NORTHERN TERRITORY GEOLOGICAL SURVEY REPORT G.S. 75/33

DETAILED INVESTIGATION OF PROPOSED RAILWAY BALLAST SITES 2 AND 3

MINING RESERVE NO.369 JAMES RANGES

RODINGA 1:250,000 SHEET AREA SG 53 - 2

NORTHERN TERRITORY

by

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Plate 1 Geological Map of Site 2, with isopach overlay and diagrammatic section.

Plate 2 Geological Map of Site 3, with isopach overlay and diagrammatic section.

1. SUMMARY

Detailed geological mapping and diamond drilling investigations have been completed at Proposed Railway Ballast Sites 2 and 3 in Mining Reserve No. 369, James Range, Northern Territory.

In situ reserves of approximately 38,000 and 300,000 cubic metres of sandstone, probably suitable for railway ballast, have been indicated at sites 2 and 3 respectively, with a further small volume of scree material available at Site 2.

2. INTRODUCTION

Following a brief examination of the proposed Central Australian Standard Gauge Railway route in the Northern Territory, an area in the James Range (designated 'Area 2'), was recommended for investigation for the supply of railway ballast and reserved from the provisions of the Mining Ordinance for this purpose (mining Reserce 344, Fruzzetti, 1971). A larger Mining Reserve (No. 369) was created following investigations by Willis and Lau (1972), in which a single exploratory diamond drill hole was recommended at each of four prospective quarry sites within Area 2. Details of location, access and regional geology were also discussed.

Drilling results were reported by Fruzzetti (1972) and further investigation of the second and third sites drilled (herein referred to as sites 2 and 3 respectively) was requested by the Commonwealth Railway in May 1974.

3. RESULTS OF INVESTIGATIONS AT SITE 2

3.1 Geology

The outcrop consists of a wedge-shaped body of indurated Tertiary sandstone (also known as 'silcrete' or 'grey billy') which overlies Palaeozoic sandstone, siltstone and limestone in angular unconformity.

As illustrated in Plate 1, the Tertiary beds are upto 8 m. thick near the northern outcrop margin, and steadily decrease in thickness to

pinch out completely on the southern side. Although the constituent grains are characteristically sub-to well-rounded, clearly they have been proximally derived from the thoroughly reworked sands of the underlying Palaeozoic rocks, and are poorly sorted with a well developed clay matrix.

The silcrete is thought to have originally been a sedimentologically immature body of argillaceous alluvial sand, which has subsequently been extensively leached and silicified through repeated groundwater movement. Lloyd (1968) has suggested that presilcrete Tertiary sediments south of Alice Springs may be Eocene to Miocene in age, and the silicification may therefore have occured during prolonged periods of weathering during the upper Miocene or Pliocene.

A poorly outcropping, weakly cemented ferruginous conglomerate noted by Morlock in DDH 1 (designated James Range DDH 2 in Fruzzetti 1972) was used to subdivide the Tertiary beds into three units during mapping, but through incomplete core recovery or its local absence, this conglomerate was not unambiguously recognized from any subsequent drill hole.

In a cursory examination, none of the locally underlying Palaeozoic rocks appeared to have any potential for use as railway ballast, and further mapping of their lithological characteristics was not undertaken.

A considerable volume of broken silcrete was observed in the scree slopes, most particularly on the southern side.

3.2 Drilling and Engineering Geology

Seven holes aggregating 71.47 metres were cored by a Mines Branch drilling crew (DDH 1 was completed in 1972, the remainder in August and September of 1974) led by S. Berger operating an EDECO MK VI diamond drill. Difficult drilling conditions were encountered and core recovery was so

poor as not to allow completely reliable assessment of the site's ballast potential.

It was concluded, largely on the basis of outcrop inspection, that with the exception of at least one thin, probably discontinuous, moderately friable conglomeratic interbed, the silcrete is lithologically most probably suitable for ballast. Its considerable mechanical strength appears to be largely the result of silicification of the originally soft white clay matrix into a brittle porcellanite 'matrix-cement'.

Quarry development would be geometrically simple, and apart from its inherent toughness, no major geological impediment to exploitation of the silicified sandstone present at Site 2 would be expected.

Core recovered from the underlying Palaeozoic rocks is mechanically weak and clearly unsuitable for ballast.

3.3 Potential Ballast Reserves

The transparent contoured overlay on Plate 1 illustrates the approximate silcrete thicknesses presently indicated by outcrop observations and drill core measurements; and the product, in appropriate units, of the area within succeeding isopach-surface traces and the average silcrete thickness thereunder, provides a first approximation to the volume of silcrete to be found within those thickness limits.

The volumes of rock available in total, and the extra available for each incremental decrease in the minimum acceptable height of the quarry face, are tabulated below and illustrated graphically in Plate 1.

Minimum face Height (metres)	Increase in available volume (cubic metres)	Total Volume (cubic metres)
7	4030	4030
6	7600	11630
5	6160	17790
4	6840	24630
3	4630	29260
2	3770	33030
1	3380	36410
0	1630	38040

As an order of magnitude estimate only, a further 10,000 cubic metres of mechanically strong rock might be available in the scree slopes.

It is concluded that Site 2 contains no more, and possibly significantly less, than 48,000 cubic metres of rock probably suitable for ballast. All of this material is relatively readily accessible.

4. RESULTS OF INVESTIGATIONS AT SITE 3

4.1 Geology

The flat top of this mesa was silicified and heavily mottled with ferruginous staining by cyclic groundwater movements during the late Tertiary, when it formed part of a locally extensive (now heavily dissected) peneplained landsurface. Lithologically it is composed of fine to very-fine moderately to well sorted subrounded to well-rounded quartz grains, generally clean, but locally with a moderately well developed argillaceous matrix. These characteristics, together with local large scale crossbedding, suggest an aeolian mode of deposition as proposed by Wells et al. (1970) for parts of the Palaeozoic Mereenie Sandstone. The whole outcrop, which dips uniformly and gently to the north, is regarded as belonging to that formation. It may be meaningfully divided (non-stratigraphically) into the indurated sandstone which forms the mesa capping and the underlying and intercalated unaltered friable sandstone.

The limit of cementation surface is highly undulatory, locally with a relatively high gradient, and probably resulted from long term interactions within the now illdefined local upper Miocene to Pliocene hydrological regime.

4.2 Drilling and Engineering Geology

Twenty-five holes aggregating 328.96 metres were cored by the diamond drill used at Site 2. DDH 1 - designated James Range DDH 3 in Fruzzetti, 1972 - was completed in 1972, the remainder in September, October and November of 1974. Core recovery was fair.

Although the capping rock is incompletely silicified, and locally contains numerous small patches of moderately friable sandstone, it is generally mechanically strong and is thought to be probably suitable for ballast.

Wide variations in silicified rock thickness were found, (see Plate 2)and it is possible that further small-wavelength high-amplitude fluctuations may exist, presently uncharted through poor core recovery or insufficiently closely-spaced pattern drilling.

4.3 Potential Ballast Reserves

The volumes of silicified capping indicated by the results of the present drilling programme and calculated as in (3.3), are tabulated below. It should be noted that these figures include significant volumes of moderately friable to friable sandstone, (see appendix II) but not the thick friable intercalation illustrated in Plate 2.

Minimum face height (metres)	Increase in available volume (thousand cubic metres)	Total Volume (thousand cubic metres)
12	2.5	2.5
11	24.15	26.65
10	44.1	70.75
9	38.95	109.7
8	45.9	155.6
7	47.25	202.85
6	30.55	233.4
5	17.6	251.0
4	19.8	270.8
3	10.5	281.3
2	12.0	293.3
1	8.4	301.7

5. CONCLUSIONS [redacted]

In situ reserves of up to 38,000 cubic metres of generally highly silicified sandstone have been indicated at Site 2. For a minimum quarry face height of 3 metres, 29,000 cubic metres would probably be recoverable. Local talus and rubble deposits might conceivably contain a further 10,000 cubic metres of material probably suitable for railway ballast.

Approximately 300,000 cubic metres of sandstone, generally moderately well silicified but with local friable intercalations, have

been indicated at Site 3, although wide variations in thickness could cause the exploitable volume to be considerably smaller.

6. ACKNOWLEDGEMENT

The assistance of D. Barraclough, geologist of the N.T.G.S. Alice Springs office, in the mapping of Site 2 is gratefully acknowledged.

7. REFERENCES

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APPENDIX I

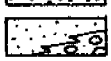
Geological Logs for Diamond Drill Holes 1-7,
Site 2.

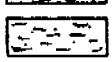
N.B. The log of 'James Range DDH 2' by J.S. Morlock in Fruzzetti 1972, has been converted to metric measurements and included as the log of "James Ranges Railway Ballast, Site 2, DDH 1"

All core lost assumed to come from bottom of lift.

Graphic Log Symbols


Sandstone - moderately well to completely silicified.


Sandstone - moderately to very friable, conglomeratic.


Claystone, silty, sandy.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 2 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 1 CO-ORDINATES R.L. GROUND 100.0 metres
LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0 - 1.83m. Silicified Sandstone: varies to conglomerate within 15cm of lower contact. Rock is highly silicified; very tough. Excellent ballast rock.	0			0 - 1.83m Recovered 1.78 m.
	1			
From 1.83 - 2.44m. Silicified Conglomerate: Made up of rounded pebbles to 2mm diameter cemented by ferruginous silica. Variable strength; rock tends to break around pebbles. Unsuitable as ballast though excellent as a marker bed.	2			1.83-2.44m Recovered .61m
From 2.44 - 4.88m. Silicified Sandstone: As for 0 - 1.83m. From 4.58 - 4.88m, patches of unsilicified sandstone begin to appear but the rock is suitable as ballast to 4.88m.	3			2.44-4.88m Recovered 2.28m.
	4			
From 4.88 - 11.28m. Sandstone: the unsilicified equivalent of the rock from 2.44 - 4.88m. Fine to very-fine-grained. Highly friable. Porous.*	5			4.88-11.28m Recovered 5.49m.
	6			
	7			
	8			
	9			
	10			

REFERENCES

LOGGED BY J.S. Morlock

SHEET 1 OF 3 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 2 REMARKS Arbitrary Topographic Datum
HOLE No DDH 1 CO-ORDINATES R.L. GROUND 100.0 metres
LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
	11			
From 11.28 - 11.73m. Sandstone: As above but somewhat silicified.*				11.28-11.73m Recovered .45m
From 11.73 - 13.72m. Sandstone: As for 4.88 - 11.28m; however becomes increasingly lutaceous with depth.*	12			11.73-13.72m Recovered 1.52m
	13			
From 13.72 - 22.86m. Argillaceous Claystone: Varies to clay by 22.86m.	14			13.72-22.86m Recovered 7.01m.
	15			
	16			
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY J.S. Morlock

SHEET 2 OF 3 DRAWING No

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 2 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 1 CO-ORDINATES R.L. GROUND 100.0 metres
LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	20			
	21			
	22			
*NOTE: Below 4.88m the rock is unsuitable as ballast.	23			Total Depth 22.86m.
	24			
	25			
	26			
	27			
	28			
	29			
	30			

REFERENCES

LOGGED BY J.S. Morlock

SHEET 3 OF 3 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Site 2 REMARKS Arbitrary topographic datum
HOLE N° DDH 2 CO-ORDINATES R.L. GROUND 97.6m
LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0-2.9m, Silcrete, very hard, completely silicified very fine to medium, rarely coarse to granule sized grains, subangular to rounded, poorly sorted, pale brown porcellanite matrix, rare fracture and solution vugs.	0		17	0- .3m Recovered 0.5m
			39	.3-1.00m Recovered .27m
	1		22	1.00-1.5m Recovered .11m
			30	1.5-1.9m Recovered .12m
	2		13	1.9-2.5m Recovered .08m
From 2.9-3.4m, Silcrete chips, white and ferruginously stained yellow and red.			10	2.5-2.9m Recovered .04m
	3		-	2.9-3.4m Recovered cuttings
From 3.4 - 6.6m Silcrete chips, as above, with loose medium to coarse grains with red argillaceous staining.	4			3.4-6.6m Recovered cuttings
	5		-	
	6			Total Depth 6.6 metres
	7			
	8			
	9			
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Site 2 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 3 CO-ORDINATES R.L. GROUND 100.1m

LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0 - 1.0m Fallen surface rubble, silcrete chips.	0		-	0 - 1.0, Recovered cuttings
From 1.0-3.8m. Silcrete-very hard completely silicified very fine to pebble conglomerate, porcellanite matrix, trace red and orange ferruginous silty clay as vug and fracture in fillings. Pebbles and granules sub-angular-subrounded reworked 'silcrete'. Near 3.8m, increasing proportion of very fine to coarse sand, variable amounts of porcellanite matrix.	1 2 3		94 84 80 33 37 43	1.0 - 1.1m Recovered .04m 1.1 - 1.2m " .07m 1.2 - 1.7m " .47m 1.7 - 2.2m " .42m 2.2 - 2.4m " .15m 2.4 - 2.5m " .04m 2.5 - 2.8m " .10m 2.8 - 2.9m " .06m 2.9 - 3.0m " .06m 3.0 - 3.1m " .23m 3.1 - 3.4m " .11m 3.4 - 3.5m " .06m 3.5 - 3.8m " .13m
From 3.8-6.65m, Silcrete-completely silcified, very hard, very fine-medium grained sub-rounded-rounded, poorly sorted minor porcellanite matrix. Common solution lines, probable bedding at 70° to core axis, very rare soft white clay filling vugs and fractures, trace red ferruginous staining along fractures, moderately friable and ferruginously stained 4.51 - 4.6m, 6.45 - 6.5m. Rare reworked pebbles near 3.8m.	4 5 6		30 60 84 66	3.8 - 4.0m " .06m 4.0 - 4.3m " .18m 4.3 - 4.8m " .42m 4.8 - 6.4m " 1.05m
From 6.65-8.2m, Sandstone, moderately friable, unsilicified fine to medium subrounded-rounded grains, abundant white clay matrix, very common red ferruginous staining along fractures and bedding planes throughout, more argillaceous near 8.2m	7 8		50 100	6.4 - 7.5m " .55m Broken core 7.5 - 8.0m " .50 Broken core
From 8.2 - 10.0m. Shale, soft, white pale green, rare red ferruginous laminae, with common red ferriginous staining, sand and silt near 8.2m	9 10		50 22	8.0 - 9.1m " .55m Broken core 9.1 - 10.0m " .20m Broken core Total depth: 10.0 metres

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Site 2 REMARKS Arbitrary Topographic Datum
HOLE No DH 4 CO-ORDINATES R.L. GROUND 96.8m
LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0 - 1.0m. Surface rubble, silcrete chips, red silty, ferruginous clay.	0		-	0 -1.0m Recovered Cuttings
From 1.0-4.4m, Silcrete, very hard completely silicified very fine-coarse subrounded-rounded sandstone, with abundant white porcellanite matrix, generally trace of red ferruginous clay along fractures, highly ferruginous along fractures 4.20 - 4.30.	1		55	1.0-1.2m Recovered .11m
			55	1.2-1.4m Recovered .11m
			80	1.4-1.6m Recovered .16m
			87	1.6-1.9m Recovered .26m
	2		70	1.9-2.3m Recovered .28m
			75	2.3-2.5m Recovered .15m
			100	2.5-2.7m Recovered .20m
				2.7-2.8m Recovered .04m
	3		60	2.8-3.0m Recovered .12m
			60	3.0-3.2m Recovered .12m
			100	3.2-3.8m Recovered .60m
	4		100	3.8-4.1m Recovered .30m
From 4.40-7.75m, Claystone, soft-moderately soft, white, pale green, commonly silty, sandy, and with common red staining 4.40-7.5, highly weathered.			39	4.1-5.0m Recovered .35m
	5			
			-	5.0-6.0m Recovered .07m
	6			
			3	6.0-7.5m Recovered .05m
	7			
	8		3	7.5-9.0m Recovered .05m
	9			Total Depth 9.0m.
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Site 2 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 5 CO-ORDINATES R.L. GROUND 96.1m
LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0-2.7m, Surface rubble, red ferruginous silty clay, heavily indurated silcrete chips	0			0-2.7m Recovered cuttings
	1		-	
	2			
From 2.7 - 4.2m, Fallen(?) Silcrete rubble - very hard, completely silicified, light brown, very fine-pebble grain size, common porcellanite matrix, with red ferruginous silt and clay.	3		12	2.7-3.3m Recovered .07m
			-	3.3-3.6m Recovered cuttings
	4		-	3.6-4.2m Recovered Broken core
From 4.2 - 6.4m, As above, with broken fragments of white, yellow and red laminated silty sandy claystone.				4.2-6.4m Recovered Broken core
	5		-	
	6			
From 6.4-7.5m, Fallen silcrete chips, red ferruginous silt and clay				6.4-7.5m Recovered cuttings
	7		-	
From 7.5-9.0m, Fallen silcrete rubble, with fragments of white-orange fine -medium grained argillaceous sandstone.	8			7.5-9.0m Recovered Broken core
	9			Total Depth 9.0 metres
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 2 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 6 CO-ORDINATES R.L. GROUND 95.8m
LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0 - 3.3m. Silcrete-tough, completely silicified very fine to coarse (rare granules) subrounded-rounded poorly sorted sandstone, with abundant white-cream porcellanite (hard siliceous clay) matrix, with very rare friable pebble sized fragments of argillaceous siltstone, and red ferruginous silt and clay in fractures, abundant 3.10-3.30m	0			0-1.2m Recovered cuttings
	1		13	1.2-1.5m Recovered .04m 1.5-1.6m Recovered .07m 1.6-1.7m Recovered .10m
	2		57	1.7-2.4m Recovered .40m
			57	2.4-3.1m Recovered .40m
	3			
From 3.3-9.9m. Claystone - moderately soft, pale yellow, grey orange, commonly silty, locally very sandy, from 9.70m becoming pale green, pure and finely micaceous, core broken throughout.			67	3.1-3.7m Recovered .40m
	4		54	3.7-5.0m Recovered .70m
	5		38	5.0-5.8m Recovered .30m
	6		29	5.8-6.5m Recovered .20m
				6.5-8.5m Recovered .40m
	7		20	
	8			
			.	8.5-9.5m Recovered .40m
	9		40	
			27	9.5-11.0m Recovered .40m Total Depth - not illustraced - 11.00 metres
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 2 REMARKS Arbitrary Topographic Datum

HOLE No. DDH 7 CO-ORDINATES R.L. GROUND 93.0m

LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0 - 1.2m. Silcrete chips, covered in red argillaceous silt.	0		-	0 - 1.2m Recovered cuttings.
	1			1.2 - 2.4m Recovered Rubble.
	2		-	2.4 - 3.2m Recovered Rubble.
From 1.2 - 5.0m. Silcrete rubble, covered in red and white argillaceous silt.	3		-	3.2 - 5.0m Recovered Rubble.
	4		-	
	5			Total Depth 5.0m.
	6			
	7			
	8			
	9			
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1

DRAWING No

APPENDIX II

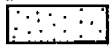
Geological Logs for Diamond Drill Holes 1-24,
Site 3.

N.B. The log of 'James Range DDH 3' by J.S. Morlock in Fruzzetti 1972, has been converted to metric measurements and included as the log of "James Ranges Railway Ballast, Site 3, DDH 1".

All core lost assumed to come from bottom of lift.

Graphic Log Symbols.

Sandstone - moderately well to completely silicified.



Sandstone - moderately to very friable.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 1 CO-ORDINATES R.L. GROUND 100.1 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0 - 11.58m. Silicified Sandstone: Bedding angle approximately 70° to core axis. From 0 - 7.92m colour varies to dark red; rest of the rock is tan coloured. The rock is highly silicified and is excellent ballast material.	0 1 2 3 4 5 6 7 8 9 10		95	0-11.58. Recovered 10.97m.

REFERENCES

LOGGED BY J.S. Norlock

SHEET 1 OF 3 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 1 CO-ORDINATES R.L. GROUND 101.1 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
	11			
From 11-58 - 22.86m. Sandstone: The unsilicified equivalent of the rock from 0 - 11.58m. Colour varies from tan to almost pure white at 22.86m. Silicification ends abruptly at upper contact at approximately 90° to core axis. Rock is highly porous and friable and is unsuitable as ballast.	12			11.58-22.86m Recovered 9.75m.
	13			
	14			
	15		87	
	16			
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY J.S. Morlock

SHEET 2 OF 3 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 1 CO-ORDINATES R.L. GROUND 421.1 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	20			
	21			
	22			
				Total Depth 22.86 m.
	23			
	24			
	25			
	26			
	27			
	28			
	29			
	30			

REFERENCES

LOGGED BY J.S. Morlock

SHEET 3 OF 3 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 2 CO-ORDINATES R.L. GROUND 104.1m

LOCATION See Plate ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0 - 1.5m Recovered .49m.
From 0 - 3.69m. Sandstone, dark brown, ferruginous mottled irregularly white and yellow, fine grained very well sorted sub-rounded-rounded, rare trace ferruginous clay matrix, scattered richly ferruginous solution vugs, probable bedding 90° to core axis well developed porosity (and probably permeability) mechanically moderately strong, with local rare solution mottles of highly silicified hard sandstone.	1		33	
	2		63	1.5 - 3.1m Recovered 1.0m.
	3			3.1 - 5.0m Recovered .59m
	4		31	
From 3.69 - 9.88m. Sandstone, white-pale brown very fine-fine grained subrounded-rounded moderately sorted, locally with well developed white argillaceous matrix, probable bedding varying from (predominantly) 90° to up to 60° to core axis, friable, mechanically weak.	5			5.0 - 8.2m Recovered 2.67m
	6		83	
	7			
	8			8.2 -10.9m Recovered 2.30m.
	9		85	
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 2 CO-ORDINATES R.L. GROUND 104.7m

LOCATION See Plate ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 9.88 - 11.62m. Sandstone, orange-brown to white, very fine to rarely medium grained, subrounded, moderately to poorly sorted, clean, regular bedding marked by more ferruginous (orange coloured) laminae at 20° to core axis, highly silicified, mechanically very strong.	10			10.9 - 14.3m Recovered 3.16m.
	11			
From 11.62 - 15.88m. Sandstone-fawn brown, fine grained subrounded-rounded, well sorted, very porous, rare trace argillaceous matrix, bedding as above, moderately friable, mechanically moderately weak.	12		93	
	13			
	14			14.3 - 16.0m Recovered 1.55m.
	15		91	
	16			Total Depth 16m.
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 3 CO-ORDINATES R.L. GROUND 102.2 metres

LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres.
From 0 - 7.82m. Sandstone, white-light brown, very fine-fine grained subrounded well sorted clean, with yellow-orange-rare dark brown ferruginous solution stains, rare vugs, locally well defined bedding 90° to core axis, with from 1.5 - 2.2m patchy Moderately friable dark brown ferruginous sandstone mottling, from 6.4 - 6.55m some porosity, in moderately well indurated sandstone, overall highly silicified, mechanically very strong.	0		77	0-.3m Recovered .23m.
			92	.3-.8m Recovered .46m.
	1		94	.8-1.5m Recovered .66m.
			40	1.5-1.6m Recovered .09m.
				1.6-2.4m Recovered .07m.
	2		72	
			80	2.4-3.0m Recovered .48m.
	3			3.0-6.0m Recovered 2.86m.
	4		95	
	5			
	6		92	6.0-6.6m Recovered .55m.
				6.6-10.0m Recovered 2.78m.
From 7.82 - 11.41m. Sandstone, fine grained well sorted subrounded, locally withmoderately well developed argillaceous matrix, otherwise porous bedding laminae locally marked by ferruginous. Staining, at 90° - 70° to core axis, rare, small vugs, red-orange from 7.82 - 8.62m, thereafter white-pale brown with minor ferruginous staining.	7			
	8		82	
	9			
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 1 CO-ORDINATES R.L. GROUND 100.3 metres

LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres.
	10			10.00-13.6m Recovered 1.41m.
			39	
	11			
	12			
	13			
				Total Depth 13.6m.
	14			
	15			
	16			
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 4 CO-ORDINATES R.L. GROUND 99.8 metres

LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0 - 7.5m. Sandstone, very fine-fine grained, subrounded, well sorted, local good trace white argillaceous matrix otherwise clean, illdefined bedding 90° to core axis, rare vugs, common resolution mottling, generally white-fawn in colour, locally purple-dark brown and moderately friable in highly ferruginous scattered blebs and patches; in general highly silicified and mechanically strong.	0		93	0-.6m Recovered .5m.
				.6-1.8m Recovered 1.0m.
	1		83	
				1.8-3.1m Recovered 1.30m.
	2		100	
	3		100	3.1-3.3m Recovered .20m.
				3.3-4.8m Recovered 1.50m.
	4		100	
	5			4.8-7.8m Recovered 2.70m.
	6		90	
From 7.5 - 11.85m. Sandstone, fine-medium grained well sorted, subrounded-rounded, locally well developed white argillaceous matrix otherwise clean, white to orange in colour, bedding marked by rare ferruginous laminae at 20° to core axis, moderately to very friable and mechanically weak throughout.	7			
	8			7.8-11.4m Recovered .45m
	9		13	
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 4 CO-ORDINATES R.L. GROUND 99.8 metres

LOCATION See Plate 1 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
	11			
				11.4-15.0m Recovered .45m.
	12			
	13		13	
	14			
	15			Total Depth 15m.
	16			
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE No DDH 5 CO-ORDINATES R.L. GROUND 105.4 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-.5m Recovered .24m.
			48	
				.5-.6m Recovered .18m.
			180	
				.6-1.0m Recovered .27m.
			68	
	1			1.0-3.7m Recovered 2.50m.
From 0 - 12.46m. Sandstone, very fine to fine grained subrounded, well sorted, throughout, orange to brown resolution ferruginous mottling common, probable bedding laminae at 90° to core axis, rare small solution cracks and vugs, generally with a trace of argillaceous matrix and pale brown in colour, some porosity, moderately silicified and hard ; scattered patches particularly well silicified and hard, with more common scattered mottles and blebs up to 5% of section with well developed orange to dark brown argillaceous matrix and moderately friable particularly at 7.6 - 8.06m and 9.2 - 9.5m, and very thin argillaceous laminae occur sparsely scattered throughout the section.	2		93	
	3			3.7-4.9m Recovered 1.27m
	4		106	
	5			4.9-5.0m Recovered .23m
				5.0-6.4m Recovered 1.36m
	6		97	
				6.4-7.5 Recovered 1.09m
	7		99	
			192	.5-7.6 Recovered .10m
				7.6-8.2 Recovered .46m
	8		77	
				8.2-9.2 Recovered .88m
	9		88	
				9.2-10.7 Recovered 1.40m
	10		93	

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 5 CO-ORDINATES R.L. GROUND 105.4 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
				10.7-13.8m Recovered 3.05m
	11			
From 12.46-15.34m. Sandstone very fine-fine grained subrounded well sorted, white to yellow orange, moderately to very porous, weakly silicified, (friable) with bedding marked by more ferruginous laminae at 70° - 90° to core axis, mechanically weak.	12		98	
	13			
				13.8-16.0m Recovered 1.54m
	14			
	15		70	
	16			Total Depth 16.0m.
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 6 CO-ORDINATES R.L. GROUND 102.8 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0		53	0-.7m Recovered .37m.
				.7-1.4m Recovered .40m.
	1		57	
From 0 - 6.45m. Sandstone, fine-very fine grained well sorted, subrounded, generally clear, white-pale yellow-purplish in colour with minor ferruginous clay staining grains, probable bedding 90° to core axis, common resolution ferruginous mottling-dark brown-yellow-purple, rare solution cracks and vugs, very low porosity, generally moderately well silicified and mechanically strong, but with 5-10% moderately friable sandstone with well developed yellow-dark brown ferruginous matrix as irregular mottling and thin bands.			60	1.4-1.5m Recovered .06m.
				1.5-2.8m Recovered 1.08m.
	2		83	
				2.8-3.4m Recovered .54m.
	3		90	
				3.4 - 4.3m Recovered .84m.
	4		93	
			90	4.3-4.8m Recovered .45m.
				4.8-7.1m Recovered 2.18m.
	5			
			95	
	6			
From 6.45 - 15.55m. Sandstone, as above, with 30% moderately friable intercalated ferruginous dark brown sandstone from 6.45 - 9.80m, with friable fine-very fine grained well sorted, porous orange sandstone with good trace ferruginous argillaceous matrix at 8.04 - 9.80m, 11.20 - 11.80m, 14.40 - 14.50m and 14.88 - 15.20m.				
	7			7.1-9.7m Recovered 1.19m.
	8			
			46	
	9			
				9.7-13.3m Recovered 2.45m.
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 1 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 6 CO-ORDINATES R.L. GROUND

LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
	11		68	
	12			
	13			
				13.3-16.0m Recovered 2.25m.
	14		93	
	15			
	16			Total Depth 16.0m.
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2

DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 7 CO-ORDINATES R.L. GROUND 103.5 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-1.3m Recovered .26m.
			20	
	1			1.3-2.0m Recovered .35m.
From 0 - 4.6m. Sandstone, fine grained subrounded well sorted, generally clean, white, with scattered irregular blebs and intercalations of resolution mottled dark brown-purple sandstone with good trace ferruginous clay staining on grains, highly silicified and mechanically strong.			50	
	2			2.0-3.0m Recovered .20m.
			20	
	3			3.0-3.3m Recovered .12m.
				3.3-4.2m Recovered .12m.
			40	
	4			4.2-6.7m Recovered 1.65m.
From 4.6 - 5.05m. Sandstone as above, 50/50 white highly silicified, dark brown moderately well silicified sandstone, intercalated.	5		66	
From 5.05 - 7.88m. Sandstone, fine grained as above, orange with good trace ferruginous clay matrix, porous, trace of bedding 70°-90° to core axis, minor intercalated white highly silicified sandstone, moderately friable to friable.	6			6.7-9.7m Recovered 1.34m.
	7			
	8		46	
	9			
				9.7-12.0m Recovered 1.64m.
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 7 CO-ORDINATES R.L. GROUND 104.4 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 7.88 - 14.38m.. Sandstone, fine grained generally with good trace white argillaceous matrix, well sorted as above, moderate to very high porosity, pale brown becoming white by 12.0m., friable to very friable.	10			
	11		71	
	12			12.0-16.0m Recovered 2.38m.
	13			
	14		60	
	15			
	16			Total Depth 16.0m.
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 8 CO-ORDINATES R.L. GROUND

LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-1.3m Recovered .30m
From 0 - .30m. Sandstone fine grained dark brown ferruginous moderately well silicified, mechanically strong.	1		25	
				1.3-3.1m Recovered Rubble
From .30 - 9.1m. Surface and fallen rubble of moderately well silicified sandstone as above.	2		-	
	3			3.1-6.4m Recovered Rubble
	4		-	
	5			
	6			6.4-9.1m Recovered Rubble
	7		-	
	8			
	9			9.1-12.9m Recovered .40m
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DH 3 CO-ORDINATES R.L. GROUND Metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 9.1 - 15.50m. Sandstone white-pale yellow, very fine-fine, rarely medium grained, subrounded-rounded, generally clean locally with moderately well developed white argillaceous matrix, porous-very porous, common small vugs, locally with dark brown ferruginous staining, traces of bedding 70° - 90° to core axis marked by more ferruginous-brown-laminae, friable to very friable.	10 11 12 13 14 15 16 17 18 19 20		11 84	12.9-16.0m Recovered 2.60m. Total Depth 16.0m.

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 9 CO-ORDINATES R.L. GROUND 1021.9 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0		85	0-.2m Recovered .17m .2-1.3m Recovered 1.10m
	1		100	
From 0 - 5.06m. Sandstone, very fine to fine grained moderately sorted subrounded, white to dark brown with common ferruginous mottling weak trace bedding 90° to core axis, generally clean, locally good trace argillaceous matrix, rare small solution vugs, moderately well indurated and mechanically strong throughout.				1.3-2.1m Recovered .80m
	2		100	
				2.1-3.2m Recovered .85m
	3		77	
				3.2-6.3m Recovered 2.87m
	4			
	5		93	
From 5.06 - 7.97m. Sandstone as above, more common orange-dark brown ferruginous, clay staining grains, less well silicified ; with 30% intercalated moderately friable sandstone.	6			
				6.3-9.5m Recovered 2.73m
	7			
From 7.97 - 9.03m. Sandstone as above, dark brown and orange, highly ferruginous, locally very well developed clay matrix generally friable to moderately friable with moderately well silicified interclations.	8		85	
	9			
				Total Depth 9.5m.
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 10 CO-ORDINATES R.L. GROUND 99.1 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-1.5m Recovered 1.49m.
			99	
	1			
From 0 - 3.02m. Sandstone, purplish fawn, very fine to fine grained, locally silt, medium sized grains, moderately sorted, subrounded to rounded, common resolution ferruginous mottling on minor clay matrix, locally to dark brown and moderately friable - 10% of section - in general moderately well silicified, with poor porosity, mechanically strong.				1.5-3.3m Recovered 1.52m.
	2		84	
	3			
				3.3-6.5m Recovered 1.25m.
From 3.3 - 3.90m. Sandstone, as above, orange brown with ferruginous staining, moderately well silicified, mechanically strong.	4			
			39	
From 3.90 - 7.45m. Sandstone fine grained as above, locally with well developed white and ferruginous stained argillaceous matrix, pale brown, orange to red with ferruginous staining, porous, friable.	5			
	6			
				6.5-9.7m Recovered .95m.
	7			
	8		30	
	9			
				9.7-12.9m Recovered .15m.
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 10 CO-ORDINATES R.L. GROUND 392.9 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL Vertical DIRECTION

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
From 9.7 - 14.65m. Sandstone, as above, clean to good trace white argillaceous matrix, common small vugs, some with white clay infilling, bedding trace 70°-90° to core axis, good trace orange ferruginous staining 14.55 - 14.65m, highly porous, friable.	11		5	
	12			
	13			12.9-16.0m Recovered 1.75m.
	14		56	
	15			
	16			Total Depth 16.0m.
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 11 CO-ORDINATES R.L. GROUND 92.5 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
0-.3m. Sandstone, purple-dark brown with ferruginous staining, fine-medium, subround-rounded, moderately to well sorted, moderately well deveoped red-dark brown argillaceous matrix, siliceous cement, moderately to well indurated.	0			0-1.5m Recovered .30m.
	1		20	
				1.5-5.1m Recovered .08m.
1.5-1.58m. Sandstone, as above, yellow orange stained, moderately friable-moderately well indurated.	2			
	3		2	
	4			
	5			5.1-9.0m. Recovered .47m.
5.1-15m. Sandstone, as above, generally with moderately well developed white argillaceous matrix, locally clean, friable-very friable, bedding approximately 60° to core axis.	6			
	7		12	
	8			
	9			9.0-12.0m. Recovered 2.80m
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 11 CO-ORDINATES R.L. GROUND 98.5 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled – metres
	10			
			93	
	11			
	12			12.0–15.0m. Recovered 2.15m.
	13		72	
	14			
	15			Total Depth 15.0 metres.
	16			
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Pit 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH12 CO-ORDINATES R.L. GROUND 1019 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0-.1m. Surface rubble of red-brown moderately well silicified sandstone, core of Sandstone, yellow-rarely red, fine-rarely medium subrounded-rounded moderately well sorted grains, minor to moderately well developed argillaceous matrix, ferruginous staining, moderately friable to friable.	0			0-6.0m Recovered .10m.
	1			
	2			
	3		2	
	4			
From 6-15m. Sandstone, as above, white, rare subperpendicular bedding marked by dark brown ferruginous bands, locally matrix absent, generally friable, but with from 12.30-12.44m brown-purple, moderately friable with ferruginous staining and cementation.	5			
	6			6.0-9.0m. Recovered .63m.
	7		21	
	8			
	9			9.0-12.0m. Recovered .50m
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Site 3 REMARKS Arbitrary Topographic Datum

HOLE No DDH 12 CO-ORDINATES R.L. GROUND 101.9 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled — metres
	10			
			17	
	11			
	12			12.0–15.0m. Recovered .55m.
	13		18	
	14			
	15			Total Depth 15.0 metres.
	16			
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 13A CO-ORDINATES R.L. GROUND 102.6 metres

LOCATION Adjacent to DDH 13 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0–4.9m. Sandstone, very fine–fine, rarely medium, subrounded, well sorted, orange–brown to purple with ferruginous clay staining to 2.23m, white and clean to 4.7m then brown as above, minor ferruginous solution mottling, moderately to well silicified throughout, with rare very thin moderately friable intercalations.	0		-	0–1.0m. Recovered Rubble
	1		-	1.0–1.3m. Recovered Surface rubble.
			177	1.3–1.6m. Recovered .53m.
				1.6–3.0m. Recovered .63m.
	2		45	
	3		22	3.0–4.0m. Recovered .22m.
	4		117	4.0–4.7m. Recovered .82m.
	5		15	4.7–6.0m. Recovered .20m.
	6			Abandoned Total depth 6.0m.
	7			
	8			
	9			
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 13 CO-ORDINATES R.L. GROUND 100.6 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0–3.84m. Sandstone, very fine–fine grained, orange brown–purple solution mottled, moderately well–well silicified, ferruginous clay staining grains, rare thin moderately friable intercalated sandstone, from 3.1m white–light brown, less ferruginous.	0 1 2 3		46	0–3.1m. Recovered 1.42m.
	4		49	3.1–4.6m. Recovered .74m.
From 4.6–6.53m. Sandstone, orange, as above, with rare dark brown moderately friable solution mottles, yellow friable from 5.12–5.15m, 5.40–5.43m, rare solution vugs.	5 6		80	4.6–7.0m. Recovered 1.93m.
From 7.0–10.82m. Sandstone, pale brown, moderately well silicified, bedding traces at 65° to core axis, dark brown ferruginous and moderately friable 7.08–7.28m, yellow, moderately friable–friable 7.99–8.27m, elsewhere rare moderately friable solution mottles.	7 8 9 10		54	7.0–10.0m. Recovered 1.63m.

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Site 3 REMARKS Arbitrary Topographic Datum
HOLE No DDH 13 CO-ORDINATES R.L. GROUND 109.6 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			10-13.0m. Recovered .82m.
	11		27	
	12			
	13			Total Depth 13.0 metres
	14			
	15			
	16			
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING No

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Site 3 REMARKS Arbitrary Topographic Datum
HOLE No DDH 14 CO-ORDINATES R.L. GROUND 102.3 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-1.2m. Recovered .80m.
			67	
	1			
From 0-4.77m. Sandstone, purple-brown-white with ferruginous solution mottling, very rare vugs and moderately friable intercalations, very fine to fine, rarely medium grained, moderately well to well silicified.			90	1.2-1.5m. Recovered .27m.
			105	1.5-1.9m. Recovered .42m.
	2		108	1.9-2.4m. Recovered .54m.
				2.4-3.2m. Recovered .73m.
			91	
	3			3.2-3.7m. Recovered .51m.
			102	
	4			3.7-6.6m. Recovered 1.07m.
	5		37	
	6			
From 6.6-7.86m. Sandstone, white-light brown as above, 60/40 intercalated with friable-moderately friable yellow-orange fine grained sandstone.				6.6-7.7m. Recovered .65m.
	7		59	
				7.7-7.9m. Recovered .16m.
			80	7.9-11.0m. Recovered .38m.
	8			
From 7.9-8.28m. Sandstone, moderately well indurated as at 0-4.77m, but probably with unrecovered friable intercalations as above.				
	9		12	
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING No

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Sec 3 REMARKS Arbitrary Topographic Datum
HOLE No DDH 14 CO-ORDINATES R.L. GROUND 102.3 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
	11			Total depth 11.0 metres.
	12			
	13			
	14			
	15			
	16			
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING No

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 15 CO-ORDINATES R.L. GROUND 103.2 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-1.5m. Recovered Rubble
From 0-1.9m. Surface rubble of purple silicified sandstone.	1		-	
				1.5-1.9m. Recovered Rubble
	2		-	1.9-5.5m. Recovered .30m.
From 1.9-2.05m. Sandstone, purple, fine grained, minor solution mottling, well silicified.	3		8	
	4			
From 2.05-15.2m. Sandstone, white, fine, sub-rounded, well sorted grains, generally clean, locally with moderately well developed white argillaceous matrix, orange with ferruginous staining 5.80-6.00 m, possible bioturbation or slumping structures 9.24-9.94m, friable-moderately friable throughout.	5			
	6			5.5-8.8m. Recovered .90m.
	7		27	
	8			
	9			8.8-12.1m. Recovered 2.89m
	10			

REFERENCES

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SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast Site 3 REMARKS Arbitrary Topographic Datum
HOLE No DDH 15 CO-ORDINATES R.L. GROUND 103.2 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
			88	
	11			
	12			12.1–16.0m. Recovered 2.92m
	13			
			75	
	14			
	15			
	16			Total Depth 16.0 metres.
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE No. DDH 16 CO-ORDINATES R.L. GROUND 104.4 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres.
	0			0-1.9m. Recovered .50m.
From 0-.50. Sandstone, purple-brown, fine grained well sorted, moderately well silicified, hard.	1		27	
	2			1.9-5.4m. Recovered Rubble
From 1.9-5.4m. Sandstone rubble, ferruginous, brown-purple, moderately friable to moderately well silicified.	3		-	
	4			
	5			
				Total Depth 5.4 metres.
	6			
	7			
	8			
	9			
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING No

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 17 CO-ORDINATES R.L. GROUND 102.3 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-3.0m. Recovered Rubble
From 0-3.0m. Fragments, rubble of moderately well silicified and highly silicified dark brown and yellow ferruginous sandstone.	1			
	2			
From 3.0-6.0m. Sandstone, white-light brown, fine, subrounded well sorted grains, generally clean, bedding laminae at 60°-90° to core axis marked by ferruginous staining, solution vugs, moderately friable.	3			3.0-4.5m. Recovered 1.15m.
	4		78	
	5		113	4.5-6.0m. Recovered 1.70m.
	6			Total Depth 6.0 metres.
	7			
	8			
	9			
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast – Site 3 REMARKS Arbitrary Topographic Datum
HOLE No DDH 18 CO-ORDINATES R.L. GROUND 109.9 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled – metres
	0			
			39	0–.7m. Recovered .27m.
From 0–1.35m. Sandstone, purple–white, orange with ferruginous solution mottling, fine, sub-rounded well sorted, moderately well to well silicified.	1			.7–2.2m. Recovered .94m.
			63	
	2			
From 1.35–3.84m. Sandstone as above, brown-purple, and orange with ferruginous staining, irregularly interbedded 50/50 moderately friable and moderately well indurated, minor solution cavities, locally well developed ferruginous argillaceous matrix.				2.2–3.4m. Recovered .22m.
			18	
	3			
				3.4–4.5m. Recovered .80m.
	4		73	
From 3.84–5.45m. Sandstone, fine, subrounded, well sorted, white–orange moderately well developed argillaceous matrix, locally clean, bedding laminae 75–90° to core axis, friable to moderately friable.				4.5–6.6m. Recovered .95m.
	5			
			45	
	6			Total Depth 6.6 metres.
	7			
	8			
	9			
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING No

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 39 CO-ORDINATES R.L. GROUND 102.3 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL ——— DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0-.08m. Sandstone, purple, fine grained moderately well silicified.	0		9	0-.9m. Recovered .08m.
	1		-	.9-1.6m. Recovered rubble.
From 1.6-5.4m. Sandstone, white to yellow orange, fine, to very fine, subrounded, well sorted, well developed white and ferruginously stained argillaceous matrix, generally friable, with thin moderately well silicified resolution intercalations from 1.6-1.90m.	2		56	1.6-3.4m. Recovered 1.0m.
	3			3.4-6.7m. Recovered 2.0m.
	4		61	
	5			
	6			Total Depth 6.7 metres.
	7			
	8			
	9			
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE No DDH 20 CO-ORDINATES R.L. GROUND 1055 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL — DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-1.5m. Recovered rubble.
	1		-	
From 0-2.9m. Rubble of moderately well silicified and white friable sandstone.				1.5-2.9m. Recovered rubble.
	2		-	
From 2.9-6.9m. Sandstone, white-orange brown with ferruginous staing (3.0-4.6m) fine-very fine, subrounded, moderately well sorted, unsilicified friable, trace bedding 80°-90°.	3		53	2.9-4.4m. Recovered .80m.
	4			4.4-7.3m. Recovered 2.50m.
	5			
	6		86	
	7			Total Depth 7.3 metres.
	8			
	9			
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 1 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE No DDH 21 CO-ORDINATES R.L. GROUND 495.1 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL = DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0		60	0-.5m. Recovered .30m.
				.5-.8m. Recovered .25m.
			83	.8-1.6m. Recovered .72m.
	1		90	
				1.6-3.0m. Recovered .37m.
	2		26	
	3			3.0-3.4m. Recovered .22m.
From 0-10.14m. Sandstone, light brown, with purple and dark brown ferruginous mottling and staining, generally fine grained sub-rounded, moderately well sorted, local good trace argillaceous matrix, generally ferruginous, rare small solution vugs, trace bedding laminations 70°-90° to core axis, generally moderately well indurated, but with several thin intercalations of ferruginous (marginally) moderately friable sandstone, in particular 3.75-3.85m, 6.3-6.45m, 7.60-7.68m.			55	
				3.4-3.9m. Recovered .45m.
			90	
	4			3.9-4.8m. Recovered .82m.
			91	
				4.8-6.0m. Recovered 1.22m.
	5			
			102	
	6			6.0-6.7m. Recovered .70m.
			100	
				6.7-9.7m. Recovered 2.97m.
	7			
	8		99	
	9			
				9.7-9.9m. Recovered .20m.
	10		100	9.9-13.0m. Recovered 1.67m

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING No

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE No. DH 21 CO-ORDINATES R.L. GROUND 125.1 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL — DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 10.14-10.66m. Sandstone, as above, orange brown, finegrained unsilicified, friable.	10			
From 10.66-11.23m. Sandstone, as above, white, fine grained, moderately well to well silicified.	11		54	
From 11.23-13.88m. Sandstone, as above, white to orange brown, fine grained, friable, with common small solution vugs.	12			
	13			13.0-16.0m. Recovered .88m
	14			
	15		29	
	16			Total Depth 16.0 metres.
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 22 CO-ORDINATES R.L. GROUND 104.1 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
From 0-11.24m. Sandstone, fine, subrounded moderately well sorted, minor very fine, siltised grains, white but heavily ferruginously solution mottled orange, brown purple to 2.5m, 2.5-11.24m white-lightbrown, from 7.5-11.24m with this interbeds with abundant white-cream argillaceous matrix, small solution vugs scattered throughout, with bedding traces 75°-90° to core axis, generally moderately well silicified, locally with thin dark brown ferruginous moderately friable scattered intercalations, particularly at 1.5-2.3m.	0			0-1.5m. Recovered 1.07m.
	1		71	
				1.5-2.7m. Recovered 1.08m.
	2		90	
				2.7-3.6m. Recovered .86m.
	3		96	
				3.6-5.8m. Recovered 2.0m.
	4		91	
	5			
				5.8-6.5m. Recovered .68m.
	6		97	
				6.5-9.6m. Recovered 2.60m.
	7		84	
	8			
	9			
				9.6-12.6m. Recovered 1.90m
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 22 CO-ORDINATES R.L. GROUND 104.4 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
	11		63	
From 11.24-14.40m. Sandstone, as above, orange brown, white from 11.40m, fine grained unsilicified, friable.	12			12.6-16.0m. Recovered 1.8m
	13			
	14		53	
	15			
	16			Total Depth 16.0 metres.
	17			
	18			
	19			
	20			

REFERENCES

LOGGED BY David Clarke

SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 23 CO-ORDINATES R.L. GROUND 103.4 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-1.2m.Recovered .20m.
			17	
	1			1.2-1.5m.Recovered .10m.
			33	
				1.5-3.0m.Recovered .98m.
	2		65	
	3			3.0-3.5m.Recovered .27m.
			54	
				3.5-4.5m.Recovered 1.03m.
From 0-10.38m. Sandstone, predominantly fine, with very fine and silt sized interstitial quartz grains, subrounded, moderately well sorted, with matrix local white and ferruginous stained argillaceous, light brown-dark brown-purple from 0-4.8m, resolution mottling, generally moderately well silicified and hard, locally moderately friable at 1.2-1.3m, 2.3-2.38m, from 4.8m light brown-orange, fine bedding laminations, moderately well silicified, rare solution vugs 10.1-10.38m.	4		103	
				4.5-6.7m.Recovered 2.11m.
	5			
			96	
	6			
				6.7-7.2m.Recovered .45m.
	7		90	
				7.2-8.8m.Recovered 1.59m.
	8		99	
				8.8-12.5m.Recovered 1.88m
	9		51	
	10			

REFERENCES

LOGGED BY David Clarke

SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 23 CO-ORDINATES R.L. GROUND 102.4 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
From 10.38-15.46m. Sandstone, as above, light brown, with common solution vugs, moderately friable from 10.38-10.55m, from 10.55m friable to moderately friable.	11			
	12			12.5-16.0m. Recovered 2.96m.
	13		85	
	14			
	15			
	16			Total Depth 16.0 metres.
	17			
	18			
	19			
	20			

REFERENCES

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SHEET 2 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum

HOLE N° DDH 24 CO-ORDINATES R.L. GROUND 122.4 metres

LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	0			0-1.0m.Recovered .22m.
			22	
	1			1.0-1.3m.Recovered .09m.
			30	
From 0-12.0m. Sandstone, predominantly fine varying to silt sized quartz subrounded, moderately well sorted, local minor argillaceous matrix, generally ferruginously stained, purple brown and heavily solution mottled to 2.5m, light brown and reddish to 12.0m, moderately well silicified and hard, with common small moderately friable ferruginous mottles 0-2.5m, from 10.3 -10.50m white, friable-moderately friable, rare small solution vugs 10.50-11.16, scattered bedding traces at 65°-90° to core axis throughout.			96	1.3-1.8m.Recovered .48m.
	2			1.8-2.8m.Recovered .98m.
			98	
	3			2.8-4.9m.Recovered 2.15m.
			102	
	4			
	5			4.9-8.2m.Recovered 1.60m.
	6		48	
	7			
	8			8.2-12.0m.Recovered 2.96m
	9		75	
	10			

REFERENCES

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SHEET 1 OF 2 DRAWING N°

GEOLOGICAL LOG OF DRILL HOLE

PROJECT James Range Railway Ballast - Site 3 REMARKS Arbitrary Topographic Datum
HOLE N° DDH 24 CO-ORDINATES R.L. GROUND 107.4 metres
LOCATION See Plate 2 ANGLE FROM HORIZONTAL DIRECTION Vertical

DESCRIPTION OF CORE	Depth in Metres	LOG	CORE RECOVERY %	Intervals Drilled - metres
	10			
	11			
	12			12.0-16.0m. Recovered .40m
From 12.0-12.40m. Sandstone, as above, light brown, unsilicified, friable.	13			
	14		10	
	15			
	16			Total Depth 16.0 metres.
	17			
	18			
	19			
	20			

REFERENCES

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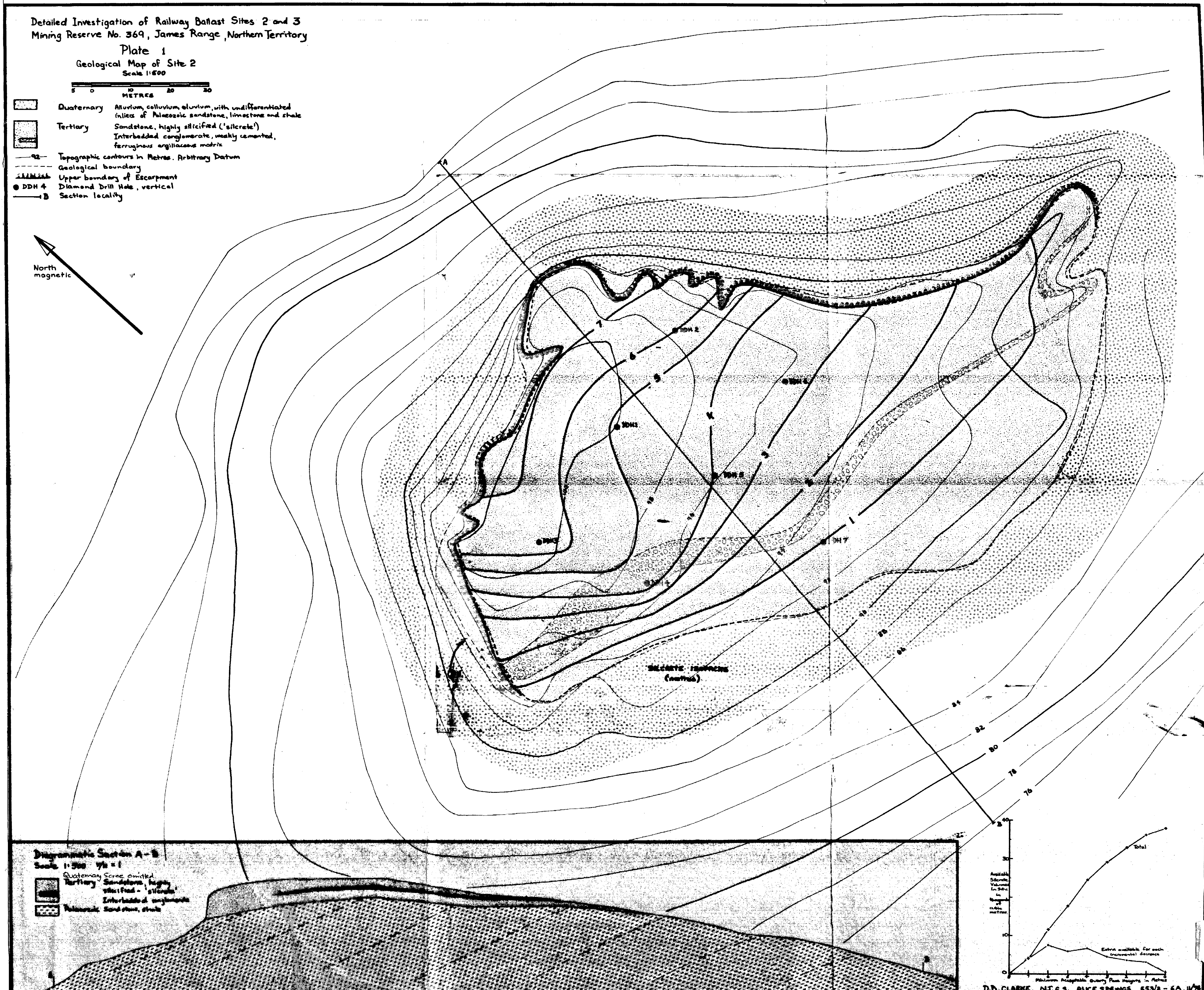
SHEET 2 OF 2 DRAWING N°



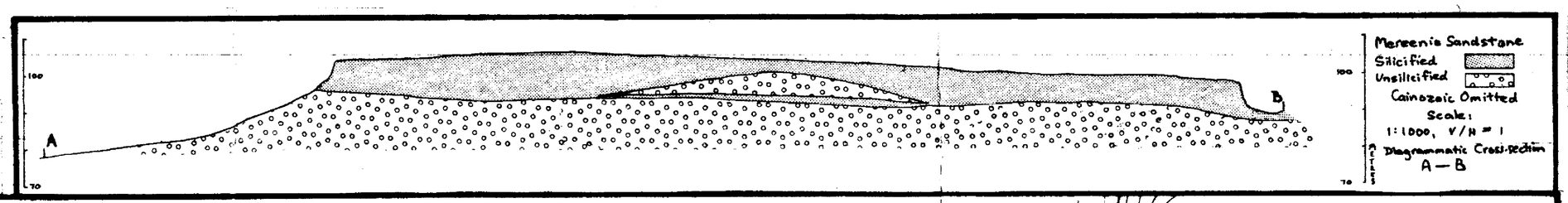
Detailed Investigation of Railway Ballast Sites 2 and 3
Mining Reserve No. 369, James Range, Northern Territory
Plate 1
Geological Map of Site 2
Scale 1:500
5 0 10 20 30
METRES
Quaternary
Alluvium, colluvium, eluvium, with undifferentiated inliers of Palaeozoic sandstone, limestone and shale
Tertiary
Sandstone, highly silicified ('silcrete')
Interbedded conglomerate, weakly cemented, ferruginous argillaceous matrix
92 Topographic contours in Metres. Arbitrary Datum
Geological boundary
Upper boundary of Escarpment
DDH 4 Diamond Drill Hole, vertical
B Section locality
North magnetic
A
B
DDH 2
DDH 7
76
78
80
82
84
Quaternary Scree omitted
Total
D.B. CLARKE, N.T.G.S., ALICE SPRINGS. 653/2 - 6A. 11/74

Detailed Investigation of Railway Ballast Sites 2 and 3
Mining Reserve No. 369, James Range, Northern Territory

Plate 2

Geological Map of Site 3
Scale 1:1000

10 0 10 20 30 40 50 60
METRES



Cainozoic Scree omitted
Palaeozoic Mereenie Sandstone, white moderately friable, with heavily silicified capping and intercalations.

—100— Topographic contours in metres. Arbitrary Datum.
Top of escarpment.
A Section Locality
● DDH 4 Diamond Drill Hole - vertical

North magnetic

DDH 5 DDH 19 DDH 20
DDH 7 DDH 10 DDH 18 DDH 17 DDH 16
DDH 11 DDH 14

>12
9-12
6-9
3-6
0-3

—3— SILICIFIED SANDSTONE ISOPACHS. THICKNESS IN METRES

Silicified Sandstone Volumes in Thousands of Cubic Metres

300
100

Extra available for each incremental decrease.
Minimum Acceptable Quarry Face Heights in Metres

D.B. CLARKE, N.T.G.S, ALICE SPRINGS, 12/74, G53/2-7A.