised H-CW mudstone.		Yellow-brown.							▼	Lower Proterozoic. AFTER DRILLING.
6		"										
7		Pulverised H-CW mudstone.		Yellow brown.								
8		"		Mauve to grey-green.								
9												
10												
11		Pulverised CW mudstone		Mauve to grey green.							▼	Lower Proterozoic. WATER STRUCK WHILST DRILLING.
12												
13												
14												
15		Pulverised CW mudstone.		Mauve-purple.								"

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 17

Date: 3/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic silt Gravelly clayey? silt. Gravelly silty clay	OL GM -ML	Dark grey Orange brown	D D	L L			P	D D		Residual topsoil. Lateritic clay subsoil.
2		Gravelly sandy clay Pulverised sandy mudstone.		red brown.	D		G	F	M?	D		4/6/74 Mod lateritised rounded quartz pebbles, gritty WHILST DRILLING, coarse sand.
3		UNCONFORMITY.		Pale greyish white to mauve-pink	M		G	ST	P	D		
4		Pulverised CW white mudstone.		White.	D.							lower Proterozoic?
5												
6		Pulverised CW mudstone.		Yellow brown	M.							lower Proterozoic
7												
8												
9												
10												
11		Pulverised CW mudstone.		Yellow brown								lower Proterozoic
12												
13												
14												
15		Pulverised CW mudstone.		Yellow brown								lower Proterozoic

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

M(Pf)208

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 18

Date: 4/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, STH	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly silt. Gravelly clay Plastic clay	ML GM CL CH	Yellowish grey Streaked Yellow orange Yellow white mottled.	D D D	L G			P M C	D D D		Colluvial topsoil. Subsoil clay.
2		Pulverised CW siltstone		mauve-pink	D							
3		Pulverised CW mudstone.		Yellow brown	D							Basal. Mullamar?
4		Pulverised CW mudstone.		Mauve pink.	D							Lower Proterozoic?
5		"		"								10/6/74
6		"		"								23/7/74
7		Pulverised CW mudstone (silty clay)		Mauve purple.	D				M	D		12/5/74 Lower Proterozoic
8												
9												
10												
11		Pulverised CW mudstone.		Orange brown								Lower Proterozoic
12												WATER STRUCK WHIST DRILLING.
13												
14												
15		Pulverised CW mudstone.		Pale brown.								Lower Proterozoic

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: C. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 19

Date: 5/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, STH	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly clay	ch	Orange brown	D		G		M ²	D		Residual clay.
1		Pulverised completely weathered to highly weathered mudstone.		Pale brown to brown white streaked.	D							lower Proterozoic
2												
3											10/6/74	
4											23/7/74	
5		Pulverised CW mudstone		Pale brown							27/8/74	
6												
7												
8												
9												
10												
11												
12		Auger Refusal at 12 m still dry at this depth.										
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 20

Date: 6/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gr or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic gravelly silt. Clay-gravel mixture Gravelly sandy clay	OL GC-CL CL	Grey Orange brown Orange red	D D M?	L	S? G S	 F F	P P? C	D D D		Residual topsoil Subsoil, gravelly latent clay. Residual gravelly clay.
2		Pulverised CW mudstone.	CL	Mottled orange and white.	D					D		6/6/74 27/8/74 Mullaman Beds
3												
4												
5		Pulverised CW mudstone.	CL		D							Mullaman Beds
6												
7		UNCONFORMITY? Pulverised CW mudstone	CL	Yellow-brown	W							Lower Proterozoic.
8												
9												WATER STRUCK WHILST DRILLING.
10												
11												
12												
13												
14												
15		Pulverised CW mudstone.	CL	Yellow brown	W							

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 21

Date: 6/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Organic sandy silt.	OL	Grey	M		G		P	D		Residual topsoil.
0.5		Gravelly clay.	CL	Orange red	M >		G	ST	M	D		Residual clay subsoil. AFTER DRILLING.
1		Gravelly clay	CL	Orange brown	M <		G	ST	C	D		
1.5		Gravelly clay	CL	Orange red	M >>		S	ST	P?	D		23/7/74 Residual clay subsoil.
2		Clay sand mixture.	SC- CL	Yellow brown	M >>		S	S	P	D		28/8/74 WHILST DRILLING LARGE QUANTITY OF WATER FROM HERE.
3		Pulverised CW mudstone.	CL	Mottled yellow orange and white.	M					D		Mullaman Beds
4		END OF HOLE 3.6m Augering stopped.										
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 22

Date: 6/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary Gar S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Very hard ferruginous laterite.		Red brown	D			H		D		Laterite, very hard.
2												
3		Pulverised mudstone and siltstone CW - HW.		Mottled orange and white.	D							Mullaman Beds
4		UNCONFORMITY.										
5												
6		Pulverised completely weathered mudstone.		White to yellow brown.								lower Proterozoic
7												
8												
9												
10											7/6/74	
11		Pulverised CW mudstone		Brown							16/7/74	Lower Proterozoic
12												
13											28/8/74	
14												WHILE DRILLING
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 23

Date: 7/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly silt.	ML	light grey	D	L	S		P	D		Residual topsoil.
		Gravelly silty clay	CL	yellow-brown to orange-red	D		G	F?	M?	D		Residual clay Subsoil.
1												
2		Pulverised H-CW mudstone	CL	Yellow brown	D							Lower Proterozoic
3												The AFTER DRILLING.
4												23/7/74
5		Pulverised Hw-CW mudstone	CL	Mostly mauve pink but some pale brown & greenish white mudstone.	D							27/8/74 Lower Proterozoic
6												
7		Pulverised Hw-CW mudstone.	CL	Mauve pink.	M							WHILST DRILLING.
8					W							
9												
10												
11												
12												
13												
14												
15		Pulverised Hw mudstone	CL	Greenish white.	W							"

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

M (Pf) 208

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Geological Log of Auger Hole

Project: Darwin East

Hole: 24

Date: 7/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS. SF. ST. V. ST. H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly clay	CH	Brown and orange mottled.	D		G	F	C	D		Gravelly lateritic clay.
2		High plasticity clay	CH	Mottled orange & grey	M			F	M	D		
3		"										
4		"										
5		"										
6		"										
7		Gravelly plastic clay.		yellow brown	M					D		
8												
9												
10												
11												
12												
13		END OF HOLE 13.0 M Auger stopped.										
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 25

Date: 11/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Organic silt	OL	Dark grey	D	L	S	S	P	D		Residual topsoil.
		Inorganic silt	ML	Grey	D	L	S	S	P	D		Residual topsoil.
1												
		silty medium plasticity clay	CL CH	Pale yellow-brown	M<		G	F?	M?	D		Modified alluvial clay?
2												
3												
		High plasticity clay	CH	Orange-red	M		G	F?		D		
4												
5		"			M <->							Alluvial clay
6												
7		Gravelly plastic clay	CH	Mottled orange and white.	M?			S?	M?	D		
8												
9												
10												
11												
12												
13												
14												
15		Gravelly Plastic clay	CH	Pale grey						D		Rounded lateritic gravels and rounded small quartz pebbles. Mullamman Beds?

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 26

Date: 12/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, < PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gor S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Organic silt.	OL	Dark grey	M	L	S		P	D		Residual topsoil
		Inorganic silt.	ML	Pale grey	M	L	S		P	D		Residual subsoil.
1		Clayey sand.	SC	Yellow brown	M	L	G		P	D		Alluvial sand?
2		Sandy clay	CH	Orange	M		G	F	C?	D		Residual clay
3												
4		Silty clay	CL	Bright orange red	M		G	S	C?	D		Residual clay terra rossa?
5		Silty clay	CH	Bright orange red.	M		G	S	C?	D		Residual clay Terra Rossa?
6		"		"								
7												
8		Pulverised CW mudstone.		Mottled yellow & grey.								Mullaman Beds.
9												
10												
11		"		"								"
12												
13												
14												
15		Pulverised CW mudstone.		Mottled yellow and grey								Mullaman Beds.

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: C. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 27

Date: 12/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic silty loam	ML	Dark grey	M	VL	S		P	D		Residual topsoil.
		Fine sand	SP	White to pale grey	M-W	L	G		P	D		Clean sand possibly transported
		Silty sand.	SM	Pale grey	W	L	S		P	D		Transported silty sand.
		Clayey sand.	SC	Mottled orange & grey	W	MD	G		P	D	12/6/74	Lateritised sand and silt.
2		Pulverised cw mudstone. (silty clay)	CH	Mottled orange and grey	D	D	G		P?	D	16/7/74	WHILST DRILLING, lateritised sand and silt?
		(sandy clay)								D	12/8/74	Mullaman Beds?
3		(gravelly clay)								D	27/8/74	
4			CH	Mottled orange and grey	M?		G	F?	P?	D		Mottled lateritic clays & lateritic gravels.
5												
6		Pulverised cw mudstone. (medium plasticity silty clays)	CH	Mottled orange and grey ↓ Mottled purple and grey.	M	?	G	ST-VST	M	D		Weakly lateritised Mullaman Beds.
7												
8												
9												
10												
11		Pulverised highly weathered mudstone (thin bands of white siliceous siltstone)		Bright yellow brown.	W	VD?				D		Mullaman Beds
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 28

Date: 13/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Organic loam	OL	Black	M	r	S		P	D		Residual organic loam.
1		Mostly fine sand with minor clay	SP	light grey	W	L	G		P	D		23/7/74 Seepage, Aquifer?
		clayey sand.	SC	Mottled orange & grey	W	L	G		P	D		19/8/74
2		Sandy lean clay	CL	Mottled yellow brown & grey	M>		G	F?	P	D		
3		" "										
4		" "										
5		Sandy clay	CL	Orange	M>		S	F	P	D		
6		Sandy clay	CL	Bright orange red.	M>		G	F	M	D		Terra Rossa?
7		sandy medium plasticity clay	CH - CH	Bright brick - red	M>			F	M	D		Terra Rossa?
8		END OF HOLE 7.5 m Auger stopped.										
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS**

Geological Log of Auger Hole

Project: Darwin East

Hole: 29

Date: 13/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Cor S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic silt.	OL	light grey	D	L	S		P	D		Residual topsoil. A1 Horizon
		Clayey sand	SC	Yellow brown	D	L	G		P	D		Residual clayey soil. A2 Horizon
2		Silty clay	CL	Orange red.	D		G	F	P	D		Residual lateritic clay B1 Horizon
3		Silty gravelly clay	CL	Red brown.	D		G	ST	P	D		Residual lateritic clay. Mullaman Beds. B2 Horizon
4												
5		Sandy silty clay	CL	Reddish brown	D		S			D		
6												WHILEST DRILLING & AFTER DRILLING.
7		Mottled completely weathered siltstone.	Ch	Mottled white brown & purple.	W					D		18/7/74 Mullaman Beds 6/8/74 27/8/74
8												
9												
10												
11		" "		" "								
12		END OF HOLE 11.5 m.										
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 30

Date: 14/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Organic silt	OL	Light grey	D	L	S		P	D		Residual topsoil. A HORIZON
1		Silty clay	CL	Yellow brown	D		G	F ?		D		Residual clay. B1 Horizon
2		Silty clay	CL	Orange	D		G	F	C ?	D		Residual clay B2 horizon
3		Silty lean clay.	CL	Bright red- brown	D		G	F	P ?	D		Deep red earth profile.
4												
5												
6												AFTER DRILLING WHILE DRILLING 19/6/74 4/7/74
7									12/7/74			
8		Medium plasticity clay	CL- CH	Dark red- brown.	M ?		S ?		P ? D	6/8/74		lateritic clay Some buckshot gravel.
9									27/8/74			
10												
11		CW Siltstone		Mottled orange and grey	D							Mullaman Beds?
12												
13												
14		CW pulverised mudstone.		Mottled orange & grey.	D							Mullaman Beds.
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 31

Date: 14/6/74

Logged by: PV B

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Silty gravel	GM	Brown	D	L	G		P	D		Residual topsoil.
1		lateritic gravelly clay	CL	Red-brown	D		S	H	M	D		lateritic red earth.
2		Pulverised HW mudstone		Pale Yellow white	D		S?			D		Weakly lateritised Mullaman Beds.
3												
4		Pulverised HW mudstone		Pale yellow white.	D					D		Mullaman Beds containing small rounded quartz pebbles.
5												23/7/74
6		UNCONFORMITY.										28/8/74
7		Pulverised H-CW mudstone.		Yellow brown	D							Lower Proterozoic?
8												
9												
10												
11		Pulverised HW mudstone		Buff.	D							Lower Proterozoic
12												
13												
14												AFTER DRILLING
15		Pulverised CW mudstone.		Yellow brown.	W							WHILST DRILLING. Lower Proterozoic.

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

M (PI) 208

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Geological Log of Auger Hole

Project: Darwin East

Hole: 32

Date: 20/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Sandy silt.	SM	light grey			S		P	D		Colluvial topsoil
1		Pulverised H-CW silt stone.		Mottled & light grey			S		P?	D		20/6/74 Mullaman Beds.
2		UNCONFORMITY.										23/7/74
3		Pulverised H-CW mudstone.		Yellow brown								12/8/74 27/8/74 Lower Proterozoic
4												
5		END OF HOLE 5.5 m.										
6		Auger refusal.										
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS**

Geological Log of Auger Hole

Project: Darwin East

Hole: 33

Date: 20/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Sand silt mixture	SM	Light grey					P	D		Colluvial.
		Fine Sand	SP	Light grey					P	D		Colluvial.
		Sandy clay	CL	Mottled grey & orange								Colluvial.
2		Pulverised CL mudstone (clayey sand)	SC	Weakly mottled grey & orange.					-			20/6/74 23/7/74 Mullaman Beds
3												12/8/74
4												27/8/74
5		Pulverised CL mudstone (clayey sand)	SC	Pale grey.						D		Mullaman Beds
6		END OF HOLE 5.5m Auger refusal.										
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobsen

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Geological Log of Auger Hole

Project: Darwin East

Hole: 34

Date: 20/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Sandy silt	5M	Grey					P	D		Topsoil Colluvial.
1		Pulverised Soft silty mudstone.		Greenish grey with orange mottled.						D		Mullaman Beds.
		UNCONFORMITY.										
2		Pulverised H-CW mudstone		Mauve-purple.								Lower Proterozoic.
3												20/6/74
4		Pulverised H-CW mudstone		Mauve purple								17/7/74 Lower Proterozoic 12/9/74
5		END OF HOLE 5.5m Auger Refusal.										
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 35

Date: 19/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast. OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SE, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly silt.	ML	Orange brown						D		Residual lateritic red-earth.
		Gravelly clay	CL	Orange brown								
1		HARD BAND OF MILKY QUARTZ.										
		Gravelly clay	CL	Orange brown								Residual lateritic red earth.
2												
3		Pulverised H-CW mudstone		Pale greenish grey						D		Mullaman Beds.
4												
5		UNCONFORMITY.									20/6/74	
6											17/7/74	
7		Pulverised H-CW mudstone		Mauve Purple.						D	19/9/74 27/8/74	Lower Proterozoic
8												
9												
10												
11		Pulverised H-CW mudstone		Mauve Purple.								
12												
13												
14		Pulverised CW mudstone		Yellow brown						D		Lower Proterozoic
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 36

Date: 20/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VI, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Organic silt	OL	Dark grey	M			S	P	L		Residual topsoil.
		Sandy silt	SM	Light grey	W			VS	P	D		Colluvial.
1												20/6/74
2		Pulverised highly to completely weathered mudstone.	ch- ch	Yellow brown	M- D				M			15/7/74 Lower Proterozoic.
3												19/8/74
4		Pulverised H-CW mudstone.		Mauve purple.								Lower Proterozoic.
5		END OF HOLE 5.5m.										
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 37

Date: 20/6/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, STH	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly silt.	ML	light grey		VL			P	D		A Horizon
1		Gravelly clay	CL	Orange brown					PZ	D		lateritised (weakly) Mullaman Beds. B Horizon.
2												
3		Pulverised HW mudstone.		Bright greenish grey								Mullaman Beds. C Horizon.
4		UNCONFORMITY.									20/6/74 24/7/74	30/7/74 DRY.
5		Pulverised H-CW mudstone.		Mauve purple.								Lower Proterozoic.
		END OF HOLE 5.5m.										
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 38

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gr S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Porous Crumb etc.	Structure	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0.0		Pulverised HW siltstone Auger refusal at 0.6 m Several holes tried.		White.	D				M		D		Mullaman Beds
0.1													
0.2													
0.3													
0.4													
0.5													
0.6													
0.7													
0.8													
0.9													
1.0													
1.1													
1.2													
1.3													
1.4													
1.5													

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 39

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 kg/Sqcm VS. SF. ST. V. ST. H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		organic silt Sandy silt Pulverised laterite	OL ML	Medium grey Pale grey Bright red	D D D	VL L G	G G H?		P P D	D D D		Topsoil. Residual subsoil. Residual
2		Gravelly sand	GP	Mottled buff and grey		D?	G		P	D		lateritic handpan Residual mottled lateritised Mullam- an Beds.
3											▼ 21/6/74 ▼ 30/7/74 ▼ 27/8/74	
4		Pulverised Mullamman Beds, silty clay		Pale buff to pale grey		W?	G			D		Completely weathered Mullamman Beds
5												
6												
7		Pulverised Mullamman Beds.	SC	pale yellow	W		G		P	D		Same as above
8												
9												
10												
11		" "	CL	Pale grey	W					D		Same as above
12												
13												
14												
15		" "	CL	White	W					D		same as above.

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 40

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 kg/Sq. cm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly silt	ML	Pale grey	D	L	G		P	D		Residual topsoil.
1		Gravel, sand, clay mixture	GC	Bright	D		G		P?	D		lateritic clay profile.
			GM	orangy red.								
2		Sandy clay	CL	Mottled dark red and	D?		G		P	D		Mottled lateritic zone ie
		Sandy silt mixture	SM	pale grey								lateritised Mullaman Beds.
3		Pulverised siltstone		white								Mullaman Beds
4												16/7/74
5		Pulverised siltstone		white						D		7/8/74 Mullaman Beds.
6												
7		Pulverised siltstone		Pale yellow to buff.								Possible Mullaman Beds
8												
9												21/6/74
10												
11		Pulverised siltstone		Pale yellow								same as above.
12												
13												
14												
15		Pulverised mudstone or clay	CL	Bright yellow to olive.								Possible base of Mullaman Beds as at DH2.

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 41

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast. OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gr. cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0.1		Gravelly silts	OL	Pale grey	D	L	G		P	D		Topsoil.
0.2		Gravelly grey silt	ML	Pale buff - grey orange	D	L	G?		P	D		Residual subsoil
1.0												
2.0		Pulverised siltstone		yellowish white	D	VD			P?	D	No casing, No water.	Mullaman Beds.
3.0		END OF HOLE 3 m Auger Refusal.										
4.0												
5.0												
6.0												
7.0												
8.0												
9.0												
10.0												
11.0												
12.0												
13.0												
14.0												
15.0												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Johnson

Geological Log of Auger Hole

Logged by: PVB

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 43

Date:

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Organic silt.	OL	Dark grey	M	L	G		P	D		Topsoil
		Fine sand	SP	Pale grey		MD	G		P	D		Residual Sand
1		Clayey sand Sandy clay - silty clay.	SC CL			D	G		P	D		Lateritised Mullaman Beds. Mottled honeycomb structure.
2												
3												
4		Pulverised weathered siltstone		pale brown to white.						D		25/6/74 Weathered Mullaman Beds.
5												
6												
7		Pulverised weathered mudstone		yellow brown to white						D		Same as above.
8												
9												
10		Pulverised weathered siltstone.		yellow brown and white						D		Same as above.
11		END OF HOLE 11.5 m.										
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 44

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic gravelly sandy silt.	OL	Grey	D	L	G		P	D		Topsoil
		Gravelly sand.	GP	Buff	D	D	G		P			Lateritised & mottled Mullaman Beds.
		Gravel, Sand, clay mixture	GC	Orange Yellow	D		G		P			ateritised Mullaman Beds
		Clayey sand.	SC	Orange Red.	D		G		P			
2		Pulverised siltstone.	CL	White to very pale grey	W?				M?		16/7/74	Completely weathered Mud-stone, Mullaman Beds
3		"									25/6/74	
		"									27/8/74	
4		Pulverised mudstone	CL	White.	W		G		P	D		Completely weathered Mullaman Beds.
5		"										
6												
7		"	SC	White.	W		G		P	D		Same
8												
9												
10		"	SC	White	W				P	D		Completely weathered Mullaman Beds containing numerous rounded quartz pebbles.
11		END OF HOLE 11.0 m.										
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. T. Smith

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 45

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gr S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm	VS. SF. ST. V. ST. H.	Massive Structure poreus Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Organic silt	OL	Black	W	L	S			P	D		Topsoil.
		Fine sand	SP	Yellowish grey	W	L	G			P	D		Residual soil.
1		Gravelly sand	GP	Pinkish buff & white mottled.	W	MD	G			P	D		Mottled Lateritised Mullaman Beds
		Gravel sand clay mixture	GC	Mottled orange & white.	W	MD	G			P	D		Mottled Mullaman Beds
2													
3													
4		Pulverised siltstone											
5		(Silty clay & Sandy clay)		Pale grey to white, some orange mottling.	W						D		Mullaman Beds
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													

Driller: Mines NT

Drill. type: Gemco

Not sampled

Checked by: G. J. ...

**BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS**

Geological Log of Auger Hole

Project: Darwin East

Hole: 46

Date: 9/8/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Go S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqm VS, SF, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Pulverised siltstone Auger refusal at 0.3 m.		white	D					D	Dry	Mullaman Beds
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 47

Date: 9/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PLW	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravel silt mixture	GM	Pale grey	D	MD	G		P	F		Gravelly topsoil
1		Gravelly sandy clay	CH	Pale orange	D		S		P	D		Gravelly lateritic clay subsoil
2		Pulverised sandstone (clayey sand)		Yellow orange								Weathered Mullaman Beds.
3		"										
4		"										
5		"										
6		pulverised sandstone	SC	white	D?		G		P?	D		Weathered sandstone Mullaman Beds.
7				Pale orange.								7/7/74 7/8/74 7/18/74
8		Pulverised sandstone	SC	Bright orange red					P	D		Weathered sandstone Mullaman Beds
9												
10												
11		Pulverised Siltstone	ML	white	W					26/6/74		Weathered siltstone. Mullaman Beds
12												
13												
14												
15		Pulverised mudstone	CL	Yellow brown								Weathered Mullaman Beds?

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 48

Date: 9/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast. OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly silt (organic)	ML	Pale grey	D	L			P	D		Residual lateritic topsoil.
1		Pulverised, lateritised silts-bone							P	D	casing.	Lateritised Mullaman Beds.
2		Pulverised Porcelanite. (silicified silts)							M	D	Dry hole	Mullaman Beds.
2.35		END OF HOLE 2.35 m Auger Refusal.										
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: C. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 49

Date: 9/8/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS SF ST V ST H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Colian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Pulverised siltstone AUGER REFUSAL AT 0.3 m. (SEVERAL HOLES TRIED)		white.							Dry	Mullaman Beds.
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

☒ Not sampled

Checked by: G. Jacobson

M (Pf) 208

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 50

Date: 9/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS SF ST V ST H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Sandy silt	HL	Pale yellow	D	L	G		P	D		Residual topsoil
		Clayey sand	SC	Pale yellow	D				P	D		
		Gravelly clayey sand	GC	Orange brown	D	MD	G		P	D		lateritic clayey profile.
2		Gravelly silt - silty gravel	GM	Buff	D	D?			P?	D		Mottled zone lateritised siltstone
3												(Mullaman Beds)
4												
5		Pulverised siltstone		white								16/7/74 Pallid zone Mullaman Beds
6												
7		Pulverised siltstone		white.								27/6/74
8												
9												
10												
11												
12		Pulverised Porcelanite		white								Mullaman Beds.
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson



CONTINUED ON NEXT FICHE

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 51

Date: 9/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS SF ST V ST H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly silt.	NL	Pale grey	D	L	G		P	D		Lateritic topsoil
		Gravelly clayey silt.	ML	Pale yellow	D	L	G		P	D		Lateritic subsoil.
		Gravelly silty clay	CL	Orange brown	D	L	S		P	D		Lateritic clay
2		Silty clay. Pulverised siltstone and Porcelanite.	CL	Mottled white and brown	D							Pulverised mottled Mullaman Beds
3		Pulverised siltstone and porcelanite.		white to pale yellow	D							Same as above
4		Mixture of pulverised porcelanite and pulverised mudstone.									16/7/74 1/8/74 19/8/74	
5												
6												
7												
8											28/6/74	
9		Pulverised siltstone		Yellow brown								Possibly Mullaman Beds, same as YB siltstone/ sandstone outcrops.
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobsen

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 52

Date: 9/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast. OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly silt.	M	Pale grey	D				P	D		skeletal soil only
1		Pulverised, mottled, lateritised siltstone		Buff, mottled white	D				P	D		Mullaman Beds
2		Pulverised siltstone		white	D					D		Mullaman Beds.
2.4		END OF HOLE 2.4m Auger Refusal.										
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 53

Date:

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Slightly organic silt	OL ML	Pale grey	D	L	G		P	D		Topsoil.
		Lateritic gravelly clayey sand	SC	Orange brown	D	L	G		P	D		Lateritic subsoil.
2		Gravelly clay	CL	Orange brown.	D	MD	G		P	D		Residual lateritic subsoil clay.
3		Gravelly silty clay.	CL	Mottled buff and white.			G?		P	D		Mottled lateritised Mullaman Beds. 16/7/74
4												27/8/74
5		Pulverised, weathered siltstone & mudstone.		Mottled pale yellow-brown and white.						D		Weathered Mullaman Beds.
6												
7		Pulverised, weathered siltstone & mudstone		Mottled pale yellow-brown & white.						D		Weathered Mullaman Beds.
8												
9												
10												
11		Pulverised, weathered siltstone & mudstone		Mottled pale yellow-brown & white.						D		28/6/74. Weathered Mullaman Beds
12												
13												
14												
15		Pulverised, weathered siltstone & mudstone.		Mottled pale yellow-brown & white.						D		Weathered Mullaman Beds.

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 54

Date:

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0.5		Gravelly silt	OL	Pale grey	D	L	G		P	D		Residual topsoil.
1.0		Gravelly sandy clay	CL	Orange red	D							Lateritic clay
1.5		Pulverised weathered siltstone and mudstone.		Mottled yellow brown and white								Weathered Mullaman Beds.
2.5		Pulverised & weathered siltstone & mudstone		Mottled yellow brown and white.						16/7/74		weathered Mullaman Beds 17/8/74
3.5												
4.5												
5.5												
6.5												
7.5		Pulverised & weathered siltstone & mudstone.										Weathered Mullaman Beds
8.5												
9.5												
10.5												
11.5		Pulverised & weathered siltstone.		Mottled pale grey & white						17/7/74		same as above
12.5												
13.5												
14.5												
15.0		Pulverised & weathered siltstone.		very pale yellow								Weathered Mullaman Beds.

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Dar .n East

Hole: 55

Date:

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Cor S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq cm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly organic silt.	OL	Pale grey	D	L	G		P	D		Residual topsoil.
1		Gravelly clayey sand	SC	Pale yellow		MD	G		P	D		Gravelly residual subsoil.
2		Clayey sand	SC	Pale orange		D?	G		P	D		Weakly lateritised. Mullaman Beds.
3		Pulverised weathered mudstone.		Pale greenish white.								Weathered Mullaman Beds.
4		Pulverised weathered mudstone.		Pale greenish white to rotted yellow - brown & white.						D		Weathered Mullaman Beds.
5												
6												17/7/74
7												7/8/74
8		UNCONFORMITY.										2/7/74
9												
10												
11		Pulverised mudstone		Dull yellow & buff.						D		Possible lower Proterozoic?
12												
13												
14				yellow orange some dark blotches.	W					D		Possible lower Proterozoic?
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole.

Project: Darwin East

Hole: 56

Date:

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (G) VL, L, MD, D, VD	Boundary for S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm	VS. SF. ST. V. STH.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic sandy silt	OL	Pale grey	D	L	G			P	D		Residual Topsoil.
		Sand silt mixture	SM	Pale yellow	D	L				UP	D		Subsoil (sandy)
		Clayey sand	SC	Mottled pale orange & white	D	MD?				P	D		Mottled lateritised. Sandy Mullaman Beds.
2		Sandy clay	CL	Mottled dark red & white	M					P	D		Same as above
3		Pulverised weathered sandstone											
4		Sand (medium)	SP	Mottled yellow brown & white ↓ Pale mauve.	D					P	D		Sandy Mullaman Beds.
5		Pulverised weathered sandstone											
6		Pulverised weathered sandstone											
7		Pulverised weathered sandstone											
8		Pulverised weathered sandstone											
9		Pulverised weathered sandstone											
10		Pulverised weathered sandstone											
11		Pulverised, weathered, silty mudstone.		white	W					M	D		2/7/74 Silty Mullaman Beds.
12		Pulverised, weathered, silty mudstone.		white	W					M	D		Same as above.
13		Pulverised, weathered, silty mudstone.		white	W					M	D		Same as above.
14		Pulverised, weathered, silty mudstone.		white	W					M	D		Same as above.
15		Pulverised, weathered, silty mudstone.		white	W					M	D		Same as above.

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobsen

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GEOLOGY & GEOPHYSICS**

Geological Log of Auger Hole

Project: Darwin East

Hole: 57

Date:

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gor S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq cm VS, SF, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly silt.	OL ML	pale grey	D				P	D	No water.	Residual topsoil. (buckshot gravel)
2		Gravelly clay	CL	Red-brown					C	D	No casing	Subsoil, some siltstone gravels.
2		END OF HOLE 2m Auger Refusal.		some white mottling.								Refusal in Mullaman Beds, white silty mudstone.
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 58

Date:

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq cm VS SF ST V ST H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Organic silt	OL	Pale grey	D	L	S		P	D		Topsoil.
1		Pulverised shale		Pale buff yellow-brown	D							lower Proterozoic
2		"										
3		"										
4		"		Pale grey- green.								"
5		"		Pale yellow- brown								
6												
7		"									▼	17/7/74
8											▼	13/8/74
9											▼	27/8/74
10												
11		"		Pale buff	W						▼	4/7/74
12												
13												
14												
15		"		Pale grey- green	W							"

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

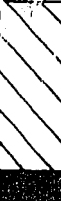
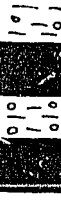
Geological Log of Auger Hole

Project: Darwin East

Hole: 59

Date:

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Cor S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SE, ST, V, ST, H.	Massive Poreus Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly clay	Ch	Red brown	D	VD				D		Hardpan laterite. Pulverised?
2												
3		Pulverised weakly mottled lateritised silty mudstone		Mottled clay red & white	D							Mullaman Beds?
4												
5		UNCONFORMITY.										
6												
7		Pulverised soft mudstone		Dull pale brown	D					D		Lower Proterozoic.
8												
9												
10												
11		Pulverised soft mudstone		Pale grey	D					D		lower Proterozoic
12												
13												
14												
15		Pulverised soft mudstone.		Pale brown	D					D		lower Proterozoic

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by:

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 60

Date: 6/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast. OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gols cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, SH	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0.0		Gravelly silt	ML	Red brown	D		G		P	D		Residual soil, lateritic.
0.5		Clayey silty gravel (pulverised, lateritised, siltstone)	CH GM	Bright Orange	D		G		P?	D		Residual lateritised.
1.0		Pulverised siltstone.										Mullawman Beds.
2.0												
3.0		Pulverised siltstone		Yellow brown & white	D		G		P?	D		Mullawman Beds weakly lateritised
4.0												
5.0												
6.0		Pulverised siltstone		white	D							17/7/74 Mullawman Beds.
7.0		END OF HOLE 7.25 m Auger Refusal.									dry	19/8/74.
8.0												
9.0												
10.0												
11.0												
12.0												
13.0												
14.0												
15.0												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: C. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 61

Date: 6/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS SF ST V, SH	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly silt.	ML	Pale grey	D	L			P	D		Alluvial silt.
1		Silty gravel	GM	Red-brown	D					D		Residual laterite
2		Mottled weakly lateritised CW siltstone.		Pale grey & orange						D		Mullaman Beds
3		Pulverised siltstone & mudstone		Pale grey to pale mauve.								Mullaman Beds
4												17/7/74
5												13/8/74
6												27/8/74
7		Pulverised mudstone		yellow- brown								Mullaman Beds
8												
9												
10												
11												Mullaman Beds.
12												
13		UNCONFORMITY										
14												
15		Pulverised mudstone.		Pale brown								Lower Proterozoic

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 61B

Date: 6/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gr. S. cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS. SF. ST. V. ST. H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Pisolitic laterite Hardpan Gravelly clay	CL	Dark red-brown Yellow-brown								(buckshot gravel)
2		Sandy clay	ch	Pale gray								Mullaman Beds. CW 21/7/74
3		Pulverised CW mudstone								26/8/74		Mullaman Beds
4		Pulverised CW mudstone (Medium clay)	CL ch	Pale gray								"
5												"
6												
7		Medium clay		Pale gray								"
8		Pulverised mudstone		Pale yellow brown.								
9												
10												
11		Pulverised mudstone		Pale yellow brown.						whilst drilling		Mullaman Beds
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: C. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 62

Date: 7/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 kg/Sq. cm	VS, SF, ST, V, STH	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly Sand (increasing clay with depth)	SW	Bright red- brown	D								Latentic gravel
2		Pulverised mudstone.	CH CH	Mottled yellow brown & white									Mullaman Beds
3		"											21/7/74
4		"											26/8/74
5		"											
6		"											
7		Pulverised mudstone		Pale yellow brown.									Basal Mullaman Beds?
8													
9													
10													
11		"		Pale yellow brown.									
12													
13													
14													
15		"		Pale yellow brown									whilst drilling

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: C. Jacobsen

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Geological Log of Auger Hole

Project: Darwin East

Hole: 63

Date: 7/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PLW	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm	Massive Structure Porous Grumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Fine sand silt mixture	SM	Pale grey.								Topsoil
1		Fine to med. sand	SP	Pale yellow-brown.								Residual Subsoil
2		Gravelly sand Gravelly sandy clay		Red brown. Orange-brown						21/7/74 26/8/74		Residual subsoil.
3		Pulverised mudstone (Sandy clay)		Mottled yellowish brown & grey								CW Mullaman Beds. CW Mullaman Beds
4		Pulverised H-CW Siltstone & mudstone		Pale greenish grey to white, some red-brown mottling.								H-CW Mullamans Beds
5												
6												whilst drilling
7												
8												
9												
10												
11												
12		Pulverised H-CW Siltstone & mudstone.		Pale greenish grey to white Some red-brown mottling								H-CW Mullamans Beds
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: C. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 64

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly sandy silt clayey sandy silt		grey red-brown red-brown								Topsoil Residual subsoil
2		Moderately lateritised. siltstone		red-brown								Moderately lateritised Mullaman Beds.
3		Pulverised CW siltstone & mudstone (silty clay)		Mauve & white, mottled.								Weakly lateritised Mullaman Beds.
4												21/7/74
5												6/8/74
6												26/8/74
7		Pulverised CW mudstone		mottled yellow brown and white.								CW Mullaman Beds.
8												
9												
10												
11												
12												
13												
14		Pulverised CW mudstone		mottled yellow brown and white.								CW Mullaman Beds.
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Josephson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 65

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm	VS. SF. ST. V. ST. H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly sand		Pale yellow-brown									
		clayey gravel	Gc	Yellow-brown.									
2		Clayey gravel to gravelly Sandy clay.	Gc ch	Dull red brown.									Moderately lateritised Mullaman Beds.
3		Pulverised HW mudstone		Yellow brown mottled white									Weakly lateritised Mullaman Beds.
4		Pulverised H-CW mudstone		White pale grey to pale green.									Mullamans Beds.
5		Pulverised mudstone.		Mauve to purple.									lower Proterozoic?
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 66

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary for S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm	VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly fine sand		Pale brown Red brown.									Topsoil
2		Gravelly clayey sand.		Bright red- brown.									Residual subsoil
3		Pulverised, laterised, Mullaman Beds (gravelly sandy clay).		Dull red brown.									Mullaman Beds.
4		Pulverised HW-CW laterised Mudstone.		Mottled red brown & white.									Mullaman Beds
5		Unconformity ?											
6												21/7/74	
7												26/8/74	
8		Pulverised HW mudstone		Mauve to purple.									lower Proterozoic whilst drilling
9													
10													
11		Pulverised HW mudstone		Mauve to purple.									lower Proterozoic.
12													
13													
14													
15		Pulverised HW mudstone.		Mauve to purple.									lower Proterozoic

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 67

Date: 8/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Cor S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 kg/Sq. cm VS, SF, ST, V, STH	Massive Porous Structure Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Calluvial Decomposed rock Horizon A, B, C Buried soil]
0		Fine clayey sand		Pale brown								Topsoil
0.5		Fine sand		Grey brown.								
1		Gravelly sand.		Red brown.								Residual Subsoil. Moderately lateritised Mullamans Beds.
2												
3		Pulverised HW mudstone.		Mottled yellow brown & white								Weakly lateritised Mullamans Beds.
4												
5		Unconformity ?										
6		Pulverised mudstone HW		Mauve Pink								21/7/74 12/8/74 Lower Proterozoic.?
7		END OF HOLE 6.5m Auger Refusal										
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 68

Date: 16/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-1/2	Moisture D.M. > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Cor S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Fine silty clay.		Dark grey								Topsoil
1		Medium plasticity clay		Dark yellow orange mottled								
2		medium plasticity clay		Mauve red & orange mottled								Residual podzolic
3		Medium plasticity clay		Yellow brown								
4		Sandy clay	cl	Yellow brown								
5												21/7/74 12/8/74
6		Silty clay CW (pulverised) Mudstone UNCONFORMITY		white								Mullaman Beds. whilst drilling
7		Pulverised mudstone		Mauve pink.						dry 28/8/74		Lower Proterozoic
8		END OF HOLE 7.8 m Auger Refusal.										
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 69

Date: 16/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary Gar S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS. SF. ST. V. ST. H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		clayey fine sand.		Orange brown.								
		Gravelly sand		Orange brown.								
1												
		Pulverised, lateritised, siltstone (gravelly sand.)		Mottled red- brown and white.								Moderately lateritised. Mullaman Beds.
2												
3												
		Pulverised mudstone HW.		Mottled red- brown and white.								Weakly lateritis- ed Mullaman Beds.
4												
5												
6											21/7/74 6/8/74 26/8/74	
7												
8												
9												
10												
11		Pulverised Mudstone HW.		Yellow-brown								Mullaman Beds
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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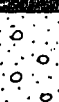
Geological Log of Auger Hole

Project: Darwin East

Hole: 70

Date: 17/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly sand		Pale grey								
		Gravelly fine sand.		Pale brown.								
		Gravelly clay sand.		Mottled red-								
		pulverised, lateritised. siltstone		brown & white.								Moderately lateritised Nullaman Beds.
2												
3												
4		Pulverised HW mudstone.		Red-Brown								Weakly lateritised Nullaman Beds.
5				Mottled, white.								
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 71

Date: 17/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PLW	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS. SF. ST. V. ST. H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried]
		Fine sand		Light grey								
1		Fine sand		Bright yellow orange.							No water	Residual Subsoil
		Gravelly fine sand.		Bright yellow orange.							No water	lateritised gravel.
2		Pulverised lateritised siltstone.		Dull yellow brown mottled white							No water	Moderately lateritised Mullaman Beds
3												
4		END OF HOLE 3.7 m Auger Refusal.										
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 72

Date: 18/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PL.W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm	VS SF, ST, V, STH	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly sand		Pale grey									Topsoil
0.5		Gravelly fine sand		Pale brown									Residual lateritic gravel.
1		Gravelly clay sand. (Pulverised, moderately lateritised Mullaman Beds)		Red-brown									
2													
3		Pulverised mudstone. (Quartzite?)		Pale grey									Mullaman Beds Quartzite?
4													
5		End of Hole 5.0 m Auger Refusal on quartzite.											
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 73

Date: 18/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary for S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm	VS SE ST V STH	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic fine sand.		Dark grey									Topsoil.
		Fine to medium sand.		Pale grey									Subsoil.
		Gravelly clayey sand		Mottled red- brown & pale grey									Lateritised gravels
2		Gravelly clayey sand.		Mottled deep red & grey									Lateritised and weathered Mullamman Beds.
3		Pulverised mudstone, gravelly sand.		Pale brown									Mullamman Beds ?
4													
5													21/7/74 26/8/74
6		END OF HOLE 6.0 M Auger Refusal.											Quartzite. ?
7													
8													
9													
10													
11													
12													
13													
14													
15													

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 74

Date: 18/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly sand.		Pale grey								Topsoil
1		Gravelly Silty sand.		Red-brown uniform.								Residual Subsoil.
2		Medium sand		Pale grey								Pulverised HW Quartzite.
2		Auger refusal at 2m										Outcrop of quartzite nearby.
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 75

Date: 18/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary for S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq cm VS SF ST V. ST H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0	0.0	Gravelly fine sand.		Pale grey.								Topsoil
1	0.0	Gravelly fine sand.		Yellow brown.								Residual sandy Subsoil.
2	1.0	Pulverised, lateritised siltstone (gravelly sand)		Mottled red brown and white.								Moderately lateritised Mullaman Beds.
3	1.0	Pulverised HW mudstone.		Mottled mauve brown and white.								Weakly lateritised Mullaman Beds.
4	1.0											
5	1.0											
6	1.0	Pulverised HW mudstone		white.								Mullaman Beds
7	1.0											21/7/74 6/8/74 26/8/74
8	1.0											
9	1.0											
10	1.0											
11	1.0	Pulverised HW mudstone Auger refusal. 11.5 m.		Mauve pink								whilst drilling lower Proterozoic?
12	1.0											
13	1.0											
14	1.0											
15	1.0											

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 76

Date: 19/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary Gor S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, STH.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0.5		Gravelly fine sand.		Pale grey								Lateritised gravel.
1.0		Gravelly sand		Pale yellow brown.								Residual subsoil.
1.5		Pulverised lateritised siltstone. (gravelly sand)		Red-brown mottled white.								Moderately lateritised Mullaman Beds.
2.0												
2.5												
3.0												
3.5		Pulverised Hw mudstone.		Mauve-brown mottled white.								Weakly lateritised Mullaman Beds.
4.0												
4.5												
5.0												
5.5												
6.0												
6.5												
7.0		Auger Refusal 7.0m										
8.0												
9.0												
10.0												
11.0												
12.0												
13.0												
14.0												
15.0												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: C. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 77

Date: 19/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm	VS SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0.0		Gravelly sand		Pale grey									Topsoil
0.5		Gravelly fine sand		Bright red-brown									Residual subsoil.
1.0		Pulverised, lateritised. siltstone Gravelly clayey sand.		Red brown mottled white									Pulverised, moderately lateritised Mullaman Beds.
2.0		Pulverised HW siltstone.		Mauve brown mottled white									Weakly lateritised Mullaman Beds.
3.0													
4.0		Pulverised highly to moderately weathered siltstone.		white									Mullaman Beds
5.0													
6.0													
7.0		"											"
8.0													
9.0													
10.0													
11.0		"											"
12.0													
13.0													whilst drilling
14.0		UNCONFORMITY.											
15.0		Pulverised HW mudstone.		Buff.									Lower Proterozoic ?

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 78

Date: 19/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly sand		Pale grey.								Topsoil
1		Gravelly clay sand		Bright red-brown.								Residual Subsoil.
2												
3		Pulverised lateritised siltstone. (gravelly sand clay)		white, weakly mottled red-brown								Mullaman Beds.
4												
5												
6		Pulverised mudstone		white (weakly mottled red-brown)								
7												
8												
9												
10												
11												
12		END OF HOLE 11.4 m Auger refusal.										
13												
14		Quartzite outcrop 20' away quite extensive.										
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS**

Geological Log of Auger Hole

Project: Darwin East

Hole: 79

Date: 20/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Fine sand Auger refusal. 0.56 m		Pale yellow brown.								Skeletal soil AW Quartzite.
2		Quartzite outcrop nearby		quite extensive.								
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 80

Date: 20/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary for 5 cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly sand		Pale grey.								Topsoil
		Gravelly sand		Red-brown.								Residual Subsoil.
1		Very gravelly sand		Red-brown								Intensely latentised Mullaman Beds.
2		Sandy clay (Pulverised HW siltstone)		Mottled yellow brown + white.								
3												
4		Pulverised mudstone (silty clay)		white.								Mullaman Beds.
5		"										
6												
7												
8												
9				white.								
10												
11		END OF HOLE 11.6 m		"							▼ 6/8/74 dry 19/8/74	
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 81

Date: 20/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS SF ST V ST H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly sand		Pale grey								Topsoil
1		Gravelly clayey sand		Red-brown								Residual subsoil.
2		Gravelly clay (Pulverised, lateritised siltstone)		Mottled red brown & white.								Moderately lateritised Mullaman Beds.
3		Pulverised HW mudstone		very pale yellow-brown								Mullaman Beds.
4												
5												
6												
7												
8												
9												
10											21/7/74 dry 12/8/74	
11		End of Hole 11m. Auger refusal										
12												
13												
14		Quartzite outcrops all around										
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 82

Date: 20/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm	Structure Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly sand		Pale grey								Topsoil
		Gravelly clayey sand.		Pale yellow brown.								Residual subsoil.
1		Pulverised moderately lateritised siltstone (clayey gravel)		Mottled yellow brown and red white.								Pulverised mudstone. Mullaman Beds.
2		Pulverised Mudstone HW.		Mottled yellow brown and white.								Weakly lateritised Mullaman Beds
3		Pulverised HW mudstone.		Mottled, mauve purple/white.								Mullaman Beds
4												
5		UNCONFORMITY										21/7/74 12/8/74 Lower Proterozoic 19/8/74 26/8/74
6		Pulverised HW mudstone.		Mauve.								Lower Proterozoic?
7												
8		END OF HOLE 8.3 m Auger refusal.		quartzite outcrops extensively.								
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 83

Date: 21/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary Gar S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm	VS. SF. ST. V. ST. H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly sand.		Pale grey.									Topsoil
		Gravelly sand		Yellow brown.									Subsoil.
1		Pulverised lateritised siltstone (gravelly sand)		Mottled red- brown and yellow brown.									Moderately lateritised. Mullaman Beds.
2		Pulverised mudstone		very pale greenish white.									Mullaman Beds.
3													21/7/74
4		Pulverised mudstone											26/8/74
5													
6													
7													
8		Pulverised mudstone											
9													
10													
11		Pulverised mudstone											
12		END OF HOLE 11.6m Auger refusal.											
13													
14													
15													

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 84

Date: 21/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly fine sand.		Pale - grey								Topsoil
0.5		Gravelly clayey sand.		red-brown								Residual subsoil
1												
1.5		Pulverised lateritised siltstone. (gravelly sand)		Mottled red- brown + white								Moderately lateritised Mullaman Beds.
2												
2.5		Pulverised weakly lateritised Hw mudstone. (clay sand)		Mottled mauve brown and white.								
3												
3.5												
4		Pulverised Hw mudstone.		white.								
4.5												
5												
5.5												
6												
6.5												
7												
7.5												
8												
8.5												
9												
9.5												
10												
10.5												
11												
11.5												
12												
12.5												
13												
13.5												
14		Pulverised Hw mudstone.		Pale yellow brown.								
14.5												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 85

Date: 22/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS SF ST V, STH	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Fine sand.		grey.								Topsoil
		Fine medium sand		Yellow brown.								Residual Subsoil
1												
		Sandy clay		Mottled red- brown and								
2												
		Pulverised weakly lateritised mudstone (sandy clay)		Mottled yellow brown & white.								Weakly lateritised Mullaman Beds
3												
		Pulverised HW mudstone		"								Mullaman Beds
4												
5				"								
6											7/8/74 26/8/74	
7		Pulverised HW gritty + sandy mudstone.		Mauve to pink.								Basal. Mullaman Beds
8												
9												
10		UNCONFORMITY?										
11												
		Pulverised HW mudstone.		Pale yellow -brown								lower Proterozoic?
12												
13												
14		Pulverised HW mudstone		Pale yellow brown								lower Proterozoic?
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 87

Date: 23/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Organic fine sand.										Organic topsoil
0.5		Lateritised gravelly sand.		Dark red-brown								Lateritic gravel.
1		Pulverised, pisolitic lateritised HW hardpan (gravelly sand)		Red brown								Residual subsoil laterite.
1.5		Gravelly clay		Mottled red brown & white								
2		Silty clay.		Pale grey								Mulleman Beds
3		Pulverised HW mudstone.		White.								30/7/74 Mulleman Beds 28/8/74
4												
5												
6												whilst drilling
7		Pulverised HW mudstone		Mottled Yellow brown and white.								Mulleman Beds.
8												
9												
10												
11												
12												
13												
14		Pulverised HW mudstone		Yellow brown								Mulleman Beds
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 88

Date: 23/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm	VS. SF. ST. V. ST. H.	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly fine sand.		Grey									Topsoil
		Gravelly sand.		Bright red brown.									Lateritic gravel.
1													
		Pulverised HW mudstone (stiff clay)		Mottled yellow brown and white.									Mullaman Beds.
2													
3													
4													
5		Pulverised CW mudstone		Bright yellow brown mottled, white									Mullaman Beds.
6													
7		UNCONFORMITY											
8													
9													
10													
11													
12		Pulverised HW Mudstone		Mauve-pink.									lower Proterozoic ?
13													
14													
15													

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 89

Date: 24/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 kg/Sq. cm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		organic silty sand.		Pale grey.								Topsoil.
0.5		silty clay	CL	Pale yellow brown.								Residual subsoil.
1		Gravelly sand (Pulverised lateritised siltstone)		Red brown mottled yellow brown.								Moderately lateritised Mullaman Beds.
2		Pulverised HW mudstone		Pale yellow- brown mottled white.								Mullaman Beds.
3												
4												
5												19/8/74
6												
7												
8												
9												
10		UNCONFORMITY.										
11		Pulverised HW mudstone		Pale buff & mauve purple.								Lower Proterozoic?
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 90

Date: 24/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0.0		Gravelly fine sand.		Pale grey.								
0.1		Gravelly clayey sand		Bright red brown.								
1.0												
1.5		Pulverised lateritised siltstone (gravelly sand)		Red-brown								Moderately lateritised Mullaman Beds
2.0												
2.5												
3.0		Pulverised CW mudstone.		Mottled mauve, purple and white.								Mullaman Beds
3.5												
4.0												
4.5												
5.0												
5.5												
6.0												
6.5												
7.0		Pulverised HW mudstone		Pale yellow brown.								Mullaman whilst drilling.
7.5												
8.0												
9.0												
10.0												
11.0												
11.6		END OF HOLE 11.6 m Auger refusal.										
12.0												
13.0												
14.0												
15.0												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

BUREAU OF MINERAL RESOURCES,
GEOLOGY & GEOPHYSICS

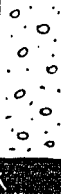
Geological Log of Auger Hole

Project: Darwin East

Hole: 91

Date: 25/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm	VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Fine sand		white.									Alluvial fine Sand.
2		clayey gravelly sand (pulverised lateritised siltstone)		Red brown.									Moderately lateritised. Mullaman Beds. 7/8/74
3		Pulverised and HW mudstone and weakly lateritised. (gravelly clay)		Mauve purple mottled white.									Weakly lateritised Mullaman Beds 26/8/74
4													
5													
6													whilst drilling
7		Pulverised HW mudstone		Mottled yellow brown & white									Mullaman Beds
8													
9													
10													
11		"		"									"
12													
13													
14													
15		"		"									"

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 92

Date: 29/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft 0 1 2 3 4 5 Kg/Sq. cm VS SF ST V ST H	Massive Structure Poreus Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Organic sandy silt. Sandy medium clay		Dark grey Mottled yellow brown & grey.								Topsoil.
2		Clay sand. Pulverised HW mudstone		Pale grey Mottled yellow brown & white								Mullaman Beds
3		Pulverised HW mudstone		Pale grey							7/8/74	
4		Pulverised HW mudstone		Pale grey							19/8/74	Mullaman Beds
5		Pulverised HW mudstone		Pale yellow brown								Mullaman Beds
6		Pulverised HW mudstone		Pale yellow brown								Mullaman Beds
7		Pulverised HW mudstone		Pale yellow brown								Mullaman Beds
8		Pulverised HW mudstone		Pale yellow brown								Mullaman Beds
9		Pulverised HW mudstone		Pale yellow brown								Mullaman Beds
10		Pulverised HW mudstone		Pale yellow brown								Mullaman Beds
11		Pulverised HW mudstone		Pale yellow brown							whilst drilling.	
12		Pulverised HW mudstone		Pale yellow brown								
13		UNCONFORMITY. ?										
14		Pulverised HW mudstone		Pale buff.								
15		Pulverised HW mudstone		Pale buff.								Lower Proterozoic

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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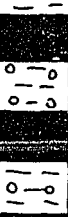
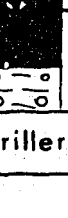
Geological Log of Auger Hole

Project: Darwin East

Hole: 93

Date: 31/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > < PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, SH	Massive Structure Pore Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Fine sand		Pale gray.								Alluvial fine Sand.
2		Gravelly clay sand. (pulverised, lateritised mudstone)		Mottled red brown & white.								Moderately lateritised Mullaman Beds.
3		Pulverised HW mudstone		Mottled mauve brown and white.						8/7/74		Weakly lateritised Mullaman Beds.
4												whilst drilling.
5												
6												
7												
8		Pulverised HW mudstone		Pale greenish white.								Mullaman Beds.
9												
10												
11												
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by:

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 94

Date: 31/7/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast. OM)	Unified symbol	COLOUR Pale or dark Comb col R-B, Y-B	Moisture D.M. > PLW	Relative density (CG) VL, L, MD, D, VD	Boundary Gr S cement	Consistency Ton/Sq. ft 0 1 2 3 4 5 Kg/Sqcm VS SF ST V ST H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Highly organic silt		Black								Topsoil.
1		Silty clay	OH	Mottled red brown and pale grey.								
2		Silty clay		Mottled yellow brown and grey.								
3		Pulverised HW mudstone		Mottled yellow brown and white.								Mullaman Beds
4											▼ 8/8/74	
5		Pulverised HW mudstone		Pale greenish white.							▼ 19/8/74 ▼ 26/8/74	Mullaman Beds
6												
7		UNCONFORMITY. ?										
8												
9												
10												
11		Pulverised HW mudstone		Buff								lower Proterozoic?
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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Geological Log of Auger Hole

Project: Darwin East

Hole: 95

Date: 1/8/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for Cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly sand.		Grey								
1		Lateritised gravelly sand.		Pale yellow brown.								
2		Pulverised, lateritised siltstone (gravelly, silt)		Mottled red brown and white.								Moderately lateritised. Mullaman Beds.
3		Pulverised Hw mudstone. (gravelly sandy clay)		Mottled mauve and white.								Weakly lateritised Mullaman Beds.
4												7/8/74
5												26/8/74
6												
7		Pulverised Hw Mudstone.		Pale greenish white.								Mullaman Beds
8												
9												
10												
11		END OF HOLE 11.5 m Auger Refusal.										
12												
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 96

Date: 1/8/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PLW	Relative density (CG) VL, L, MD, D, VD	Boundary for S cement	Consistency Test/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS SF, ST, V, ST H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly sand.		Pale grey Pale brown.								Topsoil.
1		Pulverised lateritised siltstone (gravelly sand)		Red brown mottled white.								Moderately lateritised Mullaman Beds.
2												
3		Pulverised lateritised mudstone. (gravelly sandy clay)		Mottled yellow brown and white.						8/8/74 26/8/74		Weakly lateritis- ed Mullaman Beds.
4												
5												
6		Pulverised HW mudstone.		White to pale greenish white								Mullaman Beds
7												
8												
9		UNCONFORMITY?										
10												
11		Pulverised HW mudstone.		Buff								Lower Proterozoic?
12												
13												
14												
15		Pulverised HW mudstone.		Pale yellow brown.								Lower Proterozoic?

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

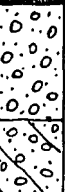
Geological Log of Auger Hole

Project: Darwin East

Hole: 97

Date:

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sqcm VS, SF, ST, V, ST, H	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
1		Gravelly sand. Gravelly sand Gravelly clayey sand		Pale grey Yellow brown Red brown.								Residual subsoil.
2		Pulverised, lateritised siltstone. (gravelly clayey sand)		Mottled yellow brown & white.								Moderately lateritised Mullaman Beds.
3		Pulverised HW mudstone		Mottled brown and white.						8/8/74 26/8/74		Weakly lateritised Mullaman Beds.
4												
5												
6												
7												
8												
9												
10												
11		Pulverised HW mudstone.		Mottled yellow brown and white.								Mullaman Beds
12												
13				Pale grey								Mullaman Beds
14												
15		Pulverised HW mudstone.		Pale yellow brown								Mullaman Beds

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 98

Date: 2/8/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M > PL, W	Relative density (CG) V, L, MD, D, VD	Boundary Gar S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS. SF. ST. V. ST. H.	Massive poreous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0	0-0	Gravelly sand.		Pale grey								Topsoil.
1	0-0	Pulverised lateritised siltstone (gravelly clayey sand)		Orange brown								Moderately lateritised Mullaman Beds
2	0-0											
3	0-0	Pulverised HW mudstone.		Mottled yellow brown and white.								Weakly lateritised Mullaman Beds
4	0-0	Pulverised HW mudstone.		Mottled mauve and white.						8/8/74 26/8/74		Weakly lateritised Mullaman Beds.
5	0-0											
6	0-0											
7	0-0	Pulverised HW mudstone.		Mottled Mauve & white.								Weakly lateritised Mullaman Beds.
8	0-0											
9	0-0											
10	0-0											
11	0-0											
12	0-0											
13	0-0											
14	0-0											
15	0-0	Pulverised HW mudstone.		Pale yellow brown								Weakly lateritised Mullaman Beds.

Drillier: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson

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GEOLOGY & GEOPHYSICS

Geological Log of Auger Hole

Project: Darwin East

Hole: 99

Date: 3/8/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D, M, > PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS, SF, ST, V, ST, H	Massive Structure Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly sand.		Pale grey								Topsoil
1		Gravelly sandy clay		Pale brown.								Residual subsoil.
2												
3		Gravelly sandy clay		Red brown								Moderately lateritised Mullaman Beds.
4												
5											▼ 8/8/74 26/8/74	
6												
7		Pulverised HW mudstone.		Mauve brown								Weakly lateritis- ed Mullaman Beds.
8												
9												
10												
11		Pulverised HW mudstone.		Mottled pale yellow brown and white.								Mullaman Beds
12												
13												
14												
15		Pulverised HW mudstone		Mottled pale yellow brown and white.								Mullaman Beds

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobsen

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Geological Log of Auger Hole

Project: Darwin East

Hole: 100

Date: 3/8/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PLW	Relative density (CG) VL, L, MD, D, VD	Boundary G or S cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 Kg/Sq. cm VS SF ST V. ST H.	Massive Porous Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
		Gravelly Sand		Pale grey								Topsoil.
		Gravelly Sand		Pale yellow brown								Residual subsoil.
1												
2		Pulverised lateritised siltstone. (gravelly clayey sand)		Red brown.								Moderately lateritised Mullaman Beds
3		Pulverised lateritised siltstone		Mottled mauve brown & white								Weakly lateritised Mullaman Beds
4												
5												
6												
7		Pulverised HW mudstone		Mottled yellow brown and white.								Mullaman Beds
8												
9												
10												
11												
12				Mottled yellow brown and white.								Mullaman Beds.
13												
14												
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: C. Jacobson

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GEOLOGY & GEOPHYSICS**

Geological Log of Auger Hole

Project: Darwin East

Hole: 101

Date: 3/8/74

Logged by: PVB

DEPTH (metres)	LOG	ENGINEERING SOILS DESCRIPTION (Text, plast, OM)	Unified symbol	COLOUR Pale or dark Comb. col. R-B, Y-B	Moisture D.M. < PL, W	Relative density (CG) VL, L, MD, D, VD	Boundary for Cement	Consistency Ton/Sq. ft. 0 1 2 3 4 5 kg/Sq. cm VS, SF, ST, V, ST, H.	Massive Poreus Crumb etc.	Sampling method	Casing water	GEOLOGICAL PEDOLOGICAL DESCRIPTION [Eolian Residual Alluvial Colluvial Decomposed rock Horizon A, B, C Buried soil]
0		Gravelly sand.		Grey brown								Topsoil
1		Gravelly clay		Bright red.								Residual subsoil.
2												
3		Pulverised HW siltstone lateritised.		Bright orange and yellow brown mottled white.								Moderately lateritised Mullaman Beds.
4												
5												
6		Pulverised HW mudstone		Mauve white mottled						26/8/74	3/8/74	Weakly lateritised Mullaman Beds.
7												
8												
9												
10												
11												
12												
13												
14		Pulverised HW mudstone		Yellow brown and white mottled, pale greenish white.								Mullaman Beds
15												

Driller: Mines NT

Drill type: Gemco

Not sampled

Checked by: G. Jacobson