EL 1821 STREAKY BAY GYPSUM

ANNUAL REPORT TO 18 FEBRUARY 1996

MINERAL TENURE

EL1821 was granted to Olliver Geological Services Pty Ltd on 19 February 1993, was transferred to Sceale Bay Development Corporation Pty Ltd, has been renewed and is due to expire on 18 February 1997.

FIELD INVESTIGATIONS

In May 1995, total of 650.7m were drilled in 18 air core holes. Results are detailed in the attached report by Mark Randell

In November 1995, the site was flown over and inspected on the ground by the new Board of Directors. The proposed lake mine site has been selected in the south eastern quadrant of Lake Purdilla. Based on previous drilling, 7 million tonnes at 92% gypsum and 2% salt are indicated.

SAMPLE EVALUATION

Geological logs of the 1989 hand auger drill holes and chemical analysis of the first 100 samples, which were not submitted to MESA by the previous tenement holder, have been obtained from Perth.

The balance of 754 untested samples have been located and transferred to MESA Core Library and split for chemical analysis. A batch of 163 had been submitted to Australian Laboratory Services in early February 1996. Results awaited.

NEGOTIATIONS

Tennant Limited representatives have contacted a number of Australian and overseas gypsum and plaster companies to discuss development of the deposits.

Positive reaction from several, has resulted in the appointment of Jonathan Guinness (Tennant Ltd) as Project manager for Sceale Bay Development Corporation Pty Ltd.

EXPENDITURE

For six months to 18 February 1996.

Consulting fees	$27 200.00
Office expenses	2 800.00
Field Expenses	2 940.45
Sampling	699.00
Total	**$33 639.45**
Cumulative Total	$319 072.45
MESA commitment	$180 000.00

PROPOSED INVESTIGATIONS

After a review of analytical results of the 163 samples being tested, further samples will be selected.

An estimated 15-20 traverses of hand auger holes will be drilled across the dunes adjacent to the proposed lake mine site in Lake Purdilla South East.

These are the highest dunes, up to 8m, in the district and have not been tested previously.

A comprehensive report on the dune gypsum will be compiled.

Jeffrey G Olliver

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STREAKY BAY GYPSUM DEPOSITS

GEOLOGICAL INVESTIGATIONS OF GYPSUM DUNES

EL1821

by

Jeffrey G Olliver

September 1996

CONTENTS

INTRODUCTION

Sceale Bay Development Corporation Pty Ltd is seeking to develop the Streaky Bay gypsum deposits, one of the largest unmined gypsum resources in Australia, 12 to 27km south of the town of Streaky Bay (Figure 1) on the western coast of Eyre Peninsula, South Australia.

However, the 58 million tonnes of lake gypsum (Olliver, et al, 1985 and 1988) contains an average of 2.2% salt which would require at least two years of rain leaching to reduce salt content to 0.025% suitable for plaster manufacture.

Large wind blown lunette dunes of high quality gypsum extend across the two main lakes, Purdilla and Toorna (Figure 2). As this material is relatively low in salt, a reappraisal of previous investigations supplemented by further hand auger drilling was undertaken to define a mineable quantity near the initial proposed lake mine site in the south eastern sector of Lake Purdilla.

MINERAL TENURE

Exploration Licence (EL) 1821 was granted to Olliver Geological Services Pty Ltd on 19 February 1993 for a period of one year. EL1821 was transferred to Sceale Bay Development Corporation Pty Ltd in December 1993, has been renewed and is due to expire on 18 February 1997.

DRILLING PROGRAMS

In 1959, South Australian Dept of Mines drilling 135 machine auger holes in the lakes and collected eight hand dug samples from 0.5 - 1.0m from the dunes (Forbes, 1959 & 1960).

In 1969, 32 holes were drilled for Elcor over the southern half of Lake Purdilla by pushing NX casing (Hall et al 1970). There was no investigation of the dune gypsum.

During September-October 1988, the following program of hand auger holes was completed across the dunes (Mason & Compston, 1990) at locations shown on figure 2.

	Lake Purdilla	Lake Toorna	North Lake	Total
Traverses	54	42	1	97
Holes	359	102	1	462
Metres	571.45	163.4	0.9	735.75
Samples	648	205	1	854

Samples were designated LPS1-854 and the first 100 were submitted for chemical analysis in 1989.

In 1996, the following two programs were completed by Denis Mainwood, David Smart, Colin Kammerman and Graham Thomas.

- April - four traverses T97 - T100 near the main Streaky Bay - Sceale Bay road - a total of 30.85m in 15 holes - 10 samples were analysed.
- June - 19 traverses T101 - T118 in the southeast of Lake Purdilla - a total of 118.35m in 36 holes - 126 samples were analysed.

CHEMICAL ANALYSIS

The results of the first batch of 100 samples analysed by Classic Comlabs Ltd are reproduced in Appendix C.

The following chemical analytical reports by Australian Laboratory Services Pty Ltd (ALS) comprise Appendix D.

Report	Date	Samples
ST14158	26/03/96	148 samples LPS263-360, 366-415 from the 1988 drillholes
ST14801	13/05/96	5 samples LPS361-365 from the 1988 drillholes
ST14842	23/05/96	10 samples from the April 1996 drillholes - Traverses 97-100
ST15354	18/07/96	126 samples from the June 1996 drillholes - traverses 101-118 and 126 samples LPS 101-116, 164-241, 464-472, 535-543, 704-717 from the 1988 drillholes.

Samples are tested as follows

(1) Assay by acid digest.
(2) Samples are dried at 250°C and gypsum content is recalculated to allow for water of hydration (.$2H_2O$).
(3) $CaCO_3$ is the stoichiometric excess of calcium over sulphur for gypsum - expressed as carbonate.
(4) $MgCO_3$ is magnesium, expressed as carbonate.
(5) NaCl is sodium, express as chloride.
(6) KCl is potassium, expressed as chloride.

QUALITY OF DUNE GYPSUM

Chemical analyses are summarised in Table 1 from the geological logs in Appendix A and B, chemical analyses in Appendix C and D and weighted averages in Appendix E.

Traverse 1 - low grade with 37.2 - 86.0% gypsum and high 0.76 - 2.80% salt
Traverse 2 - only holes 9, 27 and 28 have more than 90% average gypsum. Salt usually exceeds 1%. Overall average is 89.4% gypsum 1.4% salt and 10.3% carbonate.
Traverse 3 - 93.4% gypsum but 1.4% salt.
Traverse 4 - high dunes of 3.0m in holes 21-25 average 93.5% gypsum 0.5% salt and 4.1% carbonate

TABLE 1

SUMMARY OF CHEMICAL ANALYSIS

PROPOSED MINE SITE - SE LAKE PURDILLA

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
17	1	0.9	94.8	1.8	3.4
	2	1.7	95.7	1.3	3.0
	3	2.0	96.8	0.7	2.5
	4	1.0	95.1	0.7	4.2
18	1	0.9	95.0	1.5	3.5
	2	1.0	94.5	1.9	3.6
	3	1.0	96.3	1.1	2.6
	4	1.5	96.9	0.3	2.8
	5	2.0	96.3	0.6	3.2
	6	1.4	96.2	0.9	2.9
19	1	1.4	98.5	0.3	1.1
	2	3.0	98.5	0.3	1.7
	3	2.0	97.9	0.4	1.7
	4	1.7	96.7	0.5	2.8
20	1	0.95	96.0	1.1	2.8
	2	0.7	92.8	1.8	5.3
21	1	0.9	87.7	1.4	10.9
	2	3.0	96.3	0.1	3.5
	3	5.0	95.9	0.1	3.5
22	2	2.0	96.6	0.3	2.3
23	1	0.8	95.6	1.1	1.5
24	1	1.9	98.1	0.4	1.3
	2	2.0	97.9	0.5	1.2
26	1	1.0	96.7	0.6	2.7
27	1	1.9	94.6	0.8	3.4
	2	1.3	93.0	1.0	4.5
28	1	4.5	97.4	0.1	2.5
29	1	2.8	96.0	0.5	2.0
30	1	3.9	97.1	0.2	2.0
31	1	5.0	97.5	0.2	2.0
101	1	6.0	94.9	0.1	3.5
	2	2.45	94.9	0.1	3.5
102	1	5.0	95.1	0.1	3.6
	2	2.0	95.7	0.4	2.9
103	1	4.0	96.9	0.2	2.3
	2	2.0	97.0	0.2	1.9
104	1	6.0	98.6	0.1	1.2
	2	4.0	97.8	0.3	2.0
105	1	5.5	97.7	0.1	1.8
106	1	3.5	97.7	0.4	2.0
	2	2.6	97.5	0.3	2.2

107	**1**	5.4	97.5	0.4	2.1
	2	2.0	98.1	0.4	1.5
	3	2.2	97.9	0.4	1.9
	4	1.2	97.0	0.5	2.3
108	**1**	2.9	94.2	0.6	4.6
	2	2.25	96.8	0.9	2.3
	3	1.4	93.9	1.2	4.4
109	**1**	4.0	97.3	0.3	1.7
	2	2.0	94.3	1.2	4.2
110	**1**	4.0	97.5	0.6	1.9
	2	1.7	96.9	0.9	2.1
111	**1**	4.4	97.6	0.4	1.9
112	**1**	5.9	98.2	0.4	1.6
	2	1.0	97.7	0.7	1.7
113	**1**	5.0	97.8	0.4	1.4
	2	2.9	98.4	0.5	1.0
114	**1**	4.0	98.0	0.2	1.5
	2	2.0	98.1	0.5	1.2
115	**1**	2.5	96.4	0.7	2.6
	2	1.4	97.0	1.0	2.0
116	**1**	2.9	97.7	0.4	1.6
	2	1.8	96.9	0.6	1.8
117	**1**	3.5	96.5	0.6	1.6
	2	2.7	95.1	0.5	2.1
118	**1**	2.0	94.3	0.9	3.3
LAKE PURDILLA NORTH					
80	**1**	0.8	93.4	1.1	5.4
	2	0.8	97.0	0.4	2.2
	3	1.7	97.9	0.4	1.9
	4	2.4	97.1	0.6	2.2
	5	1.7	95.0	1.1	3.7
	6	1.7	97.6	0.4	1.8
	7	3.0	98.2	0.2	1.2
	Av		**97.0**	**0.5**	**2.2**
LAKE TOORNA					
41	**1**	1.5	96.3	0.1	3.4
	2	5.0	96.4	0.1	3.1
	3	1.7	97.0	0.3	2.8
	Av		**96.5**	**0.1**	**3.1**
48	**1**	1.0	96.7	0.1	2.4
	2	2.3	96.9	0.1	2.7
	3	4.0	96.0	0.3	3.3
	Av		**96.3**	**0.2**	**3.0**

RESERVES

Forbes (1959 & 1960) calculated only 0.5 million tonnes of dune gypsum at Lake Purdilla and only 0.17 million tonnes at Lake Toorna.

Olliver et al (1985 & 19889) did not reappraise the dunes.

Based on the 1988 hand auger holes and the 1:5 000 topographic contour plans, Mason and Compston (1990) calculated a total of 5 million tonnes in dunes *'up to 5 metres high'*, which *'are rarely higher than 3 metres'*.

During drilling in June 1996, the following traverses across dunes along the south eastern margin of Lake Purdilla were more than 3 metres above lake surface.

Traverse	Height (m)
101	7
102	7
104	7.6
105	8.5-9
107	5.4
109	4.9
112	5.9
113	5.1
114	4.5

Based on these figures, indicated resources of dune gypsum in the south east of Lake Purdilla, have been recalculated at 440 000 tonnes using bulk density of 1.3 tonnes/ cubic metre.

As there are 15 major untested dunes in the north and north east of Lake Purdilla, the 5 million tonnes calculated by Mason & Compston (1990) appear to be a reasonable total for in situ indicated resources.

LABORATORY TESTING

A two stage program of laboratory testing has been designed to produce plaster from washed salt-free gypsum using the following three composite samples from the 1996 hand auger drill holes.

1. **Moonabie - Three Mile Dune**
   85kg are available with a calculated average grade of 94.5% gypsum, 0.2% salt, 0.1% carbonate and, by difference, 5% silica.

2. **Streaky Bay A**
   225kg are available of low salt gypsum with a calculated average grade of 97.0% gypsum 0.25% salt and 2% carbonate.
   All samples contained more than 90% gypsum and less than 0.5% salt except for several samples in the upper metre or two.

3. Streaky Bay B
260kg are available with a calculated average grade of 96.8% gypsum 0.4% salt and 2.3% carbonate.
All samples were used with more than 88% gypsum irrespective of salt content which ranged up to 1.63%

Stage 1 AMDEL

The program requires supply of 30kg of each sample to Amdel, Thebarton South Australia for Stage 1.

(1) Chemical analysis
Assay each head sample and report $CaSO_4.2H_2O$, $CaCO_3$, $MgCO_3$, NaCl, KCl, Al_2O_3, Fe_2O_3 and acid insolubles.

(2) Mineralogy
Using XRay diffraction analysis and stereo binocular examination of grain mounts determine minerals present, gypsum grain size and shape and size and shape of contaminant carbonate and quartz.

(3) Density
Determine loose bulk density

(4) Washing
Wash with Adelaide tap water by mixing into a slurry and agitate for two hours. Then by sedimentation, filtering, decanting and oven drying at 40-50°C produce the following three concentrates.
(a) preliminary screening only to remove debris and obvious coarse fragments - no washing.
(b) as above followed by a single wash.
(c) as above but with up to four washes to produce the ultimate clean product.

(5) Chemical analysis
Each resultant sub sample is to be assayed to document beneficiation.

(6) Comparison
Compare ease of upgrading each raw material.

Stage 2 CSIRO

The resultant nine washed gypsum products are to be forwarded to CSIRO Division of Building Construction and Engineering Highett Victoria for Stage 2.

(1) Calcination
Calcine to first 'boil' to produce hemi hydrate only.

(2) Plaster
Manufacture hemihydrate set plaster and appraise suitability for building purposes according to Australian Standard AS2592 including

- composition - use XRay diffraction and phase analysis to detect retained calcium sulphate dihydrate and other phases with impurities insoluble in ammonium acetate.
- fineness
- water requirements
- initial setting time
- exotherm test
- compressive strength

(3) Comparison
Compare results with commercial plaster.

CONCLUSIONS

Hand auger drilling in 1996 has confirmed the high gypsum content and low salt content in gypsum dunes at Streaky Bay.

Indicated resources of 440 000 tonnes have been outlined marginal to the proposed lake mine site in the southeast of Lake Purdilla. Calculated average grade for the raw material is 96.8% gypsum, 0.4% salt and 2.3% carbonate.

Field mapping is required to upgrade resources to measured and to check the previous total estimate at Lake Purdilla and Lake Toorna of 5 million tonnes.

JEFFREY G OLLIVER

REFERENCES

Forbes, B.G., 1959 Gypsum deposits near Streaky Bay and some other locations on Eyre Peninsula. South Australian Department of Mines report 48/148 (unpublished).

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Olliver, J.G., Dubowski, E.A., and Barnes, L.C., 1985 Reappraisal of gypsum resources, Streaky Bay Lakes, Eyre Peninsula. South Australia Department of Mines and Energy report 84/80 (unpublished)

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COLOUR PLATES

Plate 1 **Southern end of Lake Purdilla** **November 1995**

View to southeast towards proposed lake mine site behind Purdilla Island with yellow cereal crop.
Hand auger traverses 4, 5 and 6 cross long white dune along edge of lake in centre.

Plate 2 **Southern end of Lake Purdilla** **November 1995**

View to northwest. Traverses 15 and 16 cross dune in left foreground.
Lake mine site off to right.

Plate 3 **Northern end of Lake Purdilla** **November 1995**
View to west with Sceale Bay in background.

Plate 4 **Northern end of Lake Purdilla** **November 1995**
View to north with island at bottom right. Dunes either side of elliptical island and fringing circular island have not been drilled.

APPENDIX A

GEOLOGICAL LOGS

HAND AUGER DRILLHOLES, 1988

TRAVERSES 1 TO 96

PROJECT: Streaky Bay — BAY GYPSUM PTY LTD — HOLE No: -

HAND AUGER

PROSPECT: ...... R.L. COLLAR: ...... m

CO-ORDS: ...... INCLINATION: ......

LOCATION: 15 km south of Streaky Bay, SA. DIRECTION: ......

Hole/Sample	InS	Gypsum	NaCl	$CaCO_3$	Depth m	LOG	DESCRIPTION	QTZ/	WATER
							TRAVERSE ONE		
1/1	1.54	77.0	0.76	21.1			GYPSUM - light brown, thin "floor" layer		
2	7.35	37.2	1.45	53.2			- cream, fine, water table		
							- base defined by gypsum nodules		
							- 10m from lake		
2/3	5.95	59.5	1.30	33.3			GYPSUM - cream, brown.		
							- salt-bush flat		
							- 20m along traverse		
3/4	6.75	63.1	1.65	27.7			GYPSUM - cream-brown f.g. nodules at 0.8m.		
							- 20m along section		
4/5	4.06	86.0	1.00	9.25			GYPSUM - cream Eoh 1.0m		
							20m along traverse		
5/6	1.78	82.0	2.80	13.7			GYPSUM - cream - Eoh 1.0m		
							- 20m along traverse		
							TRAVERSE TWO - 500m east of dune end		
1/7	0.92	84.8	0.70	12.3			GYPSUM - cream brown, up to 2mm xtals		
							- 10m from lake		
							- wet lake deposits last 15cm		
2/8	0.92	88.5	0.12	8.15			GYPSUM - cream to 2mm xtals		
9	1.06	85.5	0.17	10.8			- " rare "floor" (cm) layers		
10	1.26	84.7	1.35	12.7			- 2.4m - water table		
							2.7 coarse - 2-5 mm crystals		
3/11	1.30	83.8	1.45	12.0			GYPSUM - cream, top 30cm with organics		
12	1.36	78.7	1.75	17.6			- white crystals to 1.5cm		
4/13	1.10	79.4	1.30	16.2			GYPSUM - cream to 2mm xtals		
14	0.42	86.8	1.35	10.2			- off-white, coarse xtals at 1.3m		
5/15	0.64	85.5	0.94	10.9			GYPSUM - cream/brown		
16	0.70	82.0	1.75	13.4			- off-white, wet, coarse at 1.3m.		

SAMPLE Nos: ......

Test gypsum quality and thickness in dune deposits

Scale. 1:500.

DRILL TYPE: Hand Auger

DRILLER: ......

DRILLED: 24/9/1988

LOGGED: D. Conor

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

Hole/Sample	Ins	Gypsum	NaCl	$CaCO_3$	Depth m	LOG	DESCRIPTION TRAVERSE TWO (cont)	QTZ	WATER
6/17	1.90	89.5	0.89	7.25			GYPSUM - cream, f.g.		
18	2.00	84.7	1.60	11.30			- coarse (1cm) xtals at 1.8m		
7/19	1.06	86.7	0.53	9.85			GYPSUM - off-white, top 10cm organic		
20	0.54	83.1	1.80	13.0			- end 1.2 coarse gypsum		
8/21	1.86	84.9	3.16	9.40			GYPSUM - off-white, brown f.g., top 10cm organic		
22	0.82	86.0	2.10	10.2			- off-white, coarse xtals 1.75		
9/23	1.36	90.5	1.65	7.45			GYPSUM - off-white, cream, f.g.		
							- coarse lake material at 1.1m		
10/24	1.00	90.3	1.60	7.50			GYPSUM - cream-brown, off-white		
25	1.00	84.8	2.46	11.2			- white, coarse at 1.2m, wet.		
11/26	1.50	86.7	3.26	6.80			GYPSUM - brown, cream, puggy, f.g.		
27	1.16	87.3	1.75	8.15			- off-white, coarse at 1.8m		
							EOH 1.8		
12/28	1.36	90.8	1.10	6.55			GYPSUM - cream, f.g.		
29	1.40	89.0	2.20	7.75			- off white, minor grey		
							EOH 1.9		
13/30	1.30	90.4	1.75	6.30			GYPSUM - pale brown, puggy		
31	0.38	86.4	1.55	10.0			- cream, coarse at base		
							- EOH 1.7		
14/32	1.50	88.5	0.20	8.00			GYPSUM - cream f.g.		
33	1.80	88.1	2.06	8.00			- off-white, cream. Coarse at base		
							EOH 1.9		
15/34	1.80	89.3	1.60	7.10			GYPSUM - pale brown, cream, f.g.		
35	0.80	85.8	1.75	9.85			-		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONSTANTINE

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT: . . . .

R.L. COLLAR: . . . . m

CO-ORDS: . . . .

INCLINATION: . . . .

LOCATION: 15 km south of Streaky Bay, SA.

DIRECTION: . . . .

Hole/ Sample	Insol	Gypsum	NaCl	$CaCO_3$	Depth m	LOG	DESCRIPTION TRAVERSE 2 (cont)	QTZ %	WATER
16/36	0.90	89.6	1.05	7.55			GYPSUM, cream f.g.		
							EOH 1.1m		
17/37	0.72	89.1	2.06	7.25			GYPSUM, off-white, f.g.		
38	0.42	88.6	1.65	8.40			"		
							Eoh 1.3		
18/39	0.52	90.2	1.25	6.75			GYPSUM - pale cream/brown, f.g.		
40	0.60	89.0	1.20	8.40			- off-white		
							Eoh - 1.3		
19/41	0.68	89.2	1.80	7.65			GYPSUM - cream, f.g.		
42	0.88	87.5	1.90	9.40			- off-white		
							- eoh 1.3		
20/43	1.00	90.5	1.30	6.25			GYPSUM - cream f.g.		
44	0.70	83.9	2.84	12.6			- off-white, 1.3, wet		
							eoh 1.5m		
21/45	0.98	91.6	1.10	5.80			GYPSUM - off-white floury, f.g.		
46	0.44	85.5	1.60	10.7			- " , coarse at 2.0m, wet		
							Eoh 2.0		
22/47	0.64	89.5	1.05	7.25			GYPSUM - off-white floury → f.g.		
48	0.70	92.0	0.26	5.45			- " , cream f.g.		
49	1.06	86.2	1.95	8.85			- off-white, f.g.		
							Eoh 2.9		
23/50	1.30	87.8	0.50	8.00			GYPSUM - off-white f.g.		
51	0.22	89.6	0.58	9.20			- "		
52	1.38	78.6	0.55	18.3					
							- cream f.g.		
							EOH 2.8 - ? kopi surface		
24/53	0.92	83.3	1.66	13.5					
54	0.94	29.2	0.48	69.2			GYPSUM - off-white, cream f.g.		
							- " - Kopi? surface 1.6m		
							Gap of 140m to next sample, across		
							calcrete/soil area.		
25/55	2.34	74.5	1.73	21.7			GYPSUM - pale brown, calcrete at .8m.		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits.

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. [illegible]

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD — HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: .... m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

HOLE/ Sample No	Insol.	Gypsum	NaCl	$CaCO_3$	Depth m	LOG	DESCRIPTION	QTZ %	WATER
							TRAVERSE 2 (cont)		
26/56	1.86	78.1	1.92	16.8			GYPSUM - pale brown. calcrete at 0.75m		
							Eoh 0.75m		
27/57	0.14	92.8	0.46	6.30					
58	0.18	94.5	0.52	4.94			GYPSUM - cream, pale brown. f.g.		
59	1.62	79.0	0.89	17.5			- cream, - damp, puggy.		
							- pale brown. coarse, wet at 2.75		
28/60	0.22	92.4	0.46	4.88			GYPSOM - brown, pale brown		
61	0.46	88.9	1.63	6.75			- pale brown, base of dune 1.6		
							Eoh 1.7m		
							END OF TRAVERSE TWO		
							(ISLAND) TRAVERSE 3 north of T.2		
1/62	0.12	93.0	0.68	4.00			GYPSUM - pale brown, f.g. dune		
							- Eoh 1.0m - wet lake material		
							- 20m from edge, traverse E→W.		
2/63	0.22	92.9	0.51	4.22			GYPSUM - pale brown, creamy, f.g.		
64	0.20	95.2	0.61	3.28			" " - minor "Ros"		
65	0.22	93.9	0.60	5.15			" " "		
							Eoh 3.0m		
3/66	0.70	93.2	3.98	5.65			GYPSUM - pale brown, v. fine, damp		
67	0.28	92.1	2.24	5.60			- 1.4 - fine, drier, 1.8 white ? lake clay.		
							eoh 2.0m		
							END OF TRAVERSE 3.		
							TRAVERSE 4 - 400m east of T.2 along DUNE		
1/68	0.28	88.0	0.89	11.4			GYPSUM - cream off-white, f.g.		
							Eoh 0.5m		
							20m from lake edge, brg 032°		
2/69	0.26	87.2	0.02	12.1			GYPSUM - cream, pale white, f.g.		
70	0.94	84.6	0.49	11.0			- " - "		
							Eoh 1.9		
3/71	0.18	85.4	0.35	11.2			GYPSUM - creamy brown, f.g.		
72	0.22	85.1	1.31	10.4			- off-white coarse (3cm) at 1.5m		
							Eoh 1.5m		
4/73	0.16	84.8	0.85	12.0			GYPSUM - off-white, f.g. (<2mm)		
							Eoh 1.0m		

SAMPLE Nos:

Scale. 1:500.

Test gypsum quality and thickness in dune deposits.

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. Conrad

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
- HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

Hole/	Insol.	Gypsum	NaCl	$CaCO_3$	Depth m	LOG	DESCRIPTION	QTZ%	WATER
5/74	0.22	83.9	0.45	13.1			GYPSUM - pale brown, f.g.		
75	0.12	87.5	0.74	9.15			- off-white, coarse at 1.5m		
							Eoh 1.5m		
6/76	0.20	90.2	0.39	9.15			GYPSUM - off-white, cream, f.g.		
77	0.18	85.0	1.05	11.2			" "		
							Eoh 1.4m		
							onto salt-bush flat.		
7/78	0.58	86.5	1.22	10.4			GYPSUM - pale brown to cream f.g.		
							Eoh 0.9m		
8/79	0.22	87.4	1.77	8.15			GYPSUM - pale brown to cream f.g. → off-white		
							0.9m		
9/80	0.28	92.5	1.43	5.55			GYPSUM - pale brown to off-white		
							- Eoh 0.9m		
10/81	0.10	89.5	1.13	6.90			GYPSUM - cream f.g.		
							- Eoh 1.0m		
11/82	0.10	92.3	0.89	5.85			GYPSUM - cream, off-white, f.g.		
							Eoh 1.0m.		
12/83	0.18	92.2	1.06	5.25			GYPSUM - off-white, cream f.g.		
							Eoh 0.95m		
13/84	0.18	92.1	1.56	4.82			GYPSUM - off-white, f.g.		
							Eoh 1.0m		
14/85	0.10	91.4	0.90	5.40			GYPSUM - cream, off-white, f.g.		
							Eoh 1.0m		

SAMPLE Nos:

Scale. 1:500.

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. C[illegible]

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, SA

DIRECTION:

	GEOCHEMISTRY				Depth m	LOG	DESCRIPTION	QTZ %	WATER
	Insol.	Gypsum	NaCl	$CaCO_3$					
15/86	0.48	86.8	1.14	10.9			GYPSUM - pale brown f.g.		
87	0.26	85.1	1.67	11.1			white, coarse at 1.2m.		
							Eoh 1.2m		
16/88	0.24	90.9	0.65	5.65			GYPSUM - off-white f.g.		
89	0.24	89.3	1.25	7.85			- off-white, coarse at 1.6		
							Eoh 1.65m		
17/90	0.82	89.2	1.45	9.25			GYPSUM - pale brown, becoming cream, f.g.		
91	0.26	88.1	1.98	7.90			- white, f.g.		
							Eoh 1.6m		
18/92	0.20	91.5	0.78	5.70			GYPSUM - cream, pale brown, f.g.		
93	0.22	91.8	1.42	5.15			- off-white, wet, coarse at 1.5m		
							Eoh 1.6m		
19/24	0.30	90.9	1.20	5.55			GYPSUM - off-white, cream f.g.		
25	0.20	89.8	1.27	7.10			- off-white, coarse & wet 1.2		
							Eoh 1.2m		
20/96	0.78	84.5	2.76	11.7			GYPSUM - brown (top 15cm) then off-white		
97	0.18	89.0	1.00	7.85			- off-white		
							Eoh 1.3m		
							END OF SALTBUSH FLAT.		
							older dunes.		
21/98	0.26	92.5	0.73	4.48			GYPSUM - off-white, f.g. minor "flour"		
99	0.30	94.0	0.14	3.36			- off-white "		
100	0.32	92.5	0.77	4.76			" "		
							Eoh 3.0m		
22/101		92.2	1.34	3.48			GYPSUM - off-white, cream, f.g.		
102		95.8	0.29	3.21			- off-white f.g. even 1mm		
103		92.8	0.61	4.10			- " " coarse wet 3.25m		
104		84.0	1.82	11.46			Eoh 3.4m		
23/105		90.2	1.40	6.33			GYPSUM - brown, then cream to off-white, f.g.		
106		95.6	0.25	2.34			- off-white f.g.		
107		94.2	0.25	3.36			- " "		
							Eoh 3.05m -		
24/108		92.5	0.90	5.36			GYPSUM palebrown → offwhite, f.g.		
109		92.2	0.31	5.29			offwhite		
110		93.7	0.32	4.07			"		
111		82.5	0.97	14.14			"		
							Eoh 3.7m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: P. CONRAD

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
- HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY				Depth m	LOG	DESCRIPTION	QTZ %	WATER
25 / 112		96.0	0.22	3.11			GYPSUM - pale brown - cream		
113		94.3	0.29	3.72			- off-white "		
114		88.2	1.00	8.31			" " rust layer at base 2.9		
							Eoh 3.0m		
26 / 115		90.8	1.04	5.76			GYPSUM - off-white, cream, f.g.		
116		92.0	1.54	6.93			" rust layer 1.5m, wet		
							Eoh 1.5m		
							END OF TRAVERSE 4		
							TRAVERSE 5 - 400m east of 4 along lake		
1/117							GYPSUM - pale brown, off-white f.g. to 1.5mm		
118							- " " , damp, coarse at 1.3m		
							Eoh 1.4m		
							20m from lake shore		
2/119							GYPSUM - off-white, cream, f.g.		
120							" " coarse at 1.9m		
							Eoh 2.0m		
3/121							GYPSUM - pale brown, off-white, f.g.		
122							- " "		
							Eoh 1.6m		
4/123							GYPSUM - off-white, f.g. to 1.5mm		
124							- " "		
							- Eoh 2.05m		
5/125							GYPSUM - off-white to pale brown, f.g.		
							Eoh 1.0m		
							Salt-bush flat.		
6/126							GYPSUM - pale brown to off-white, f.g.		
127							" "		
							Eoh 1.90m		
							Dune.		
7/128							GYPSUM - pale brown to off-white f.g.		
129							- off-white, damp, coarse at 1.2		
							Eoh 1.2m		
							salt-flat again		
8/130							GYPSUM - pale brown, to cream, f.g.		
							Eoh 1.1m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits.

Scale. 1:500.

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: 27 / 9 /198

LOGGED: D. Co[illegible]

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
HAND AUGER

HOLE No: -

PROSPECT:

CO-ORDS:

R.L. COLLAR: m

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
9	131							GYPSUM - cream, f.g Eoh 0.95m		
10	132							GYPSUM - cream then off-white f.g Eoh 1.0m		
11	133							GYPSUM - off-white, f.g EOH 1.0m		
12	134							GYPSUM - pale brown to off-white, f.g Eoh 1.1m		
13	135							GYPSUM - cream to off-white f.g Eoh 1.0m		
14	136 137							GYPSUM - off-white, f.g Eoh 1.2m		
15	138 139							GYPSUM - pale brown to cream, f.g Eoh 1.2m		
16	140 141							GYPSUM - pale brown off-white, f.g - off-white, wet & coarse at 1.2m Eoh 1.2m		
17	142 143							GYPSUM - cream, off-white, f.g - off-white, coarse, wet at 1.25 Eoh 1.25m		
18	144 145							GYPSUM - off-white, f.g. - off-white. EOH 1.25		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: P. Conrad [?]

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD

HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, SA.

DIRECTION:

	GEOCHEMISTRY				Depth m	LOG	DESCRIPTION	QTZ %	WATER
19	146						GYPSUM - off-white, f.g.		
	147						- "		
							Eoh 1.29m		
20	148						GYPSUM - cream, off-white		
	149								
							Eoh 1.25m		
21	150						GYPSUM - cream to pale brown, off-white after 0.5		
	151						- off-white		
							Eoh 1.4m		
22	152								
	153						GYPSUM - cream to pale brown, f.g.		
							- off-white		
							Eoh 1.7m		
23	154						GYPSUM - pale brown to cream f.g.		
	155						- cream to off-white		
							Eoh 1.7m		
24	156						GYPSUM - cream, off-white, f.g.		
	157						- " "		
							Eoh 1.9m		
25	158						GYPSUM - clayey to 0.8m. pale brown to cream		
	159						- cream to off-white		
							Eoh 1.65m		
26	160						GYPSUM - pale brown, puggy to 0.5m then cream		
	161						cream.		
							Eoh 2.0m		
27	162						GYPSUM - cream, off-white f.g.		
	163						" "		
							1.8m - qtz-sand/clays + gypsum		
							END OF TRAVERSE 5		
							GYPSUM		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONSTANTINE

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
- HAND AUGER

HOLE No: -

PROSPECT: LAKE PURDILLA

R.L. COLLAR: .... m

CO-ORDS: ....

INCLINATION: ....

LOCATION: 15 km south of Streaky Bay SA

DIRECTION: ....

GEOCHEMISTRY Sample		Gyp	Salt	Carb	Depth m	LOG	DESCRIPTION TRAVERSE 6 - to 065° MAG from lake	QTZ %	WATER
1/164		87.0	0.81	10.80			GYPSUM - off-white, cream. f.g.		
							Eoh 0.8m		
							20m from lake		
2/165		94.6	0.02	5.44			GYPSUM - off-white, cream, f.g.		
166		93.5	0.09	6.41			" "		
167		90.2	0.45	7.65			" "		
							Eoh 2.9m		
3/168		91.5	0.11	7.45			GYPSUM - off-white, f.g. gypsum		
169		91.7	0.09	7.17			- " "		
170		91.0	0.74	7.62			- " "		
							Eoh 2.8m		
4/171		92.2	1.15	5.40			GYPSUM - top 0.5m brown floury then off-white		
							Eoh 1.0m - 5cm xtals		
5/172		91.6	0.55	6.02			GYPSUM - top 10cm brown then cream f.g.		
173		91.9	1.13	6.17			- cream, off-white		
							Eoh 1.5m		
6/174		92.7	0.82	5.43			GYPSUM - pale brown, f.g.		
							Eoh 1.0		
							Saltbush flat		
7/175		93.1	1.27	5.39			GYPSUM - brown to 15cm then off-white		
176		89.8	1.63	7.71			- off-white		
							Eoh 1.1m		
8/177		92.3	0.73	3.97			GYPSUM - off-white, f.g.		
178		90.5	1.58	6.88			- " " , f.g.		
							Eoh 1.3		
							dune again		
9/179		96.3	0.23	3.40			GYPSUM - off-white f.g.		
180		93.8	0.89	4.96			"		
							Eoh 1.5m		
10/181		92.5	1.19	5.52			GYPSUM - off-white, f.g.		
182		90.0	1.15	7.26			" "		
							Eoh 1.9m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER: ....

DRILLED: / /198

LOGGED: D. Confort

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT: LAKE PURDILLA

R.L. COLLAR: .... m

CO-ORDS: ....

INCLINATION: ....

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION: ....

GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
11/183		92.1	0.56	4.62			GYPSUM - cream to off-white, f.g		
184		92.1	0.45	4.39			" " "		
							Eoh 2.1m		
12/185		93.2	0.16	4.20			GYPSUM, off-white f.g.		
186		94.4	0.13	4.65			"		
187		92.2	0.23	4.76			"		
188		94.3	0.44	5.86			"		
189		80.5	1.31	16.50			" Eoh 4.85m		
13/190		96.0	0.22	3.95			GYPSUM - off-white f.g.		
191		95.0	0.46	4.33			" cream		
192		94.2	0.39	5.42			" "		
193		94.6	0.28	5.48			" "		
194		92.0	0.69	7.71			" " Eoh 4.4m		
							END OF TRAVERSE 6.		
							TRAVERSE 7		
							120m from end of dune-peninsular		
1/195		92.4	0.42	7.46			GYPSUM - pale brown f.g.		
196		78.2	1.47	20.66			cream off-white, f.g		
							Eoh 1.6m		
							20m from lake shore		
2/197		90.1	0.54	9.64			GYPSUM - cream to off-white		
198		85.6	1.35	13.32			- off-white, most layer		
							Eoh 1.3m		
							END OF TRAVERSE 7		
							TRAVERSE 8 brg 330°		
1/199		84.4	1.79	14.03			GYPSUM pale brown to off-white f.g.		
							Eoh 1.1 20m from lake shore		
2/200		85.3	2.28	12.47			GYPSUM - cream to off-white f.g		
							Eoh 1.2m		
3/201		89.2	1.24	9.29			GYPSUM - pale brown to off-white f.g.		
202		79.7	1.87	18.67			- off-white grey at 1.4m		
							Eoh 1.4		
4/203		90.4	1.61	7.68			GYPSUM - pale brown to off-white		
204		69.8	2.05	27.34			off-white to grey at 1.35m		
							Eoh 1.6m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. Comfort

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
HAND AUGER

HOLE No: -

PROSPECT: ....

CO-ORDS: ....

R.L. COLLAR: .... m

INCLINATION: ....

LOCATION: 15 km south of Streaky Bay, SA.

DIRECTION: ....

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ	WATER
5	205		90.7	0.98	7.75			GYPSUM - pale brown to cream		
	206		90.8	1.42	7.86			- off-white grey at 1.5m		
								Eoh 1.6m		
								end of flats		
6	207		94.7	0.38	5.26			GYPSUM - cream, f.g. - DONE		
	208		95.2	0.25	4.97			- " to off-white		
	209		92.9	0.69	6.20			off-white rusty layer 2.95m		
								Eoh 3.0m		
7	210		93.5	1.04	5.47			GYPSUM - off-white f.g.		
	211		94.5	0.16	5.26			- "		
	212		93.6	0.29	6.54			- "		
	213		83.3	0.56	15.89			- " gypsum hardpan at 3.5m		
								Eoh 3.5m		
8	214		94.9	0.45	4.67			GYPSUM - off-white, f.g.		
	215		92.4	0.39	7.21			- "		
	216		86.0	0.49	12.57			- off-white, brown at 2.4m		
								Eoh 2.5m - cemented		
9	217		94.9	1.41	3.84			GYPSUM - cream, f.g.		
	218		87.4	0.65	10.33			"		
								Eoh 1.6m		
10	219		91.0	2.15	4.81			GYPSUM - cream to pale brown, f.g.		
	220		93.4	0.63	5.25			- off-white		
								Eoh 1.5m		
11	221		95.2	0.88	3.50			GYPSUM - pale brown (to 10cm) then cream		
	222		94.2	1.01	3.16			cream to off-white		
								Eoh 1.9m		
12	223		94.0	0.44	3.70			GYPSUM - pale brown to off-white.		
	224		93.7	0.74	4.71			- off-white & cream		
	225		86.8	1.31	10.18			- off-white, coarse at 2.25m		
								Eoh 2.4m		
13	226		92.6	0.60	5.27			GYPSUM - brown to 15cm then cream, f.g.		
	227		93.3	0.85	5.54			- cream to off-white, rust & grey at base		
								Eoh 2.0m		
14	228		92.1	0.06	6.71			GYPSUM - cream to off-white, f.g.		
	229		92.2	1.29	6.03			" "		
	230		91.4	0.11	7.50			" "		
								Eoh 2.7m		

SAMPLE Nos: ....

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER: ....

DRILLED: / /198

LOGGED: D. Comfort

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD – HAND AUGER

HOLE No: -

PROSPECT: ....

R.L. COLLAR: .... m

CO-ORDS: ....

INCLINATION: ....

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION: ....

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
15	231		91.3	0.24	8.34			GYPSUM – cream to off-white f.g.		
	232		87.2	1.08	11.08			– " " "		
								Eoh 1.7m		
								END OF TRAVERSE 8		
								TRAVERSE 9 – Island brg 085°		
1	233		89.2	0.14	10.77			GYPSUM – off-white, dune f.g. minor roots		
	234		89.1	1.06	9.92			– " grey at 1.7m		
								Eoh 2.0		
								20m from lake shore		
2	235		82.5	0.25	14.75			GYPSUM – off-white, cream, f.g.		
	236		93.5	0.37	5.86			– "		
	237		91.0	0.39	7.67			– 2.7m cemented gypsum		
								Eoh 2.7m		
3	238		66.8	3.00	25.8			GYPSUM – cream/pinkish very fine calcrete at 0.3m		
								END OF TRAVERSE 9 – shallow calcrete		
								TRAVERSE 10 – Island dune		
1	239		71.8	0.58	25.52			GYPSUM – off-white, f.g.		
	240		64.5	1.34	32.81			"		
	241		35.4	1.44	57.87			– brown at 2.2m, calcrete at 2.3		
								Eoh 2.3 END OF TRAVERSE 10		
								TRAVERSE 11		
1	242							GYPSUM – cream, off-white, f.g.		
	243							– off-white, coarse at 1.9m		
								Eoh 1.9m		
								20m from lake		
2	244							GYPSUM – off-white, f.g.		
	245							" coarse at 1.3m		
								Eoh 1.3m		
3	246							GYPSUM off-white, f.g.		
	247							coarse at 1.25m		
								Eoh 1.25m		
4	248							GYPSUM off-white, f.g.		
								Eoh 2.1m		
								into saltbush flat		
5	249							GYPSUM – pale brownish cream, off-white at depth		
	250							– off-white		
								Eoh 1.2m		

SAMPLE Nos: ....

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER: ....

DRILLED: 29/9/198

LOGGED: D. Conrad

Scale: 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
HAND AUGER

PROSPECT:

CO-ORDS:

LOCATION: 15 km south of Streaky Bay, S.A.

HOLE No: -

R.L. COLLAR: m

INCLINATION:

DIRECTION:

Hole	# (GEOCHEMISTRY)		Gyp	Salt		Depth m	LOG	DESCRIPTION	QTZ/WATER
6	251							GYPSUM - pale brown to 10cm then off-white	
								Eoh 1.1m	✓
7	252							GYPSUM - pale brown to 10cm then off-white	
	253							off-white, wet	✓
								Eoh 1.25m	
8	254							GYPSUM - brown, then off-white	
	255							- off-white & grey, wet	x
								Eoh 1.2m	
9	256							GYPSUM, brown then off-white/cream, f.g	
	257							off-white, f.g	
								Eoh 1.35	
10	258							GYPSUM - pale brown at surface to off-white	
	259							- off-white f.g wet at 1.3m	
								Eoh 1.4m	
11	260							GYPSUM - pale brown to 10cm then cream	
	261							- 1.25 - calcrete nodules	
								Eoh 1.25m	
								1.5m Dune ridge between samples	
12	262							GYPSUM - cream ~~to off-white~~ f.g	
								Eoh 0.3m calcrete.	
								END OF TRAVERSE 11	
								TRAVERSE 12 040°	
1	263		93.8 x	0.27	5.97			GYPSUM - off-white, f.g.	
	264		90.5 x	1.30	8.22			- white - off-white	
								Eoh 1.7	
			[illegible]	[illegible]				20m from lake.	
2	265		92.1 x	0.98	6.85			GYPSUM - brown to off-white at 0.5m	
	266		90.3 x	1.72	8.02			- off-white	
			[illegible]	[illegible]				Eoh 1.4m	
3	267	✓	91.8	2.17	6.03			GYPSUM - off-white to cream, f.g	
								brown near surface	
								Eoh 1.1m	

x adjusted

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

Scale. 1:500.

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: 29/9/1988

LOGGED: D. CONFEXT

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
- HAND AUGER

HOLE No: -

PROSPECT:

CO-ORDS:

R.L. COLLAR: m

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
4	268		91.7*	1.74	6.50			GYPSUM - off-white, f.g.		
								EOH 1.1m		wet at 1.0m
5	269		94.8*	1.00	4.18			GYPSUM - cream to off-white		
	270		90.5*	1.91	7.59			- off white		
								EOH 1.2m		
6	271		93.5*	1.72	4.77			GYPSUM - cream to off-white f.g.		
								EOH 1.1m		
7	272		92.9	2.04	5.19			GYPSUM cream to off-white, f.g.		
								EOH 1.1m		
8	273		92.6*	1.87	5.54			GYPSUM - off-white to cream, f.g.		
								EOH 1.1m		
9	274		93.3*	1.50	5.18			GYPSUM - off-white to cream, f.g.		
								EOH 1.0m		
10	275		92.5*	1.84	5.67			GYPSUM - cream to off-white f.g.		
								- EOH 1.2m		
								- outer dune at edge of lake		
11	276		95.5	0.37	4.08			GYPSUM - cream to off-white		
							c c	- calcrete at 1.1m not sampled		
12	277		93.4	1.99	4.60			GYPSUM brown to pale brown		
	278		94.9*	0.52	4.49		c c	cream to off-white		
							c	calcrete at 1.3m		
13	279		95.3*	1.14	3.57			GYPSUM - cream, f.g.		
	280		89.4*	0.54	10.01			- cream, f.g.		
							c c	- red-brown clay 2.1 - not sampled		
							c			

*adjusted

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: 29 / 9 / 1988

LOGGED: D. CONSET

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay SA

DIRECTION:

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
14	281		95.2*	0.51	4.23			GYPSUM - cream to off-white f.g.		
	282		93.4*	0.27	4.33			" " "		
	283		91.1*	0.60	8.22			" " " - clay at 2.3m		
								END OF TRAVERSE 12		
								TRAVERSE 13 - brg 045°		
1	284		88.9*	1.74	9.82			GYPSUM - off-white, f.g.		
								Eoh 0.9m - wet.		
								20m from lake shore.		
2	285		93.2*	0.56	6.20			GYPSUM - off-white f.g. dune gypsum		
	286		90.4*	1.53	7.52			- " , wet at 1.4m		
								Eoh 1.5m		
3	287		94.2*	0.32	5.43			GYPSUM - off-white f.g.		
	288		88.8*	2.47	8.67					
								Eoh 1.6m		
4	289		91.5*	2.42	6.04			GYPSUM - top 10cm pale brown then off-white		
								- grey at 1.0-1.1m (not sampled)		
								Eoh 1.1m		
5	290		91.8*	2.31	5.87			GYPSUM - top 5cm brown then off-white		
								1.1m grey, wet		
								Eoh 1.1m		
6	291		94.6*	1.28	4.18			GYPSUM - off-white f.g.		
								Eoh 1.1m - wet, grey layer		
7	292		94.0*	1.14	4.84			GYPSUM - off-white, f.g.		
								- off-white, wet at 1.2m		
								Eoh 1.3m		
8	293		95.8*	0.75	3.41			GYPSUM - off-white - to cream f.g.		
	294		95.1*	1.10	3.77			- off-white,		
	295		87.5*	1.34	10.97			- calcrete at 2.4m		
								Eoh 2.4		
9	296		95.1*	0.58	4.32			GYPSUM - off-white, f.g.		
	297		94.7*	1.14	4.17			- off-white,		
	298		95.4*	0.54	4.07			- "		
								Eoh 3.0m - brown ? soil		
								END OF TRAVERSE 13.		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. Comfort

Scale 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ%	WATER
							TRAVERSE 14. ISLAND		
1 299		87.0*	2.13	17.83			GYPSUM - brown to 10cm then off-white		
							Eoh 0.9m		
							20m from lake edge		
2 300		87.0*	1.87	11.04			GYPSUM - brown then off-white		
							EOH 1.0m - wet		
3 301		86.3*	2.95	10.65			GYPSUM - brown to 10cm then off-white		
							EOH 1.0m wet sample.		
4 302		79.6	1.08	20.98			GYPSUM - off-white to cream, f.g.		
303		79.6	2.55	19.29			" "		
							Eoh 1.6m		
							END OF TRAVERSE 14.		
							TRAVERSE 15 - brg 035°		
1 304		40.7*	1.00	8.28			GYPSUM - pale brown to cream		
							Eoh 1.0m		
2 305		95.4*	0.26	4.34			GYPSUM - cream to off-white.		
306		94.4*	0.75	4.88			- " " grey Eat 1.9m		
							Eoh 2.0m		
3 307		97.9*	0.01	2.08			GYPSUM - off-white to cream.		
308		91.2*	0.10	2.70			- " " "		
309		97.4*	0.31	2.18			- " " "		
310		95.9*	0.15	3.91			- " " "		
311		91.5*	0.44	7.97			- Eoh 4.6m		
							END OF TRAVERSE 15		
							TRAVERSE 16 - samphire flat.		
							brg 333°.		
1 312		92.3*	2.67	4.96			GYPSUM - pale brown, f.g. -> cream		
							- rusty layer 0.7		
							Eoh 0.8m		
2 313		92.3*	2.35	5.33			GYPSUM - pale brown to 10cm then off-white		
							Eoh 1.0m		

*adjusted

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONFREY

Scale. 1:500.

PROJECT: Streaky Bay — BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay S.A.

DIRECTION:

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ/	WATER
3	314		93.0 *	1.98	4.96			GYPSUM - pale brown to off-white Eoh 0.8m		
4	315		90.7 *	2.76	6.41			GYPSUM - cream to off-white, f.g. Eoh 1.0m - wet		
5	316		90.7 *	3.21	5.92			GYPSUM - cream to off-white, f.g. Eoh 0.9m - wet		
6	317		91.0 *	2.97	5.90			GYPSUM - cream to off-white, f.g. Eoh 1.0m		
7	318		94.4 *	1.14	4.36			GYPSUM - off-white, cream, f.g. Eoh 0.8		
8	319		89.8 *	2.17	7.89			GYPSUM off-white to cream Eoh 1.1m		
9	320		69.0	1.48	12.53			GYPSUM - off-white to cream, f.g. Eoh 0.8, clays from 0.7 130m to next sample		
10	321		93.7 *	1.99	4.06			GYPSUM cream, puggy Eoh 1.0m		
11	322		93.7	1.33	4.59			GYPSUM - cream, puggy to 0.5m Eoh 1.6m		
12	323		91.0 *	1.56	7.36			GYPSUM - cream to off-white - clayey soil at 0.9m EOH 1.0m		
								END OF TRAVERSE 16		

* adjusted

SAMPLE Nos:

Scale. 1:500.

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. Comfort

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD

HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
								TRAVERSE 17		
1	324		94.8 x	1.82	3.36			GYPSUM - pale brown to off white.		
								Eoh 0.9m		
2	325		94.8 x	1.38	3.92			GYPSUM - brown to 5cm then off-white		
	326		92.0 x	1.08	1.73			cream/off-white		
								Eoh 1.7m		
3	327		97.2 x	0.60	2.13			GYPSUM - cream off-white, f.g.		
	328		96.4 x	0.80	2.80			- off-white, f.g.		
								Eoh 2.0m		
4	329		95.1 x	0.68	4.16			GYPSUM - cream to off-white, f.g.		
	330		88.1 x	1.05	10.71			- Eoh 1.7m		
								END OF TRAVERSE 17		
								TRAVERSE 18.		
1	331		95.0 x	1.53	3.48			GYPSUM - off-white, f.g., brown at surface		
								Eoh 0.9m		
								20m from lake shore		
2	332		94.5 x	1.89	3.56			GYPSUM - cream to off white, f.g.		
								Eoh 1.0m		
3	333		96.3 x	1.09	2.59			GYPSUM - cream to off-white f.g.		
								Eoh 1.0m		
4	334		96.7 x	0.17	3.08			GYPSUM - off-white, f.g.		
	335		97.2 x	0.62	2.17			- brown (soil) at 1.5m		
								Eoh 1.5m		
5	336		96.5 x	0.43	3.09			GYPSUM - off-white, f.g.		
	337		96.0 x	0.69	3.34			" "		
	338		97.2 x	1.29	1.46			- puggy, cream col. damp.		
								Eoh 2.7m		
6	339		96.5 x	0.83	2.63			GYPSUM, cream to off white, f.g.		
	340		95.5 x	1.04	3.43			- off-white, damp, grey at 1.4m		
								Eoh 1.4m		
								END OF TRAVERSE 18		

x adjusted

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONFERT(?)

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD

HAND AUGER

HOLE No: -

PROSPECT: ....

R.L. COLLAR: .... m

CO-ORDS: ....

INCLINATION: ....

LOCATION: 15 km south of Streaky Bay SA

DIRECTION: ....

	GEOCHEMISTRY				Depth m	LOG	DESCRIPTION	QTZ/	WATER
							TRAVERSE 19		
1	341	99.1*	0.06	0.76			GYPSUM - off white, f.g		
	342	96.9*	1.05	1.95			" Eoh 1.4m		
2	343	99.7*	0.27	1.73			GYPSUM - off white, f.g.		
	344	98.0*	0.23	1.72			- " "		
	345	97.8*	0.40	1.76			- " " "		
	346	95.7*	1.26	2.96			C - brown, damp at 3.3m		
							Eoh 3.3m		
3	347	98.3*	0.22	1.40			GYPSUM - off white, f.g		
	348	97.4*	0.49	2.07			" "		
	349	92.7*	1.53	5.67			pale brown, grey Eoh 2.3m		
4	350	96.8*	0.43	2.68			GYPSUM - off white, f.g.		
	351	96.6*	0.49	2.84			" - wet at 1.7m		
							Eoh 1.7m		
							END OF TRAVERSE 19		
							TRAVERSE 20. 75m from dune end		
1	352	96.0*	1.10	2.83			GYPSUM off white f.g.		
							Eoh 0.98m		
							dune up 0.3m before next site		
							10m from dune edge.		
2	353	92.8*	1.79	5.31			GYPSUM - pale brown to off white f.g		
							Eoh 0.7		
							END OF TRAVERSE 20		
							TRAVERSE 21.		
1	354	87.7*	1.40	10.87			GYPSUM - off white, cream f.g		
							Eoh 0.9m		
2	355	95.7*	0.14	4.06			GYPSUM - cream, off white f.g		
	356	96.6*	0.08	3.31			- " " - puggy fine layer	1.5	
	357	96.7*	0.08	3.21			-		
	358	59.8	0.95	38.42			- cream, shell fragments, soil at 3.7m		
							Eoh 3.7m		
3	359	95.5*	0.04	4.26			GYPSUM - cream off white f.g.		
	360	98.4*	0.08	1.53			- off white, f.g.		
	361	96.5	0.13	2.31			- "		
	362	95.6	0.08	3.58			- " "		
	363	93.3	0.19	5.63			- " "		
						?	Hole abd. 5.0m - max depth		
							dune ends 10m -> down to		
							calcrete island		
							END OF TRAVERSE 21		

* adjusted

SAMPLE Nos: ....

Test gypsum quality and thickness in dune deposits

Scale. 1:500.

DRILL TYPE: Hand Auger

DRILLER: ....

DRILLED: / /198

LOGGED: D. Consta...

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
- HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY				Depth m	LOG	DESCRIPTION	QTZ / WATER
							TRAVERSE 22	
1	364	94.4	0.63	3.20			GYPSUM - cream, off-white, f.g. EoH, @ 1.0m	
2	365	96.5	0.14	1.84			GYPSUM - off-white, f.g.	
	366	96.7 *	0.52	2.71			- " " brown at 2.0m EoH 2.0m	
							END OF TRAVERSE 22	
							TRAVERSE 23	
1	367	95.6 *	1.06	1.48			GYPSUM - off-white, f.g. EoH - 0.8m - brown soil 20m from lake	
							END OF TRAVERSE - CALCRETE	
							brg 155°. TRAVERSE 24 - ISLAND	
1	368	98.3	0.25	1.24			GYPSUM - off-white f.g. brown at surface	
	369	97.8	0.56	1.26			- cream, pale brown (white) EoH 1.9m	
2	370	97.8	0.44	0.92			GYPSUM - cream, off-white, f.g.	
	371	97.9 *	0.57	1.49			- " " EoH 2.0m wet gypsum	
							88m to next site	
3	372	84.7	1.68	12.32			GYPSUM - pale brown (near surface) - EoH 0.6m - calcrete/limestone	
							END OF TRAVERSE 24	
							TRAVERSE 25 (3.65m)	
1	373	95.9 *	1.07	2.94			GYPSUM - pale brown, f.g. -> to off-white wet at 0.9m - EoH	
2	374	94.3 *	1.79	3.82			GYPSUM - pale brown, f.g. -> off-white EoH 0.9m	
3	375	97.1 *	1.10	1.67			GYPSUM - pale brown to off-white, f.g.	
	376	94.6 *	0.70	4.63			- cream, off-white EoH 1.85 - rock base	
							END OF TRAVERSE 25	
							TRAVERSE 26	
1	377	96.7 *	0.60	2.65			GYPSUM - off-white, f.g. pale brown - part EoH 1.0m - wet sample	
							20m from lake edge	

* adjusted

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits.

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. Comfort

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT: ...

R.L. COLLAR: ... m

CO-ORDS: ...

INCLINATION: ...

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION: ...

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
2	378		95.0 x	1.44	3.52			GYPSUM - pale brown to off-white. Eoh 0.9m - wet sample		
3	379		97.3 x	0.56	1.75			GYPSUM - pale brown to off-white		
	380		94.0 x	1.60	4.27			- off-white, wet at 1.2m Eoh 1.2m		
4	381		97.0	0.81	2.10			GYPSUM - pale brown to off-white f.g.		
	382		93.1 x	2.05	4.78			- off-white, f.g. Eoh 1.2m		
5	383		98.7 x	0.60	0.55			GYPSUM - pale brown to off-white, f.g. Eoh 0.9m		
6	384		86.6	2.22	1.31			GYPSUM - pale brown, f.g. → off-white Eoh 0.95		
7	385		96.7 x	2.13	1.08			GYPSUM - pale brown to off-white f.g. Eoh. 0.9m		
8	386		94.8 x	2.36	2.74			GYPSUM - cream to off-white, f.g. Eoh 0.6m - wet sample		
9	387		88.5	2.45	6.76			GYPSUM - cream to off-white, f.g. Eoh 0.65m		
10	388		88.4	2.74	6.40			GYPSUM - pale brown to off-white, f.g. Eoh 0.83		
11	389		90.0	2.63	6.15			GYPSUM - pale brown to off-white, f.g. Eoh 0.7		
12	390		91.7	2.72	4.18			GYPSUM - pale brown to off-white, f.g. Eoh 0.7m		
13	391		94.2	1.92	3.68			GYPSUM - pale brown to off-white Eoh 0.7		
14	392		89.9	2.70	5.46			GYPSUM pale brown to off-white Eoh 0.9		
15	393		95.8	1.92	2.17			GYPSUM - pale brown to off-white, f.g.		
	394		84.0	3.54	10.45			- off-white, f.g. wet at 1.2m Eoh 1.2		
								~~GYPSUM~~ Dune rises ~1m then limestone at 15.		

x adjusted

SAMPLE Nos: ...

Test gypsum quality and thickness in dune deposits

Scale. 1:500.

DRILL TYPE: Hand Auger

DRILLER: ...

DRILLED: / /198

LOGGED: D. CONFRED

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD

- HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
								TRAVERSE 27		
1	395		95.7	0.54	2.68			GYPSUM - off-white to cream "floury"		
	396		93.4	1.18	4.24			" "		
								Eoh 1.9		
								10m to lake		
								10m to next sample		
2	397		93.5	1.11	3.71			GYPSUM - off-white, f.g. "floury"		
	398		91.5	0.57	7.00			- " "		
								Eoh 1.3m - 10m to rock outcrop		
								END OF TRAVERSE 27		
								TRAVERSE 28		
1	399		97.2	0.02	2.86			GYPSUM - off-white f.g.		
	400		97.9 *	-	2.07			- "		
	401		97.3	0.22	2.13			- "		
	402		98.8 *	0.17	1.79			- " soil at 4.5m		
	403		94.5	0.51	4.52			TRAVERSE 29 - end of dune - 20m		
1	404		96.9	0.34	2.81			GYPSUM - brown to 10cm, then off-white, f.g.		
	405		94.3	0.63	1.32			- off-white "floury"		
	406		97.1	0.68	1.82			- " , - brown clay 2.7m		
								Eoh 2.8. not sampled		
								TRAVERSE 30 - single high dune		
1	407		97.8	0.08	2.30			GYPSUM - off-white, f.g.		
	408		98.4	0.03	1.14			- " "		
	409		97.2	0.18	1.83			- " "		
	410		94.9	0.71	2.82			- " " , brown soil @ 3.9		
								Eoh 3.9m END OF TRAVERSE 30		
								~~GYPSUM~~		
								TRAVERSE 31 - single high dune		
1	411		97.4	0.06	1.41			GYPSUM - off-white f.g.		
	412		97.7	0.07	1.62			"		
	413		97.6 *	0.22	1.79			"		
	414		97.3 *	0.24	2.45			"		
	415		97.6	0.26	2.62			" - hole abd max depth		
								GYPSUM		
								LAKE TOORNA		
								TRAVERSE 32		
1	416							GYPSUM - off-white, f.g. calcrete at 0.3m		
								Eoh 0.3m.		
								20m from lake shore		
								200m along dune to TRAVERSE 33		
1	417							GYPSUM - pale brown		
								Eoh 0.4m ~~to~~ limestone base.		
								TRAVERSE 33		

* adjusted

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONFE[illegible]

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay S.A.

DIRECTION:

	GEOCHEMISTRY	Depth m	LOG	DESCRIPTION	QTZ %	WATER
				TRAVERSE 34		
1	418			GYPSUM pale brown to off white, f.g. Eoh 0.7m.		
2	419 420			GYPSUM - pale brown off white at depth - off-white to cream, wet at 1.4 Eoh 1.5m		
				END OF TRAVERSE 34		
				TRAVERSE 35 - FREEMANS PIT		
1	421 422			GYPSUM - off white f.g - " cream 13m from lake Eoh 1.5 - limestone		
				END OF TRAVERSE 35		
				TRAVERSE 36 - 100m NW of		
1	423 424			GYPSUM - off white f.g. pale brown in part - Eoh 1.5m - limestone		
				END OF TRAVERSE 36		
				TRAVERSE 37 - 100m from end of		
1	425			GYPSUM - off white, f.g. Eoh 1.0m 2m from lake shore		
2	426 427			GYPSUM - off white cream - cream to pale brown white at 1. Eoh 2.0m		
3	428 429			GYPSUM - off white, f.g. - off white, f.g. Eoh 1.8m		
				Samphire flat		
4	430			GYPSUM - off white white, wet at 0.6m Eoh 0.7m		
5	431			GYPSUM - off white white f.g. Eoh 0.8m		
6	432			GYPSUM - cream then white, wet at 0.6m Eoh 0.6m		
7	433			GYPSUM - off white, f.g. Eoh 0.7m		
8	434			GYPSUM - off white f.g. Rock at 0.9m Eoh 0.9m		
9	435			GYPSUM - cream "floury" & poggy at surface then white Eoh 1.0m		
10	436 437			GYPSUM - poggy cream then white - off white, f.g Eoh 1.8m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONFER

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay SA

DIRECTION:

	GEOCHEMISTRY	Depth m	LOG	DESCRIPTION	QTZ %	WATER
11	438			GYPSUM - puggy, cream to 0.5, then white		
				Eoh 1.0m		
				END OF TRAVERSE 37		
				TRAVERSE 38 - 200 m east of 37		
1	439			GYPSUM - pale brown to off-white		
				Eoh 0.6m		
2	440			GYPSUM - pale brown then off-white		
				Eoh 1.0m		
3	441			GYPSUM - cream to off-white f.g.		
	442			- off-white		
				- Eoh 2.0m		
4	443			GYPSUM - pale brown to off-white f.g.		
	444			- off-white		
	445			- off-white, white at 2.4m.		
				Eoh 2.6m		
5	446			GYPSUM - pale brown, f.g.		
				- Eoh 0.9 - rock.		
6	447			GYPSUM - cream to off-white f.g.		
	448			- off-white, white clay 1.8m		
				Eoh 1.9m rock 1.9m		
				Dune up 0.5m then to rock at 15m		
				TRAVERSE 39		
1	449			GYPSUM - pale brown to off-white f.g.		
				Eoh 0.8m - wet sample.		
				20m from lake edge		
2	450			GYPSUM - pale brown to off-white f.g.		
	451			- off-white f.g. Eoh 1.6m		
3	452			GYPSUM - top 10cm brown then off-white		
	453			- off-white wet at 1.4		
				Eoh 1.8m ? basement rock		
4	454			GYPSUM - off-white, f.g.		
	455			- "		
	456			" - rock at 2.7m		
				Dune ends 6m		
				TRAVERSE 40		
1	457			GYPSUM - brown to 0.2m then off-white		
				Eoh 0.7m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONSTANTINE

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, SA.

DIRECTION:

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
								TRAVERSE 40 (cont)		
2	458							GYPSUM - off-white, f.g.		
	459							"		
	460							"		
								Eoh 2.25 - rock		
3	461							GYPSUM - off-white f.g.		
	462							- "		
	463							- puggy cream soil at 2.3m		
								10m to end of dune		
								TRAVERSE 41		
1	464		96.7	-	2.93			GYPSUM - cream to off-white		
	465		95.6	0.11	4.24			"		
								Eoh 1.8m Rock		
2	466		95.9	-	4.06			GYPSUM - off-white to cream, f.g.		
	467		96.8	0.06	3.07			- off-white to white, dry		
	468		94.7	0.27	3.37			- " "		
	469		95.9	0.21	3.70			- " " "		
	470		98.8	-	1.19			- cream to off-white, clay at 4.9		
								Hole Abd - 5m max depth		
3	471		97.0	0.35	2.86			GYPSUM - cream to off-white		
	472		97.0	0.24	2.69			off-white f.g.		
								Eoh 1.7 - rock		
								TRAVERSE 42		
1	473							GYPSUM - cream f.g.		
	474							- off-white, wet at 1.7m		
								Eoh 1.9m		
2	475							GYPSUM - pale brown to 10cm, cream		
								- Eoh 0.8m		
								40m to next sample		
3	476							GYPSUM - cream, off-white from 0.6m		
								Eoh 1.0m		
								TRAVERSE 43 - shallow dune arc.		
1	477							GYPSUM - pale brown, cream, white at 0.9		
	478							- white, wet		
								Eoh 1.2m		
2	479							GYPSUM - cream to off-white - 0.5m - cemented		
								Eoh 1.0m		
								cemented		
3	480							GYPSUM - off-white to cream f.g. 1.0		
	481							- white, off-white		
								Eoh 1.3m		

SAMPLE Nos:

Scale. 1:500.

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. [illegible]

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY	Depth m	LOG	DESCRIPTION
				TRAVERSE 43
4	482			GYPSUM - cream, off-white
				Eoh 1.0m
5	483			GYPSUM - cream, off-white, f.g. Wet at 1.0m
				Eoh 1.0m
6	484			GYPSUM - off-white, f.g.
	485			" "
				Eoh 1.7m
7	486			GYPSUM - cream, off-white, f.g.
				Eoh 0.7m
8	487			GYPSUM - cream, white at 0.3
				Eoh 0.5m
9	488			GYPSUM - cream then white at 0.3
				Eoh 0.6m
10	489			GYPSUM - cream then white at 0.3m
				Eoh 1.0m
11	490			GYPSUM - cream then white, f.g damp
				Eoh 0.9m
12	491			GYPSUM - pale brown, to cream rock at 0.9
				Eoh 0.9m basement
13	492			GYPSUM - pale brown to 10cm, cream.
				Eoh 0.9m - rock.
14	493			GYPSUM - pale brown to off-white f.g.
	494			off-white rock at 1.25m
				Eoh 1.25m
				TRAVERSE 44
1	495			GYPSUM - pale brown (10cm), off-white
				Eoh 0.6m
2	496			GYPSUM - pale brown to 10cm, off-white
				Eoh 0.7m
3	497			GYPSUM - cream to off-white, f.g.
				Eoh 1.0m
4	498			GYPSUM - cream to off white, f.g.
				Eoh 1.0m
5	499			GYPSUM - cream to off-white
				Eoh. 1.0m
6	500			GYPSUM - cream f.g.
	501			- off-white
				Eoh 1.2m
7	502			GYPSUM - off-white, f.g.
	503			- "
				Eoh 2.0m
				END OF TRAVERSE 44.

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONSTANTINE

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT: ....

R.L. COLLAR: .... m

CO-ORDS: ....

INCLINATION: ....

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION: ....

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
								TRAVERSE 45 - ISLAND		
1	S04							GYPSUM - off-white, f.g		
	S05							- off-white, - rock at 1.5m		
								Eoh 1.5m		
2	S06							GYPSUM - off-white, rock at 0.5m		
								Eoh 0.5m		
								END OF TRAVERSE 45		
								TRAVERSE 46		
1	S07							GYPSUM - off-white, f.g - brown, damp at 1.0m		
								Eoh 1.0m		
2	S08							GYPSUM - off-white, f.g		
	S09							- " - brown, wet at 1.5		
								Eoh 1.6m		
3	S10							GYPSUM - off-white, f.g, pale brown to 5cm		
	S11							- white, off-white, wet at 1.5m		
								Eoh 1.5m		
4	S12							GYPSUM - off-white, f.g		
	S13							" rock at 1.8m		
								Eoh 1.8m		
5	S14							GYPSUM - white, off-white		
								- Eoh 1.0 - rock		
1	S15							TRAVERSE 47		
	~~S15~~							GYPSUM - off white, white (damp) at 0.8		
								Eoh 0.8m		
2	S16							GYPSUM - off-white, f.g		
	S17							"		
	S18							- pale brown, white at 2.2m, wet		
								Eoh 2.3m		
3	S19							GYPSUM - off-white, f.g		
	S20							- "		
	S21							- " white, wet at 2.3m		
								Eoh 2.5m		
4	S22							GYPSUM - ~~off-white~~, f.g, pale brown, puggy		
	S23							- pale brown, puggy, cream at 1.6		
	S24							- cream, f.g.		
	S25							- " - clayey layer 3.4m		
								Eoh 3.6m rock		
5	S26							GYPSUM - pale brown, puggy (floury) f.g		
	S27							" , white at 1.5, wet		
								Eoh 1.7m		
6	S28							GYPSUM - pale brown, very fine puggy		
	S29							, cream, puggy, white & wet at 1.5m		
								Eoh 1.8m		
7	S30							GYPSUM - cream to off-white dry		
	S31							- off-white, f.g, white at 1.5m		
								Eoh 1.7m		
8	S32							GYPSUM - off-white, f.g		
	S33							- off-white, f.g, white & wet 1.3m		
								Eoh 1.5		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits.

Scale. 1:500.

DRILL TYPE: Hand Auger

DRILLER: ....

DRILLED: 6/10/1988

LOGGED: D. Comstock

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY				Depth m	LOG	DESCRIPTION	QTZ %	WATER
							TRAVERSE 47 cont.		
9	S34						GYPSUM - off-white f.g, white & wet at 0.7		
							Eoh 0.8m		
							TRAVERSE 48.		
1	S35	96.7	0.14	2.39			GYPSUM - off-white f.g, brown at 0.9m		
							Eoh 1.0 - 20m from edge		
2	S36	96.8	0.03	2.95			GYPSUM - off white		
	S37	97.1	0.06	2.14			- " "		
	S38	96.3	0.54	3.37			- " 2.3m brown layer, then white		
							Eoh 2.5m		
3	S39	97.6	0.02	2.09			GYPSUM - off-white, f.g.		
	S40	95.6	0.10	4.22			- " "		
	S41	95.0	0.68	4.01			- off-white, cream, f.g.		
	S42	95.7	0.42	2.86			- " "		
	S43	96.5	0.80	2.68			- " white, wet at 4.3m		
							Eoh 4.3m		
							TRAVERSE 49 - narrow dune		
1	S44						GYPSUM - off-white, f.g.		
	S45						"		
	S46						- pale brown, brown at 2.2m		
							Eoh 2.3m		
							TRAVERSE 50 - at track		
1	S47						GYPSUM - off-white, f.g.		
	S48						- brown, then white (wet)		
							Eoh 1.3m		
2	S49						GYPSUM - off-white, f.g.		
	S50						- " " f.g.		
	S51						- 2.9 - white, damp, (lake)		
							Eoh 3.0m		
							TRAVERSE 51 - Dune width 40m		
1	S52						GYPSUM - off-white, f.g.		
	S53						"		
	S54						- pale brown, white at 2.9m, wet		
							Eoh 3.0m		
							TRAVERSE 52		
1	S55						GYPSUM - off-white		
	S56						- pale brown, off-white, wet at 1.7		
							Eoh 1.7m		
2	S57						GYPSUM - cream to off white		
	S58						" " wet 1.5-1.7		
							Eoh 1.9m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONSTAD

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT: ....

R.L. COLLAR: .... m

CO-ORDS: ....

INCLINATION: ....

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION: ....

Hole	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
								TRAVERSE S3 - END OF DUNG 100m to		
1	S59							GYPSUM - off-white, wet & white at 0.8		
								Eoh 0.9m		
2	S60							GYPSUM - off-white, wet & white at 0.9m		
								Eoh 1.0m		
								TRAVERSE S4 - not pegged		
1	S61							GYPSUM - off-white, f.g. - floury		
	S62							- " "		
	S63							- cream, rock at 2.5m		
								Eoh 2.5m		
								TRAVERSE S5		
1	S64							GYPSUM - off-white, f.g. - floury		
	S65							- " "		
	S66							- cream, f.g. 1-2mm xtals.		
								Eoh 2.8m - rock		
2	S67							GYPSUM - off-white, f.g., cream		
								rock 1.0m		
								TRAVERSE S6		
1	S68							GYPSUM - brown, poggy f.g. - abundant organic mat		
								Eoh 1.0m - white wet		
2	S69							GYPSUM - off-white, f.g. cream		
	S70							- cream, white at 1.4m		
								Eoh 1.4m		
3	S71							GYPSUM - off-white, cream, f.g.		
	S72							" "		
								Eoh 1.9m		
								TRAVERSE S7		
1	S73							GYPSUM - off-white, f.g.		
	S74							- cream, f.g. brown soil at 1.8m		
								Eoh 1.8m		
								TRAVERSE S8		
1	S75							GYPSUM, cream to off-white		
	S76							"		
	S77							" rock at 2.2m		
								Eoh 2.2m		
								TRAVERSE S9		
1	S78							GYPSUM - off-white, f.g.		
	S79							"		
	S80							" rock 2.5m		
								Eoh 2.5m		

SAMPLE Nos: ....

Test gypsum quality and thickness in dune deposits.

DRILL TYPE: Hand Auger

DRILLER: ....

DRILLED: / /198

LOGGED: D. Conor [illegible]

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD

HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY	Depth m	LOG	DESCRIPTION	QTZ %	WATER
				TRAVERSE 60		
1	581			GYPSUM - off-white, f.g.		
	582			- off-white, cream, f.g.		
	583			" " , damp at 2.7		
				Eoh 3.0m		
2	584			GYPSUM - off-white, cream f.g.		
	585			" "		
	586			" "		
	587			" "		
	588			" "		
				Eoh 5.0m - maximum depth		
				TRAVERSE 61		
1	589			GYPSUM - pale brown, f.g.		
				Eoh 0.9m rock		
				TRAVERSE 62 - concave dune		
1	590			GYPSUM - pale brown, cream, puggy		
	591			" " "		
				Eoh 1.6m		
				TRAVERSE 63		
1	592			GYPSUM - pale brown to off-white		
				Eoh 1.2 rock		
2	593			GYPSUM - off-white		
	594			"		
	595			" wet, white at 2.6m		
				Eoh 2.8m		
				TRAVERSE 64		
1	596			GYPSUM - pale brown to off-white f.g.		
	597			- pale brown, soil at 1.4		
				Eoh 1.5m		
				TRAVERSE 65		
1	598			GYPSUM - off-white f.g. - puggy layers		
	599			- " , soil 1.5m		
				Eoh 1.5m		
				TRAVERSE 66		
1	600			GYPSUM - off-white, cream f.g. brown in pl		
	601			- pale brown to off-white		
	602			- off-white, cream f.g. sand		
	603			- " grey clay at 3.3m		
				Eoh 3.5m - rock (not sampled)		
				TRAVERSE 67		
1	604			GYPSUM - off-white, f.g.		
	605			- rock at 1.3m		
				Eoh 1.3m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONSTANTINE

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
HAND AUGER

HOLE No: -

PROSPECT: ....

R.L. COLLAR: .... m

CO-ORDS: ....

INCLINATION: ....

LOCATION: 15 km south of Streaky Bay S.A.

DIRECTION: ....

	GEOCHEMISTRY	Depth m	LOG	DESCRIPTION	QTZ	WATER
				TRAVERSE 68		
1	606			GYPSUM - off-white, f.g.		
	607			- " , cream,		
	608			- " " , rock 2.3m		
				Eoh 2.3m		
				TRAVERSE 69		
1	609			GYPSUM - off-white, rock at 0.9m		
				Eoh 0.9m		
				TRAVERSE 70		
1	610			GYPSUM - off-white, f.g. floury		
	611			- brown, off-white rock at 1.6m		
				Eoh 1.6m		
				TRAVERSE 71		
1	612			GYPSUM - off-white, f.g. floury		
	613			- off-white to cream, wet at 1.3m		
				Eoh 1.4m		
				TRAVERSE 72		
1	614			GYPSUM - off-white f.g.		
	615			- " f.g.		
	616			- off-white, cream, f.g.		
	617			" " " wet layers		
	618			- white, cream, wet at 4.3m		
				Eoh 4.3m		
				TRAVERSE 73		
1	619			GYPSUM - off-white, cream f.g.		
	620			" rock 1.5m		
				Eoh 1.5m		
				TRAVERSE 74 - LAKE PURDILLA		
1	621			GYPSUM - off-white, wet at 0.7m		
				Eoh 0.7		
2	622			GYPSUM - off white f.g.		
				Eoh 0.8m		
3	623			GYPSUM - pale brown to white wet at 0.3		
				EOH 0.4m		
4	624			GYPSUM - brown to off-white wet at 0.6		
				Eoh 0.6m		
5	625			GYPSUM - pale brown to off-white, f.g.		
				Eoh - 0.8m		
6	626			GYPSUM - off-white, f.g.		
	627			- white, wet at 1.3m		
				Eoh 1.4		
7	628			GYPSUM - off-white, f.g.		
	629			-		
	630			- off-white, wet at 2.9m		
				Eoh 2.9m		

SAMPLE Nos:

Scale. 1:500.

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER: COMPSTON

DRILLED: 8/10/1988

LOGGED: D. COMPSTON

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD

HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, SA

DIRECTION:

Hole	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
								TRAVERSE 74 (cont)		
8	631							GYPSUM - off-white, f.g.		
	632							- "		
	633							- damp at 2.5m		
9	634							GYPSUM - off-white, f.g.		
	635							"		
	636							" - wet at 2.9m		
								Eoh 2.5m		
10	637							GYPSUM - off-white, pale brown, floury, puggy		
	638							- cream, - sandy		
	639							- off-white, cream "		
								Eoh 2.4m		
11	640							GYPSUM - cream, off-white		
	641							- cream, wet at 1.7m		
								Eoh 1.7m		
								TRAVERSE 75		
1	642							GYPSUM - cream, off-white, wet at 0.9m		
								Eoh 1.0m		
2	643							GYPSUM - off-white, f.g. sand.		
	644							- " , wet at 1.5m		
								Eoh 1.5m		
3	645							GYPSUM - pale brown, to 15cm, off-white		
								Eoh 1.0m		
4	646							GYPSUM - off-white, f.g. sandy		
	647							- off-white, damp at 1.6		
								Eoh 1.7m		
5	648							GYPSUM, pale brown at surface, off-white		
	649							- off-white, white, wet at 1.7m		
								Eoh 1.8m		
6	650							GYPSUM - off-white, f.g.		
	651							- " , white & wet at 1.4		
								Eoh 1.5m		
7	652							GYPSUM - cream, off-white		
	653							- off-white, wet at 1.6m		
								Eoh 1.7m		
8	654							GYPSUM - cream, off-white, f.g.		
	655							- off-white, white		
								Eoh 1.2m		
								TRAVERSE 76		
1	656							GYPSUM - cream, off-white, f.g.		
								Eoh 0.7m		
2	657							GYPSUM - cream, off-white, f.g.		
								Eoh 0.8m		
3	658							GYPSUM - pale brown to 10cm, cream, off-white		
	659							- off-white, f.g., wet at 1.2m		
								Eoh 1.2m		
4	660							GYPSUM - cream, off-white, f.g.		
	661							- off-white, rust layer at 1.2m		
								Eoh 1.2m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: P. Comfort

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

Hole	GEOCHEMISTRY (Sample)					Depth m	LOG	DESCRIPTION	QTZ %	WATER
5	662							GYPSUM - cream, off-white, f.g.		
	663							- " Eoh 1.2m		
								Eoh 1.2m.		
6	664							GYPSUM - off-white f.g.		
	665							- white, Eoh 1.2m		
								Eoh 1.2m		
7	666							GYPSUM - pale brown, poggy, white at 0.3m		
								Eoh 0.3m - small gully		
8	667							GYPSUM - cream, off-white f.g.		
	668							- " , soil at 1.7m (not samp)		
								Eoh 1.7m		
								TRAVERSE 77		
1	669							GYPSUM - off-white, f.g.		
	670							- " , f.g.		
								Eoh 2.0m		
2	671							GYPSUM - off-white, cream f.g.		
	672							- " " , rust layer 1.7m		
								Eoh 1.7m		
3	673							GYPSUM - pale brown to 15cm, off-white		
								- Eoh 1.8m		
4	674							GYPSUM - off-white, cream, f.g.		
								Eoh ~~0~~0.9m rust layer		
5	675							GYPSUM - pale brown to 20cm, cream, off-white		
	676							- off-white, grey (wet) at 1.2m		
								Eoh 1.3m		
6	677							GYPSUM - pale brown, off-white		
	678							- cream, clay rich soil at 1.7m		
								Eoh 1.8m		
								TRAVERSE 78		
1	679							GYPSUM - off-white, f.g.		
	680							- off-white, cream, f.g.		
								Eoh 2.0m		
2	681							GYPSUM - off-white, f.g.		
	682							- "		
	683							- "		
	684							- "		
	685							- " rock at 4.2m		
								Eoh 4.2m		
								TRAVERSE 79		
1	686							GYPSUM - pale brown, off-white f.g.		
								Eoh 0.5m		
2	687							GYPSUM - pale brown, off-white f.g.		
								Eoh 0.5m		
3	688							GYPSUM - off-white, f.g., wet at 0.95m		
								Eoh 1.0m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: P. Conor...

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
- HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
								TRAVERSE 79 (cont)		
4	689							GYPSUM - off-white, f.g.		
	690							"		
	691							" white, wet at 2.2m		
								Eoh 2.2m		
5	692							GYPSUM - brown to 10cm, off-white f.g.		
	693							- off-white, f.g.		
								Eoh 1.8m		
6	694							GYPSUM - brown to 10cm, then cream.		
	695							- cream, off-white wet at 1.8		
								Eoh 2.0m		
7	696							GYPSUM - pale brown, f.g. - damp to 1.5m		
	697							" puggy		
								Eoh 1.7m kopi layer 1.7m then white		
8	698							GYPSUM - cream, off-white, f.g.		
	699							- " "		
	700							-		
							r	Eoh 2.7m Rock		
9	701							GYPSUM - off-white, f.g.		
	702							"		
	703							" soil at 2.7m (not sampled)		
								Eoh 2.7m		
								TRAVERSE 80.		
1	704		93.4	1.11	5.35			GYPSUM - pale brown to 15cm, off-white		
								Eoh 0.8m		
2	705		97.0	0.36	2.16			GYPSUM - pale brown to 10cm, off-white		
								Eoh 0.8m		
3	706		97.8	0.32	2.21			GYPSUM - off-white f.g.		
	707		98.1	0.40	1.46			- " , white, wet at 1.6m		
								Eoh 1.7m		
4	708		96.7	0.92	2.35			GYPSUM cream to off-white, f.g.		
	709		97.3	0.29	2.37			off-white		
	710		97.6	0.76	1.57			" wet at 2.4m		
								Eoh 2.4m		
5	711		94.9	1.21	3.78			GYPSUM - pale brown to 15cm, off-white, f.g.		
	712		95.2	1.02	3.69			- off-white, f.g. wet at 1.6m		
								Eoh 1.7m		
6	713.		97.7	0.19	2.04			GYPSUM - off-white, f.g.		
	714		97.4	0.94	1.55			- off-white, wet at 1.7m		
								Eoh 1.9m - 28m to next site		
7	715		98.3	0.22	1.25			GYPSUM - off-white, f.g.		
	716		97.3	0.17	2.44			" "		
	717		99.1	0.19	0.04			" "		
	718							- clay, wet at 4.3m		
	719							Eoh 4.3m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. [illegible]

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD

HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay SA

DIRECTION:

	GEOCHEMISTRY	Depth m	LOG	DESCRIPTION	QTZ	WATER
				TRAVERSE 81		
1	720			GYPSUM - off-white f.g. sand		
	721			- off-white, wet at 1.5m		
				Eoh 1.6m		
2	722			GYPSUM - off-white f.g. sand.		
	723			" - wet at 1.8m		
				Eoh 1.9m		
3	724			GYPSUM - pale brown to off-white, puggy to [illegible]		
	725			- off-white, wet at 1.7m		
				Eoh 1.7m		
4	726			GYPSUM - brown to 10cm off-white f.g.		
	727			- off-white, wet at 1.3m		
				Eoh 1.3m		
5	728			GYPSUM - pale brown, puggy to 15cm, off-white		
				Eoh 1.0m - rusty layer at 0.9m		
6	729			GYPSUM - off-white, f.g. sand		
	730			- off-white, rusty at 1.3m		
				Eoh 1.4m		
7	731			GYPSUM - puggy, brown to 0.6, pale brown		
				Eoh 0.9m		
8	732			GYPSUM - pale brown, sandy, f.g.		
	733			- pale brown, wet at 1.3m		
				Eoh 1.3m		
9	734			GYPSUM - cream, off-white, rusty layer 0.7		
				Eoh 0.9m		
				END OF TRAVERSE		
				TRAVERSE 82		
1	735			GYPSUM - off-white, f.g. sand, wet at 0.8m		
				Eoh 0.8m		
2	736			GYPSUM - pale brown, f.g. off-white at 0.5m		
				Eoh 0.8m		
3	737			GYPSUM, - off-white, f.g. - rusty at 0.8m		
				Eoh 0.8m		
4	738			GYPSUM - cream, off-white f.g.		
				Eoh 0.9m - rusty layer		
5	739			GYPSUM - off-white f.g.		
	740			- soil 1.8m - not sampled		
		*		Eoh 1.8m * 45m to next sample		
6	741			GYPSUM - off-white, f.g. rock 0.9m		
				Eoh 0.9m		
7	742			GYPSUM - cream, f.g. sand		
	743			- cream, f.g. soil at 1.6m		
				Eoh 1.6m		
				END OF TRAVERSE		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: 11 / 10 / 1988

LOGGED: D. [illegible]

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD - HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

GEOCHEMISTRY	Depth m	LOG	DESCRIPTION
			TRAVERSE 83
1 744			GYPSUM - off-white, f.g.
			Eoh 0.9m
2 745			GYPSUM - brown to 10cm, off-white, cream
746			- off-white, cream, f.g.
			EOH 1.3m
3 747			GYPSUM - brown to 20cm pale brown, off-white
748			- off-white, rusty layer at 1.3m
			Eoh 1.3m
4 749			GYPSUM - brown to 10cm, cream & off-white
			Eoh 1.0m
5 750			GYPSUM - off-white f.g. cream
			- Eoh 1.0m - rusty layer
6 751			GYPSUM - off-white, sandy, f.g.
752			- cream, f.g. rust layer at 1.5m
			Eoh 1.5m
7 753			GYPSUM - brown to 10cm, cream,
754			- off-white, f.g. soil at 1.5m
			Eoh 1.5m
8 755			GYPSUM - cream, off-white, rusty at 0.95
			Eoh 1.0m
			TRAVERSE 84
1 756			GYPSUM - off-white f.g., cream
757			- off-white, damp
			Eoh 1.3m
2 758			GYPSUM - brown to 15cm, off-white & cream
			Eoh 1.0m white damp.
3 759			GYPSUM - cream off-white
			Eoh 0.8m
4 760			GYPSUM - cream to 15cm, off-white
			Eoh 0.8m
5 761			GYPSUM - cream to off-white, piggy
			Eoh 0.9m damp rust layer
6 762			GYPSUM cream f.g.
			Eoh 1.0m - white damp
			island - 10m along traverse
			TRAVERSE 85
1 763			GYPSUM - off-white, cream
764			- off-white, damp
			Eoh 1.3m
2 765			GYPSUM - pale brown, cream, piggy to 0.5m
766			- cream, off-white
			Eoh 1.4m
3 767			GYPSUM - cream to 20cm, off-white & damp
			Eoh 1.0m
4 768			GYPSUM - cream to 15cm, off-white, f.g.
			Eoh 0.9m

SAMPLE Nos:

Scale. 1:500.

Test gypsum quality and thickness in dune deposits.

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. Comfort

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD — HAND AUGER

HOLE No: -

PROSPECT: ....

R.L. COLLAR: .... m

CO-ORDS: ....

INCLINATION: ....

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION: ....

	GEOCHEMISTRY	Depth m	LOG	DESCRIPTION	QTZ	WATER
5	769			GYPSUM - cream off-white, f.g.		
				Eoh 0.9m		
6	770			GYPSUM - cream, off-white, f.g.		
				Eoh 1.0m - rust layer		
				TRAVERSE 86		
1	771			GYPSUM - off-white, f.g.		
				- Eoh 0.9m - white, wet		
2	772			GYPSUM - pale brown, cream, f.g.		
	773			- cream, off-white, f.g.		
	774			- off-white, white.		
				Eoh 2.3m		
3	775			GYPSUM - cream off-white, wet at 0.9m		
				Eoh 0.9m		
4	776			GYPSUM - pale brown to cream,		
				Eoh 0.9m		
				TRAVERSE 87		
1	777			GYPSUM - off-white, f.g. pog layer at 1.0m		
	778			- off-white		
				Eoh 1.7m		
2	779			GYPSUM - cream to brown (organic matter)		
	780			- cream, rock at 1.7m		
				Eoh 1.7m		
3	781			GYPSUM - cream off-white, f.g.		
	782			- off-white		
				Eoh 1.3m		
4	783			GYPSUM - cream, off-white		
				Eoh 0.9m		
				TRAVERSE 88.		
1	784			GYPSUM - pale brown, to cream f.g. sand		
	785			- cream, white at 1.4m		
				Eoh 1.6m		
2	786			GYPSUM - cream, off-white, f.g.		
	787			- " " , wet at 1.8m		
				Eoh 1.8m		
3	788			GYPSUM - pale brown to 15cm, cream, off-white		
	789			- off-white, f.g.; Rock at 1.5m		
				Eoh 1.5m		
				TRAVERSE 89		
1	790			GYPSUM - brown to 10cm, off-white		
	791			- off-white		
				Eoh 1.3m		
2	792			GYPSUM - pale brown (organic) to 0.5, off-white		
	793			- off-white,		
				Eoh 1.5m		

SAMPLE Nos: ....

Test gypsum quality and thickness in dune deposits.

DRILL TYPE: Hand Auger

DRILLER: ....

DRILLED: / /198

LOGGED: D. Conybeare

Scale. 1:500.

PROJECT: Streaky Bay — BAY GYPSUM PTY LTD — HOLE No: -

PROSPECT: — HAND AUGER — R.L. COLLAR: ... m

CO-ORDS: ... — INCLINATION: ...

LOCATION: 15 km south of Streaky Bay, S.A. — DIRECTION: ...

	GEOCHEMISTRY	Depth m	LOG	DESCRIPTION	QTZ %	WATER
3	794			GYPSUM - off-white cream, Eoh 0.9m		
4	795			GYPSUM, cream off-white Eoh 0.7m		
				TRAVERSE 90		
1	796			GYPSUM - off-white f.g		
	797			- cream, wet at 1.4m Eoh 1.4m		
2	798			GYPSUM - off-white f.g sand, minor brown		
	799			- cream, off-white Eoh 1.7m		
3	800			GYPSUM - off-white f.g		
	801			- off-white, kopi (5cm) at 1.3m Eoh 1.5m		
4	802			GYPSUM - cream, off-white f.g - Eoh 0.7m		
5	803			GYPSUM - cream, off-white f.g. - Eoh 0.8m		
6	804			GYPSUM - cream, off-white, f.g. Eoh 1.0m		
7	805			GYPSUM - cream off-white f.g. Eoh 0.8m		
8	806			GYPSUM - Cream f.g. Eoh 0.75		
9	807			GYPSUM - cream f.g. Eoh 0.8m		
10	808			GYPSUM - off-white f.g Eoh 1.0m		
				TRAVERSE 91		
1	809			GYPSUM - cream off-white - Eoh 1.0m		
2	810			GYPSUM - off-white, f.g to 3mm xtals		
	811			" " Eoh 1.4m		
3	812			GYPSUM - cream, off-white, f.g		
	813			" "		
	814			" " sal 2.7 - not sampled Eoh 2.8m		
				TRAVERSE 92		
1	815			GYPSUM - off-white, f.g.		
	816			- " f.g		
	817			- " clay at 2.7 Eoh 2.8m rock		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

Scale. 1:500.

DRILL TYPE: Hand Auger

DRILLER: ...

DRILLED: / /198

LOGGED: D. CONFEX[illegible]

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay, S.A.

DIRECTION:

GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
							TRAVERSE 93		
1 818							GYPSUM - off-white, f.g.		
819							"		
820							"		
821							" - soil/grit 3.6m		
							Eoh 3.6m		
2 822							GYPSUM - off-white, f.g.		
823							"		
824							-		
							- grit/clay at 2.3m		
							Eoh 2.3m		
							TRAVERSE 94		
1 825							GYPSUM - off-white, f.g.		
							Eoh 0.9m		
2 826							GYPSUM - brown to 10cm, cream, very fine (puggy)		
827							- off-white, calcrete at 2.3m		
							Eoh 2.3m		
3 828							GYPSUM - pale brown to cream, f.g. sand		
829							- cream, soil at 1.4m, not sampled		
							Eoh 1.3m		
							TRAVERSE 95		
1 830							GYPSUM - off-white, f.g., wet at 0.7m		
							Eoh 0.7m		
2 831							GYPSUM - brown to pale brown, f.g. - organic		
832							- cream, flaky in part, wet at 1.8m		
							Eoh 1.8m		
3 833							GYPSUM - off-white, f.g.		
834							- cream, off white, f.g.		
835							" ", wet at 2.9m		
							Eoh 3.0m		
							TRAVERSE 96		
1 836							GYPSUM - off-white, f.g., wet at 0.7m		
							Eoh 0.8m		
2 837							GYPSUM - pale brown (roots), off-white, f.g.		
							Eoh 0.9m (wet)		
3 838							GYPSUM - pale brown, off-white, f.g.)		
							Eoh 0.8m		
4 839							GYPSUM - cream, off-white, f.g.		
840							- off-white, white		
							Eoh 1.5m		
5 841							GYPSUM - cream, off-white, f.g.		
842							- off-white, wet at 1.5m		
							Eoh 1.5m		
6 843							GYPSUM - cream, f.g.		
							Eoh 1.0m		
7 844							GYPSUM - cream, pale brown, f.g.		
845							" ", wet at 1.5m		
							Eoh 1.5m		

SAMPLE Nos:

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. COMFORT

Scale. 1:500.

PROJECT: Streaky Bay

BAY GYPSUM PTY LTD
HAND AUGER

HOLE No: -

PROSPECT:

R.L. COLLAR: m

CO-ORDS:

INCLINATION:

LOCATION: 15 km south of Streaky Bay SA

DIRECTION:

	GEOCHEMISTRY					Depth m	LOG	DESCRIPTION	QTZ %	WATER
8	846							GYPSUM - off-white, floury, tree roots		
	847							- off-white, f.g.		
	848							- "		
	849							- "		
								Eoh 3.7m - wet, grey, coarse		
9	850							GYPSUM - off-white, f.g.		
	851							"		
	852							" - soggy at 2.5 - 2.7m		
	853							" - wet, grey at 3.7m		
								Eoh 3.7m		
								NORTHERN MOST LAKE -		
1	854							GYPSUM? - cream, soggy, v. f.g. - damp		
								Eoh 0.9m rock		

SAMPLE Nos:

Scale. 1:500.

Test gypsum quality and thickness in dune deposits

DRILL TYPE: Hand Auger

DRILLER:

DRILLED: / /198

LOGGED: D. CONSTANTINE

APPENDIX B

GEOLOGICAL LOGS

HAND AUGER DRILLHOLES, 1996

TRAVERSES 97 TO 118

HOLE	INTERVAL (metres)	LITHOLOGY	GYPSUM (%)	SALT (%)
TRAVERSE 97				
1 (West)	1-0.8	Light yellow to dark brown fine rounded lime sand	-	-
		END OF HOLE 0.80M ROCK		
2 (Crest)	0-1.0	Light brown-grey lime sand	-	-
	1.00-1.8	Ditto	-	-
		END OF HOLE 1.80m ROCK		
3 (East)	0-1.8	Light brown lime sand	-	-
		END OF HOLE 1.8m CALCRETE		
TRAVERSE 98				
1 (West)	0-1.3	Lime sand	-	-
		END OF HOLE 1.3m WATER TABLE		
2 (Crest)	0-2.5	Lime sand	-	-
		WATER TABLE 1.3m		
		END OF HOLE 2.5m		
3 (East)	0-2.0	Lime sand	-	-
		WATER TABLE 1.3m		
		END OF HOLE 2.0m		
4 (EastII)	0-1.0	Off white fine gypsum crystals, calcareous	52.91	1.58
	1-1.45	Cream lime sand	-	-
		WATER TABLE & ROCK 1.3m		
		END OF HOLE 1.45m		
TRAVERSE 99				
1 (WestI)	0-0.9	Lime sand	-	-
	0.9-2.0	Fine gypsum crystals in lime sand	41.45	0.72
	2.0-3.0	Mainly lime sand	-	-
		END OF HOLE 3.0m MUD & WATER TABLE		
2 (WestII)	0-1.0	Lime sand and gastropods	-	-
	1.0-2.0	Cream lime sand and fine gypsum crystals	35.02	0.78
	2.0-2.5	As above and lime sand	-	-
		END OF HOLE 2.5m		

ref: sbgy15

HOLE	INTERVAL (metres)	LITHOLOGY	GYPSUM (%)	SALT (%)
3 (Crest)	0-1.0	White gypsum crystals and lime sand	68.06	0.35
	1.0-2.0	White low grade gypsum	37.95	0.76
	2.0-3.0	As above	18.62	1.03
	3.0-3.6	White lime sand	-	-
		END OF HOLE 3.6m		
4 (EastI)	0-2.3	Lime sand	-	-
		END OF HOLE 2.3m ROCK & WATER TABLE		
5 (EastII)	0-1.4	Lime sand	-	-
		END OF HOLE 1.4m ROCK		
TRAVERSE 100				
1 (West)	0-0.9	Lime sand	-	-
		END OF HOLE 0.9m		
2 (Crest)	0-1.0	Lime sand and gypsum	58.37	0.39
	1.0-2.0	Ditto	30.36	0.84
	2.0-3.0	Lime sand	9.54	1.27
	3.0-4.0	Ditto	16.88	0.90
	4.0-4.5	Ditto	-	-
		END OF HOLE 4.5m		
3 (East)	0-1.0	Lime sand	-	-
		END OF HOLE 1.0m		
TRAVERSE 101				
1	0-1.0	Pale brown gypsite and white fine gypsum	95.4	0.07
	1.0-2.0	White to pale brown fine to medium gypsum	96.6	0.06
	2.0-3.0	White fine to medium gypsum with occasional very white thin gypsite layers	95.6	0.08
	3.0-4.0	as above	94.2	0.10
	4.0-5.0	as above	94.0	0.14
	5.0-6.0	as above	93.4	0.10
		END OF HOLE 6.0m STILL IN GYPSUM		

HOLE	INTERVAL (metres)	LITHOLOGY	GYPSUM (%)	SALT (%)
2 (West)	0-1.0	Off white fine to medium gypsum	96.1	0.07
	1.0-2.0	Whiter & slightly coarser	95.2	0.12
	2.0-3.0	as above	91.5	0.69
		END OF HOLE 2.45m GREY MUD		
TRAVERSE 102				
1	0-1.0	Pale brown to white fine gypsum with some gypsite	96.0	0.07
	1.0-2.0	Pale brown to white fine to medium gypsum	96.6	0.15
	2.0-3.0	as above	95.3	0.16
	3.0-4.0	Light brown 3.0-3.5m and white 3.5-4.0m with occasional gypsite layers	93.7	0.20
	4.0-5.0	as above	93.7	0.16
		END OF HOLE 5.0m STILL IN GYPSUM ESTIMATED TO 7.0m		
2 (West)	0-1.0	Light brown gypsite to 0.5m over white fine gypsum	95.1	0.82
	1.0-2.0	White fine to medium clean gypsum	96.3	0.19
	2.0-3.0	White to pale brown lower grade fine to medium gypsum	70.8	0.95
		END OF HOLE 3.0m WATER TABLE STILL IN GYPSUM		
TRAVERSE 103				
1	0-1.0	Gypsite over off white fine gypsum	97.3	0.19
	1.0-2.0	Pale brown to white fine to medium gypsum	96.8	0.27
	2.0-3.0	white	96.7	0.20
	3.0-4.0	Very pale brown	93.0	0.52
	4.0-4.40	Gypsum over brown gypseous clay at 4.35m		
		END OF HOLE 4.40m IN CALCRETE		
2 (NW)	0-1.0	Pale brown to white fine gypsum	96.8	0.20
	1.0-2.0	White fine to medium gypsum	97.1	0.14
	2.0-2.4	as above	83.2	0.99
		END OF HOLE 2.4m MUD & CALCRETE		

HOLE	INTERVAL (metres)	LITHOLOGY	GYPSUM (%)	SALT (%)
TRAVERSE 104				
1	0-1.0	Pale brown to white fine gypsum	97.7	0.16
	1.0-2.0	White fine to medium gypsum	98.8	0.14
	2.0-3.0	White finer, decayed vegetation 2.9-3.0m	98.3	0.12
	3.0-4.0	white fine gypsum with hard layers of white gypsite	98.9	0.16
	4.0-5.0	as above	98.8	0.14
	5.0-6.0	as above	99.2	0.13
	END OF HOLE 6.0m STILL IN GYPSUM ESTIMATED TO 7.5M			
2	0-1.0	Brown to white fine gypsum	98.5	0.12
	1.0-2.0	Off white to pale brown fine to medium gypsum with white gypsite layers	98.5	0.13
	2.0-3.0	Brownish	97.8	0.35
	3.0-4.0	Off white medium gypsum	96.2	0.44
	END OF HOLE 4.0m WATER TABLE & GRAVEL			
TRAVERSE 105				
1	0-1.0	Dark brown fine gypsum with vegetation	94.3	0.12
	1.0-2.0	Pale brown to white fine to medium gypsum	98.5	0.08
	2.0-3.0	as above	98.0	0.19
	3.0-4.0	Very pale brown fine to medium gypsum with white gypsite layers	98.6	0.07
	4.0-5.0	as above	98.9	0.14
	5.0-5.5	as above	98.4	0.26
	END OF HOLE 5.5m STILL IN GYPSUM ESTIMATED TO 8.5m			
TRAVERSE 106				
1	0-1.0	Brown fine gypsum	98.3	0.15
	1.0-2.0	Pale brown fine gypsum with minor white gypsite	97.7	0.21
	2.0-3.0	Darker with brown gypsite	97.0	0.92
	3.0-3.95	Paler with white gypsite	98.0	0.42
	END OF HOLE 3.95m CALCRETE			
2	0-1.0	Off white fine to medium gypsum	98.7	0.15
	1.0-2.0	as above with white gypsite	97.6	0.17
	2.0-2.6	as above slightly coarser	95.4	0.75
	END OF HOLE 2.6m MUD			

ref: sbgy15

HOLE	INTERVAL (metres)	LITHOLOGY	GYPSUM (%)	SALT (%)
TRAVERSE 107				
1	0-1.0	Very pale brown fine gypsum	97.8	0.51
	1.0-2.0	Whiter & coarser	97.7	0.30
	2.0-3.0	White	98.2	0.21
	3.0-4.0	Brownish with tree roots	97.8	0.45
	4.0-5.0	White	97.1	0.44
	5.0-5.4	Off white	95.3	0.70
		END OF HOLE 5.4m CALCRETE		
2	0-1.0	Off white gypsite to fine gypsum	98.0	0.58
	1.0-2.0	White fine to medium gypsum	98.1	0.18
	2.0-2.5	Coarser with yellow & grey gypsite	96.3	0.94
		END OF HOLE 2.5m MUD		
3	0-1.0	Off white gypsite to fine gypsum	97.8	0.44
	1.0-2.0	White fine to medium gypsum	98.1	0.36
	2.0-2.2	Yellowish medium gypsum		
		END OF HOLE 2.2m MUD		
4	0-1.0	Off white fine to coarse gypsum	97.0	0.50
	1.0-2.0	White fine gypsum and gypsite		
		END OF HOLE 1.2m WATERTABLE 1.1m		
TRAVERSE 108				
1	0-1.0	Off white fine gypsum with vegetation	88.2	0.79
	1.0-2.0	Off white fine gypsum with white gypsite	98.0	0.36
	2.0-2.9	as above	96.8	0.65
		END OF HOLE 2.9m MUD & CALCRETE		
2	0-1.0	Off white fine gypsum	97.2	0.79
	1.0-2.25	Off white fine to medium gypsum with white gypsite	96.5	0.95
		WATER TABLE 1.7m		
		END OF HOLE 2.25m CALCRETE		

ref: sbgy15

HOLE	INTERVAL (metres)	LITHOLOGY	GYPSUM (%)	SALT (%)
3 (W)	0-1.0	Off white to yellow fine to medium gypsum	94.5	1.04
	1.0-1.4	White gypsite to fine gypsum grey at base	92.5	1.63
		WATER TABLE 1.0m		
		END OF HOLE 1.4m ROCK		
TRAVERSE 109				
1	0-1.0	Off white fine to medium gypsum	96.9	0.24
	1.0-2.0	White fine to medium gypsum	96.6	0.21
	2.0-3.0	as above	97.7	0.41
	3.0-4.0	as above	97.9	0.20
	4.0-4.9	as above, grey mud at 4.9m	93.6	1.13
		WATER TABLE 4.4m		
		END OF HOLE 4.9m STILL IN WET GYPSUM		
2	0-1.0	Grey & white banded gypsite and fine gypsum	95.8	1.12
	1.0-2.0	as above	92.7	1.34
		WATER TABLE 1.5m		
		END OF HOLE 2.0m STILL IN GYPSUM		
TRAVERSE 110				
1	0-1.0	Off white gypsite to fine gypsum with vegetation	97.7	0.86
	1.0-2.0	Whiter	98.1	0.62
	2.0-3.0	White fine gypsum	97.3	0.47
	3.0-4.0	Yellowish medium gypsum	97.0	0.45
	4.0-4.5	Coarse with grey fine gypsum/gypsite at base	88.2	1.28
		WATER TABLE 4.0m		
		END OF HOLE 4.5m STILL IN GYPSUM		
2 (W)	0-1.0	Off white fine to medium gypsum	96.6	0.93
	1.0-1.7	as above with grey gypsum at base	97.4	0.73
		WATER TABLE 1.4m		
		END OF HOLE 1.7m IN WET GYPSUM		

HOLE	INTERVAL (metres)	LITHOLOGY	GYPSUM (%)	SALT (%)
TRAVERSE 111				
1	0-1.0	Off white gypsite	97.7	0.58
	1.0-2.0	White fine gypsum	97.9	0.37
	2.0-3.0	as above	97.5	0.29
	3.0-4.0	fine to medium	97.5	0.37
	4.0-4.4	as above	96.9	0.60
		WATER TABLE 4.3m		
		END OF HOLE 4.4m CALCRETE		
TRAVERSE 112				
1	0-1.0	Off white to grey gypsite to fine gypsum	99.0	0.31
	1.0-2.0	White fine gypsum, minor gypsite	98.2	0.31
	2.0-3.0	as above with grey gypsite	97.0	0.65
	3.0-4.0	Off white fine to medium gypsum	98.2	0.32
	4.0-5.0	Fine to coarse	98.5	0.23
	5.0-5.9	Fine to coarse with gypsite	98.0	0.57
		END OF HOLE 5.9m WATER TABLE & CALCRETE		
2 (W)	0-1.0	Banded grey & white gypsite over off white fine gypsum	97.7	0.65
	1.0-1.5	White to yellow fine gypsum	95.9	1.33
		WATER TABLE 0.8m		
		END OF HOLE 1.5m STILL IN WET GYPSUM		
TRAVERSE 113				
1	0-1.0	White to pale grey gypsite to fine gypsum	98.0	0.45
	1.0-2.0	White fine gypsum	98.6	0.33
	2.0-3.0	as above	97.8	0.42
	3.0-4.0	Slightly coarser	98.0	0.31
	4.0-5.1	as above	96.8	0.32
		END OF HOLE 5.1m CALCRETE		
2	0-1.0	Off white gypsite to fine gypsum	99.4	0.61
	1.0-2.0	White fine gypsum	98.1	0.18
	2.0-2.9	Coarser with grey gypseous clay at base	97.6	0.60
		WATER TABLE 2.45m		
		END OF HOLE 2.9m CALCRETE		

HOLE	INTERVAL (metres)	LITHOLOGY	GYPSUM (%)	SALT (%)
TRAVERSE 114				
1	0-1.0	Minor white gypsite over fine gypsum	98.3	0.16
	1.0-2.0	White fine gypsum	98.5	0.19
	2.0-3.0	Slightly coarser	98.0	0.17
	3.0-4.0	White medium gypsum	97.0	0.34
		END OF HOLE 4.0m MUD & CALCRETE		
2 (SW)	0-1.0	Minor gypsite over white fine to medium gypsum	98.2	0.44
	1.0-2.0	as above	98.0	0.64
	2.0-2.6	Banded grey gypseous mud	-	
		END OF HOLE 2.6m		
TRAVERSE 115				
1	0-1.0	Minor gypsite over white fine gypsum	98.4	0.68
	1.0-2.0	White fine gypsum	97.1	0.52
	2.0-2.4	as above		
	2.4-2.5	Grey gypseous mud	90.9	1.06
		WATER TABLE 2.2m		
		END OF HOLE 2.5m		
2 (SE)	0-1.0	Off white fine gypsum	97.6	1.04
	1.0-1.4	White fine to medium gypsum	95.5	0.93
		END OF HOLE 1.4m MUD		
TRAVERSE 116				
1	0-1.0	Pale grey gypsite to fine gypsum	97.3	0.45
	1.0-2.0	White fine gypsum	97.6	0.34
	2.0-2.9	as above, with minor white gypsite	98.3	0.44
		WATER TABLE 2.8m		
		END OF HOLE 2.9mn CALCRETE		
2 (SE)	0-1.0	Off white to white fine gypsum	97.3	0.52
	1.0-1.8	White, pale grey and yellow fine to medium gypsum	96.3	0.68
		WATER TABLE 1.6m		
		END OF HOLE 1.8m CALCRETE		

ref: sbgy15

HOLE	INTERVAL (metres)	LITHOLOGY	GYPSUM (%)	SALT (%)
TRAVERSE 117				
1	0-1.0	Off white gypsite to fine gypsum	97.4	1.14
	1.0-2.0	White fine to medium gypsum	97.1	0.29
	2.0-3.0	as above	95.9	0.32
	3.0-3.5	as above	94.8	0.34
	END OF HOLE 3.5m IN GYPSUM ESTIMATE TO 6.0m			
2 (SW)	0-1.0	white fine gypsum	95.1	0.47
	1.0-2.0	Slightly coarser	94.1	0.65
	2.0-2.7	White fine to medium gypsum	96.7	0.44
		WATER TABLE 2.4m		
		END OF HOLE 2.7m IN WET GYPSUM		
TRAVERSE 118				
1	0-1.0	Brown gypsite to white fine gypsum	95.1	0.98
	1.0-2.0	Pale brown to white fine to medium gypsum	93.5	0.73
	2.0-2.1	White gypsum		
		END OF HOLE 2.1m CALCRETE		

APPENDIX C

CHEMICAL ANALYSIS

Classic Comlabs Ltd Report 8AD 3304

CLASSIC COMLABS LTD
Analytical Laboratories (INC. IN W.A.)

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JOB NUMBER: 8AD3304

Your Reference:

Date Received: 13-OCT-1988 Turnaround 35 days
Date Relayed: 17-NOV-1988
Date Reported: 17-NOV-1988

Number of Samples: 100

Report Analyte Codes
N.A. - Not Analysed.
L.N.R. - Listed But Not Received.
I.S. - Insuffiicent Sample for Analysis.

Report Comprising: Cover Sheet
Pages 1 to 4

Comments:

Report Dist'n: Carbon Copies(CC),Electronic Media(EM),Magnetic Media(MM)

Type	Recipient	Location	Date	Copies

Approved Signature:

for

Harry Fishman
Managing Director.
CLASSIC COMLABS LTD
(Please address any enquiries to Mr. Trevor Francis)

This report relates specifically to the sample(s) tested in so far as that the sample(s) is truly representative of the sample source as supplied.

CLASSIC COMLABS LTD
Analytical Laboratories (INC. IN W.A.)

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Job: 8AD3304

ANALYTICAL REPORT

SAMPLE	Insol	Gypsum	NaCl	CaCO3
LPS 01	1.54	77.0	0.76	21.1
LPS 02	7.35	37.2	1.45	53.2
LPS 03	5.95	59.5	1.30	33.3
LPS 04	6.75	63.1	1.65	27.7
LPS 05	4.06	86.0	1.00	9.25
LPS 06	1.78	82.0	2.80	13.7
LPS 07	0.92	84.8	0.70	12.3
LPS 08	0.92	88.5	0.12	8.15
LPS 09	1.06	85.5	0.17	10.8
LPS 10	1.26	84.7	1.35	12.7
LPS 11	1.30	83.8	1.45	12.0
LPS 12	1.36	78.7	1.75	17.6
LPS 13	1.10	79.4	1.30	16.2
LPS 14	0.42	86.8	1.35	10.2
LPS 15	0.64	85.5	0.94	10.9
LPS 16	0.70	82.0	1.75	13.4
LPS 17	1.90	89.5	0.89	7.25
LPS 18	2.00	84.7	1.60	11.3
LPS 19	1.06	86.7	0.53	9.85
LPS 20	0.54	83.1	1.80	13.0
LPS 21	1.86	84.9	3.16	9.40
LPS 22	0.82	86.0	2.10	10.2
LPS 23	1.36	90.5	1.65	7.45
LPS 24	1.00	90.3	1.60	7.50
LPS 25	1.00	84.8	2.46	11.2
UNITS	%	%	%	%
SCHEME	GRAV1	GRAV2	SIE1	GRAV4

CLASSIC COMLABS LTD
Analytical Laboratories (INC. IN WA.)

Job: 8AD3304

ANALYTICAL REPORT

SAMPLE	Insol	Gypsum	NaCl	CaCO3
LPS 26	1.50	86.7	3.26	6.80
LPS 27	1.16	87.3	1.75	8.15
LPS 28	1.36	90.8	1.10	6.55
LPS 29	1.40	89.0	2.20	7.75
LPS 30	1.30	90.4	1.75	6.30
LPS 31	0.38	86.4	1.55	10.0
LPS 32	1.50	88.5	0.20	8.00
LPS 33	1.80	88.1	2.06	8.00
LPS 34	1.80	89.3	1.60	7.10
LPS 35	0.80	85.8	1.75	9.85
LPS 36	0.90	89.6	1.05	7.55
LPS 37	0.72	89.1	2.06	7.25
LPS 38	0.42	88.6	1.65	8.40
LPS 39	0.52	90.2	1.25	6.75
LPS 40	0.60	89.0	1.20	8.40
LPS 41	0.68	89.2	1.80	7.65
LPS 42	0.88	87.5	1.90	9.40
LPS 43	1.00	90.5	1.30	6.25
LPS 44	0.70	83.9	2.84	12.6
LPS 45	0.98	91.6	1.10	5.80
LPS 46	0.44	85.5	1.60	10.7
LPS 47	0.64	89.5	1.05	7.25
LPS 48	0.70	92.0	0.26	5.45
LPS 49	1.06	86.2	1.95	8.85
LPS 50	1.30	87.8	0.50	8.00
UNITS	%	%	%	%
SCHEME	GRAV1	GRAV2	SIE1	GRAV4

Job: 8AD3304

ANALYTICAL REPORT

SAMPLE	Insol	Gypsum	NaCl	CaCO3
LPS 051	0.22	89.6	0.58	9.20
LPS 052	1.38	78.6	0.55	18.3
LPS 053	0.92	83.3	1.66	13.5
LPS 054	0.94	29.2	0.48	69.2
LPS 055	2.34	74.5	1.73	21.7
LPS 056	1.86	78.1	1.92	16.8
LPS 057	0.14	92.8	0.46	6.30
LPS 058	0.18	94.5	0.52	4.94
LPS 059	1.62	79.0	0.89	17.5
LPS 060	0.22	92.4	0.46	4.88
LPS 061	0.46	88.9	1.63	6.75
LPS 062	0.12	93.0	0.68	4.00
LPS 063	0.22	92.9	0.51	4.22
LPS 064	0.20	95.2	0.61	3.28
LPS 065	0.22	93.9	0.60	5.15
LPS 066	0.70	93.2	3.98	5.65
LPS 067	0.28	92.1	2.24	5.60
LPS 068	0.28	88.0	0.89	11.4
LPS 069	0.26	87.2	0.02	12.1
LPS 070	0.94	84.6	0.49	11.0
LPS 071	0.18	85.4	0.35	11.2
LPS 072	0.22	85.1	1.31	10.4
LPS 073	0.16	84.8	0.85	12.0
LPS 074	0.22	83.9	0.45	13.1
LPS 075	0.12	87.5	0.74	9.15
UNITS	%	%	%	%
SCHEME	GRAV1	GRAV2	SIE1	GRAV4

Job: 8AD3304

ANALYTICAL REPORT

SAMPLE	Insol	Gypsum	NaCl	CaCO3
LPS 076	0.20	90.2	0.39	9.15
LPS 077	0.18	85.0	1.05	11.2
LPS 078	0.58	86.5	1.22	10.4
LPS 079	0.22	87.4	1.77	8.15
LPS 080	0.28	92.5	1.43	5.55
LPS 081	0.10	89.5	1.13	6.90
LPS 082	0.10	92.3	0.89	5.85
LPS 083	0.18	92.2	1.06	5.25
LPS 084	0.18	92.1	1.56	4.82
LPS 085	0.10	91.4	0.90	5.40
LPS 086	0.48	86.8	1.14	10.9
LPS 087	0.26	85.1	1.67	11.1
LPS 088	0.24	90.9	0.65	5.65
LPS 089	0.24	89.3	1.25	7.85
LPS 090	0.82	89.2	1.45	9.25
LPS 091	0.26	88.1	1.98	7.90
LPS 092	0.20	91.5	0.78	5.70
LPS 093	0.22	91.8	1.42	5.15
LPS 094	0.30	90.9	1.20	5.55
LPS 095	0.20	89.8	1.27	7.10
LPS 096	0.78	84.5	2.76	11.7
LPS 097	0.18	89.0	1.00	7.85
LPS 098	0.26	92.5	0.73	4.48
LPS 099	0.30	94.0	0.14	3.36
LPS 100	0.32	92.5	0.77	4.76
UNITS	%	%	%	%
SCHEME	GRAV1	GRAV2	SIE1	GRAV4

APPENDIX D

CHEMICAL ANALYSIS

ALS Reports	**ST14158**	**26/03/96**
	ST14801	**13/05/96**
	ST14842	**23/05/96**
	ST15354	**18/07/96**

[redacted]

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14158
SUB BATCH: 0
No. OF SAMPLES: 163
DATE RECEIVED: 27/02/96
DATE COMPLETED: 26/03/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
LPS. 263		96.60	5.86	0.11	0.16	0.11	0.01
LPS. 264		92.90	7.92	0.30	1.30	<0.01	0.01
LPS. 265		92.10	6.60	0.25	0.86	0.12	0.02
LPS. 266		92.40	7.71	0.31	1.66	0.06	0.01
LPS. 267		91.80	5.65	0.38	2.06	0.11	0.02
LPS. 268		94.20	6.18	0.32	1.68	0.06	0.02
LPS. 269		97.40	4.00	0.18	1.00	<0.01	0.02
LPS. 270		92.30	7.28	0.31	1.82	0.09	0.01
LPS. 271		95.40	4.47	0.30	1.67	0.05	0.02
LPS. 272		92.90	4.86	0.33	1.96	0.08	0.02
LPS. 273		94.60	5.21	0.33	1.76	0.11	0.02
LPS. 274		96.10	4.90	0.28	1.44	0.06	0.02
LPS. 275		94.50	5.31	0.36	1.75	0.09	0.02
LPS. 276		97.70	4.02	0.06	0.37	<0.01	0.02
LPS. 277		93.40	4.08	0.52	1.92	0.07	0.06
LPS. 278		97.10	4.35	0.14	0.52	<0.01	0.05
LPS. 279		97.20	3.35	0.22	1.14	<0.01	0.02
LPS. 280		91.00	9.77	0.24	0.54	<0.01	0.05
LPS. 281		97.60	4.14	0.09	0.49	0.02	0.03
LPS. 282		96.60	4.25	0.08	0.27	<0.01	0.02
LPS. 283		93.20	7.89	0.33	0.52	0.08	0.06
LPS. 284		89.80	9.20	0.62	1.68	0.06	0.05
LPS. 285		96.60	5.98	0.22	0.47	0.09	0.04
LPS. 286		93.80	7.13	0.39	1.51	0.02	0.03
LPS. 287		97.60	5.29	0.14	0.32	<0.01	0.02
LPS. 288		91.50	8.16	0.51	2.33	0.14	0.02
LPS. 289		94.20	5.37	0.67	2.30	0.12	0.04
LPS. 290		94.60	5.30	0.57	2.29	0.02	0.03
LPS. 291		96.50	3.92	0.26	1.28	<0.01	0.02
LPS. 292		95.80	4.56	0.28	1.12	0.02	0.03

COMMENTS:

1). The CaCO3 is the stoichiometric excess of calcium over sulfur for gypsum-expressed as the carbonate. Some totals exceed 100% indicating that excess calcium may exist in another form eg; oxide.
2). Assay by acid digest. 3). MgCO3 is magnesium, expressed as the carbonate. 4). NaCl is sodium, expressed as the chloride.

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

All pages of this report have been checked and approved for release.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14158
SUB BATCH: 0
No. OF SAMPLES: 163
DATE RECEIVED: 27/02/96
DATE COMPLETED: 26/03/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
LPS. 293		98.40	3.24	0.17	0.68	0.07	0.02
LPS. 294		97.70	3.53	0.24	0.99	0.11	0.02
LPS. 295		89.60	10.60	0.37	1.13	0.21	0.09
LPS. 296		97.10	4.18	0.14	0.47	0.11	0.03
LPS. 297		97.80	3.93	0.24	1.00	0.14	0.02
LPS. 298		98.80	3.95	0.12	0.38	0.16	0.02
LPS. 299		82.30	17.20	0.63	1.94	0.19	0.06
LPS. 300		89.60	10.50	0.54	1.70	0.17	0.05
LPS. 301		88.00	10.00	0.65	2.86	0.09	0.06
LPS. 302		79.60	20.50	0.48	1.05	0.03	0.08
LPS. 303		79.60	18.70	0.59	2.47	0.08	0.07
LPS. 304		91.70	8.01	0.27	0.96	0.04	0.02
LPS. 305		96.10	4.25	0.09	0.24	0.02	0.02
LPS. 306		95.40	4.73	0.15	0.70	0.05	0.02
LPS. 307		98.40	2.08	<0.01	0.01	<0.01	0.02
LPS. 308		99.30	2.64	0.06	0.10	<0.01	0.02
LPS. 309		99.60	2.07	0.11	0.21	0.10	0.03
LPS. 310		97.60	3.82	0.09	0.15	<0.01	0.02
LPS. 311		93.50	7.75	0.22	0.36	0.05	0.05
LPS. 312		94.40	4.29	0.67	2.53	0.14	0.04
LPS. 313		94.00	4.82	0.51	2.27	0.08	0.04
LPS. 314		95.60	4.49	0.47	1.86	0.12	0.05
LPS. 315		92.60	5.71	0.70	2.60	0.16	0.06
LPS. 316		93.20	5.14	0.78	2.99	0.22	0.06
LPS. 317		92.50	5.07	0.83	2.81	0.16	0.07
LPS. 318		96.90	4.05	0.31	1.02	0.12	0.05
LPS. 319		91.20	7.26	0.63	2.09	0.08	0.09
LPS. 320		69.00	11.80	0.73	1.39	0.09	0.15
LPS. 321		94.70	3.42	0.64	1.92	0.07	0.10
LPS. 322		93.70	4.17	0.42	1.29	0.04	0.06

COMMENTS:

5). KCl is potassium, expressed as the chloride. 6). Assays are based on drying the samples at 250'C, and recalculating the assays back to allow for the water of hydration (.2H2O). 7). The -- results for CaCO3 on the last page actually were negative figures, indicating a stoichiometric excess of sulfur over calcium for gypsum.

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No. OF SAMPLES: 163
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CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: SOIL
PROJECT:

SAMPLE NUMBER	ELEMENT	$CaSO_4.2H_2O$	$CaCO_3$	$MgCO_3$	NaCl	KCl	Fe_2O_3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.01	0.01	0.01	0.01	0.01	0.01
LPS. 323		91.60	6.83	0.53	1.50	0.06	0.06
LPS. 324		95.10	2.98	0.38	1.76	0.06	0.03
LPS. 325		95.80	3.47	0.45	1.34	0.04	0.05
LPS. 326		99.70	1.51	0.22	1.07	0.01	0.09
LPS. 327		99.10	1.99	0.14	0.58	0.02	0.04
LPS. 328		98.60	2.63	0.17	0.78	0.02	0.03
LPS. 329		98.00	3.98	0.18	0.66	0.02	0.03
LPS. 330		89.80	10.30	0.41	0.99	0.06	0.08
LPS. 331		96.70	3.08	0.40	1.50	0.03	0.03
LPS. 332		95.80	3.14	0.42	1.86	0.03	0.03
LPS. 333		98.10	2.33	0.26	1.07	0.02	0.04
LPS. 334		98.10	2.99	0.09	0.17	<0.01	0.02
LPS. 335		99.20	2.01	0.16	0.59	0.03	0.03
LPS. 336		98.00	2.95	0.14	0.39	0.04	0.02
LPS. 337		97.00	3.13	0.21	0.67	0.02	0.02
LPS. 338		99.00	1.23	0.23	1.23	0.06	0.02
LPS. 339		98.00	2.42	0.21	0.79	0.04	0.03
LPS. 340		97.60	3.11	0.32	1.02	0.02	0.04
LPS. 341		99.70	0.70	0.06	0.06	<0.01	0.03
LPS. 342		98.90	1.74	0.21	1.01	0.04	0.03
LPS. 343		99.70	1.63	0.10	0.25	0.02	0.03
LPS. 344		99.80	1.63	0.09	0.23	<0.01	0.02
LPS. 345		99.70	1.68	0.08	0.40	<0.01	0.02
LPS. 346		97.10	2.71	0.25	1.24	0.02	0.04
LPS. 347		99.70	1.32	0.08	0.22	<0.01	0.04
LPS. 348		99.10	1.97	0.10	0.47	0.02	0.02
LPS. 349		93.00	5.35	0.32	1.51	0.02	0.03
LPS. 350		98.50	2.58	0.10	0.41	0.02	0.06
LPS. 351		98.80	2.70	0.14	0.46	0.03	0.04
LPS. 352		98.00	2.54	0.29	1.04	0.06	0.05

COMMENTS:

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ANALYTICAL REPORT

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CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.01	0.01	0.01	0.01	0.01	0.01
LPS. 353		94.10	4.70	0.61	1.74	0.05	0.04
LPS. 354		88.90	10.50	0.37	1.36	0.04	0.05
LPS. 355		98.00	3.94	0.12	0.11	0.03	0.04
LPS. 356		98.30	3.25	0.06	0.06	0.02	0.02
LPS. 357		98.10	3.14	0.07	0.05	0.03	0.02
LPS. 358		59.80	37.60	0.82	0.87	0.08	0.24
LPS. 359		96.80	4.13	0.13	0.02	0.02	0.05
LPS. 360		99.70	1.47	0.06	0.04	0.04	0.02
LPS. 371		99.10	1.29	0.20	0.52	0.05	0.05
LPS. 372		84.70	11.50	0.82	1.53	0.15	0.13
LPS. 373		97.40	2.60	0.34	0.98	0.09	0.05
LPS. 374		95.30	3.35	0.47	1.71	0.08	0.06
LPS. 375		98.60	1.41	0.26	1.01	0.09	0.05
LPS. 376		95.60	4.40	0.23	0.68	0.02	0.05
LPS. 377		98.00	2.44	0.21	0.60	<0.01	0.02
LPS. 378		96.10	3.15	0.37	1.44	<0.01	0.04
LPS. 379		98.00	1.59	0.16	0.56	<0.01	0.03
LPS. 380		95.30	3.81	0.46	1.58	0.02	0.09
LPS. 381		97.00	1.88	0.22	0.76	0.05	0.03
LPS. 382		94.40	4.26	0.52	1.98	0.07	0.06
LPS. 383		99.70	0.38	0.17	0.54	0.06	0.04
LPS. 384		86.60	0.78	0.53	2.15	0.07	0.04
LPS. 385		97.70	0.52	0.56	2.03	0.10	0.06
LPS. 386		96.40	1.94	0.80	2.27	0.09	0.08
LPS. 387		88.50	5.61	1.15	2.37	0.08	0.12
LPS. 388		88.40	5.15	1.25	2.64	0.10	0.16
LPS. 389		90.00	4.91	1.24	2.54	0.09	0.11
LPS. 390		91.70	3.39	0.79	2.62	0.10	0.07
LPS. 391		94.20	3.15	0.53	1.86	0.06	0.07
LPS. 392		89.90	4.80	0.66	2.61	0.09	0.11

COMMENTS:

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CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: SOIL

PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
LPS. 393		95.80	1.88	0.29	1.39	0.03	0.04
LPS. 394		84.00	9.47	0.98	3.54	0.09	0.21
LPS. 395		95.70	2.48	0.20	0.54	<0.01	0.02
LPS. 396		93.40	3.90	0.34	1.15	0.03	0.05
LPS. 397		93.50	3.48	0.23	1.08	0.03	0.03
LPS. 398		91.50	6.65	0.35	0.53	0.04	0.08
LPS. 399		97.20	2.81	0.05	0.02	<0.01	0.02
LPS. 400		99.60	2.01	0.06	<0.01	<0.01	0.02
LPS. 401		97.30	2.04	0.09	0.22	<0.01	0.02
LPS. 402		98.80	1.73	0.06	0.17	<0.01	0.02
LPS. 403		94.50	4.29	0.23	0.49	0.02	0.05
LPS. 404		96.90	2.68	0.13	0.34	<0.01	0.02
LPS. 405		94.30	1.14	0.18	0.63	<0.01	0.02
LPS. 406		97.10	1.63	0.19	0.67	0.01	0.05
LPS. 407		97.80	2.21	0.09	0.07	0.01	0.02
LPS. 408		98.40	1.08	0.06	0.03	<0.01	0.02
LPS. 409		97.20	1.73	0.10	0.18	<0.01	0.02
LPS. 410		94.90	2.60	0.22	0.71	<0.01	0.04
LPS. 411		97.40	1.35	0.06	0.06	<0.01	0.02
LPS. 412		97.70	1.55	0.07	0.07	<0.01	0.02
LPS. 413		97.30	1.67	0.12	0.19	0.03	0.02
LPS. 414		97.00	2.38	0.07	0.21	0.03	0.02
LPS. 415		97.60	2.48	0.14	0.20	0.06	0.03
LPS. 366		97.20	2.55	0.16	0.52	<0.01	0.02
LPS. 367		95.60	1.22	0.26	1.06	<0.01	0.03
LPS. 368		98.30	1.13	0.11	0.25	<0.01	0.02
LPS. 369		97.80	1.08	0.18	0.53	0.03	0.02
LPS. 370		97.80	0.80	0.12	0.43	0.01	0.02
MA DUNE		81.70	----	0.12	0.15	0.08	0.19
MB DUNE		83.40	----	0.17	0.12	0.26	0.19

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ADDRESS:
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MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
MC DUNE		91.00	----	0.06	<0.01	0.06	0.04
MD DUNE		90.30	----	0.05	<0.01	0.02	0.12
ME LAKE		73.10	----	2.05	5.90	3.28	0.41
MF DUNE 0-0.6		90.80	----	0.04	0.11	0.01	0.07
MG DUNE 0-0.75		89.60	----	0.02	0.05	<0.01	0.07
MH DUNE 0-0.6		91.40	----	0.05	0.13	<0.01	0.05
MI DUNE 0-0.6		92.50	----	0.03	0.21	<0.01	0.05
MJ SHORE 0-0.6		3.05	----	0.03	0.02	0.23	0.49
MK SHORE 0-0.6		7.28	----	0.07	0.26	0.26	0.42
ML LAKE 0-0.6		87.30	----	0.31	1.55	1.03	0.20
MM LAKE 0-0.6		96.00	----	0.09	0.42	0.15	0.11
MN LAKE 0-0.6		94.30	----	0.14	0.62	0.26	0.11
MO TRACK COMPOSITE		93.70	----	0.04	<0.01	0.06	0.80

COMMENTS:

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lice Springs Laboratory
hone: (089) 52 6020 Fax: (089) 52 6028
endigo Laboratory
hone: (054) 46 1390 Fax: (054) 46 1389
risbane Laboratory
hone: (07) 3243 7222 Fax: (07) 3243 7218
harters Towers Laboratory
hone: (077) 87 4155 Fax: (077) 87 4220
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (090) 21 1457 Fax: (090) 21 6253
Mt Isa Laboratory
Phone: (077) 49 5545 Fax: (077) 49 5546
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Orange Laboratory
Phone: (063) 601 1722 Fax: (063) 601 1189
Perth Laboratory
Phone: (09) 249 2988 Fax: (09) 249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
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[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14158
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CONTACT: MR J OLLIVER
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MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: SOIL
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 / * / M290 / 0.01					
LPS. 263		<0.01					
LPS. 264		<0.01					
LPS. 265		<0.01					
LPS. 266		<0.01					
LPS. 267		<0.01					
LPS. 268		<0.01					
LPS. 269		<0.01					
LPS. 270		<0.01					
LPS. 271		<0.01					
LPS. 272		<0.01					
LPS. 273		<0.01					
LPS. 274		0.02					
LPS. 275		0.02					
LPS. 276		<0.01					
LPS. 277		0.02					
LPS. 278		<0.01					
LPS. 279		<0.01					
LPS. 280		0.01					
LPS. 281		<0.01					
LPS. 282		<0.01					
LPS. 283		0.05					
LPS. 284		0.02					
LPS. 285		0.03					
LPS. 286		<0.01					
LPS. 287		<0.01					
LPS. 288		0.02					
LPS. 289		0.02					
LPS. 290		<0.01					
LPS. 291		0.01					
LPS. 292		0.02					

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ANALYTICAL REPORT

LABORATORY: STAFFORD
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CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: SOIL

PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 / % / M290 / 0.01					
LPS. 293		<0.01					
LPS. 294		0.02					
LPS. 295		0.08					
LPS. 296		0.02					
LPS. 297		0.02					
LPS. 298		0.01					
LPS. 299		0.03					
LPS. 300		0.02					
LPS. 301		0.01					
LPS. 302		<0.01					
LPS. 303		<0.01					
LPS. 304		<0.01					
LPS. 305		<0.01					
LPS. 306		<0.01					
LPS. 307		<0.01					
LPS. 308		<0.01					
LPS. 309		0.03					
LPS. 310		<0.01					
LPS. 311		0.04					
LPS. 312		0.03					
LPS. 313		0.02					
LPS. 314		0.03					
LPS. 315		0.05					
LPS. 316		0.10					
LPS. 317		0.05					
LPS. 318		0.06					
LPS. 319		0.07					
LPS. 320		0.14					
LPS. 321		0.13					
LPS. 322		0.04					

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

[redacted]

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14158
SUB BATCH: 0
No. OF SAMPLES: 163
DATE RECEIVED: 27/02/96
DATE COMPLETED: 26/03/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	A1203 % M290 0.01					
LPS. 323		0.04					
LPS. 324		0.02					
LPS. 325		0.04					
LPS. 326		0.08					
LPS. 327		0.02					
LPS. 328		0.01					
LPS. 329		<0.01					
LPS. 330		0.02					
LPS. 331		0.01					
LPS. 332		<0.01					
LPS. 333		0.01					
LPS. 334		<0.01					
LPS. 335		0.01					
LPS. 336		<0.01					
LPS. 337		<0.01					
LPS. 338		<0.01					
LPS. 339		0.01					
LPS. 340		0.02					
LPS. 341		0.02					
LPS. 342		0.03					
LPS. 343		0.03					
LPS. 344		0.02					
LPS. 345		0.05					
LPS. 346		0.06					
LPS. 347		0.02					
LPS. 348		0.06					
LPS. 349		0.03					
LPS. 350		0.06					
LPS. 351		0.02					
LPS. 352		0.02					

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14158
SUB BATCH: 0
No. OF SAMPLES: 163
DATE RECEIVED: 27/02/96
DATE COMPLETED: 26/03/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: SOIL
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 / % / M290 / 0.01
LPS. 353		0.05
LPS. 354		0.02
LPS. 355		0.04
LPS. 356		<0.01
LPS. 357		0.01
LPS. 358		0.17
LPS. 359		0.04
LPS. 360		0.02
LPS. 371		0.02
LPS. 372		0.12
LPS. 373		0.03
LPS. 374		0.03
LPS. 375		0.04
LPS. 376		0.04
LPS. 377		0.02
LPS. 378		0.01
LPS. 379		<0.01
LPS. 380		0.01
LPS. 381		0.02
LPS. 382		0.01
LPS. 383		0.03
LPS. 384		0.02
LPS. 385		0.03
LPS. 386		0.05
LPS. 387		0.03
LPS. 388		0.05
LPS. 389		0.03
LPS. 390		0.01
LPS. 391		0.01
LPS. 392		0.02

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14158
SUB BATCH: 0
No. OF SAMPLES: 163
DATE RECEIVED: 27/02/96
DATE COMPLETED: 26/03/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

SAMPLE NUMBER							
	ELEMENT	Al2O3					
	UNIT	%					
	METHOD	M290					
	L.O.R.	0.01					
LPS. 393		<0.01					
LPS. 394		0.03					
LPS. 395		<0.01					
LPS. 396		0.01					
LPS. 397		<0.01					
LPS. 398		0.05					
LPS. 399		<0.01					
LPS. 400		<0.01					
LPS. 401		<0.01					
LPS. 402		<0.01					
LPS. 403		0.02					
LPS. 404		<0.01					
LPS. 405		0.01					
LPS. 406		0.03					
LPS. 407		0.02					
LPS. 408		<0.01					
LPS. 409		0.01					
LPS. 410		0.02					
LPS. 411		0.01					
LPS. 412		0.02					
LPS. 413		0.02					
LPS. 414		<0.01					
LPS. 415		<0.01					
LPS. 366		0.02					
LPS. 367		<0.01					
LPS. 368		<0.01					
LPS. 369		<0.01					
LPS. 370		<0.01					
MA DUNE		<0.01					
MB DUNE		0.60					

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

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ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14158
SUB BATCH: 0
No. OF SAMPLES: 163
DATE RECEIVED: 27/02/96
DATE COMPLETED: 26/03/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: SOIL
PROJECT:

SAMPLE NUMBER / ELEMENT / UNIT / METHOD / L.O.R.	A1203 / % / M290 / 0.01
MC DUNE	0.09
MD DUNE	0.15
ME LAKE	6.25
MF DUNE 0-0.6	0.15
MG DUNE 0-0.75	0.09
MH DUNE 0-0.6	0.13
MI DUNE 0-0.6	0.03
MJ SHORE 0-0.6	0.56
MK SHORE 0-0.6	0.66
ML LAKE 0-0.6	2.22
MM LAKE 0-0.6	0.33
MN LAKE 0-0.6	0.45
MO TRACK COMPOSITE	0.07

OMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14158
SUB BATCH: 0
No. OF SAMPLES: 163
DATE RECEIVED: 27/02/96
DATE COMPLETED: 26/03/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: QUALITY CONTROL

PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
*** LPS. 271		95.40	4.67	0.30	1.64	0.06	0.02
		95.40	4.47	0.30	1.67	0.05	0.02
*** LPS. 281		97.20	3.37	0.09	0.54	0.03	0.02
		97.60	4.14	0.09	0.49	0.02	0.03
*** LPS. 291		96.40	3.82	0.26	1.30	<0.01	0.02
		96.50	3.92	0.26	1.28	<0.01	0.02
*** LPS. 315		91.20	6.64	0.62	2.57	0.11	0.06
		92.60	5.71	0.70	2.60	0.16	0.06
*** LPS. 325		96.20	3.01	0.45	1.41	0.06	0.06
		95.80	3.47	0.45	1.34	0.04	0.05
*** LPS. 335		98.80	2.68	0.15	0.64	0.04	0.02
		99.20	2.01	0.16	0.59	0.03	0.03
*** LPS. 359		96.50	4.39	0.10	0.02	0.01	0.04
		96.80	4.13	0.13	0.02	0.02	0.05
*** LPS. 379		97.50	2.39	0.15	0.44	<0.01	0.02
		98.00	1.59	0.16	0.56	<0.01	0.03
*** LPS. 389		90.80	3.54	1.30	2.45	0.13	0.12
		90.00	4.91	1.24	2.54	0.09	0.11
*** LPS. 413		97.80	1.38	0.10	0.17	0.05	0.03
		97.30	1.67	0.12	0.19	0.03	0.02
*** LPS. 414		97.60	0.95	0.10	0.23	0.05	0.02
		97.00	2.38	0.07	0.21	0.03	0.02

COMMENTS:

Results which appear on this report are routine laboratory checks for QUALITY CONTROL purposes.

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory Phone: (089) 52 6020 Fax: (089) 52 6028
Bendigo Laboratory Phone: (054) 46 1390 Fax: (054) 46 1389
Brisbane Laboratory Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory Phone: (077) 87 4155 Fax: (077) 87 4220
Cloncurry Laboratory Phone: (077) 42 1323 Fax: (077) 42 1685
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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14158
SUB BATCH: 0
No. OF SAMPLES: 163
DATE RECEIVED: 27/02/96
DATE COMPLETED: 26/03/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: QUALITY CONTROL
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Al2O3 % M290 0.01					
*** LPS. 271		<0.01 <0.01					
*** LPS. 281		<0.01 <0.01					
*** LPS. 291		<0.01 0.01					
*** LPS. 315		0.03 0.05					
*** LPS. 325		0.05 0.04					
*** LPS. 335		0.02 0.01					
*** LPS. 359		0.02 0.04					
*** LPS. 379		<0.01 <0.01					
*** LPS. 389		0.05 0.03					
*** LPS. 413		0.01 0.02					
*** LPS. 414		<0.01 <0.01					

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14801
SUB BATCH: 0
No. OF SAMPLES: 9
DATE RECEIVED: 07/05/96
DATE COMPLETED: 13/05/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.1	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	Fe2O3 % M290 0.01	KCl % M290 0.01
STREAKY BAY LPS 361		96.5	2.26	0.05	0.11	0.02	<0.01
STREAKY BAY LPS 362		95.6	3.52	0.06	0.03	0.01	<0.01
STREAKY BAY LPS 363		93.3	5.54	0.09	0.17	0.02	0.02
STREAKY BAY LPS 364		94.4	3.00	0.20	0.62	0.01	0.02
STREAKY BAY LPS 365		96.5	1.74	0.10	0.14	<0.01	<0.01
ASHVILLE TM 36		89.1	4.74	1.23	0.98	0.06	0.01
ASHVILLE TM 37		91.4	4.82	1.15	0.39	0.06	<0.01
ASHVILLE TM 38		85.8	8.02	1.50	1.23	0.07	0.02
ASHVILLE TM 39		90.0	5.99	1.32	0.72	0.06	<0.01

COMMENTS:

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Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

David James

All pages of this report have been checked and approved for release.

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

LABORATORY: STAFFORD
BATCH NUMBER: ST14801
SUB BATCH: 0
No. OF SAMPLES: 9
DATE RECEIVED: 07/05/96
DATE COMPLETED: 13/05/96

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER							
	ELEMENT	A1203					
	UNIT	%					
	METHOD	M290					
	L.O.R.	0.01					
STREAKY BAY LPS 361		0.01					
STREAKY BAY LPS 362		0.08					
STREAKY BAY LPS 363		0.05					
STREAKY BAY LPS 364		0.03					
STREAKY BAY LPS 365		0.01					
ASHVILLE TM 36		0.07					
ASHVILLE TM 37		0.05					
ASHVILLE TM 38		0.06					
ASHVILLE TM 39		0.03					

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14801
SUB BATCH: 0
No. OF SAMPLES: 9
DATE RECEIVED: 07/05/96
DATE COMPLETED: 13/05/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: DUPLICATES
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.1	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	Fe2O3 % M290 0.01	KCl % M290 0.01
*** STREAKY BAY LPS 361		95.6	2.62	0.06	0.09	0.02	<0.01
Original Result		96.5	2.26	0.05	0.11	0.02	<0.01

COMMENTS:

Results which appear on this report are routine laboratory duplicates for QUALITY CONTROL purposes.

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14801
SUB BATCH: 0
No. OF SAMPLES: 9
DATE RECEIVED: 07/05/96
DATE COMPLETED: 13/05/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: DUPLICATES PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	A1203 % M290 0.01					
*** STREAKY BAY LPS 361		0.02					
Original Result		0.01					

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST14842
SUB BATCH: 0
No. OF SAMPLES: 40
DATE RECEIVED: 09/05/96
DATE COMPLETED: 23/05/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: GYPSUM

PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
TRANEASE 2 HOLE 4 0-1		52.91	40.31	2.05	1.52	0.06	0.13
TRANEASE 3 HOLE 1 1-2		41.45	53.69	1.48	0.71	0.01	0.09
TRANEASE 3 HOLE 2 1-2		35.02	59.58	2.21	0.75	0.03	0.12
TRANEASE 3 HOLE 3 0-1		68.06	29.74	0.48	0.35	<0.01	0.05
TRANEASE 3 HOLE 3 1-2		37.95	56.09	2.08	0.75	0.01	0.10
TRANEASE 3 HOLE 3 2-3		18.62	74.30	2.55	0.99	0.04	0.14
TRANEASE 4 HOLE 2 0-1		58.67	38.65	0.53	0.39	<0.01	0.06
TRANEASE 4 HOLE 2 1-2		30.36	65.78	1.11	0.84	<0.01	0.08
TRANEASE 4 HOLE 2 2-3		9.54	83.83	2.31	1.22	0.05	0.16
TRANEASE 4 HOLE 2 3-4		16.88	77.37	2.12	0.87	0.03	0.17

OMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY:	STAFFORD
BATCH NUMBER:	ST14842
SUB BATCH:	0
No. OF SAMPLES:	40
DATE RECEIVED:	09/05/96
DATE COMPLETED:	23/05/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:   SAMPLE TYPE: GYPSUM   PROJECT:

SAMPLE NUMBER	ELEMENT	Al203					
	UNIT	%					
	METHOD	M290					
	L.O.R.	0.01					
TRANEASE 2 HOLE 4 0-1		0.10					
TRANEASE 3 HOLE 1 1-2		0.05					
TRANEASE 3 HOLE 2 1-2		0.06					
TRANEASE 3 HOLE 3 0-1		0.03					
TRANEASE 3 HOLE 3 1-2		0.06					
TRANEASE 3 HOLE 3 2-3		0.06					
TRANEASE 4 HOLE 2 0-1		0.04					
TRANEASE 4 HOLE 2 1-2		0.06					
TRANEASE 4 HOLE 2 2-3		0.10					
TRANEASE 4 HOLE 2 3-4		0.06					

OMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

CONTACT: MR J ULLIVER
CLIENT: ULLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.1	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
T101 H1 0-1		95.4	2.48	0.07	0.06	0.01	0.05
T101 H1 1-2		96.6	2.63	0.06	0.06	<0.01	0.02
T101 H1 2-3		95.6	3.39	0.11	0.08	<0.01	0.02
T101 H1 3-4		94.2	3.48	0.10	0.10	<0.01	0.02
T101 H1 4-5		94.0	3.84	0.11	0.13	0.01	0.02
T101 H1 5-6		93.4	4.31	0.12	0.10	<0.01	0.02
T101 H2 0-1		96.1	3.47	0.11	0.07	<0.01	0.03
T101 H2 1-2		95.2	3.22	0.10	0.12	<0.01	0.02
T101 H2 2-2.45		91.5	7.42	0.15	0.66	0.03	0.04
T102 H1 0-1		96.0	2.66	0.07	0.06	0.01	0.03
T102 H1 1-2		96.6	2.42	0.08	0.13	0.02	0.02
T102 H1 2-3		95.3	3.00	0.08	0.14	0.02	0.02
T102 H1 3-4		93.7	4.59	0.10	0.18	0.02	0.06
T102 H1 4-5		93.7	4.96	0.11	0.14	0.02	0.03
T102 H2 0-1		95.1	3.24	0.20	0.78	0.04	0.03
T102 H2 1-2		96.3	2.28	0.08	0.17	0.02	0.02
T102 H2 2-3		70.8	26.36	0.49	0.89	0.06	0.14
T103 H1 0-1		97.3	1.63	0.07	0.17	0.02	0.02
T103 H1 1-2		96.8	2.28	0.10	0.25	0.02	0.02
T103 H1 2-3		96.7	2.59	0.10	0.18	0.02	0.02
T103 H1 3-4		93.0	5.50	0.19	0.49	0.03	0.05
T103 H2 0-1		96.8	1.87	0.12	0.18	0.02	0.02
T103 H2 1-2		97.1	1.72	0.10	0.12	0.02	0.02
T103 H2 2-2.4		83.2	14.22	0.43	0.93	0.06	0.06
T104 H1 0-1		97.7	1.04	0.06	0.14	0.02	0.02
T104 H1 1-2		98.8	0.95	0.07	0.13	0.01	0.03
T104 H1 2-3		98.3	1.50	0.10	0.10	0.02	0.02
T104 H1 3-4		98.9	1.28	0.08	0.13	0.03	0.02
T104 H1 4-5		98.8	0.95	0.06	0.13	0.01	0.02
T104 H1 5-6		99.2	0.97	0.06	0.12	0.01	0.02

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (089) 52 6020 Fax: (089) 52 6028
Bendigo Laboratory
Phone: (054) 46 1390 Fax: (054) 46 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Phone: (077) 87 4155 Fax: (077) 87 4220
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (090) 21 1457 Fax: (090) 21 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Orange Laboratory
Phone: (063) 601 1722 Fax: (063) 601 1189
Perth Laboratory
Phone: (09) 249 2988 Fax: (09) 249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

All pages of this report have been checked and approved for release.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY:	STAFFORD
BATCH NUMBER:	ST15354
SUB BATCH:	0
No. OF SAMPLES:	252
DATE RECEIVED:	03/07/96
DATE COMPLETED:	18/07/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.1	0.01	0.01	0.01	0.01	0.01
T104 H2 0-1		98.5	1.32	0.07	0.10	0.02	0.02
T104 H2 1-2		98.5	1.30	0.07	0.11	0.02	0.02
T104 H2 2-3		97.8	1.66	0.10	0.33	0.02	0.02
T104 H2 3-4		96.2	3.33	0.16	0.42	0.02	0.05
T105 H1 0-1		94.3	3.06	0.10	0.10	0.02	0.03
T105 H1 1-2		98.5	1.60	0.09	0.08	<0.01	0.02
T105 H1 2-3		98.0	1.54	0.10	0.17	0.02	0.02
T105 H1 3-4		98.5	1.60	0.09	0.06	0.01	0.02
T105 H1 4-5		98.9	0.90	0.07	0.14	<0.01	0.02
T105 H1 5-5.5		98.4	1.15	0.10	0.25	0.01	0.05
T106 H1 0-1		98.3	1.58	0.09	0.13	0.02	0.10
T106 H1 1-2		97.7	2.06	0.12	0.21	<0.01	0.02
T106 H1 2-3		97.0	2.19	0.23	0.90	0.02	0.03
T106 H1 3-3.95		98.0	1.50	0.10	0.42	<0.01	0.02
T106 H2 0-1		98.7	1.08	0.05	0.13	0.02	0.02
T106 H2 1-2		97.6	2.13	0.07	0.14	0.03	0.02
T106 H2 2-2.6		95.4	3.48	0.29	0.75	0.04	0.05
T107 H1 0-1		97.8	1.81	0.13	0.46	0.05	0.02
T107 H1 1-2		97.7	1.86	0.10	0.27	0.03	0.02
T107 H1 2-3		98.2	1.51	0.09	0.17	0.04	0.02
T107 H1 3-4		97.8	1.74	0.13	0.41	0.04	0.02
T107 H1 4-5		97.1	2.29	0.13	0.35	0.09	0.03
T107 H1 5-5.4		95.3	3.44	0.22	0.64	0.06	0.06
T107 H2 0-1		98.0	1.31	0.13	0.56	0.02	0.02
T107 H2 1-2		98.1	1.54	0.09	0.18	<0.01	0.02
T107 H2 2-2.5		96.3	2.50	0.19	0.94	0.05	0.05
T107 H3 0-1		97.8	1.57	0.14	0.42	0.02	0.02
T107 H3 1-2.2		98.1	1.84	0.12	0.31	0.05	0.02
T107 H4 0-1.2		97.0	2.02	0.27	0.48	0.02	0.02
T108 H1 0-1		88.2	8.76	0.43	0.73	0.06	0.12

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.1	0.01	0.01	0.01	0.01	0.01
T108 H1 1-2		98.0	1.61	0.13	0.34	0.02	0.04
T108 H1 2-2.9		96.8	2.39	0.15	0.61	0.04	0.04
T108 H2 0-1		97.2	1.82	0.18	0.75	0.04	0.02
T108 H2 1-2.25		96.5	2.32	0.25	0.91	0.04	0.03
T108 H3 0-1		94.5	3.56	0.34	0.99	0.05	0.06
T108 H3 1-1.4		92.5	5.09	0.42	1.56	0.07	0.07
T109 H1 0-1		96.9	1.55	0.09	0.21	0.03	0.02
T109 H1 1-2		96.5	1.43	[illegible]	0.18	0.03	0.02
T109 H1 2-3		97.7	1.77	0.13	0.37	0.04	0.02
T109 H1 3-4		97.9	1.54	0.10	0.19	0.01	0.02
T109 H1 4-4.9		93.6	4.36	0.27	1.10	0.03	0.06
T109 H2 0-1		95.8	2.17	0.29	1.08	0.04	0.05
T109 H2 1-2		92.7	5.71	0.21	1.27	0.07	0.10
T110 H1 0-1		97.7	1.34	0.15	0.82	0.04	0.05
T110 H1 1-2		98.1	1.17	0.12	0.60	0.02	0.02
T110 H1 2-3		97.3	2.04	0.14	0.45	0.02	0.02
T110 H1 3-4		97.0	2.40	0.14	0.43	0.02	0.04
T110 H1 4-4.5		88.2	9.71	0.56	1.21	0.07	0.15
T110 H2 0-1		96.6	2.19	0.20	0.89	0.04	0.05
T110 H2 1-1.7		97.4	1.54	0.23	0.70	0.03	0.05
T111 H1 0-1		97.7	1.41	0.17	0.56	0.02	0.10
T111 H1 1-2		97.9	1.49	0.14	0.35	0.02	0.03
T111 H1 2-3		97.5	1.99	0.13	0.26	0.03	0.05
T111 H1 3-4		97.5	1.96	0.13	0.33	0.04	0.05
T111 H1 4-4.4		96.9	2.23	0.17	0.55	0.05	0.07
T112 H1 0-1		99.0	0.92	0.10	0.28	0.03	0.04
T112 H1 1-2		98.2	1.51	0.10	0.29	0.02	0.03
T112 H1 2-3		97.0	2.33	0.18	0.63	0.02	0.06
T112 H1 3-4		98.2	1.69	0.14	0.30	0.02	0.02
T112 H1 4-5		98.5	1.16	0.10	0.21	0.02	0.02

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.1	0.01	0.01	0.01	0.01	0.01
T112 H1 5-5.9		98.0	1.27	0.14	0.54	0.03	0.04
T112 H2 0-1		97.7	1.38	0.33	0.62	0.03	0.04
T112 H2 1-1.5		95.9	2.87	0.29	1.24	0.09	0.07
T113 H1 0-1		98.0	1.45	0.11	0.40	0.05	0.02
T113 H1 1-2		98.6	0.91	0.10	0.29	0.04	0.02
T113 H1 2-3		97.6	1.07	0.12	0.38	0.04	0.02
T113 H1 3-4		98.0	1.34	0.10	0.28	0.03	0.02
T113 H1 4-5		96.8	1.38	0.11	0.30	0.02	[illegible]
T113 H2 0-1		99.4	<0.01	0.12	0.59	0.02	0.02
T113 H2 1-2		98.1	1.09	0.10	0.17	0.01	0.02
T113 H2 2-2.9		97.6	1.73	0.15	0.57	0.03	0.05
T114 H1 0-1		98.3	1.05	0.07	0.14	0.02	0.02
T114 H1 1-2		98.5	1.19	0.07	0.17	0.02	0.02
T114 H1 2-3		98.0	1.33	0.07	0.14	0.03	0.02
T114 H1 3-4		97.0	2.21	0.12	0.32	0.02	0.03
T114 H2 0-1		98.2	1.11	0.11	0.41	0.03	0.02
T114 H2 1-2		98.0	0.95	0.13	0.58	0.06	0.08
T115 H1 0-1		98.4	0.47	0.13	0.66	0.02	0.02
T115 H1 1-2		97.1	1.94	0.16	0.50	0.02	0.03
T115 H1 2-2.5		90.9	6.83	0.59	1.01	0.05	0.17
T115 H2 0-1		97.6	1.09	0.23	0.99	0.05	0.02
T115 H2 1-1.4		95.5	3.43	0.22	0.87	0.06	0.06
T116 H1 0-1		97.3	1.66	0.10	0.43	0.02	0.02
T116 H1 1-2		97.6	1.56	0.10	0.28	0.06	0.02
T116 H1 2-2.9		98.3	1.24	0.10	0.42	0.02	0.02
T116 H2 0-1		97.3	1.55	0.16	0.50	0.02	0.10
T116 H2 1-1.8		96.3	1.78	0.17	0.63	0.05	0.03
T117 H1 0-1		97.4	1.08	0.18	1.08	0.06	0.03
T117 H1 1-2		97.1	1.50	0.09	0.26	0.03	0.02
T117 H1 2-3		95.9	1.55	0.08	0.28	0.04	0.03

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

[redacted]

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

CONTACT: MR J GULLIVER
CLIENT: GULLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: GYPSUM

PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.1	0.01	0.01	0.01	0.01	0.01
T117 H1 3-3.5		94.8	2.06	0.10	0.28	0.06	0.03
T117 H2 0-1		95.1	1.71	0.12	0.44	0.03	0.02
T117 H2 1-2		94.1	2.46	0.18	0.60	0.05	0.02
T117 H2 2-2.7		96.7	1.52	0.11	0.41	0.03	0.03
T118 H1 0-1		95.1	2.27	0.25	0.94	0.04	0.02
T118 H1 1-2		93.5	3.84	0.19	0.68	0.05	0.03
LPS 101		92.2	3.25	0.23	1.28	0.06	0.02
LPS 102		95.8	3.14	0.07	0.26	0.03	0.01
LPS 103		92.8	3.97	0.13	0.56	0.05	0.02
LPS 104		84.0	11.01	0.45	1.64	0.13	0.07
LPS 105		90.2	6.99	0.34	1.29	0.11	0.06
LPS 106		95.5	2.28	0.06	0.22	0.03	0.02
LPS 107		94.2	3.29	0.07	0.23	0.02	0.02
LPS 108		92.5	5.18	0.18	0.84	0.06	0.02
LPS 109		92.2	5.16	0.13	0.30	0.01	0.02
LPS 110		93.7	3.94	0.13	0.51	0.01	0.02
LPS 111		82.5	13.70	0.44	0.93	0.04	0.07
LPS 112		96.0	3.05	0.06	0.22	<0.01	0.01
LPS 113		94.3	3.63	0.09	0.28	0.01	0.02
LPS 114		88.2	7.97	0.34	0.95	0.05	0.06
LPS 115		90.8	5.48	0.28	1.00	0.04	0.02
LPS 116		92.0	6.57	0.36	1.48	0.06	0.02
LPS 164		87.0	10.48	0.32	0.79	0.02	0.02
LPS 165		94.6	5.30	0.14	0.02	<0.01	0.02
LPS 166		93.5	6.30	0.11	0.09	<0.01	0.02
LPS 167		90.2	7.46	0.19	0.45	<0.01	0.01
LPS 168		91.5	7.35	0.10	0.11	<0.01	0.02
LPS 169		91.7	7.06	0.11	0.09	<0.01	0.01
LPS 170		91.0	7.40	0.22	0.73	0.01	0.02
LPS 171		92.2	5.09	0.31	1.11	0.04	0.02

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/95
DATE COMPLETED: 18/07/95

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: GYPSUM

PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.1	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
LPS 172		91.6	5.85	0.17	0.53	0.02	0.02
LPS 173		91.9	5.94	0.23	1.07	0.06	0.02
LPS 174		92.7	5.23	0.20	0.78	0.04	0.01
LPS 175		93.1	5.04	0.35	1.23	0.04	0.01
LPS 176		89.8	7.40	0.31	1.59	0.04	0.02
LPS 177		92.3	3.74	0.23	0.71	0.02	0.02
LPS 178		90.5	6.56	0.32	1.54	0.04	0.02
LPS 179		96.3	3.29	0.11	0.22	0.01	0.02
LPS 180		93.8	4.78	0.18	0.87	0.02	0.02
LPS 181		92.5	5.27	0.25	1.04	0.15	0.04
LPS 182		90.0	7.02	0.24	1.10	0.05	0.02
LPS 183		92.1	4.49	0.13	0.54	0.02	0.02
LPS 184		92.1	4.29	0.10	0.42	0.03	0.01
LPS 185		93.2	4.14	0.08	0.15	<0.01	0.01
LPS 186		94.4	4.55	0.10	0.13	<0.01	0.02
LPS 187		92.2	4.56	0.10	0.20	0.13	0.02
LPS 188		94.3	5.72	0.14	0.34	0.10	0.03
LPS 189		80.5	15.87	0.63	1.16	0.15	0.12
LPS 190		96.0	3.84	0.11	0.20	0.02	0.02
LPS 191		95.0	4.23	0.10	0.38	0.08	0.04
LPS 192		94.2	5.32	0.10	0.37	0.02	0.14
LPS 193		94.6	5.36	0.12	0.26	0.02	0.02
LPS 194		92.0	7.48	0.23	0.64	0.05	0.04
LPS 195		92.4	7.31	0.15	0.42	<0.01	0.02
LPS 196		78.2	20.23	0.43	1.35	0.12	0.07
LPS 197		90.1	9.43	0.21	0.51	0.03	0.02
LPS 198		85.6	13.03	0.29	1.30	0.05	0.02
LPS 199		84.4	13.36	0.67	1.72	0.07	0.03
LPS 200		85.3	11.89	0.58	2.23	0.05	0.03
LPS 201		89.2	8.80	0.49	1.18	0.06	0.03

COMMENTS:

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

CONTACT: MR J [illegible]
CLIENT: [illegible] GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: [illegible]
PROJECT:

SAMPLE NUMBER	ELEMENT	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.1	0.01	0.01	0.01	0.01	0.01
LPS 202		79.7	18.11	0.56	1.81	0.06	0.04
LPS 203		90.4	7.29	0.39	1.56	0.05	0.02
LPS 204		69.8	26.56	0.78	2.00	0.05	0.09
LPS 205		90.[illegible]	7.42	0.33	0.96	0.02	0.02
LPS 206		90.8	7.55	0.31	1.38	0.04	0.03
LPS 207		94.7	5.13	0.13	0.38	<0.01	0.02
LPS 208		95.2	4.87	0.10	0.25	<0.01	0.03
LPS 209		92.9	6.05	0.15	0.66	0.03	0.02
LPS 210		93.5	5.20	0.27	1.00	0.04	0.02
LPS 211		94.5	5.12	0.14	0.16	<0.01	0.01
LPS 212		93.6	6.38	0.16	0.27	0.02	0.02
LPS 213		83.3	15.58	0.31	0.54	0.02	[illegible]
LPS 214		94.9	4.58	0.09	0.44	0.01	0.02
LPS 215		92.4	[illegible]	0.10	0.37	0.02	0.02
LPS 216		86.0	12.33	0.24	0.47	0.02	0.11
LPS 217		94.9	3.61	0.23	1.37	0.04	0.10
LPS 218		87.4	10.06	0.27	0.62	0.03	0.13
LPS 219		91.0	4.15	0.66	2.06	0.09	[illegible]
LPS 220		93.4	5.07	0.18	0.60	0.03	0.12
LPS 221		95.2	3.27	0.23	0.83	0.05	0.10
LPS 222		94.2	3.00	0.16	0.97	0.04	0.10
LPS 223		94.0	3.59	0.11	0.42	0.02	0.10
LPS 224		93.7	4.57	0.14	0.72	0.02	0.10
LPS 225		86.8	9.80	0.38	1.26	0.05	0.12
LPS 226		92.6	5.08	0.19	0.57	0.03	0.10
LPS 227		93.3	5.38	0.16	0.82	0.03	0.10
LPS 228		92.1	6.65	0.06	0.05	0.01	0.10
LPS 229		92.2	5.82	0.21	1.24	0.05	0.09
LPS 230		91.4	7.43	0.07	0.10	0.01	0.10
LPS 231		91.3	8.20	0.14	0.22	0.02	0.12

COMMENTS:

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• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY:	STAFFORD
BATCH NUMBER:	S715354
SUB BATCH:	0
No. OF SAMPLES:	252
DATE RECEIVED:	03/07/96
DATE COMPLETED:	18/07/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	CaSO4.2H2O % M290 0.1	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
LPS 232		87.2	10.79	0.29	1.05	0.03	0.10
LPS 233		89.2	10.64	0.13	0.13	0.01	0.11
LPS 234		89.1	9.71	0.21	1.03	0.03	0.10
LPS 235		82.5	14.56	0.19	0.23	0.02	0.13
LPS 236		93.5	5.73	0.13	0.35	0.02	0.11
LPS 237		91.0	7.48	0.19	0.56	0.05	0.13
LPS 238		66.8	23.91	1.89	2.86	0.14	0.22
LPS 239		71.8	24.95	0.59	0.54	0.04	0.14
LPS 240		64.5	31.98	0.83	[illegible]	0.07	0.22
LPS 241		[illegible]	56.16	[illegible]	1.32	0.12	[illegible]
LPS 464		96.7	2.87	0.08	<0.01	<0.01	0.10
LPS 465		95.5	4.14	0.10	[illegible]	<0.01	0.09
LPS 466		95.9	4.00	0.06	<0.01	<0.01	0.08
LPS 467		96.8	2.94	0.13	0.06	<0.01	0.10
LPS 468		[illegible]	3.22	0.15	0.26	0.01	0.10
LPS 469		95.9	3.60	0.10	0.20	0.01	0.10
LPS 470		98.8	1.19	<0.01	<0.01	<0.01	0.07
LPS 471		97.0	2.74	0.12	0.34	0.01	0.10
LPS 472		97.0	2.57	0.12	0.24	<0.01	0.09
LPS 535		96.7	2.28	0.11	0.14	<0.01	0.24
LPS 536		96.8	2.76	0.19	0.02	0.01	0.10
LPS 537		97.1	2.03	0.11	0.05	0.01	0.10
LPS 538		96.3	3.20	0.17	0.52	0.02	0.09
LPS 539		97.6	2.03	0.06	0.02	<0.01	0.09
LPS 540		95.6	4.10	0.12	0.10	<0.01	0.10
LPS 541		95.0	3.83	0.18	0.66	0.02	0.19
LPS 542		95.7	2.73	0.13	0.41	0.01	0.11
LPS 543		96.5	2.54	0.14	0.78	0.02	0.10
LPS 704		93.4	5.02	0.33	1.06	0.05	0.11
LPS 705		97.0	2.05	0.11	0.34	0.02	0.10

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	CaSO4.2H2O % M290 0.1	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
LPS 706		97.8	2.11	0.10	0.30	0.02	0.09
LPS 707		98.1	1.38	0.08	0.39	0.01	0.09
LPS 708		96.7	2.18	0.17	0.89	0.05	0.09
LPS 709		97.3	2.31	0.06	0.27	0.02	0.09
LPS 710		97.6	1.47	0.10	0.74	0.02	0.09
LPS 711		94.9	3.33	0.45	1.15	0.06	0.12
LPS 712		95.2	3.36	0.13	0.98	0.04	0.10
LPS 713		97.7	2.00	0.04	0.17	0.01	0.09
LPS 714		97.4	1.42	0.13	0.92	0.02	0.09
LPS 715		98.3	1.21	0.04	0.21	0.01	0.10
LPS 716		97.3	2.42	0.02	0.16	0.01	0.10
LPS 717		99.1	<0.01	0.04	0.17	0.02	0.10

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

ice Springs Laboratory
none: (089) 52 6020 Fax: (089) 52 6028
endigo Laboratory
none: (054) 46 1390 Fax: (054) 46 1389
risbane Laboratory
none: (07) 3243 7222 Fax: (07) 3243 7218
harters Towers Laboratory
none: (077) 87 4155 Fax: (077) 87 4220
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (090) 21 1457 Fax: (090) 21 6253
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Phone: (07) 575 7654 Fax: (07) 575 7641
Orange Laboratory
Phone: (063) 601 1722 Fax: (063) 601 1189
Perth Laboratory
Phone: (09) 249 2988 Fax: (09) 249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

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A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
McLAREN VALE SA 5171

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	AL2O3 / % / M290 / 0.01
T101 H1 0-1		0.02
T101 H1 1-2		0.01
T101 H1 2-3		0.02
T101 H1 3-4		0.02
T101 H1 4-5		0.02
T101 H1 5-6		0.02
T101 H2 0-1		0.02
T101 H2 1-2		0.02
T101 H2 2-2.45		0.02
T102 H1 0-1		0.02
T102 H1 1-2		0.02
T102 H1 2-3		0.01
T102 H1 3-4		0.02
T102 H1 4-5		0.02
T102 H2 0-1		0.02
T102 H2 1-2		0.02
T102 H2 2-3		0.04
T103 H1 0-1		0.02
T103 H1 1-2		0.02
T103 H1 2-3		0.02
T103 H1 3-4		0.03
T103 H2 0-1		0.02
T103 H2 1-2		0.02
T103 H2 2-2.4		0.07
T104 H1 0-1		0.01
T104 H1 1-2		0.01
T104 H1 2-3		0.02
T104 H1 3-4		0.02
T104 H1 4-5		0.01
T104 H1 5-6		0.02

OMMENTS:

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ice Springs Laboratory
none: (089) 52 6020 Fax: (089) 52 6028
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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	AL2O3 % M290 0.01					
T104 H2 0-1		0.02					
T104 H2 1-2		0.02					
T104 H2 2-3		0.02					
T104 H2 3-4		0.03					
T105 H1 0-1		0.02					
T105 H1 1-2		0.02					
T105 H1 2-3		0.02					
T105 H1 3-4		0.02					
T105 H1 4-5		0.01					
T105 H1 5-5.5		0.02					
T106 H1 0-1		0.06					
T106 H1 1-2		0.02					
T106 H1 2-3		0.03					
T106 H1 3-3.95		0.02					
T106 H2 0-1		0.02					
T106 H2 1-2		0.02					
T106 H2 2-2.6		0.04					
T107 H1 0-1		0.05					
T107 H1 1-2		0.02					
T107 H1 2-3		0.02					
T107 H1 3-4		0.01					
T107 H1 4-5		0.02					
T107 H1 5-5.4		0.04					
T107 H2 0-1		0.01					
T107 H2 1-2		0.01					
T107 H2 2-2.5		0.02					
T107 H3 0-1		0.01					
T107 H3 1-2.2		0.05					
T107 H4 0-1.2		0.03					
T108 H1 0-1		0.10					

OMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: GYPSUM

PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.
	AL2O3 / % / M290 / 0.01
T108 H1 1-2	0.05
T108 H1 2-2.9	0.04
T108 H2 0-1	0.02
T108 H2 1-2.25	0.02
T108 H3 0-1	0.06
T108 H3 1-1.4	0.05
T109 H1 0-1	0.03
T109 H1 1-2	0.02
T109 H1 2-3	0.01
T109 H1 3-4	0.01
T109 H1 4-4.9	0.04
T109 H2 0-1	0.05
T109 H2 1-2	0.06
T110 H1 0-1	0.03
T110 H1 1-2	0.02
T110 H1 2-3	0.02
T110 H1 3-4	0.02
T110 H1 4-4.5	0.09
T110 H2 0-1	0.02
T110 H2 1-1.7	0.03
T111 H1 0-1	0.02
T111 H1 1-2	0.03
T111 H1 2-3	0.03
T111 H1 3-4	0.03
T111 H1 4-4.4	0.03
T112 H1 0-1	0.04
T112 H1 1-2	0.02
T112 H1 2-3	0.06
T112 H1 3-4	0.02
T112 H1 4-5	<0.01

OMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

ice Springs Laboratory
none: (089) 52 6020 Fax: (089) 52 6028
endigo Laboratory
none: (054) 46 1390 Fax: (054) 46 1389
risbane Laboratory
one: (07) 3243 7222 Fax: (07) 3243 7218
narters Towers Laboratory
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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/0[illegible]/96
DATE COMPLETED: 18/07/96

CONTACT: MR J ULLIVER
CLIENT: ULLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	AL2O3 / % / M290 / 0.01					
T112 H1 3-3.9		0.02					
T112 H2 0-1		0.03					
T112 H2 1-1.5		0.04					
T113 H1 0-1		0.02					
T113 H1 1-2		0.02					
T113 H1 2-3		0.03					
T113 H1 3-4		0.03					
T113 H1 4-5		0.02					
T113 H2 0-1		0.02					
T113 H2 1-2		0.02					
T113 H2 2-2.9		0.05					
T114 H1 0-1		0.02					
T114 H1 1-2		0.02					
T114 H1 2-3		0.01					
T114 H1 3-4		0.02					
T114 H2 0-1		0.02					
T114 H2 1-2		0.03					
T115 H1 0-1		0.02					
T115 H1 1-2		0.02					
T115 H1 2-2.5		0.06					
T115 H2 0-1		0.04					
T115 H2 1-1.4		0.05					
T116 H1 0-1		0.02					
T116 H1 1-2		0.02					
T116 H1 2-2.9		0.01					
T116 H2 0-1		0.02					
T116 H2 1-1.8		0.04					
T117 H1 0-1		0.02					
T117 H1 1-2		0.02					
T117 H1 2-3		0.01					

COMMENTS:

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lice Springs Laboratory
hone: (089) 52 6020 Fax: (089) 52 6028
endigo Laboratory
hone: (054) 46 1390 Fax: (054) 46 1389
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Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/95
DATE COMPLETED: 18/07/95

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	AL2O3 % M290 0.01					
T117 H1 3-3.5		0.03					
T117 H2 0-1		0.02					
T117 H2 1-2		0.02					
T117 H2 2-2.7		0.04					
T118 H1 0-1		0.02					
T118 H1 1-2		0.04					
LPS 101		0.03					
LPS 102		0.01					
LPS 103		<0.01					
LPS 104		0.05					
LPS 105		0.09					
LPS 106		0.01					
LPS 107		<0.01					
LPS 108		0.02					
LPS 109		<0.01					
LPS 110		<0.01					
LPS 111		0.02					
LPS 112		<0.01					
LPS 113		<0.01					
LPS 114		0.02					
LPS 115		<0.01					
LPS 116		0.02					
LPS 164		0.02					
LPS 165		0.01					
LPS 166		<0.01					
LPS 167		0.01					
LPS 168		0.01					
LPS 169		<0.01					
LPS 170		0.09					
LPS 171		0.02					

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: GYPSUM

PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	AL2O3 % M290 0.01
LPS 172		0.01
LPS 173		0.01
LPS 174		0.02
LPS 175		0.02
LPS 176		0.02
LPS 177		0.02
LPS 178		0.02
LPS 179		0.01
LPS 180		0.02
LPS 181		0.03
LPS 182		0.03
LPS 183		0.02
LPS 184		<0.01
LPS 185		0.01
LPS 186		0.01
LPS 187		0.02
LPS 188		0.06
LPS 189		0.19
LPS 190		0.03
LPS 191		0.04
LPS 192		0.06
LPS 193		0.02
LPS 194		0.05
LPS 195		0.02
LPS 196		0.08
LPS 197		0.02
LPS 198		<0.01
LPS 199		0.01
LPS 200		0.01
LPS 201		0.02

COMMENTS:

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• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 232
DATE RECEIVED: 03/0[illegible]/95
DATE COMPLETED: 18/0[illegible]/95

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	AL2O3 % M290 0.01					
	LPS 202	0.02					
	LPS 203	0.02					
	LPS 204	0.03					
	LPS 205	0.01					
	LPS 206	0.02					
	LPS 207	0.01					
	LPS 208	0.01					
	LPS 209	0.01					
	LPS 210	0.01					
	LPS 211	<0.01					
	LPS 212	<0.01					
	LPS 213	0.06					
	LPS 214	0.02					
	LPS 215	0.03					
	LPS 216	0.11					
	LPS 217	0.01					
	LPS 218	0.05					
	LPS 219	0.10					
	LPS 220	0.03					
	LPS 221	0.04					
	LPS 222	<0.01					
	LPS 223	<0.01					
	LPS 224	<0.01					
	LPS 225	0.04					
	LPS 226	0.03					
	LPS 227	0.01					
	LPS 228	0.02					
	LPS 229	0.02					
	LPS 230	0.02					
	LPS 231	0.03					

COMMENTS:

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• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: GYPSUM

PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	AL2O3 % M290 0.01					
LPS 232		0.01					
LPS 233		0.01					
LPS 234		0.02					
LPS 235		0.06					
LPS 236		0.03					
LPS 237		0.06					
LPS 238		0.15					
LPS 239		0.03					
LPS 240		0.04					
LPS 241		0.25					
LPS 464		0.02					
LPS 465		<0.01					
LPS 466		0.03					
LPS 467		<0.01					
LPS 468		0.01					
LPS 469		<0.01					
LPS 470		<0.01					
LPS 471		0.01					
LPS 472		0.01					
LPS 535		0.01					
LPS 536		0.02					
LPS 537		0.01					
LPS 538		0.03					
LPS 539		0.01					
LPS 540		0.01					
LPS 541		<0.01					
LPS 542		<0.01					
LPS 543		0.01					
LPS 704		0.02					
LPS 705		0.01					

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (089) 52 6020 Fax: (089) 52 6028
Bendigo Laboratory
Phone: (054) 46 1390 Fax: (054) 46 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Phone: (077) 87 4155 Fax: (077) 87 4220
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (090) 21 1457 Fax: (090) 21 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Orange Laboratory
Phone: (063) 601 1722 Fax: (063) 601 1189
Perth Laboratory
Phone: (09) 249 2988 Fax: (09) 249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

[redacted]

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

CONTACT: MR J ULLIVER
CLIENT: ULLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

LABORATORY: STAFFORD
BATCH NUMBER: ST15354
SUB BATCH: 0
No. OF SAMPLES: 252
DATE RECEIVED: 03/07/96
DATE COMPLETED: 18/07/96

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	AL2O3 % M290 0.01						
LPS 706		<0.01						
LPS 707		<0.01						
LPS 708		<0.01						
LPS 709		<0.01						
LPS 710		0.01						
LPS 711		0.05						
LPS 712		0.01						
LPS 713		0.01						
LPS 714		0.01						
LPS 715		<0.01						
LPS 716		<0.01						
LPS 717		<0.01						

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

APPENDIX E

CALCULATION OF WEIGHTED AVERAGE GRADES

FOR HAND AUGER HOLES

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
1	1	0-1.0	77.0	0.76	21.1
		1.0-1.7	37.2	1.45	53.2
	2	0-1.0	59.5	1.30	33.3
	3	0-1.0	63.1	1.65	27.7
	4	0-1.0	86.0	1.00	9.25
	5	0-1.0	82.0	2.80	9.25
2	1	**0-0.85**	**84.8**	**0.70**	**12.3**
	2	0-1.0	88.5	0.12	8.15
		1-2.0	85.5	0.17	10.8
		2-2.7	84.7	1.35	12.7
		Av	**86.4**	**0.5**	**10.3**
	3	0-1.0	83.8	1.45	12.0
		1-1.5	78.7	1.75	17.6
		Av	**82.1**	**1.6**	**13.9**
	4	0-1.0	79.4	1.30	16.2
		1-1.3	86.8	1.35	10.2
		Av	**81.1**	**1.3**	**14.8**
	5	0-1.0	85.5	0.94	10.9
		1-1.3	82.0	1.75	13.4
		Av	**84.7**	**1.5**	**11.5**
	6	0-1.0	89.5	0.89	7.25
		1-1.8	84.7	1.60	11.3
		Av	**87.4**	**1.2**	**9.1**
	7	0-1.0	86.7	0.53	9.85
		1-1.2	83.1	1.80	13.0
		Av	**86.1**	**0.7**	**10.4**
	8	0-1.0	84.9	3.16	9.40
		1-1.75	86.0	2.10	10.2
		Av	**85.4**	**2.7**	**9.7**
	9	**0-1.1**	**90.5**	**1.65**	**7.45**
	10	0-1.0	90.3	1.60	7.50
		1-1.2	84.8	2.46	11.2
		Av	**89.4**	**1.7**	**8.1**
	11	0-1.0	86.7	3.26	6.80
		1-1.8	87.3	1.75	8.15
		Av	**87.0**	**2.6**	**7.4**
	12	0-1.0	90.8	1.10	6.55
		1-1.9	89.0	2.20	7.75
		Av	**89.9**	**1.6**	**7.1**
	13	0-1.0	90.4	1.75	6.30
		1-1.7	86.4	1.55	10.0
		Av	**88.8**	**1.7**	**7.8**
	14	0-1.0	88.5	0.20	8.00
		1-1.9	88.1	2.06	8.00
		Av	**88.3**	**1.1**	**8.0**

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
	15	0-1	89.3	1.60	7.10
		1-2	85.8	1.75	9.85
		Av	**87.6**	**1.7**	**8.5**
	16	**0-1.1**	**89.6**	**1.05**	**7.55**
	17	0-1.0	89.1	20.6	7.25
		1-1.3	88.6	1.65	8.40
		Av	**89.0**	**2.0**	**7.5**
	18	0-1.0	90.2	1.25	6.75
		1-1.3	89.0	1.20	8.40
		Av	**89.9**	**1.2**	**7.1**
	19	0-1.0	89.2	1.80	7.65
		1-1.3	87.5	1.90	9.40
		Av	**88.8**	**1.8**	**8.1**
	20	0-1.0	90.5	1.30	6.25
		1-1.5	83.9	2.84	12.6
		Av	**88.3**	**1.8**	**8.4**
	21	0-1.0	91.6	1.10	5.80
		1-2.0	85.5	1.60	10.7
		Av	**88.6**	**1.4**	**8.3**
	22	0-1.0	89.5	1.05	7.25
		1-2.0	92.0	0.26	5.45
		2-2.9	86.2	1.95	8.85
		Av	**89.3**	**1.1**	**7.1**
	23	0-1.0	87.8	0.50	8.00
		1-2.0	89.6	0.58	9.20
		2-2.8	78.6	0.55	18.3
		Av	**85.8**	**0.5**	**11.4**
	24	**0-1.0**	**83.3**	**1.66**	**13.5**
		1-1.6	29.2	0.48	69.2
	25	**0-0.8**	**74.5**	**1.73**	**21.7**
	26	**0-0.75**	**78.1**	**1.92**	**16.8**
	27	0-1.0	92.8	0.46	6.30
		1-2.0	94.5	0.52	4.94
		Av	**93.7**	**0.49**	**5.6**
		2-2.75	79.0	0.89	17.5
	28	0-1.0	92.4	0.46	4.88
		1-1.7	88.9	1.63	6.35
		Av	**91.0**	**0.9**	**5.7**
	Traverse 2	**Average**	**89.4**	**1.4**	**10.3**
3	**1**	**0-1.0**	**93.0**	**0.68**	**4.00**
	2	0-1.0	92.9	0.51	4.22
		1-2.0	95.2	0.61	3.28
		2-3.0	93.9	0.60	5.15
		Av	**94.0**	**0.57**	**4.2**

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
	3	0-1.0	93.2	3.98	5.65
		1-2.0	92.1	2.24	5.60
		Av	92.7	3.1	5.6
	Traverse 3	Average	93.4	1.4	4.6
4	1	0-0.5	88.0	0.89	11.4
	2	0-1.0	87.2	0.02	12.1
		1-1.9	84.6	0.49	11.0
		Av	86.0	0.2	11.6
	3	0-1.0	85.4	0.35	11.2
		1-1.5	85.1	1.31	10.4
		Av	85.3	0.7	10.9
	4	0-1.0	84.8	0.85	12.0
	5	0-1.0	83.9	0.45	13.1
		1-1.5	87.5	0.74	9.15
		Av	85.1	0.5	11.8
	6	0-1.0	90.2	0.39	9.15
		1-1.4	85.0	1.05	11.2
		Av	88.7	0.6	9.7
	7	0-0.9	86.5	1.22	10.4
	8	0-0.9	87.4	1.77	8.15
	9	0-0.9	92.5	1.43	5.55
	10	0-1.0	89.5	1.13	6.90
	11	0-1.0	92.3	0.89	5.85
	12	0-0.95	92.2	1.06	5.25
	13	0-1.0	92.1	1.56	4.82
	14	0-1.0	91.4	0.90	5.40
	15	0-1.0	86.8	1.14	10.9
		1-1.2	85.1	1.67	11.1
		Av	86.5	1.2	10.9
	16	0-1.0	90.9	0.65	5.65
		1-1.65	89.3	1.25	7.85
		Av	90.3	0.9	6.5
	17	0-1.0	89.2	1.45	9.25
		1-1.6	88.1	1.98	7.90
		Av	88.8	1.6	8.7
	18	0-1.0	91.5	0.78	5.70
		1-1.6	91.8	1.42	5.15
		Av	91.6	1.0	5.5
	19	0-1.0	90.9	1.20	5.55
		1-1.2	89.8	1.27	7.10
		Av	90.7	1.2	5.8
	20	0-1.0	84.5	2.76	11.7
		1-1.3	89.0	1.00	7.85
		Av	85.5	2.4	10.8

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
	21	0-1.0	92.5	0.73	4.48
		1-2.0	94.0	0.14	3.36
		2-3.0	92.5	0.77	4.76
		Av	**93.0**	**0.5**	**4.2**
	22	0-1.0	92.2	1.34	3.48
		1-2.0	95.8	0.29	3.21
		2-3.0	92.8	0.61	4.10
		Av	**93.6**	**0.75**	**3.6**
		3-3.4	84.0	1.82	11.46
	23	0-1.0	90.2	1.40	6.33
		1-2.0	95.6	0.25	2.34
		2-3.09	94.2	0.25	3.36
		Av	**93.4**	**0.6**	**4.0**
	24	0-1.0	92.5	0.90	5.36
		1-2.0	92.2	0.31	5.29
		2-3.0	93.7	0.32	4.07
		Av	**92.8**	**0.5**	**4.9**
		3-3.7	82.5	0.97	14.14
	25	0-1.0	96.0	0.22	3.11
		1-2.0	94.3	0.29	3.72
		Av	**95.2**	**0.3**	**3.4**
		2-3.0	88.2	1.00	8.31
	26	0-1.0	90.8	1.04	5.76
		1-1.5	92.0	1.54	6.93
		Av	**91.4**	**1.29**	**6.3**
5 not tested					
6	**1**	**0-0.8**	**87.0**	**0.81**	**10.80**
	2	0-1.0	94.6	0.02	5.44
		1-2.0	93.5	0.09	6.41
		2-2.9	90.2	0.45	7.65
		Av	**92.9**	**0.2**	**6.5**
	3	0-1.0	91.5	0.11	7.45
		1-2.0	91.7	0.09	7.17
		2-2.8	91.0	0.74	7.62
		Av	**91.4**	**0.3**	**7.4**
	4	**0-1.0**	**92.2**	**1.15**	**5.40**
	5	0-1.0	91.6	0.55	6.02
		1-1.5	91.9	1.13	6.17
		Av	**91.7**	**0.7**	**6.1**
	6	**1-1.0**	**92.7**	**0.82**	**5.43**
	7	0-1.0	93.1	1.27	5.39
		1-1.1	89.8	1.63	7.71
		Av	**92.8**	**1.3**	**5.6**
	8	0-1.0	92.3	0.73	3.97
		1-1.3	90.5	1.58	6.88
		Av	**91.9**	**0.9**	**4.6**

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
	9	0-1.0	96.3	0.23	3.40
		1-1.5	93.8	0.89	4.96
		Av	**95.5**	**0.5**	**3.9**
	10	0-1.0	92.5	1.19	5.52
		1-1.9	90.0	1.15	7.26
		Av	**91.3**	**1.2**	**6.3**
	11	0-1.0	92.1	0.56	4.62
		1-2.1	92.1	0.45	4.39
		Av	**92.1**	**0.5**	**4.5**
	12	0-1.0	93.2	0.16	4.20
		1-2.0	94.4	0.13	4.65
		2-3.0	92.2	0.23	4.76
		3-4.0	94.3	0.44	5.86
		Av	**93.5**	**0.24**	**4.9**
		4.85	80.5	1.31	16.50
	13	0-1.0	96.0	0.22	3.95
		1-2.0	95.0	0.46	4.33
		2-3.0	94.2	0.39	5.42
		3-4.0	94.6	0.28	5.48
		Av	**95.0**	**0.3**	**4.8**
		4-4.4	92.0	0.69	7.71
7	**1**	**0-1.0**	**92.4**	**0.42**	**7.46**
		1-1.6	78.2	1.47	20.66
	2	0-1.0	90.1	0.54	9.64
		1-1.3	85.6	1.35	13.32
8	**1**	**0-1.1**	**84.4**	**1.79**	**14.03**
	2	**0-1.2**	**85.3**	**2.28**	**12.47**
	3	**0-1.0**	**89.2**	**1.24**	**9.29**
		1-1.4	79.7	1.87	18.67
	4	**0-1.0**	**90.4**	**1.61**	**7.68**
		1-1.6	69.8	2.05	27.34
	5	**0-1.0**	**90.7**	**0.98**	**7.75**
		1-1.6	90.8	1.42	7.86
	6	0-1.0	94.7	0.38	5.26
		1-2.0	95.2	0.25	4.97
		2-3.0	92.9	0.69	6.20
		Av	**94.3**	**0.4**	**5.5**
	7	0-1.0	93.5	1.04	5.47
		1-2.0	94.5	0.16	5.26
		2-3.0	93.6	0.29	6.54
		Av	**93.9**	**0.5**	**5.8**
		3-3.5	83.3	0.56	15.89
	8	0-1.0	94.9	0.45	4.67
		1-2.0	92.4	0.39	7.21
		Av	**93.7**	**0.4**	**5.9**
		2-2.5	86.0	0.49	12.57

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
	9	**0-1.0**	**94.9**	**1.41**	**3.84**
		1-1.6	87.4	0.65	10.33
	10	0-1.0	91.0	2.15	4.81
		1-1.5	93.4	0.63	5.25
		Av	**91.8**	**1.6**	**5.0**
	11	0-1.0	95.2	0.88	3.50
		1-1.9	94.2	1.01	3.16
		Av	**94.7**	**0.9**	**3.3**
	12	0-1.0	94.0	0.44	3.70
		1-2.0	93.7	0.74	4.71
		Av	**93.9**	**0.6**	**4.2**
		2-2.4	86.8	1.31	10.18
	13	0-1.0	92.6	0.60	5.27
		1-2.0	93.3	0.85	5.54
		Av	**93.0**	**0.7**	**5.4**
	14	0-1.0	92.1	0.06	6.71
		1-2.0	92.2	1.29	6.03
		2-2.7	91.4	0.11	7.50
		Av	**92.0**	**0.5**	**6.7**
	15	**0-1.0**	**91.3**	**0.24**	**8.34**
		1-1.7	87.2	1.08	11.08
9	**1**	**0-1.0**	**89.2**	**0.14**	**10.77**
		1-2.0	89.1	1.06	9.92
	2	0-1.0	82.5	0.25	14.75
		1-2.0	93.5	0.37	5.86
		2-2.7	91.0	0.39	7.67
		Av	**88.8**	**0.3**	**9.6**
	3	0-0.3	66.8	3.00	25.8
10	**1**	0-1.0	71.8	0.58	25.52
		1-2.0	64.5	1.34	32.81
		2-2.3	35.4	1.44	57.87
11 not tested					
12	**1**	0-1.0	93.8	0.27	5.87
		1-1.7	90.5	1.30	8.22
		Av	**92.4**	**0.7**	**6.9**
	2	0-1.0	92.1	0.98	6.85
		1-1.4	90.3	1.72	8.02
		Av	**91.6**	**1.2**	**7.2**
	3	**0-1.1**	**91.8**	**2.17**	**6.03**
	4	**0-1.1**	**91.7**	**1.74**	**6.50**
	5	0-1.0	94.8	1.00	4.18
		1-1.2	90.5	1.91	7.59
		Av	**94.3**	**1.2**	**4.7**
	6	**0-1.1**	**93.5**	**1.72**	**4.77**
	7	**0-1.1**	**92.9**	**2.01**	**5.19**

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
	8	**0-1.1**	**92.6**	**1.87**	**5.54**
	9	**0-1.0**	**93.3**	**1.50**	**5.18**
	10	**0-1.2**	**92.5**	**1.84**	**5.67**
	11	**0-1.1**	**95.5**	**0.37**	**4.08**
	12	0-1.0	93.4	1.99	4.60
		1-1.3	94.9	0.52	4.49
		Av	**93.7**	**1.7**	**4.6**
	13	0-1.0	95.3	1.14	3.57
		1-2.1	89.4	0.54	10.01
		Av	**92.2**	**0.83**	**6.9**
	14	0-1.0	95.2	0.51	4.23
		1-2.0	93.4	0.27	4.33
		2-2.3	91.1	0.60	8.22
		Av	**93.9**	**0.4**	**4.8**
13	**1**	**0-0.9**	**88.9**	**1.74**	**9.82**
	2	**0-1.0**	**93.2**	**0.56**	**6.20**
		1-1.5	90.9	1.53	7.52
	3	**0-1.0**	**94.2**	**0.32**	**5.43**
		1-1.6	88.8	2.47	8.67
	4	1-1.1	91.5	2.42	6.04
	5	0-1.1	91.8	2.31	5.87
	6	0-1.1	94.6	1.28	4.18
	7	0-1.3	94.0	1.14	4.84
	8	0-1.0	95.8	0.75	3.41
		1-2.0	95.1	1.10	3.77
		Av	**95.5**	**0.9**	**3.6**
		2.24	87.5	1.34	10.97
	9	0-1.0	95.1	0.58	4.32
		1-2.0	94.7	1.14	4.17
		2-3.0	95.4	0.54	4.07
		Av	**95.1**	**0.8**	**4.2**
14	**1**	0-0.9	80.0	2.13	17.83
	2	0-1.0	87.0	1.87	11.04
	3	0-1.0	86.3	2.95	10.65
	4	0-1.0	79.6	1.08	20.98
		1-1.6	79.6	2.55	19.29
15	**1**	**0-1.0**	**90.7**	**1.00**	**8.28**
	2	0-1.0	95.4	0.26	4.34
		1-2.0	94.4	0.75	4.88
		Av	**94.9**	**0.5**	**4.6**
	3	0-1.0	97.9	0.01	2.08
		1-2.0	97.2	0.10	2.70
		2-3.0	97.4	0.31	2.18
		3-4.0	95.9	0.15	3.91
		4-4.6	91.5	0.41	7.97

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
16	**1**	0-0.7	92.3	2.67	4.96
	2	0-1.0	92.3	2.35	5.33
	3	0-0.8	93.0	1.98	4.96
	4	0-1.0	90.7	2.76	6.41
	5	0-0.9	90.7	3.21	5.92
	6	0-1.0	91.0	2.97	5.90
	7	0-0.8	94.4	1.14	4.36
	8	0-1.1	89.8	2.17	7.89
	9	0-0.8	69.0	1.48	12.53
	10	0-1.0	93.7	1.99	4.06
	11	0-1.0	93.7	1.33	4.59
	12	0-0.9	91.0	1.56	7.36
17	**1**	0-0.9	94.8	1.82	3.36
	2	0-1.0	94.8	1.38	3.92
		1-1.7	97.0	1.08	1.73
		Av	**95.7**	**1.3**	**3.0**
	3	0-1.0	97.2	0.60	2.13
		1-2.0	96.4	0.80	2.80
		Av	**96.8**	**0.7**	**2.5**
	4	**0-1.0**	**95.1**	**0.68**	**4.16**
		1-1.7	88.1	1.05	10.71
18	**1**	0-0.9	95.0	1.53	3.48
	2	0-1.0	94.5	1.89	3.56
	3	0-1.0	96.3	1.09	2.59
	4	0-1.0	96.7	0.17	3.08
		1-1.5	97.2	0.62	2.17
		Av	**96.9**	**0.3**	**2.8**
	5	0-1.0	96.5	0.43	3.09
		1-2.0	96.0	0.69	3.34
		Av	**96.3**	**0.6**	**3.2**
		2-2.7	97.2	1.29	1.46
	6	0-1.0	96.5	0.83	2.63
		1-1.4	95.5	1.04	3.43
		Av	**96.2**	**0.9**	**2.9**
19	**1**	**0-1.0**	**99.1**	**0.06**	**0.76**
		1-1.4	96.9	1.05	1.95
		Av	**98.5**	**0.3**	**1.1**
	2	0-1.0	99.7	0.27	1.73
		1-2.0	98.0	0.23	1.72
		2-3.0	97.8	0.40	1.76
		Av	**98.5**	**0.3**	**1.7**
		3-3.3	95.7	1.26	2.96

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
	3	0-1.0	98.3	0.22	1.40
		1-2.0	97.4	0.49	2.07
		Av	**97.9**	**0.4**	**1.7**
		2-2.3	92.7	1.53	5.67
	4	0-1.0	96.8	0.43	2.68
		1-1.7	96.6	0.49	2.84
		Av	**96.7**	**0.5**	**2.8**
20	**1**	0-0.95	96.0	1.10	2.83
	2	0-0.7	92.8	1.79	5.31
21	**1**	0-0.9	87.7	1.40	10.87
	2	0-1.0	95.7	0.14	4.06
		1-2.0	96.6	0.08	3.31
		2-3.0	96.7	0.08	3.21
		Av	**96.3**	**0.1**	**3.5**
		3-3.7	59.8	0.95	38.42
	3	0-1.0	95.5	0.04	4.26
		1-2.0	98.4	0.08	1.53
		2-3.0	96.5	0.13	2.31
		3-4.0	95.6	0.04	3.58
		4-5.0	93.3	0.19	5.63
		Av	**95.9**	**0.1**	**3.5**
22	**1**	0-1.0	94.4	0.63	3.20
	2	0-1.0	96.5	0.14	1.84
		1-2.0	96.7	0.52	2.71
		Av	**6.6**	**0.3**	**2.3**
23	**1**	0-0.8	95.6	1.06	1.48
24	**1**	0-1.0	98.3	0.25	1.24
		1-1.9	97.8	0.56	1.26
		Av	**98.1**	**0.4**	**1.3**
	2	0-1.0	97.8	0.44	0.92
		1-2.0	97.9	0.57	1.49
		Av	**97.9**	**0.5**	**1.2**
	3	0-0.6	84.7	1.68	12.32
25	**1**	0-0.9	95.9	1.07	2.94
	2	0-0.9	94.3	1.79	3.82
	3	0-1.0	97.1	1.10	1.67
		1-1.85	94.6	0.70	4.63
		Av	**96.0**	**0.9**	**3.0**
26	**1**	0-1.0	96.7	0.60	2.65
	2	0-0.9	95.0	1.44	3.52
	3	0-1.0	97.3	0.56	1.75
		1-1.2	94.0	1.60	4.27

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
	4	0-1.0	97.0	0.81	2.10
		1-1.2	93.1	2.05	4.78
	5	0-0.9	98.7	0.60	0.55
	6	0-0.95	86.6	2.22	1.31
	7	0-0.9	96.7	2.13	1.08
	8	0-0.6	94.8	2.36	2.74
	9	0-0.65	88.5	2.45	6.76
	10	0-0.3	88.4	2.74	6.40
	11	0-0.7	90.0	2.63	6.15
	12	0-0.7	91.7	2.72	4.18
	13	0-0.7	94.2	1.92	3.68
	14	0-0.9	89.9	2.70	5.46
	15	0-1.0	95.8	1.42	2.17
		1-1.2	84.0	3.52	10.45
27	**1**	0-1.0	95.7	0.54	2.68
		1-1.9	93.4	1.18	4.24
		Av	**94.6**	**0.8**	**3.4**
	2	0-1.0	93.5	1.11	3.71
		1-1.3	91.5	0.57	7.00
		Av	**93.0**	**1.0**	**4.5**
28	**1**	0-1.0	97.2	0.02	2.86
		1-2.0	97.9	-	2.07
		2-3.0	97.3	0.22	2.13
		3-4.0	98.8	0.17	1.79
		4-4.5	94.5	0.51	4.52
		Av	**97.4**	**0.1**	**2.5**
29	**1**	0-1.0	96.9	0.34	2.81
		1-2.0	94.3	0.63	1.32
		2-2.8	97.1	0.68	1.82
		Av	**96.0**	**0.5**	**2.0**
30	**1**	0-1.0	97.8	0.08	2.30
		1-2.0	98.4	0.03	1.14
		2-3.0	97.2	0.18	1.83
		3-3.9	94.9	0.71	2.82
		Av	**97.1**	**0.2**	**2.0**
31	**1**	0-1.0	97.4	0.06	1.41
		1-2.0	97.7	0.07	1.62
		2-3.0	97.1	0.22	1.79
		3-4.0	97.3	0.24	2.45
		4-5.0	97.6	0.26	2.62
		Av	**97.5**	**0.2**	**2.0**

32 - 40 not tested

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
41	1	0-1.0	96.7	-	2.93
		1-1.5	95.6	0.11	4.24
		Av	**96.3**	**0.1**	**3.4**
	2	0-1.0	95.9	-	4.06
		1-2.0	96.8	0.06	3.07
		2-3.0	94.7	0.27	3.37
		3-4.0	95.9	0.21	3.70
		4-5.0	98.8	-	1.19
		Av	**96.4**	**0.1**	**3.1**
	3	0-1.0	97.0	0.35	2.86
		1-1.7	97.0	0.24	2.69
		Av	**97.0**	**0.3**	**2.8**
42-47 not tested					
48	1	**0-1.0**	**96.7**	**0.14**	**2.39**
	2	0-1.0	96.8	0.03	2.95
		1-2.0	97.1	0.06	2.14
		2-2.3	96.3	0.54	3.37
		Av	**96.9**	**0.1**	**2.7**
	3	0-1.0	97.6	0.02	2.09
		1-2.0	95.6	0.10	4.22
		2-3.0	95.0	0.68	4.01
		3-4.0	95.7	0.42	2.86
		Av	**96.0**	**0.3**	**3.3**
		4-4.3	96.5	0.80	2.68
49-79 not tested					
80	1	**0-0.8**	**93.4**	**1.11**	**5.35**
	2	**0-0.8**	**97.0**	**0.36**	**2.16**
	3	0-1.0	97.8	0.32	2.21
		1-1.7	98.1	0.40	1.46
		Av	**97.9**	**0.4**	**1.9**
	4	0-1.0	96.7	0.92	2.35
		1-2.0	97.3	0.29	2.37
		2-2.4	97.6	0.76	1.57
		Av	**97.1**	**0.6**	**2.2**
	5	0-1.0	94.9	1.21	3.78
		1-1.7	95.2	1.02	3.69
		Av	**95.0**	**1.1**	**3.7**
	6	1-1.0	97.7	0.19	2.04
		1-1.7	97.4	0.94	1.55
		Av	**97.6**	**0.4**	**1.8**
	7	0-1.0	98.3	0.22	1.25
		1-2.0	97.3	0.17	2.44
		2-3.0	99.1	0.19	0.04
		Av	**98.2**	**0.2**	**1.2**

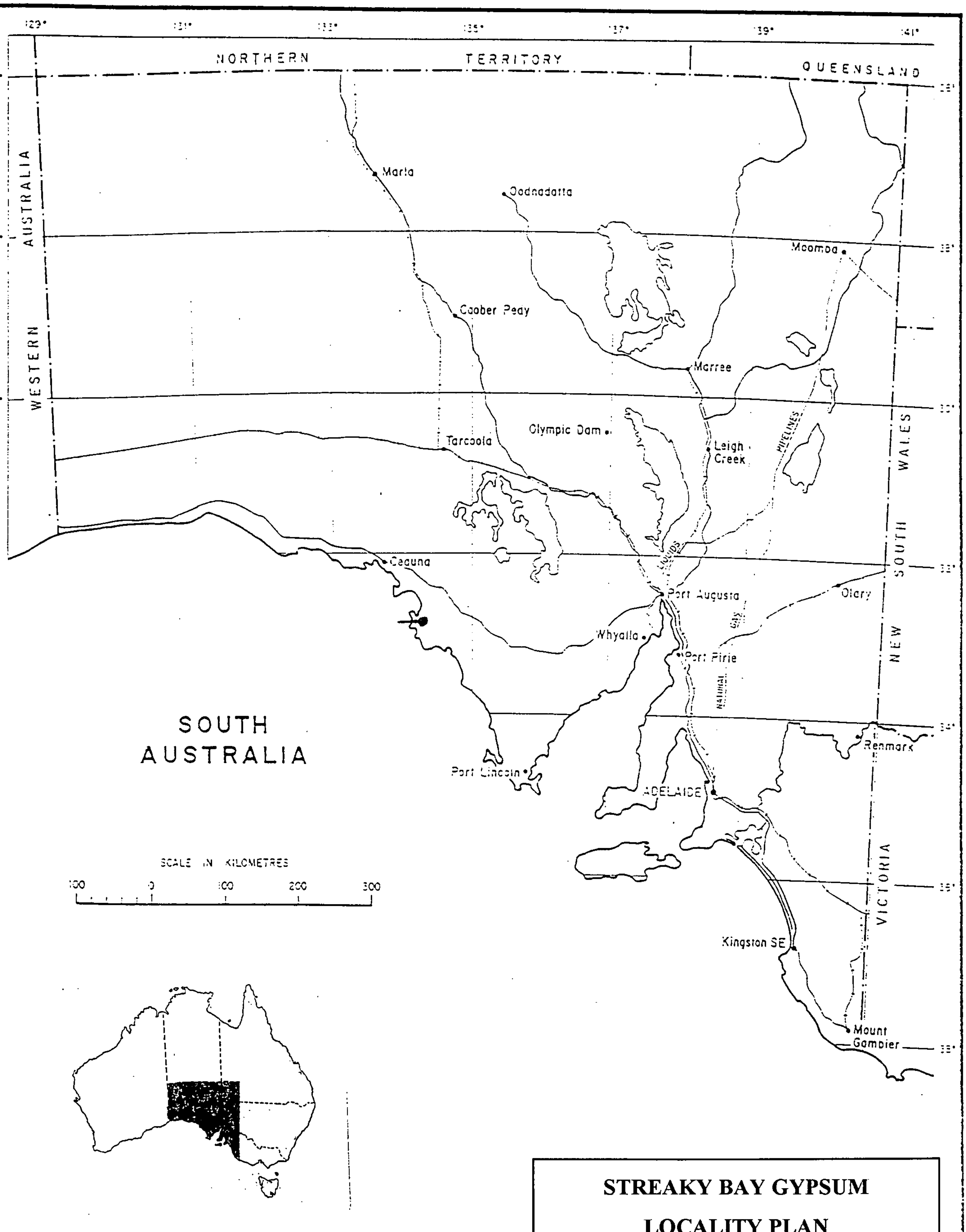
Traverse	Hole	Metres	Gypsum	Salt	Carbonate
		3-4.0	not tested		
		4-4.3	not tested		
81-97 not tested					
98	**4**	0-1.0	52.91	1.58	42.36
99	**1**	1-2.0	41.45	0.72	55.17
	2	1-2.0	35.02	0.78	61.79
	3	0-1.0	68.06	0.35	30.22
		1-2.0	37.95	0.76	58.17
		2-3.0	18.62	1.03	76.85
100	**2**	0-1.0	58.67	0.39	39.18
		1-2.0	30.36	0.84	66.89
		2-3.0	9.54	1.27	86.14
		3-4.0	16.88	0.90	79.49
101	**1**	0-1.0	95.4	0.07	2.55
		1-2.0	96.6	0.06	2.69
		2-3.0	95.6	0.08	3.50
		3-4.0	94.2	0.10	3.58
		4-5.0	94.0	0.14	3.95
		5-6.0	93.4	0.10	4.43
		Av	**94.9**	**0.11**	**3.5**
	2	0-1.0	96.1	0.07	3.58
		1-2.0	95.2	0.12	3.32
		2-2.45	91.5	0.69	7.57
		Av	**94.9**	**0.1**	**3.5**
102	**1**	0-1.0	96.0	0.07	2.73
		1-2.0	96.6	0.15	2.50
		2-3.0	95.3	0.16	3.08
		3-4.0	93.7	0.20	4.69
		4-5.0	93.7	0.16	5.07
		Av	**95.1**	**0.1**	**3.6**
	2	0-1.0	95.1	0.82	3.44
		1-2.0	96.3	0.19	2.36
		Av	**95.7**	**0.4**	**2.9**
		2-3.0	70.8	0.95	26.85
103	**1**	0-1.0	97.3	0.19	1.70
		1-2.0	96.8	0.27	2.38
		2-3.0	96.7	0.20	2.69
		3-4.0	93.0	0.52	5.69
		Av	**96.9**	**0.2**	**2.3**
	2	0-1.0	96.8	0.20	1.99
		1-2.0	97.1	0.14	1.82
		Av	**97.0**	**0.2**	**1.9**
		2-2.4	83.2	0.99	14.65

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
104	**1**	0-1.0	97.7	0.16	1.10
		1-2.0	98.8	0.14	1.02
		2-3.0	98.3	0.12	1.60
		3-4.0	98.9	0.16	1.36
		4-5.0	98.8	0.14	1.01
		5-6.0	99.2	0.13	1.03
		Av	**98.6**	**0.1**	**1.2**
	2	0-1.0	98.5	0.12	1.39
		1-2.0	98.5	0.13	1.37
		2-3.0	97.8	0.35	1.76
		3-4.0	96.2	0.44	3.49
		Av	**97.8**	**0.3**	**2.0**
105	**1**	0-1.0	94.3	0.12	3.16
		1-2.0	98.5	0.08	1.69
		2-3.0	98.0	0.19	1.64
		3-4.0	98.6	0.07	1.69
		4-5.0	98.9	0.14	0.97
		5-5.5	98.4	0.26	1.25
		Av	**97.7**	**0.1**	**1.8**
106	**1**	0-1.0	98.3	0.15	1.67
		1-2.0	97.7	0.21	2.18
		2-3.0	97.0	0.92	2.42
		3-3.5	98.0	0.42	1.60
		Av	**97.7**	**0.4**	**2.0**
	2	0-1.0	98.7	0.15	1.14
		1-2.0	97.6	0.17	2.20
		2-2.6	95.4	0.75	3.77
		Av	**97.5**	**0.3**	**2.2**
107	**1**	0-1.0	97.8	0.51	1.94
		1-2.0	97.7	0.30	1.96
		2-3.0	98.2	0.21	1.60
		3-4.0	97.8	0.45	1.87
		4-5.0	97.1	0.44	2.42
		5-5.4	95.3	0.70	3.60
		Av	**97.5**	**0.4**	**2.1**
	2	0-1.0	98.0	0.58	1.44
		1-2.0	98.1	0.18	1.63
		Av	**98.1**	**0.4**	**1.5**
		2-2.5	96.3	0.94	2.69
	3	0-1	97.8	0.44	1.71
		1-2.2	98.1	0.36	1.96
		Av	**97.9**	**0.4**	**1.9**
	4	**0-1.2**	**97.0**	**0.50**	**2.29**

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
108	**1**	0-1.0	88.2	0.79	9.19
		1-2.0	98.0	0.36	1.74
		2-2.9	96.8	0.65	2.57
		Av	**94.2**	**0.6**	**4.6**
	2	0-1.0	97.2	0.79	2.00
		1-2.25	96.5	0.95	2.58
		Av	**96.8**	**0.9**	**2.3**
	3	0-1.0	94.5	1.04	3.90
		1-1.4	92.5	1.63	5.51
		Av	**93.9**	**1.2**	**4.4**
109	**1**	0-1.0	96.9	0.24	1.64
		1-2.0	96.6	0.21	1.52
		2-3.0	97.7	0.41	1.90
		3-4.0	97.9	0.20	1.64
		Av	**97.3**	**0.3**	**1.7**
		4-4.9	93.6	1.13	4.63
	2	0-1.0	95.8	1.12	2.46
		1-2.0	92.7	1.34	5.98
		Av	**94.3**	**1.2**	**4.2**
110	**1**	0-1.0	97.7	0.86	1.52
		1-2.0	98.1	0.62	1.29
		2-3.0	97.3	0.47	2.18
		3-4.0	97.0	0.45	2.54
		Av	**97.5**	**0.6**	**1.9**
		4-4.5	88.2	1.28	10.27
	2	0-1.0	96.6	0.93	2.39
		1-1.7	97.4	0.73	1.77
		Av	**96.9**	**0.9**	**2.1**
111	**1**	0-1.0	97.7	0.58	1.58
		1-2.0	97.9	0.37	1.63
		2-3.0	97.5	0.29	2.12
		3-4.0	97.5	0.37	2.09
		4-4.4	96.9	0.60	2.40
		Av	**97.6**	**0.4**	**1.9**
112	**1**	0-1.0	99.0	0.31	1.02
		1-2.0	98.2	0.31	1.61
		2-3.0	97.0	0.65	2.51
		3-4.0	98.2	0.32	1.83
		4-5.0	98.5	0.23	1.26
		5-5.9	98.0	0.57	1.41
		Av	**98.2**	**0.4**	**1.6**
	2	**0-1.0**	**97.7**	**0.65**	**1.71**
		1-1.5	95.9	1.33	3.16

Traverse	Hole	Metres	Gypsum	Salt	Carbonate
113	**1**	0-1.0	98.0	0.45	1.56
		1-2.0	98.6	0.33	1.01
		2-3.0	97.8	0.42	1.19
		3-4.0	98.0	0.31	1.64
		4-5.0	96.8	0.32	1.49
		Av	**97.8**	**0.4**	**1.4**
	2	0-1.0	99.4	0.61	0.12
		1-2.0	98.1	0.18	1.19
		2-2.9	97.6	0.60	1.88
		Av	**98.4**	**0.5**	**1.0**
114	**1**	0-1.0	98.3	0.16	1.12
		1-2.0	98.5	0.19	1.26
		2-3.0	98.0	0.17	1.40
		3-4.0	97.0	0.34	2.33
		Av	**98.0**	**0.2**	**1.5**
	2	0-1.0	98.2	0.44	1.22
		1-2.0	98.0	0.64	1.08
		Av	**98.1**	**0.5**	**1.2**
115	**1**	0-1.0	98.4	0.68	0.60
		1-2.0	97.1	0.52	2.10
		2-2.5	90.9	1.06	7.42
		Av	**96.4**	**0.7**	**2.6**
	2	0-1.0	97.6	1.04	1.32
		1-1.4	95.5	0.93	3.65
		Av	**97.0**	**1.0**	**2.0**
116	**1**	0-1.0	97.3	0.45	1.76
		1-2.0	97.6	0.34	1.66
		2-2.9	98.3	0.44	1.34
		Av	**97.7**	**0.4**	**1.6**
	2	0-1.0	97.3	0.52	1.71
		1-1.8	96.3	0.68	1.95
		Av	**96.9**	**0.6**	**1.8**
117	**1**	0-1.0	97.4	1.14	1.26
		1-2.0	97.1	0.29	1.59
		2-3.0	95.9	0.32	1.63
		3-3.5	94.8	0.34	2.16
		Av	**96.5**	**0.6**	**1.6**
	2	0-1.0	95.1	0.47	1.83
		1-2.0	94.1	0.65	2.64
		2-2.7	96.7	0.44	1.63
		Av	**95.1**	**0.5**	**2.1**

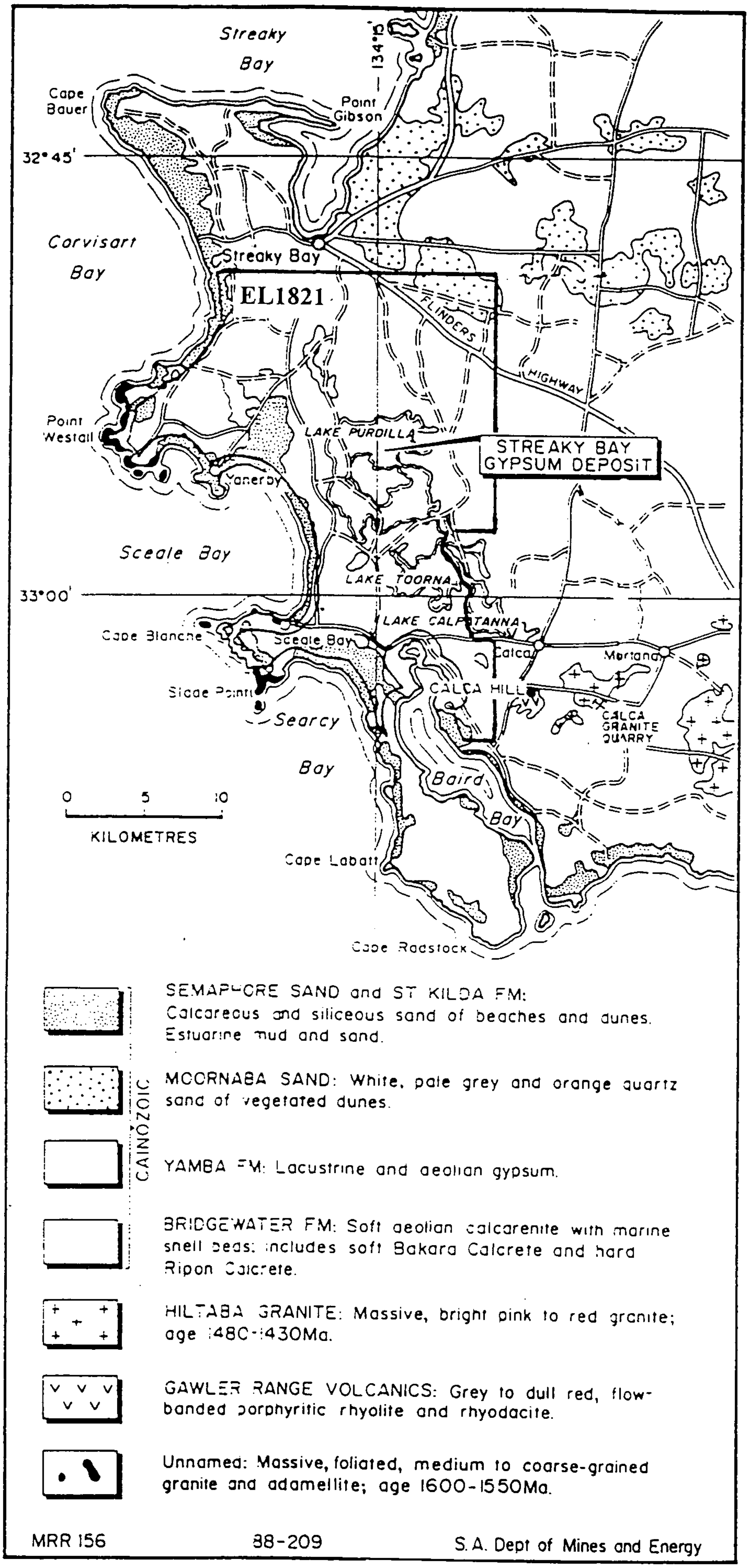
Traverse	Hole	Metres	Gypsum	Salt	Carbonate
118	**1**	0-1.0	95.1	0.98	2.52
		1-2.0	93.5	0.73	4.03
		Av	**94.3**	**0.9**	**3.3**



STREAKY BAY GYPSUM

LOCALITY PLAN
SOUTH AUSTRALIA

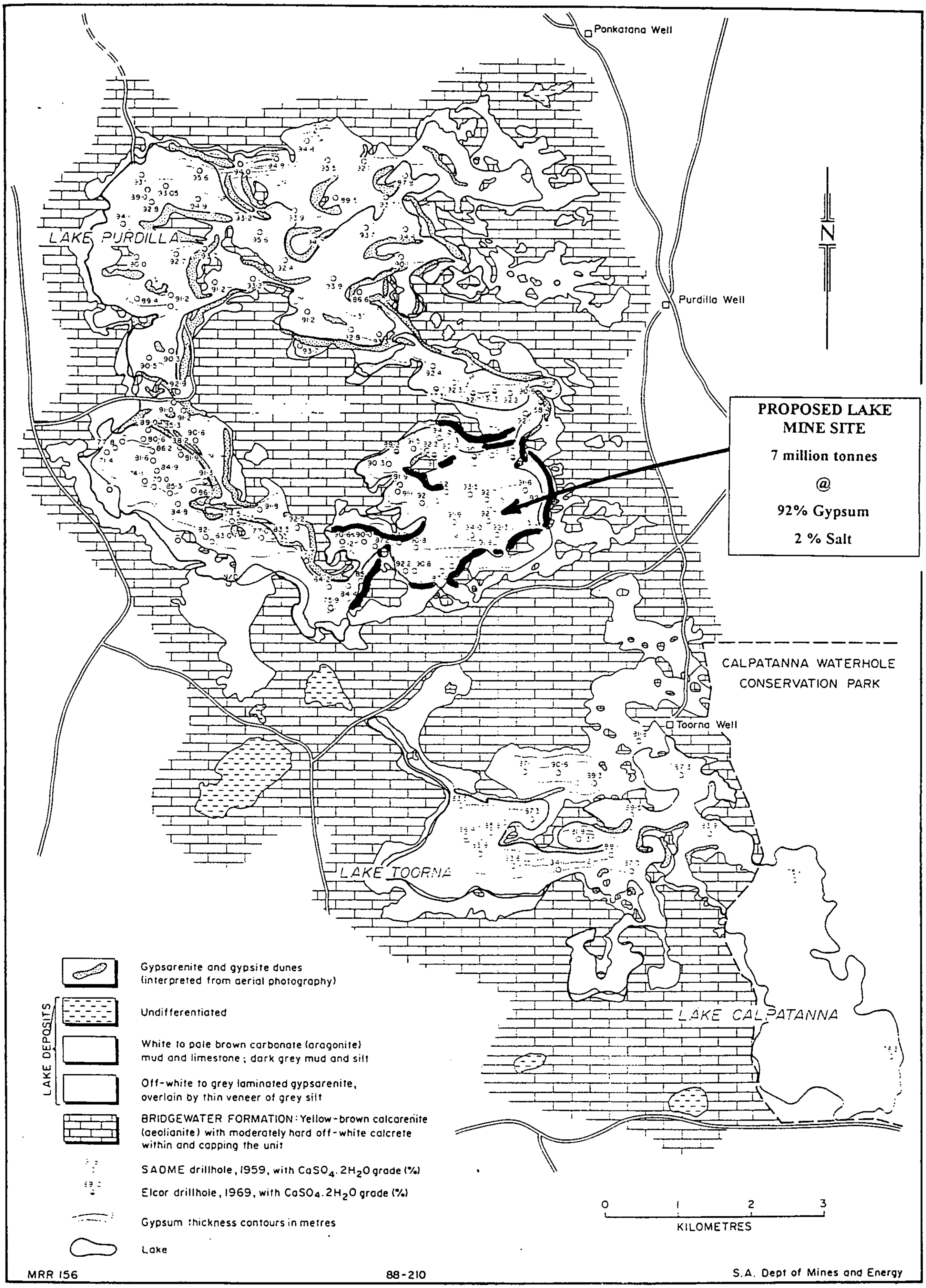
FIG 1



STREAKY BAY GYPSUM

REGIONAL GEOLOGY

FIG 2



Adapted from Olliver, Dub owski and Barnes (1988)

STREAKY BAY GYPSUM

SITE GEOLOGY

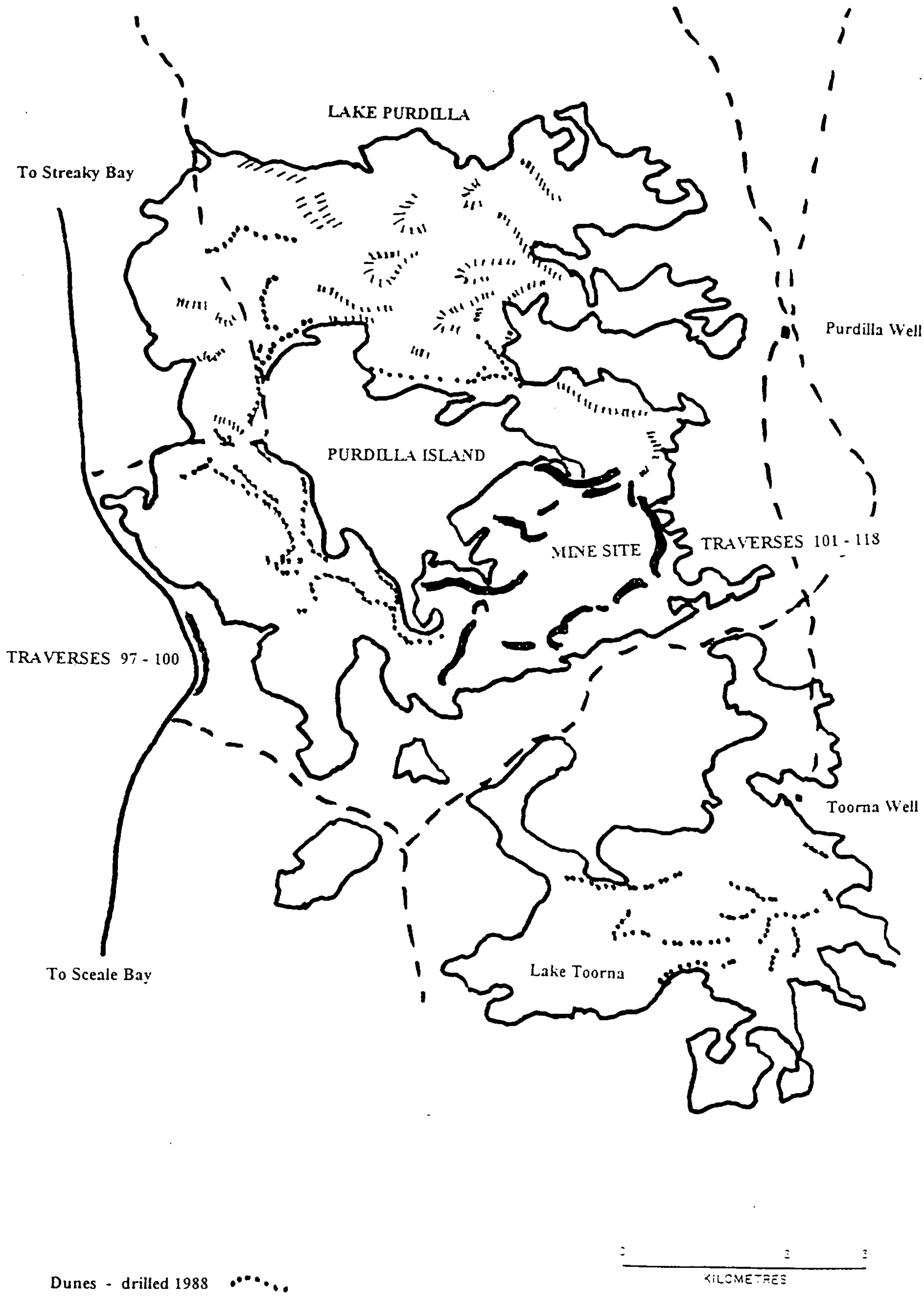
FIG 3

Drilling Traverses
Hand Auger Holes on Dunes

STREAKY BAY GYPSUM

DRILLING TRAVERSES
HAND AUGER HOLES ON DUNES

1:40 000 **FIG 4**



Dunes - drilled 1988

- drilled 1996

- not drilled

Adapted from Olliver, Dub owski and Barnes (1988)

STREAKY BAY GYPSUM

DUNE DRILLING PROGRAMS

FIG 5

STREAKY BAY & MOONABIE DUNE GYPSUM

SUMMARY OF WASHING TESTS

INTRODUCTION

Three bulk samples of 30kg were supplied to Amdel to determine bulk density, mineralogy and chemical analysis, and to wash each sample and forward to CSIRO for plaster manufacture.

The samples represented

Streaky Bay A - low salt composite from 1996 hand auger holes with salt content less than 0.5%.

Streaky Bay B - bulk sample from all hand auger holes with more than 88% gypsum irrespective of salt content which ranged to a maximum of 1.63%

Moonabie - composite from 1996 hand auger holes ar Three Mile Dune.

The amended Amdel report no. N8149 is attached with ALS report no. ST15937 with check chemical analysis of raw and third wash samples.

BULK DENSITY

Compacted density varied from 1.30 to 1.34. Therefore for calculations of in-situ resources, a figure of 1.3 should be used henceforth.

Loose density varied from 1.06 to 1.10. Therefore for uncompacted stockpiles, a figure of 1.0 should be used.

MINERALOGY

Streaky bay dune gypsum consists essentially of white gypsum ranging from rounded to subrounded crystals to a maximum of 1.5mm down to fine grained angular gypsum flour.

Contaminants are tiny inclusions and free particles of white carbonate and traces of clay, iron oxides, opaque grains and organic debris.

Moonabie is similar but brownish, coarser to a maximum of 2mm and more angular than Streaky Bay with quartz as well as the other contaminants.

CHEMICAL COMPOSITION

Chemical analyses by Amdel and ALS are compared to Table 1.

Basically Streaky Bay dune gypsum contain 98% gypsum, 1-2% carbonate and no quartz whereas Moonabie contains 94-95% gypsum, trace carbonate and 4-5% quartz. One wash is probably sufficient to reduce salt content to 0.02-0.04%

JAPANESE SAMPLE

A composite sample of 25kg of Streaky Bay A was washed by hand by my son and I on 12 October 1996.

Initially the sample was screened through 2mm mesh to remove coarse organic debris. Lumps of white gypsum flour were crushed by hand.

TABLE 1

COMPARISON OF CHEMICAL ANALYSIS

Streaky Bay A	**% Gypsum**		**% Salt**		**% Carbonate**	
	Amdel	ALS	Amdel	ALS	Amdel	ALS
Raw	96.4	98.4	0.08	0.16	3.28	1.43
First Wash	98.2	-	0.03	-	-	-
Second Wash	98.3	-	0.03	-	-	-
Third Wash	98.3	98.7	0.02	0.04	-	1.23
Streak Bay B						
Raw	95.8	97.4	0.15	0.25	2.94	2.05
First Wash	98.1	-	0.05	-	-	-
Second Wash	98.0	-	0.03	-	-	-
Third Wash	98.1	98.4	0.03	0.03	-	1.90
Moonabie						
Raw	96.1	94.8	0.05	0.09	1.13	0.03
First Wash	95.1	-	0.02	-	-	-
Second Wash	95.3	-	0.02	-	-	-
Third Wash	95.4	95.4	0.02	0.02	-	0.02

The screened product was washed and mixed in plastic containers with organic matter continually skimmed off or decanted.

The containers were drained and rewashed several times and the resultant material allowed to dry in the sun. 20kg was packaged and despatched to Shane Veitch, Tennant Ltd, Melbourne to forward to Japan.

Subsamples have been retained for chemical analysis.

CONCLUSIONS

Amdel has produced high quality washed gypsum eminently suitable for plaster manufacture.

The sample despatched to Japan appears to be of comparable quality.

JEFF OLLIVER
November 1996

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15937
SUB BATCH: 0
No. OF SAMPLES: 10
DATE RECEIVED: 27/08/96
DATE COMPLETED: 18/09/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.01	0.01	0.01	0.01	0.01	0.01
MOONABIE RAW		94.80	<0.01	0.03	0.09	<0.01	0.07
MOONABIE 3RD WASH		95.40	<0.01	0.02	<0.01	0.02	0.08
STREAKY BAY A RAW		98.40	1.34	0.09	0.16	<0.01	0.02
STREAKY BAY A 3RD WASH		98.70	1.17	0.06	0.04	<0.01	0.02
STREAKY BAY B RAW		97.40	1.94	0.11	0.25	<0.01	0.02
STREAKY BAY B 3RD WASH		98.40	1.83	0.07	0.03	<0.01	0.02
ASHVILLE TM40		90.00	5.51	1.44	1.32	<0.01	0.03
ASHVILLE TM41		90.60	5.91	1.33	0.42	<0.01	0.05
ASHVILLE TM42		88.40	6.88	1.49	1.19	<0.01	0.07
ASHVILLE TM43		90.20	5.64	1.27	0.98	<0.01	0.05

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.
• Results apply to sample(s) as submitted by client.

All pages of this report have been checked and approved for release.

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Bendigo Laboratory Phone: (054) 46 1390 Fax: (054) 46 1389
Brisbane Laboratory Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory Phone: (077) 87 4155 Fax: (077) 87 4220
Cloncurry Laboratory Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory Phone: (090) 21 1457 Fax: (090) 21 6253
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Orange Laboratory Phone: (063) 601 1722 Fax: (063) 601 1189
Perth Laboratory Phone: (09) 249 2988 Fax: (09) 249 2942
Townsville Laboratory Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST15937
SUB BATCH: 0
No. OF SAMPLES: 10
DATE RECEIVED: 27/08/96
DATE COMPLETED: 18/09/96

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
P O BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: GYPSUM

PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.					
	A1203 / % / M290 / 0.01					
MOONABIE RAW	0.13					
MOONABIE 3RD WASH	0.11					
STREAKY BAY A RAW	0.02					
STREAKY BAY A 3RD WASH	<0.01					
STREAKY BAY B RAW	0.01					
STREAKY BAY B 3RD WASH	<0.01					
ASHVILLE TM40	0.03					
ASHVILLE TM41	0.02					
ASHVILLE TM42	0.02					
ASHVILLE TM43	0.02					

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

CALCINING OF GYPSUM AND APPRAISAL OF PRODUCT FOR PLASTER SUITABILITY CONDUCTED FOR SCEALE BAY DEVELOPMENT CORPORATION PTY LTD

December 1996

DBCE Doc. 96/214(M)

Improving the Built Environment

CSIRO
AUSTRALIA

CSIRO BUILDING, CONSTRUCTION AND ENGINEERING

DBCE Doc. 96/214 (M)

CALCINING OF GYPSUM AND APPRAISAL OF PRODUCT FOR PLASTER SUITABILITY CONDUCTED FOR SCEALE BAY DEVELOPMENT CORPORATION PTY LTD

by

G.A. King and N. Sherman

December 1996

Please address all enquiries to:

The Chief
CSIRO Division of Building, Construction and Engineering
PO Box 56
HIGHETT VIC 3190

Distribution List

Jonathan Guinness (SBDC Pty Ltd)	3
G.A. King	1
N. Sherman	1
I. Cole	1
D.W.S. Ho	1
File	(original)

CALCINING OF GYPSUM AND APPRAISAL OF PRODUCT FOR PLASTER SUITABILITY CONDUCTED FOR SCEALE BAY DEVELOPMENT CORPORATION PTY LTD

by

G.A. King and N. Sherman

EXECUTIVE SUMMARY

Six samples of Run of Mine gypsum that had been washed were provided by Sceale Bay Development Corporation Pty Ltd for calcination by CSIRO and evaluation of the suitability of the calcined products for use as building plasters.

Calcinations were carried out in a laboratory scale kettle and were successful in producing materials that were essentially calcium sulfate hemihydrate.

Each calcined sample was evaluated for composition, fineness, water requirement, initial setting time, and compressive strength according to Australian Standard AS 2592. X-ray diffraction and phase analysis was also carried out. The kinetics of the hydration reaction were studied using the 'Exotherm' procedure. The same evaluations were conducted on a sample of a commercial casting plaster used as a 'control'.

All of the samples easily met the requirements of the standard for composition (% insoluble in ammonium acetate), and compressive strength and the requirements for fineness was also met by all samples. Two of the samples either met (or very nearly met) the requirement for initial setting time. With four of the samples the initial setting time was too long but the materials would probably respond to the addition of an accelerator.

On the basis of the samples provided to CSIRO all of the gypsums from the SBDC deposits would appear to have the potential to be made into casting plasters that would meet the requirements of the Australian standard.

WORK PROGRAM

Following discussions between Sceale Bay Development corporation Pty Ltd (hereinafter in this report referred to as SBDC) and CSIRO DBCE, an agreements was entered into on 13 August 1996 for CSIRO to conduct calcination of samples of gypsum from SBDC's "two deposits situated at Sceale Bay and Moonabie on South Australia's Eyre Peninsula".

Calcination of Gypsum

Six dried samples of gypsum ready for calcination will be supplied by SBDC. These will be calcined in our laboratory kettle to the end of the first "boil" (approximately 3.5–4 hours) but before the second "boil" to produce only calcium sulfate hemihydrate as is usually carried out in the Australian plaster industry. Grinding will be carried out (after calcination) a maximum of two times in order to meet the fineness criterion of AS 2592 (Gypsum Plaster for Building Purposes).

Each of the 6 calcined gypsums and a sample of commercially produced casting plaster (for purposes of comparison) will be subjected to the following evaluation.

Evaluation of Calcined Gypsums

<u>Composition</u>
Formation of hemihydrate, any residual gypsum, formation of undesirable anhydrite phases (AIII and AII) as well as impurities in the initial samples silica (SiO_2), calcite ($CaCO_3$), halite (NaCl) using powder pattern X-ray diffraction and phase analysis.

Impurities insoluble in ammonium acetate solution according to AS 2592 Appendix B.

<u>Fineness</u>
Fineness of the plaster i.e. the percentage retained on a 600 µm AS sieve according to AS 2592 Appendix D.

<u>Water requirement</u>
Water requirement i.e. the water required to make a mix of standard consistency according to AS 2592 Appendix F.

<u>Initial setting time</u>
Initial setting time i.e. the time of initial set of the plaster in accordance with AS 2592 Appendix G.

If the setting times fall outside the limits specified in the Standard a further investigation can be carried out if required to study the influence of accelerators or retarders on the samples of calcined gypsum.

<u>Kinetics of hydration by Exotherm</u>
The kinetics of hydration, by measuring the increase in temperature of gypsum plaster slurries (exotherm). The data will be processed in accordance with the Ridge Equation (Ref: Ridge, M.J. (1964) 'Nature' (London) 204, 70–1). Two parameters k, a measure of the self-acceleration of the reaction and α_o, a measure of the extent of heterogeneous nucleation in the system will be derived. Also the period of induction (θ), a parameter related to the setting time of the slurry will be obtained.

<u>Compressive strength</u>
The compressive strength of cast gypsum cubes in accordance with AS 2592 Appendix E.

EXPERIMENTAL PROCEDURES

The samples provided by SBDC and referred to throughout this report have the following codes: I for Sceale Bay B. II for Moonabie, and III for Sceale Bay A. All of the samples were provided to CSIRO after having been washed by others. The number following the code refers to the number of washings the sample had been given; for example sample code I–1 refers to the single washed sample from Sceale Bay B.

CSIRO Program

Calcination of Gypsum

The gypsum samples were calcined in an electrically heated laboratory scale kettle. The charge was placed in a removable stainless steel inner container and was stirred with three mixing blades about 100 mm apart (on a central shaft). The temperature of the charge was monitored using two thermocouples, one located near the bottom of the container and the other towards the top of the gypsum charge. The kettle was preheated to approximately 200°C and the gypsum charge was generally 3–3.5 kg.

Calcination was continued until the temperature as indicated by the bottom thermocouple showed that the charge had completed the plateau phase following the first 'boil' and was beginning the second 'boil'. It was desired that complete transformation to calcium sulfate hemihydrate was achieved with minimal further decomposition to the soluble anhydrite phase. At the completion of each calcination the removable container was lifted from the kettle and the charge emptied into a stainless steel tray. The calcined product was covered and placed in a conditioned room running at 21°C and 67% RH. The calcined product had to be ground twice in a laboratory 'Raymond' rotary mill in order to meet the fineness criterion of AS 2592.

X-Ray Diffraction

X-ray diffraction was carried out using Siemens equipment, Cobalt Kα radiation (40 kV, 12 mA) iron filter, and a scan speed of 1°/min. Phases searched for in the calcined products were as follows: calcium sulfate hemihydrate $CaSO_4.^1/_2H_2O$, calcium sulfate dihydrate $CaSO_4.2H_2O$, soluble anhydrite AIII $CaSO_4$, insoluble anhydrite AII $CaSO_4$, silica SiO_2, calcite $CaCO_3$, and Halite (salt) NaCl. It is very difficult to distinguish between the patterns of $CaSO_4.^1/_2H_2O$ and soluble anhydrite AIII because almost all of the peaks of the two phases overlap each other.

Sieve Analysis

A restricted sieve analysis was actually carried out on the calcined samples as opposed to just ensuring that not more than 1% (by mass) was retained on a 600 µm AS sieve. The fractions retained on 600 µm, 150 µm, and 53 µm sieves were determined.

Water Requirement and Initial Setting Time

These parameters were determined in accordance with Australian Standard AS 2592.

Exotherm

Plaster slurries were made up using 100 g of the conditioned hemihydrates together with the mass of water as determined by the water requirement. The slurries were placed in a polythene envelope inside a Dewar flask and the increase in temperature monitored using a probe and digital voltmeter. The fraction of hemihydrate hydrated at any time (α) was obtained by the relation $\alpha = \Delta T/\Delta T_{max}$ where ΔT is the increase in temperature at elapsed time t (from the initial temperature), and ΔT_{max} is the maximum increase in temperature (i.e. $T_{final} - T_{initial}$). The 'Ridge' equation has been shown to describe the kinetics of the setting of gypsum slurries very well and was used in this case to examine the data. The equation describes a function $F(\alpha)$ which varies with time t as follows

$$F(\alpha) \equiv \frac{1}{2}\log_e \frac{[1-(1-\alpha)^{1/3}]^2}{1+(1-\alpha)^{1/3}+(1-\alpha)^{2/3}} - \sqrt{3}\tan^{-1}\frac{[2(1-\alpha)^{1/3}+1]}{\sqrt{3}} = kt + F(\alpha_o) \text{ for } \alpha_o < \alpha < 1$$

where α is the fraction of hemihydrate hydrated, t is the time elapsed from the initial time (which is usually not the same as the time the reactants wre mixed) and k and α_o are constants. The parameter k is a measure of the self-acceleration of the reaction, and α_o is a measure of the extent of heterogeneous nucleation, i.e., the calculated quantity of 'effective' gypsum nuclei present at the commencement of hydration. The period of induction θ defined as the time taken for the rate of temperature increase to exceed 0.1°C min^{-1}, was also obtained from the exotherms.

Compressive Strength of Cast Gypsum Cubes

Cubes (25 x 25 x 25 mm) were prepared in accordance with AS 2592 Appendix E. Compression testing was carried out on a Baldwin Universal Testing Machine Model 60–H using the loading rate designated in the standard.

RESULTS AND DISCUSSION

Calcination and Phase Composition

Details of calcination for each of the SBDC samples and the X-ray Diffraction Phase Composition of the samples together with a sample of commercially available casting plaster are given in Table 1.

The laboratory scale calcination has been successful in producing materials that are essentially calcium sulfate hemihydrate. Residual gypsum was not detected in any of the samples and neither was soluble anhydrite AIII. The latter phase is however very difficult to distinguish from calcium sulfate hemihydrate. A trace of insoluble anhydrite AII was present in calcined gypsum samples II–1 and II–3. Based on previous work in CSIRO, up to about 5% of the phase could have been present. It was also detected in samples III–1 and III–3, but in comparison was present at a reduced level. Silica (SiO_2) was easily detected in the calcined gypsum samples II–1 and II–3 (quite substantial peaks present) and this is consistent with the chemical analyses (provided by SBDC for the information of CSIRO) viz acid insolubles in excess of 4%. Calcite ($CaCO_3$) was detected in all samples and the X-ray patterns were consistent with sample III having the highest content (based on the peak with a d spacing of 3.035 (I=100), at 34.3° for Cobalt radiation). This is also consistent with the chemical analysis results. Halite was not detected in any of the X-ray traces. This is to be expected at levels of sodium chloride of the order of 0.03%.

Details of Exotherms and Kinetics of Hydration (Setting) Reactions

Details of the exotherms carried out on the calcined samples of SBDC gypsums and two samples of a commercial casting plaster are given in Table 2. In general the results fit the Ridge equation very well (high values for the correlation coefficient R). the only exception being sample III–3. This is the case for both the initial exotherm and a repeat exotherm; there is no obvious explanation immediately apparent for this. Repeat exotherms were carried out for samples III–1 and III–3 to see if a period of 'aging' of the calcined gypsums (in the constant temperature room) changed significantly the water requirement or the kinetic parameters k and α_o. In fact this has not occurred. The changes were greater for sample III–3 but have shifted in opposite directions for k and α_o, the influences tending to counteract each other, and the induction period and time of maximum temperature remaining essentially constant.

The influence of washing of the gypsum prior to calcination has not had a consistent influence on the kinetic parameters or the rate of hydration. For samples I and III the slope of the Ridge line, k, is constant or relatively so but for sample II the slope k has approximately halved. In contrast α_o, the measure of the extent of heterogeneous nucleation is at very low levels for samples I–1 and III–1, but has increased for samples I–3 and III–3, very markedly for sample III, whereas considering the range over which it changes it is quite constant for sample II. The same effect is observed with the repeat exotherms for sample III.

The combined influence of the changes in k and α, has resulted in a reduction in the Induction Period θ for samples I and III but a significant increase for sample II.

There is one unusual feature in the exotherms that must be commented upon and this is the initial jump in temperature that has occurred upon mixing of the hemihydrate and water with 5 of the 6 samples (the only exception was sample III–3). In three cases (I–1, I–3, III–1) the temperature rise was quite exceptional particularly for sample I–1. Small temperature fluctuations at the beginning of an exotherm are usual, but they are generally of the order of a degree or less and can be related to the air temperature of the room and the temperature of the dry hemihydrate and mixing water being slightly different. In fact small decreases in temperature can be observed. It must be borne in mind that the temperature probe is running continuously (prior to starting the exotherm) and the first temperature recorded is 30 secs after the start of addition of the hemihydrate to the gauging water. It can take $1-1^1/_2$ mins for the reactants to be mixed, placed into the plastic envelope in the Dewar flask and the temperature probe inserted.

Thus in the case of sample I–1 the room temperature (and presumably that of the reactants hemihydrate and water as they are conditioned in the room) was about 21°C but the first measurement made by the probe in the plaster mix shows a temperature in excess of 29°C. The temperature then falls very slowly by nearly 2° over a time frame of 70 minutes. stabilizes and then slowly starts to increase as the hydration reaction of the hemihydrate begins. The sudden jump in temperature can surely only be attributed to a rapid exothermic chemical reaction but there is no obvious compound/phase present in amounts to produce this. The phenomenon has not been observed by us (to this extent) previously.

SUMMARY OF RESULTS

A summary of all results for the SBDC gypsum samples and a commercial casting plaster is given in Table 3. The following parameters are included in the table.

- Water Requirement
- Initial Setting Time (Knife edge)
- Exotherm Parameters k, α_o, θ
- Sieve Analysis
- Density and compressive strength of cast gypsums made from plaster slurries at the water requirement
- % insolubles in ammonium acetate

Initial Setting Time

The standard requires that the time of initial set shall be between 20 min and 35 min. The SBDC sample II–3 and the commercial casting plaster complied exactly with this (setting times of 35 and 30 minutes respectively). Sample II–1 was very close (15 minutes). The setting times of samples I and III are long, however they should be responsive to the action of accelerators. Both accelerators and retarders are added to commercial plasters to achieve combinations of particular setting properties. Figure 1 shows a good relationship between the Time of Initial Set and the Induction Period θ.

Water Requirement

The standard testing consistency or water requirement of the hemihydrates is reasonable with sample III being the lowest (and therefore the most desirable). The density of cast gypsums produced from plaster mixes is inversely related to the amount of water used to make the mix. Hemihydrates with low water requirements require less water to make mixes of standard consistency which are required for aspects of manufacturing cast plaster products. The theoretical amount of water needed to hydrate 100 g of hemihydrate is only 18.6 g but an excess has to be added to produce a workable mix; this is what is known as the water requirement. The excess water is evaporated upon drying and produces porosity in the cast. Figure 2 shows a line relationship between the density of the cast gypsum and the water/solids ratio of the plaster mix; superimposed on the plot are the current data. The results are plotted at a larger scale in Figure 3 and identified by code. If anything the densities of the casts are slightly higher than might be expected at the water/solids ratios.

Fineness

All of the SBDC calcined gypsum samples met the fineness criterion of AS 2592 (after grinding had been carried out). The commercial casting plaster felt "finer to the touch" and this may be related to its smaller size fractions between 150 and 600 µm and the fact that it had no material larger than 600 µm.

Compressive Strength

In all cases the mean compressive strength of each of the two sets of four cubes were within about 6% (the standard requires 12.5%). The cubes were cast at the water/plaster ratio to form a mixture of standard testing consistency (i.e. at the water requirement) as required by Appendix E of AS 2592. This makes it more difficult to compare the performance re the compressive strength of the different samples, as compressive strength is directly related to the density of the cast which in turn depends on the water/plaster ratio of the mix. A plot of the results (compressive strength v density of the cast) is given in Figure 4 and it is seen that a reasonable relationship exists.

The compressive strength of the cubes made from the commercial casting plaster is significantly higher than any of the SBDC samples and this may be related to the particle size distribution. Nonetheless all the cast gypsums made from the SBDC samples easily met the requirements of the standard for compressive strength, and in one case (Sample I–1) the compressive strength was double that required in the standard.

Composition – % Insoluble in Ammonium Acetate

All of the samples were very much lower in percent insolubles in ammonium acetate than the limit imposed by the standard (20%). The figures of 4–5% for sample II are related to their silica content.

CONCLUSIONS AND RECOMMENDATIONS

On the basis of the samples provided to CSIRO all of the gypsums from the SBDC deposits would appear to have the potential to be made into casting plasters that would meet the requirements of Australian Standard AS 2592.

The setting times of the Sceale Bay samples II–1 and II–3 are either within or very close to the limits required by the standard. The setting times of samples I and III as they stand are much too long for commercial applications. However it is important to note that the work carried out in this project has only involved relatively simple processing viz. A calcination of washed crude ex mine material followed by a simple grinding. These samples would probably respond to the addition of an accelerator.

All of the cast gypsums made from the SBDC samples easily met the requirements of the standard for compressive strength but to fairly compare the performance of the different samples requires sets of specimens to be made at the same density, ie at the same water/plaster ratio.

Some samples of glass fibre reinforced cast plaster sheet were made from one of the SBDC samples and appeared very satisfactory.

It is recommended that the following work be undertaken.

1. Study the action of two accelerators potassium sulfate (K_2SO_4) and gypsum ($CaSO_4.2H_2O$) on the hydration kinetics and setting of the SBDC samples I and III.
2. Produce sets of cubes for each of the samples studied in this report at one constant density, and determine if any significant differences exist in the compressive strength.
3. On one sample selected as the best candidate (by SBDC and CSIRO) investigate the influence of varying the calcination conditions and grinding treatment on setting characteristics, particle size distribution, and mechanical properties of casts.
4. Conduct some foaming experiments with one of the products from stage 3 to determine the response to CSIRO's formulation, and the strength of the foamed product.

TABLE 1. DETAILS OF CALCINATION OF SBDC GYPSUM SAMPLES AND XRD PHASE COMPOSITION OF CALCINED PRODUCTS AND A COMMERCIAL CASTING PLASTER (CONTROL)

Sample Code	Temperatures (°C) at various stages during the calcination (bottom thermocouple)					Total calcination time	X-ray Diffraction Phase Composition						
	First Plateau		Second Plateau		At end of calcination		Hemihydrate	Gypsum (residual)	Anhydrite III soluble anhydrite	Anhydrite II insoluble anhydrite	Silica	Calcite	Halite
	Start	Finish	Start	Finish		(hrs-mins)	$CaSO_4.{}^1/_2H_2O$	$CaSO_4.2H_2O$	$CaSO_4$	$CaSO_4$	SiO_2	$CaCO_3$	NaCl
I–1	100	120	194	196	212	4–20	~100	ND	ND	ND	ND	D	ND
I–3	100	125	194	196	220	4–30	~100	ND	ND	ND	ND	D	ND
II–1	116	160	200	206	252	4–16	<100	ND	ND	Trace	D	D	ND
II–3	120	164	198	212	244	4–9	<100	ND	ND	Trace	D	D	ND
III–1	100	120	194	196	223	4–23	~100	ND	ND	D	ND	D	ND
III–3	100	120	194	196	206	4–45	~100	ND	ND	D	ND	D	ND
Control							~100	ND	ND	ND	ND	D	ND

Notes: The first 'boil' occurs between the first and second plateaus
The second 'boil' occurs between the second and third plateaus
X-ray Phase Composition: N.D. Phase not detected
D Phase detected
Trace Based on previous work up to about 5% of the phase could be present
~100 Product is essentially composed of this phase
For samples II–1 and II–3 Substantial peaks for SiO_2 were present
For samples III–1 and III–3 the AII content is notably less than for samples II–1 and II–3

TABLE 2. DETAILS OF EXOTHERMS OF SAMPLES OF CALCINED GYPSUM (SBDC) AND A COMMERCIAL CASTING PLASTER (CONTROL)

	I–1	I–3	II–1	II–3	III–1	III–1 (repeat exotherm)	III–3	III–3 (repeat exotherm)	Commercial Casting Plaster Control	
Date of calcination	2–9–96	9–9–96	26–9–96	1–10–96	3–10–96	3–10–96	7–10–96	7–10–96	Sept 96	May 96
Date of exotherm	26–9–96	27–9–96	3–10–96	4–10–96	7–10–96	25–10–96	14–10–96	28–10–96	1–10–96	28–10–96
Days elapsed between calcination and exotherm	24	18	7	3	4	22	7	21		
Wataer/Solids ratio	0.62	0.66	0.70	0.64	0.565	0.574	0.558	0.567	0.60	0.546
Temperature of room (°C) at start of mixing (time=0)	21.06	21.17	21.11	21.59	21.38	21.86	21.11	20.74	21.59	21.59
Initial jump in temperature (°C)	8.33	3.74	0.64	1.07	3.21	3.31	0	0	0	0
Initial Temperature (°C)	27.58	24.91	21.86	22.66	22.88	22.93	21.22	20.52	21.38	22.02
Initial time (mins)	73.0	38.0	3	4.5	193	256	4.5	3.5	8	4
Maximum temperature (°C)	47.25	44.74	42.17	42.6	42.97	41.10	40.78	40.41	45.59	49.44
Time at maximum temperature (mins)	130.5	104.5	33	65	313	378.5	140	149.5	70	62
ΔT_{max} (°C)	19.67	19.83	20.31	19.94	20.09	18.17	19.56	19.89	24.21	27.42
Time at half ΔT_{max}	102.0	84.5	23.5	49.5	282	339	117.5	124	52.5	44.5
Induction Period θ (mins)	83	61.5	4.5	23.5	253.5	309	91.5	97	26	7
Slope of line k	0.1401	0.1449	0.2528	0.1276	0.0918	0.0794	0.0653	0.0486	0.1240	0.1103
Intercept $F(\alpha_o)$	−18.4489	−15.9175	−9.5519	−9.9546	−29.7833	−30.8045	−11.7107	−10.1765	−10.0562	−8.4429
Correlation coefficient R	0.9683	0.9957	0.9985	0.9828	0.9664	0.9826	0.8793	0.8896	0.9979	0.9949
Number of points in regression	88	87	54	106	137	159	147	262	99	107
$\alpha_o * 10^2$	0.000021	0.000381	0.2262	0.1513	1×10^{6}	1×10^{6}	0.0261	0.1212	0.1367	0.6835

TABLE 3. SUMMARY OF RESULTS FOR CALCINED 'SBDC' GYPSUM SAMPLES AND A COMMERCIAL CASTING PLASTER (CONTROL)

Sample Code	Water Requirement[1] (ml)	Initial Setting Time Knife Edge (mins)	Exotherm Parameters			Sieve Analysis (% in size fraction)				Density[3] (kg/m^3)	Compressive[3] Strength (MPa)	% insoluble in ammonium acetate
			k	$\alpha_o \times 10^2$	Induction Period θ (mins)	>600μm	600-150	150-53	<53μm			
I-1	61.7	65	0.1401	2.1×10^{-5}	83	0.85	17.65	21.80	59.70	1273	16.52	0
										(10.2)	(0.60)	
I-3	66.0	55	0.1449	3.81×10^{-4}	61.5	0.92	9.83	14.25	75.00	1163	11.28	0
										(8.1)	(0.92)	
II-1	70.0	15	0.2528	0.2262	4.5	0.70	6.10	5.00	88.20	1073	11.06	4.75
										(7.6)	(1.10)	
II-3	64.2	35	0.1276	0.1513	23.5	0.66	6.59	4.85	87.90	1140	10.97	4.00
										(6.5)	(0.58)	
III-1	56.5	210	0.0918	1×10^{-6}	253.5	0.48	18.72	19.10	61.70	1325	15.44	0
	57.4[2]		0.0794	1×10^{-6}	309					(7.7)	(2.02)	
III-3	55.8	95	0.0653	0.0261	91.5	0.96	14.64	8.70	75.70	1264	14.18	0
	56.7[2]		0.0486	0.1212	97					(6.6)	(0.61)	
Control	54.6	30	0.1103	0.6835	7	0	~5[6]	~25[6]	~70[6]	1260	21.00	3.6[4]
										(7.0)	(0.90)	2.0[5]

1. Water requirement is volume of water required per 100 g of hemihydrate to make a plaster slurry of standard testing consistency.
2. Repeat exotherms carried out 3 weeks after calcination.
3. Mean of 8 determinations, standard deviations in brackets.
4. On their Technical Data Sheet the manufacturers of the commercial plaster quote a figure of 3.6% for typical ammonium acetate insolubles.
5. As determined by CSIRO on the sample tested.
6. Interpolated from Technical Data Sheet.

FIGURE 1.

INITIAL SET OF CALCINED GYPSUMS
v INDUCTION PERIOD

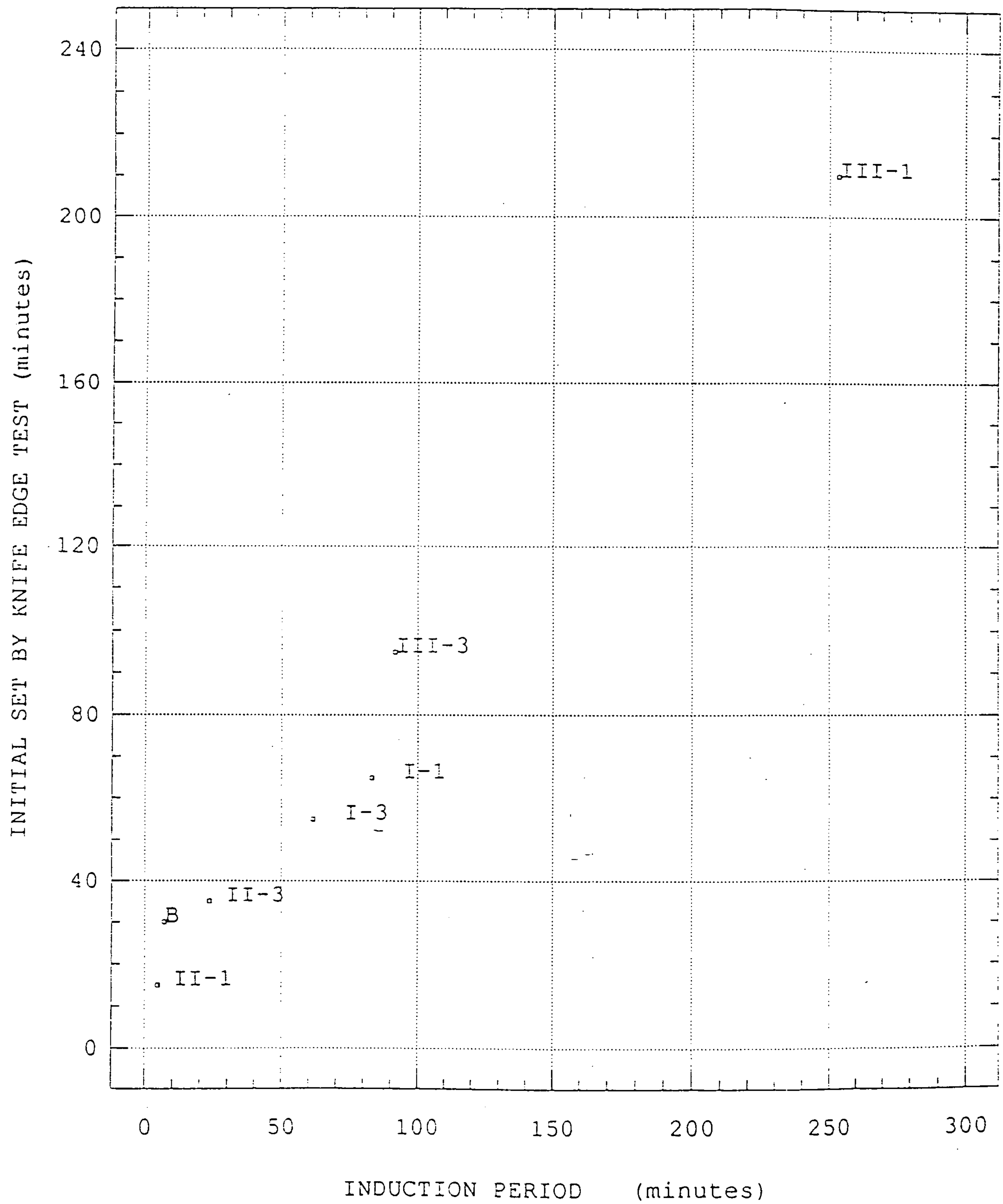


FIGURE 2.

DENSITY OF CAST GYPSUM v
WATER/SOLIDS RATIO

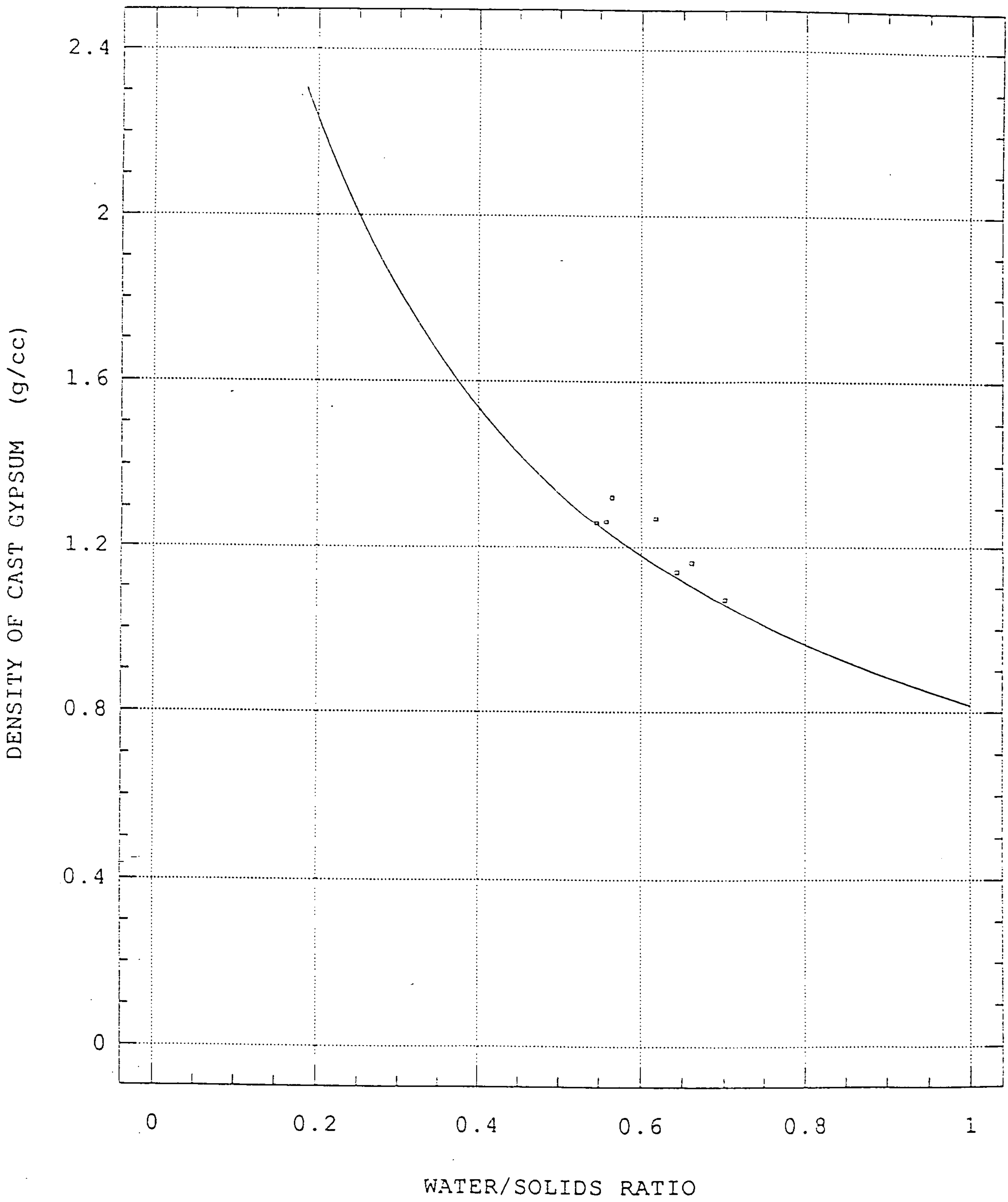


FIGURE 3.

DENSITY OF CAST GYPSUMS v WATER REQUIREMENT

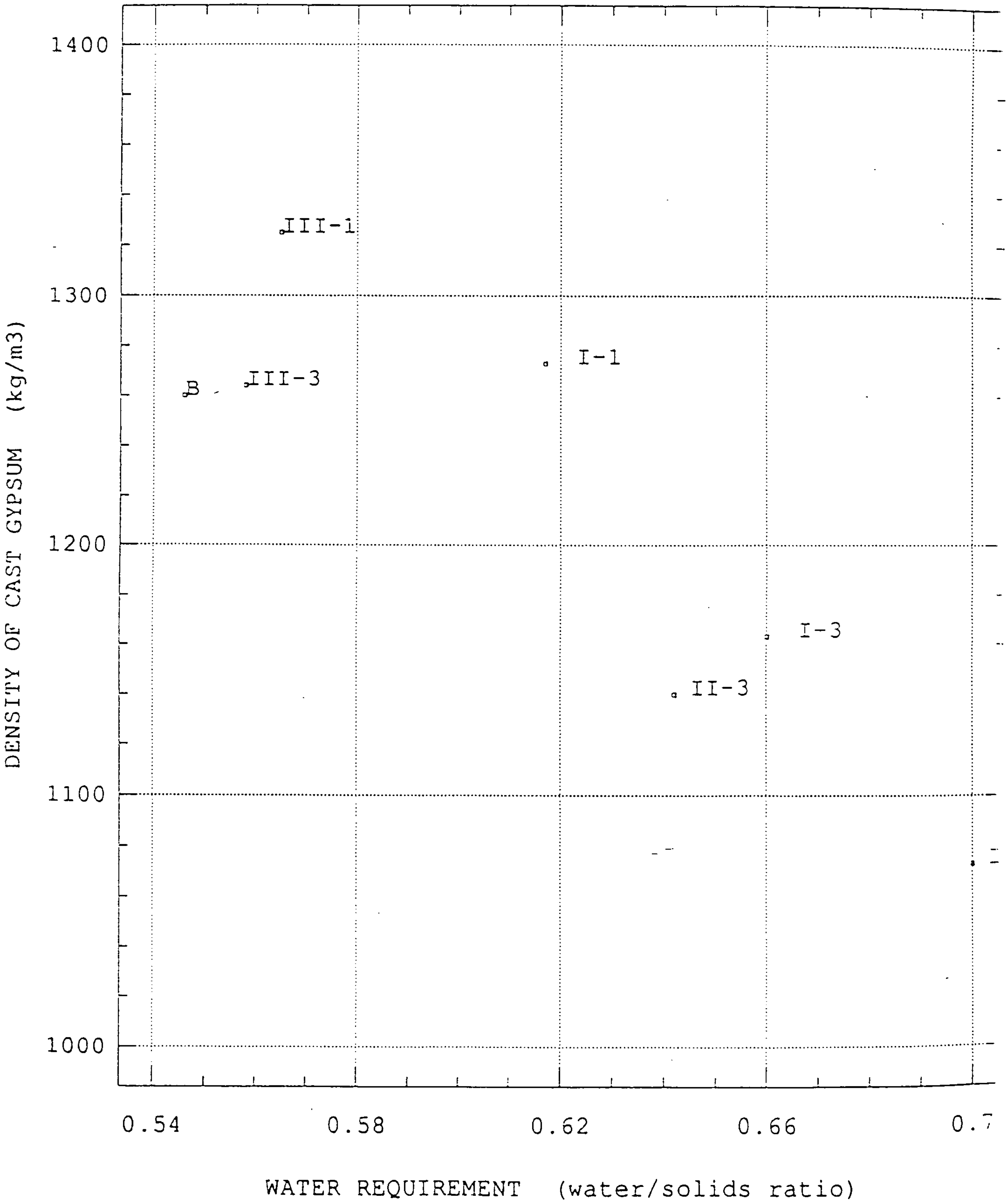
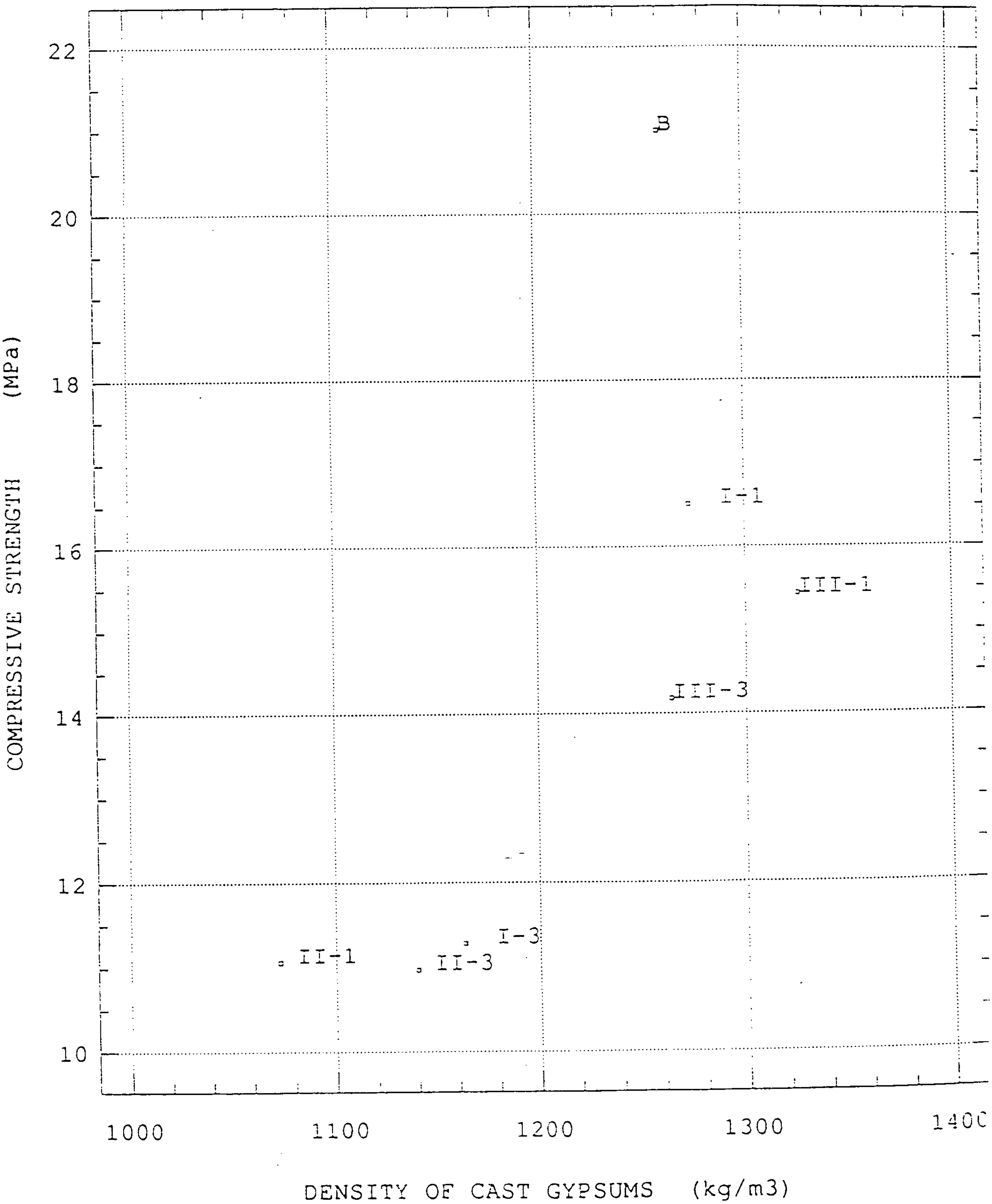
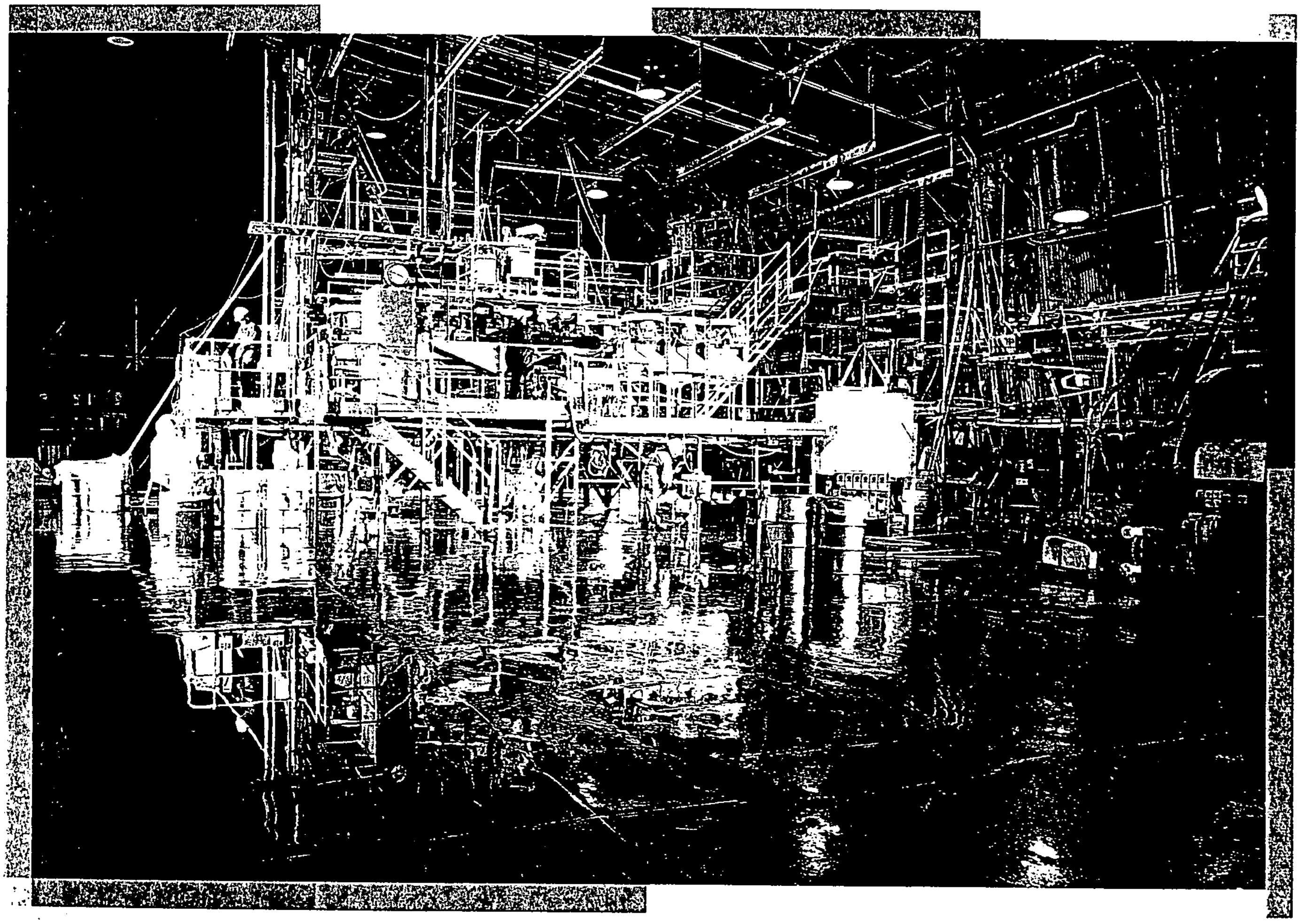


FIGURE 4.

COMPRESSIVE STRENGTH OF CAST GYPSUMS
v DENSITY



TENNANT LIMITED



GYPSUM TESTWORK

Report No. N8149 (amended) 11 October 1996

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Attention: Mr J Guinness

REPORT N8149 (Amended)

GYPSUM TESTWORK

This report replaces Amdel Report N8149 issued on 3 September 1996. We request that all copies of the report issued on 3 September 1996 be destroyed and replaced by copies of this amended report. We sincerely regret the inconvenience caused.

YOUR REFERENCE: Fax dated 29/7/96

SAMPLE IDENTIFICATION: Streaky Bay "A" and "B", Moonabie

MATERIAL: Gypsum

LOCATION: South Australia

DATE RECEIVED: 8 August 1996

PROJECT MANAGER: J R Tuffley

Ric Phillips
Manager
Mineral Processing Services

JRT:msm1

cc: Mr Jeff Olliver
PO Box 24
McLaren Vale SA 5171

1. INTRODUCTION

Tennant Limited is investigating the quality of gypsum obtained from parts of Eyre Peninsula in South Australia. Amdel was commissioned to carry out a range of testes including bulk density, analysis, mineralogy and washing.

Samples were delivered to Amdel by Mr Jeff Olliver on 8 August 1996.

2. SAMPLES RECEIVED

Each sample consisted of 30 kilograms of dune gypsum deposits as follows:

Streaky Bay A - Low salt composite - 1m intervals in 1996 hand auger holes with salt content less than 0.5 percent

Streaky Bay B - Bulk - all intervals with more than 88 percent gypsum irrespective of salt content which ranged up to 1.63 percent

Moonabie - Three Mile Dune - composite of 1996 hand auger drill holes

3. PROCEDURE AND RESULTS

3.1. Sample Preparation

Each sample was screened on a 1.7mm screen to remove organic debris and coarse material including what appeared to be lumps of mud. Some fine organics did pass through the screen.

A head sample of about 1.5kg was then obtained by riffle splitting and was dried at 50°C. The following sub-samples were then obtained from the dried material:

- 100g for chemical analysis
- 50g for XRD
- 0.5kg for optical mineralogy
- 0.5kg for Mr J. Olliver.

3.2. Chemical Analysis

The chemical analyses of the three samples are listed in Table 1. These show that the NaCl level was already very low before washing. The major impurities were $CaCO_3$, mainly in the Streaky Bay samples, and silica in the Moonabie sample.

3.3. XRD and Mineralogy

A detailed report on the mineralogy of the three samples is included in Appendix A.

3.4. Bulk Density

The bulk density of each sample was determined in two ways. A rigid 1 litre container was filled with sand and care was taken not to cause any compaction. Using the same container, maximum compaction was obtained by rapping the side of the container. The following results were obtained:

Sample	**Bulk Density, kg/l**	
	No Compaction	**Compaction**
Streaky Bay A	1.10	1.34
Streaky Bay B	1.06	1.30
Moonabie	1.06	1.31

3.5. Washing

Each sample was washed in Adelaide tap water by mechanically agitating a slurry containing 40% solids. The slurry was agitated for two hours, then allowed to settle. The supernatant liquor, containing some organics and slimes, was then decanted. The proportion of slimes was much greater in the Moonabie sample than in the other two.

The sample was then filtered, but this proved to be difficult and slow even in a pressure filter. As a result, a rather sloppy filter cake was then placed in an oven to dry at a temperature not in excess of 65°C.

An assay sample was obtained from the product and about 8kg was set aside as the product of the first wash.

The remaining product was washed again using the method described above. Once again an assay sample and a product sample of about 8kg were obtained.

The remainder was then washed for a third time. An assay sample and a 2kg sample for Mr J Olliver were obtained. The three products (each weighing about 8kg) from each sample were forwarded to CSIRO in Melbourne for further testwork.

Analyses of the products are listed in Table 2. These show that the washings were successful in removing most of the NaCl and that one washing may be sufficient.

The washed samples contain high grade gypsum with the only major impurity being silica in the Moonabie sample.

TABLES

TABLE 1 : ANALYSES OF AS-RECEIVED GYPSUM SAMPLES

Component	Streaky Bay "A"	Streaky Bay "B"	Moonabie
Gypsum, %	96.4	95.8	96.1
Na_2O, %	0.13	0.18	0.08
K_2O, %	0.03	0.04	0.08
CaO, %	32.9	33.3	30.8
MgO, %	0.04	0.05	0.02
CO_2, %	1.45	1.30	0.50
Fe_2O_3, %	0.23	0.04	0.17
Al_2O_3, %	0.07	0.05	0.22
SO_3, %	46.1	46.1	44.2
Acid insolubles, %	0.10	0.16	4.30
Cl, ppm	500	900	300
Expressed as compounds:			
$CaSO_4.2H_2O$, %	96.4	95.8	96.1
$CaCO_3$, %	3.20	2.83	1.09
$MgCO_3$, %	0.08	0.11	0.04
NaCl, %*	0.08	0.15	0.05
Al_2O_3, %	0.07	0.05	0.22
Fe_2O_3, %	0.23	0.04	0.17
Acid insolubles, %	0.10	0.16	4.30

* Based on chloride content

TABLE 2 : ANALYSES OF WASHED PRODUCTS

	Gypsum %	Cl ppm	NaCl %	Acid insol. %	SO_3 %
Streaky Bay "A"					
1st wash	98.2	200	0.03	0.16	46.2
2nd wash	98.3	200	0.03	0.18	46.9
3rd wash	98.3	100	0.02	0.14	47.2
Streaky Bay "B"					
1st wash	98.1	300	0.05	0.20	46.6
2nd wash	98.0	200	0.03	0.24	46.2
3rd wash	98.1	200	0.03	0.18	46.6
Moonabie					
1st wash	95.1	100	0.02	4.24	45.2
2nd wash	95.3	100	0.02	4.40	45.5
3rd wash	95.4	100	0.02	4.54	45.4

APPENDIX A

MINERALOGY REPORT

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28 August 1996

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REPORT N814900G/96
MINERALOGY OF GYPSUM SAMPLES

YOUR REFERENCE:	IWR 10668
SAMPLE IDENTIFICATION:	Streaky Bay A + B, Moonabie
MATERIAL:	3 gypsum samples
DATE SAMPLE(S) RECEIVED	14 August 1996
DATE AUTHORISATION RECEIVED:	14 August 1996
WORK REQUIRED:	X-ray diffraction analysis and microscopy

Investigation and report by:	Michael Till
Microscopy by:	Michael J. W. Larrett

Keith Henley

Dr Keith J Henley
Manager, Mineralogical Services

The results contained in this report relate only to the sample(s) submitted for testing. Amdel Ltd accepts no responsibilities for the representivity of the sample(s) submitted.

fws

MINERALOGY OF GYPSUM SAMPLES

1. INTRODUCTION

Three samples of gypsum were submitted for examination to determine their mineralogy according to the client's (Tennant Limited) instructions.

2. PROCEDURE

Representative subsamples were examined mineralogically using a combination of stereobinocular and transmitted-light techniques (temporary oil mounts) to identify the minerals present and to comment on their relevant particle sizes, morphology, inclusions, coatings, and contaminants, etc. Pulverised portions of the samples were analysed by X-ray diffraction.

3. RESULTS

The minerals detected by X-ray diffraction are a follows:

Streaky Bay A	Streaky Bay B	Moonabie
Gypsum D	Gypsum D	Gypsum D Quartz Tr

Semiquantitative abbreviations

D = Dominant. Used for the component apparently most abundant, regardless of its probable percentage level.

Tr = Trace. Components judged to be below about 5%.

Mineralogical observations are as follows:

Streaky Bay A

This sample consists of quite coarse, off-white, granular gypsum and fine gypsum "flour", with traces of other impurities.

Microscopic examination shows gypsum to be the predominant phase present. In the coarser particle sizes, it occurs as rounded to subrounded particles, and more rarely as subhedral prismatic crystals ranging in size from 1.5mm down to 0.10mm. The majority are of a dirty off-white colouration and contain abundant brownish and black, often diffuse, included materials, possibly clay or materials of (?)organic origin, sometimes in weak zonal orientation. Many appear to have brownish surficial coatings of (?)iron-oxide(s).

The finer gypsum "flour" component consists of angular, subangular, and subprismatic particles ranging in size from 0.10mm down to submicron sizes, and is much cleaner than the coarse component.

Also present are traces of clay, (?)iron-oxide(s), carbonate, organic material (possibly roots) and black opaque material. The clay forms liberated aggregates up to 0.1mm wide and may also be the cause or partial cause of the turbidity in the gypsum. The carbonate typically forms very small (<5μm) inclusions in gypsum and similar sized liberated particles. Minor carbonate also forms radiating, fibrous aggregates up to 0.02mm in size. Opaques form liberated rounded particles generally between 0.1 and 0.2mm in size. The organic material has a reddish-brown colour and forms elongate, root-like particles up to ~2mm long.

Streaky Bay B

This sample is almost identical to Streaky Bay A, except that it appears to contain slightly heavier iron-staining.

Moonabie

This sample consists of quite coarse, dirty brownish-white gypsum grading to gypsum "flour", with traces of other impurities.

Microscopic examination shows gypsum to be the predominant phase present, occurring as subangular to subprismatic (elongate) and rarely angular particles of a dirty brownish-white colouration, ranging from 2.0mm down to submicron sizes. The individual particles contain varying amounts of included clay and/or (?)organic material (but not quite so distinctive as the Streaky Bay samples), which impart a dusty, sometimes turbid, appearance. Patchy brown (?)surficial coatings of iron-oxide(s) are quite common and traces of discrete brown particles of iron-oxide appear to be somewhat more abundant than those occurring in the Streaky Bay samples. Traces of fine grained black opaque material and a minute trace of quartz are also present. The opaques typically form round, liberated particles below 0.1mm in size or smaller, irregular inclusions in gypsum. Minor organic, plant matter forms elongate particles up to ~2mm long.

SUMMARY

All three gypsum samples are similar, containing extremely high percentages of gypsum. Particles sizes of the gypsum are similar, with Moonabie being slightly coarser. A progressive decrease in particle size is accompanied by an increase in purity in terms of liberation of iron-oxides and included material.

The Moonabie sample is expected to have a higher content of iron than the Streaky Bay samples. The Streaky Bay samples exhibit a higher degree of crystallinity than does the Moonabie sample.

STREAKY BAY - E.L. 1821

SIX MONTHS TO 18 FEBRUARY, 1997

EXPLORATION COMPLETED - GOLD

GEOCHEMICAL SAMPLING

An initial calcrete sampling program was conducted on E.L. 1821 during October 1996. A total of 119 samples were collected on public access roads at approximately 1 km spacing. Sampling was conducted without prior assessment of the regolith, which has subsequently proven to be inappropriate for calcrete sampling. Consequently best results of 1 ppb Au were obtained from 14 sample sites with the remainder below detection levels. Samples were also analysed for Cu and As, with no significant results being returned.

FUTURE EXPLORATION - GOLD

Due to difficulties experienced using conventional calcrete sampling techniques on E.L. 1821, similar problems are expected using other regolith sampling methods. Therefore future exploration shall focus on using aeromagnetic imagery to isolate possible RAB drilling targets.

SAMPLE	EAST	NORTH	EL	PROSPECT	DATE	DEPTH	ORDER	JOB	NOTES
1025	424390	6365410	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1026	424100	6364230	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1027	424010	6361780	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1028	423190	6361820	1821	Regional	24/10/96	0.2	83918	AD015782	Massive
1029	421940	6361780	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1030	420850	6361810	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1031	419450	6361750	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1032	418310	6361800	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1033	415600	6361600	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1034	421962	6359580	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1035	422640	6360370	1821	Regional	24/10/96	0.2	83918	AD015782	Massive
1036	423300	6361380	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1037	420790	6358050	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1038	420060	6358370	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1039	419120	6358010	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1040	419070	6359000	1821	Regional	24/10/96	0.2	83918	AD015782	Massive
1041	418100	6358060	1821	Regional	24/10/96	0.2	83918	AD015782	Massive
1042	414760	6357570	1821	Regional	24/10/96	0.3	83918	AD015782	Massive
1043	415300	6358030	1821	Regional	24/10/96	0.2	83918	AD015782	Massive
1044	425120	6367230	1821	Regional	24/10/96	0.4	83918	AD015782	Massive
1045	425480	6368310	1821	Regional	24/10/96	0.1	83918	AD015782	Massive
1046	424160	6360780	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1047	424790	6359730	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1048	425360	6358750	1821	Regional	25/10/96	0.6	83918	AD015782	Massive
1049	425910	6357960	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1050	425880	6356280	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1051	426050	6355180	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1052	426340	6354260	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1053	426960	6353660	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1054	427100	6352200	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1055	428070	6351800	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1056	428760	6351190	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1057	429540	6350830	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1058	430040	6348400	1821	Regional	25/10/96	0.1	83918	AD015782	Massive

SAMPLE	Au	Ca	CaNAu	As	Cu	Ag	Bi	Co	Mo	Ni	Pb	Pd	Sb	Te	U3O8
1025	<1	21.34	-	<5	1.6										
1026	<1	20.49	-	13	1.3										
1027	<1	24.91	-	9	0.9										
1028	<1	25.53	-	9	1.7										
1029	<1	28.31	-	<5	1.1										
1030	<1	22.11	-	14	1.7										
1031	<1	20.6	-	6	2.2										
1032	<1	24.77	-	17	2.0										
1033	<1	21.09	-	11	1.3										
1034	<1	27.24	-	18	1.1										
1035	<1	25.54	-	<5	3.3										
1036	1	31.59	-	7	2.1										
1037	<1	27.11	-	<5	1.5										
1038	<1	27.03	-	10	2.5										
1039	<1	30.17	-	<5	0.9										
1040	1	27.14	-	<5	4.1										
1041	<1	26.71	-	<5	2.3										
1042	<1	27.73	-	8	5.0										
1043	<1	24.09	-	18	4.6										
1044	<1	26.06	-	16	1.5										
1045	<1	30.42	-	12	1.4										
1046	<1	28.12	-	<5	1.0										
1047	<1	27.49	-	6	1.5										
1048	<1	30.95	-	6	0.9										
1049	<1	28.46	-	<5	1.4										
1050	1	24.87	-	24	2.8										
1051	<1	29.09	-	9	2.1										
1052	<1	30.35	-	11	1.3										
1053	<1	25.09	-	13	1.2										
1054	<1	26.02	-	<5	1.0										
1055	<1	25.49	-	7	1.7										
1056	<1	25.81	-	<5	1.6										
1057	<1	27.78	-	<5	1.0										
1058	1	25.87	-	14	1.3										

SAMPLE	W	Zn
1025		
1026		
1027		
1028		
1029		
1030		
1031		
1032		
1033		
1034		
1035		
1036		
1037		
1038		
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SAMPLE	EAST	NORTH	EL	PROSPECT	DATE	DEPTH	ORDER	JOB	NOTES
1059	429880	6349370	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1060	430340	6351040	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1061	431280	6351600	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1062	432060	6352000	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1063	432400	6352150	1821	Regional	25/10/96	0.2	83918	AD015782	Massive
1064	432310	6352900	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1065	433020	6353070	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1066	433840	6353080	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1067	434640	6353500	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1068	434500	6354300	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1069	434220	6355410	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1070	434210	6356170	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1071	434600	6357030	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1072	434090	6357930	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1073	434350	6358200	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1074	434030	6358900	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1075	433760	6359840	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1076	433380	6360560	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1077	432360	6360880	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1078	431550	6361160	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1079	431590	6361900	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1080	431240	6362880	1821	Regional	25/10/96	0.2	83918	AD015782	Massive
1081	430500	6363330	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1082	430370	6364120	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1083	429820	6364720	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1084	430280	6365550	1821	Regional	25/10/96	0.2	83918	AD015782	Massive
1085	430350	6366420	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1086	429780	6367770	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1087	430950	6367900	1821	Regional	25/10/96	0.2	83918	AD015782	Massive
1088	432020	6367230	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1089	432530	6366240	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1090	434340	6364510	1821	Regional	25/10/96	0.2	83918	AD015782	Massive
1091	435690	6363690	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1092	435610	6362730	1821	Regional	25/10/96	0.1	83918	AD015782	Massive

SAMPLE	Au	Ca	CaNAu	As	Cu	Ag	Bi	Co	Mo	Ni	Pb	Pd	Sb	Te	U3O8
1059	<1	30.37	-	14	2.3										
1060	<1	26.94	-	<5	1.3										
1061	<1	27.4	-	11	1.6										
1062	<1	27.07	-	5	1.0										
1063	<1	28.67	-	9	1.1										
1064	<1	24.33	-	<5	1.4										
1065	<1	26.11	-	9	1.4										
1066	<1	25.23	-	<5	1.3										
1067	<1	24.41	-	<5	1.5										
1068	<1	25.25	-	8	1.4										
1069	1	23.28	-	<5	1.3										
1070	<1	25.01	-	9	1.1										
1071	<1	16.48	-	8	1.2										
1072	<1	30.28	-	9	1.4										
1073	1	26.98	-	<5	1.7										
1074	1	26.39	-	5	2.0										
1075	<1	28.32	-	5	1.1										
1076	<1	27.70	-	<5	1.4										
1077	1	27.46	-	10	1.6										
1078	<1	28.64	-	<5	1.6										
1079	<1	26.98	-	14	1.2										
1080	<1	27.37	-	6	1.6										
1081	<1	22.40	-	7	2.5										
1082	<1	30.38	-	<5	1.7										
1083	<1	27.79	-	5	2.2										
1084	<1	28.06	-	<5	1.3										
1085	<1	27.44	-	10	1.0										
1086	<1	25.17	-	13	1.3										
1087	<1	25.36	-	10	1.1										
1088	<1	26.97	-	<5	0.7										
1089	<1	27.79	-	<5	1.1										
1090	<1	25.73	-	9	1.8										
1091	<1	29.81	-	<5	1.3										
1092	<1	24.22	-	10	1.7										

SAMPLE	W	Zn
1059		
1060		
1061		
1062		
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1066		
1067		
1068		
1069		
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1092		

SAMPLE	EAST	NORTH	EL	PROSPECT	DATE	DEPTH	ORDER	JOB	NOTES
1093	435500	6361210	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1094	435120	6359970	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1095	435000	6359340	1821	Regional	25/10/96	0.1	83918	AD015782	Massive
1096	427380	6368090	1821	Regional	26/10/96	0.2	83918	AD015782	Massive
1097	427790	6367270	1821	Regional	26/10/96	0.3	83918	AD015782	Massive
1098	427420	6366040	1821	Regional	26/10/96	0.2	83918	AD015782	Massive
1099	427140	6365050	1821	Regional	26/10/96	0.2	83918	AD015782	Massive
1100	427140	6364260	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1101	426640	6363570	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1102	426380	6362600	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1103	426430	6361980	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1104	427180	6361400	1821	Regional	26/10/96	0.2	83918	AD015782	Massive
1105	427230	6360800	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1106	428180	6360250	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1107	427480	6359420	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1108	427264	6358830	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1109	427000	6358610	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1110	428120	6356230	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1111	428680	6355400	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1112	429270	6355100	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1113	427580	6355620	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1114	426820	6355300	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1115	426580	6354060	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1116	427720	6345900	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1117	428850	6345980	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1118	429620	6346180	1821	Regional	26/10/96	01.	83918	AD015782	Massive
1119	430190	6344690	1821	Regional	26/10/96	0.4	83918	AD015782	Massive
1120	430330	6342820	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1121	437630	6342710	1821	Regional	26/10/96	0.2	83918	AD015782	Massive
1122	436530	6342740	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1123	435140	6342600	1821	Regional	26/10/96	0.2	83918	AD015782	Massive
1124	437280	6343810	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1125	436930	6344550	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1126	436490	6345270	1821	Regional	26/10/96	0.1	83918	AD015782	Massive

SAMPLE	Au	Ca	CaNAu	As	Cu	Ag	Bi	Co	Mo	Ni	Pb	Pd	Sb	Te	U3O8
1093	<1	28.59	-	<5	1.2										
1094	<1	24.11	-	21	2.3										
1095	<1	24.54	-	9	1.0										
1096	<1	28.27	-	<5	1.6										
1097	<1	28.42	-	7	1.5										
1098	<1	24.16	-	<5	1.6										
1099	<1	29.60	-	<5	1.4										
1100	<1	30.35	-	15	1.4										
1101	<1	28.60	-	<5	1.6										
1102	1	26.73	-	5	2.3										
1103	<1	29.28	-	<5	1.1										
1104	<1	28.44	-	9	1.4										
1105	<1	25.99	-	<5	2.5										
1106	<1	35.04	-	9	4.3										
1107	<1	27.79	-	<5	1.4										
1108	1	28.13	-	<5	1.2										
1109	<1	30.81	-	6	1.3										
1110	<1	27.93	-	<5	1.1										
1111	<1	24.99	-	<5	1.5										
1112	<1	29.07	-	7	1.1										
1113	<1	27.23	-	<5	1.4										
1114	<1	28.23	-	<5	1.4										
1115	<1	22.53	-	8	1.3										
1116	1	26.56	-	<5	2.1										
1117	<1	31.39	-	<5	1.5										
1118	<1	26.88	-	<5	2.0										
1119	1	27.41	-	11	1.2										
1120	<1	27.77	-	13	1.1										
1121	<1	28.93	-	<5	1.7										
1122	<1	26.02	-	7	1.4										
1123	<1	24.50	-	6	1.5										
1124	<1	25.20	-	6	1.5										
1125	<1	26.88	-	<5	2.9										
1126	<1	24.04	-	<5	1.5										

SAMPLE	W	Zn
1093		
1094		
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1100		
1101		
1102		
1103		
1104		
1105		
1106		
1107		
1108		
1109		
1110		
1111		
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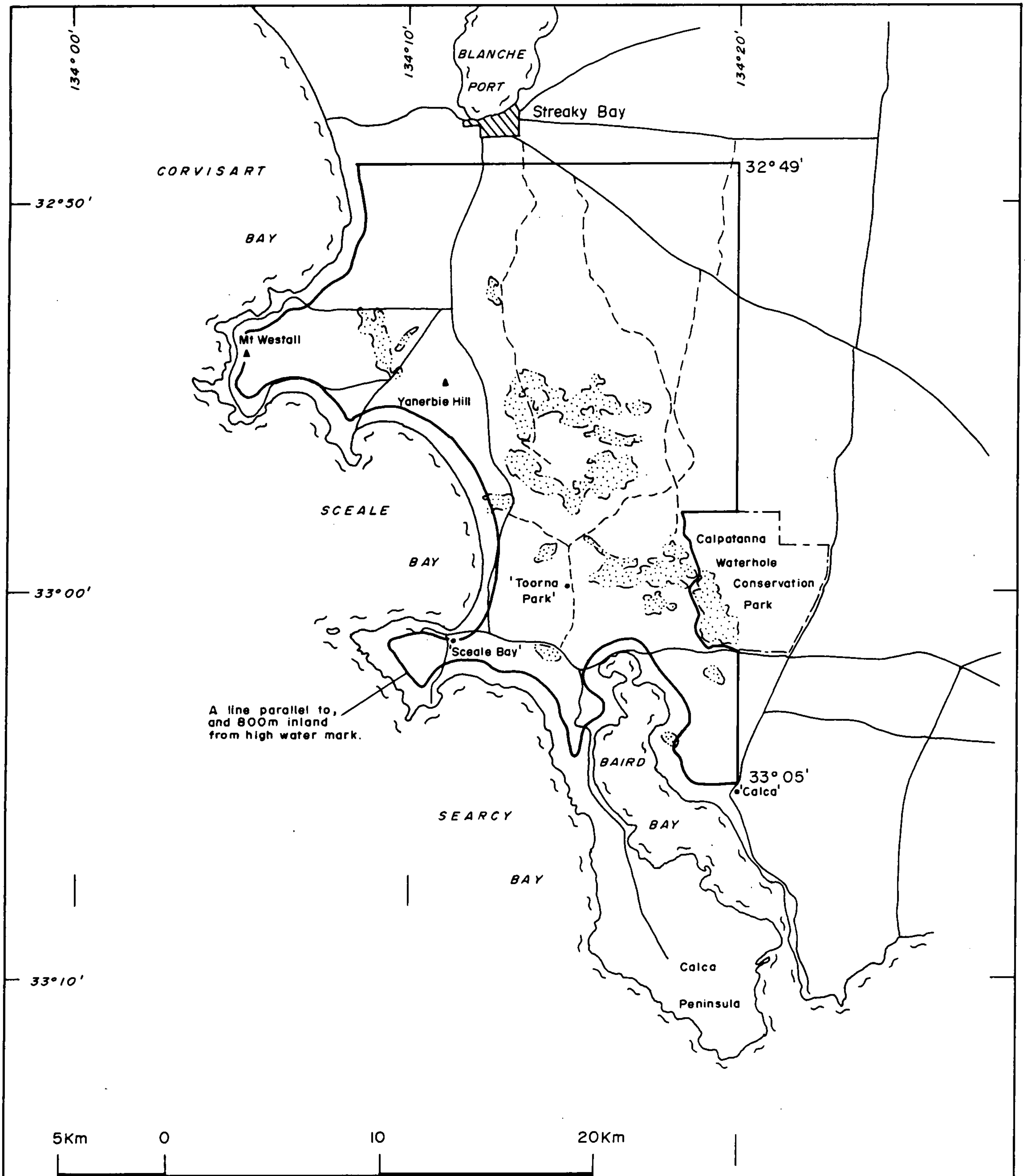
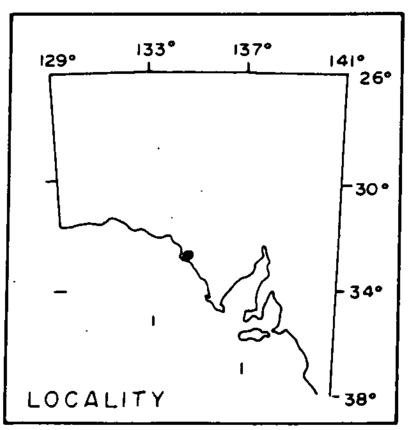
1117		
1118		
1119		
1120		
1121		
1122		
1123		
1124		
1125		
1126		

SAMPLE	EAST	NORTH	EL	PROSPECT	DATE	DEPTH	ORDER	JOB	NOTES
1127	435850	6346440	1821	Regional	26/10/96	0.2	83918	AD015782	Massive
1128	435890	6347280	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1129	435690	6347990	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1130	435550	6348740	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1131	435860	6349450	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1132	435680	6340200	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1133	435340	6351140	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1134	435170	6352010	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1135	435450	6352370	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1136	436430	6352320	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1137	437700	6352270	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1138	436490	6363460	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1139	436780	6364370	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1140	436880	6365470	1821	Regional	26/10/96	0.1	83918	AD015782	Massive (friable)
1141	436760	6367760	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1142	437210	6368550	1821	Regional	26/10/96	0.1	83918	AD015782	Massive
1143	422240	6368540	1821	Regional	26/10/96	0.2	83918	AD015782	Massive

SAMPLE	Au	Ca	CaNAu	As	Cu	Ag	Bi	Co	Mo	Ni	Pb	Pd	Sb	Te	U3O8
1127	<1	27.53	-	7	1.2										
1128	<1	24.10	-	<5	1.7										
1129	<1	26.24	-	9	1.2										
1130	<1	27.92	-	<5	1.4										
1131	<1	30.76	-	<5	1.0										
1132	1	27.85	-	12	1.2										
1133	<1	25.77	-	<5	1.3										
1134	<1	25.51	-	<5	1.2										
1135	<1	23.31	-	<5	1.1										
1136	<1	21.68	-	<5	1.0										
1137	<1	25.25	-	<5	1.2										
1138	<1	25.24	-	<5	1.4										
1139	<1	22.42	-	<5	1.2										
1140	<1	23.83	-	<5	4.5										
1141	<1	24.44	-	<5	4.1										
1142	<1	28.30	-	6	1.2										
1143	1	24.63	-	<5	3.9										

SAMPLE	W	Zn
1127		
1128		
1129		
1130		
1131		
1132		
1133		
1134		
1135		
1136		
1137		
1138		
1139		
1140		
1141		
1142		
1143		





Ref: Streaky Bay S15302 / Elliston S15306

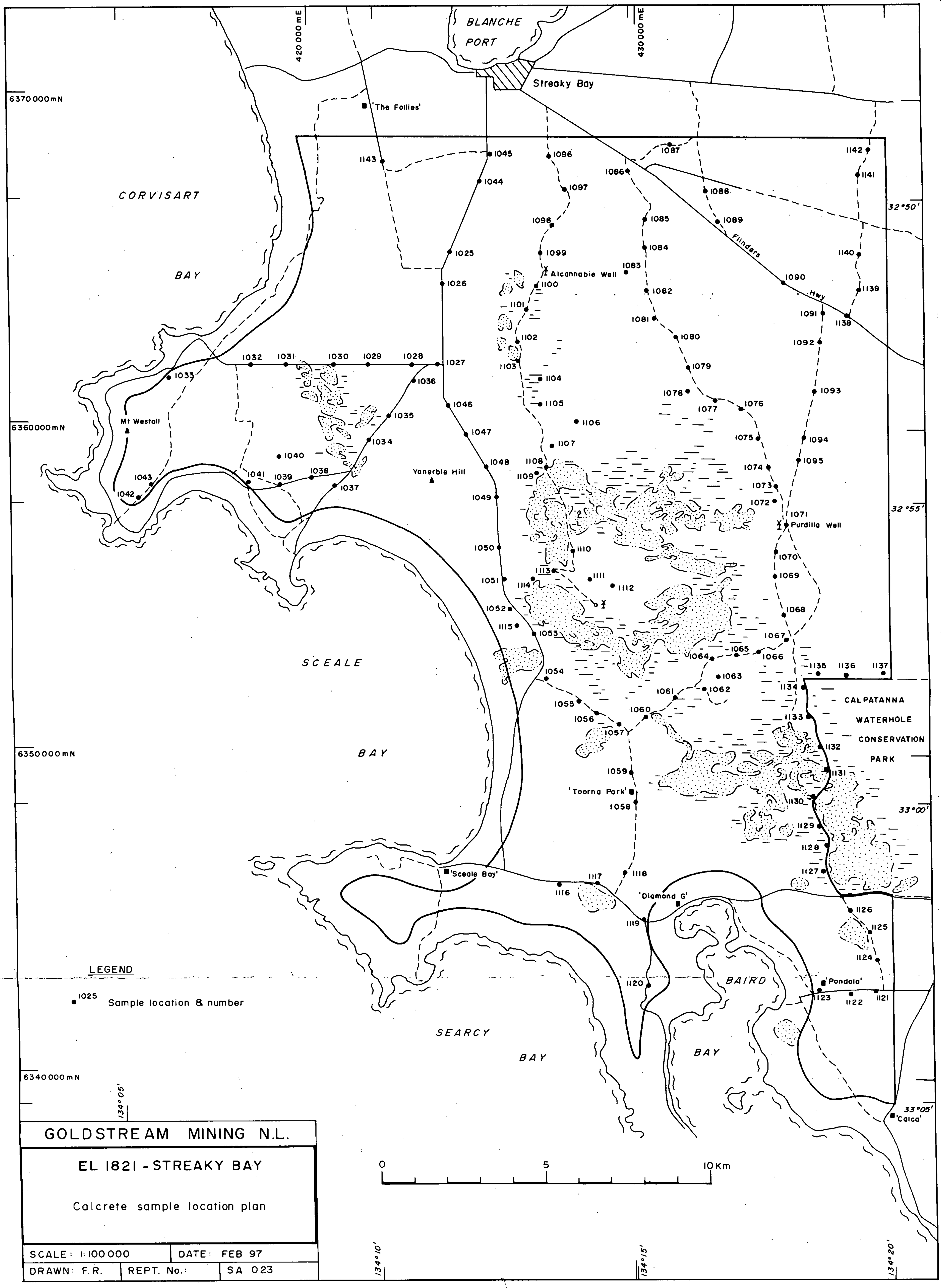
GOLDSTREAM MINING N.L.

EL 1821 - STREAKY BAY

Location plan

Area: 385 Km^2

SCALE: 1:250 000	DATE: FEB 97	
DRAWN: F.R.	REPT. No.:	SA 021



GOLDSTREAM MINING N.L.

EL 1821 - STREAKY BAY

Calcrete sample location plan

SCALE: 1:100 000	DATE: FEB 97	
DRAWN: F.R.	REPT. No.:	SA 023

SBDC

SCEALE BAY DEVELOPMENT CORPORATION

Level 11
210 George Street
Sydney NSW 2000
Australia

Telephone: (02) 9321 0328
Facsimile: (02) 9321 0350

28 April, 1998

Mr George Kwitco
Company Exploration
Primary Industries and Resources SA
GPO Box 2355
ADELAIDE SA 5000

Dear George,

EL1821 ANNUAL REPORT

Please find attached Annual Report for the period 19 February 1997 to 18 February 1998.

1. Tenure - Exploration Licence 1821 was granted to Olliver Geological Services Pty Ltd on 19 February 1993 and was subsequently transferred to Sceale Bay Development Corporation Pty Ltd ("SBDC"). The tenement expired on 18 February 1998, but has been subsequently replaced in full by exploration licence EL2489.

2. Work Completed - a number of work programs were undertaken on the tenement in the year ended 18 February 1998. The following reports cover the various aspects of this work.

(1) Pre-Feasibility Study Report - Tennant Limited (Jonathan Guinness), 10 July 1997

(2) Proposed Gypsum Loading Facility - Aztec Analysis, June 1997

(3) Streaky Bay Gypsum Deposits - 1997 Reappraisal of Gypsum Resources by Jeffrey G Olliver - Olliver Geological Services Pty Ltd July 1997

(4) Gypsum Column Washes and Scrubber Washing of Gypsum - Amdel, March/April 1998

(5) Streaky Bay EL1821 - Six Months to 18 August 1997, SBDC (Not attached)

(6) Streaky Bay EL1821 - Six Months to 18 February 1998, SBDC (Not attached)

Yours sincerely,

Jonathan Guinness

RECEIVED

amdel
A.C.N. 008 127 802

Amdel Limited
Mineral Services

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(Int): 61 8 8416 5200
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INTERNATIONAL QUALITY MANAGEMENT SYSTEM

FACSIMILE TRANSMISSION

Date:	1 April 1998	Total pages including cover sheet:	2
To:	Jonathan Guiness	Fax No:	02 93210350
Company:	Sceale Bay Development	City/Country:	
From:	Paul Capps	Offer/Quotation No:	
Department:	Mineral Processing	Project/Job No:	P6117

Jonathan,

SCRUBBER WASHING OF GYPSUM

Results of the fresh water scrubber wash runs on Samples A (representing seawater washed material) and B (representing untreated material) are attached. Each test was run using a different water to solids ratio, as indicated by the % solids figure.

Washing of the seawater washed material resulted in lower salt levels as the quantity of water was increased (ie. % solids decreased). The lowest level achieved of 150ppm Na equates to a salt content of 380ppm (0.038% NaCl). However, washing at 50% solids achieved a level only slightly higher at 350ppm Na (890ppm or 0.089% NaCl) while using only 44% of the water.

Washing of the untreated material did not achieve such low salt levels within the range of test conditions examined, with a best result of 550ppm Na (1400ppm or 0.14% NaCl).

These results suggest that, for scrubber washing, seawater washing prior to fresh water washing would be of significant benefit in terms of fresh water usage and reduced salt levels. Seawater scrubber washing of untreated material will now be tested.

Regards

If there is a problem with this transmission please phone 08 8416 5257

3. SCRUBBER WASHING

FRESH WATER WASHING OF SEAWATER WASHED SAMPLE (A)

	Product Assays					
	Total, ppm			Water Soluble, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Feed	2050	3700	1100	2000	3800	130
60% solids	500	900	800	420	900	70
50% solid	350	600	1000	290	550	65
40% solids	300	400	1100	220	400	65
30% solids	150	200	750	150	200	55

FRESH WATER WASHING OF UNTREATED SAMPLE (B)

	Product Assays					
	Total, ppm			Water Soluble, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Feed	8500	14800	2050	8600	15000	850
60% solids	1550	2800	1350	1500	2900	120
50% solid	1000	1500	1400	900	1500	95
40% solids	550	900	1000	500	900	70
30% solids	550	900	1250	550	900	70

amdel
A.C.N. 008 127 802

Amdel Limited
Mineral Services

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(Int): 61 8 8352 8243

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PO Box 338
Torrensville Plaza
South Australia 5031
AUSTRALIA

INTERNATIONAL QUALITY MANAGEMENT SYSTEM

FACSIMILE TRANSMISSION

Date:	1 April 1998	Total pages including cover sheet:	14
To:	Jonathan Guiness	Fax No:	02 93210350
Company:	Sceale Bay Development	City/Country:	
From:	Paul Capps	Offer/Quotation No:	
Department:	Mineral Processing	Project/Job No:	P6117

Jonathan,

GYPSUM COLUMN WASHES

Attached are updated results for the column wash tests. I discovered some errors in wash solution volumes and times in the earlier results; please discard them.

Exit solutions from the maximum flow and 10L/m^2/h tests are now constant and of Na concentrations virtually the same as the tap water being used to irrigate the columns. I suggest that we shut these columns down and proceed to assay the solids. We would then be able to consider conditions for the seawater column wash tests.

Exit solution concentrations from the simulated rainfall columns are still high. These columns will run for an extended period. I will start to reduce the solution sampling frequency.

Please confirm your agreement to shutting down the high flow columns.

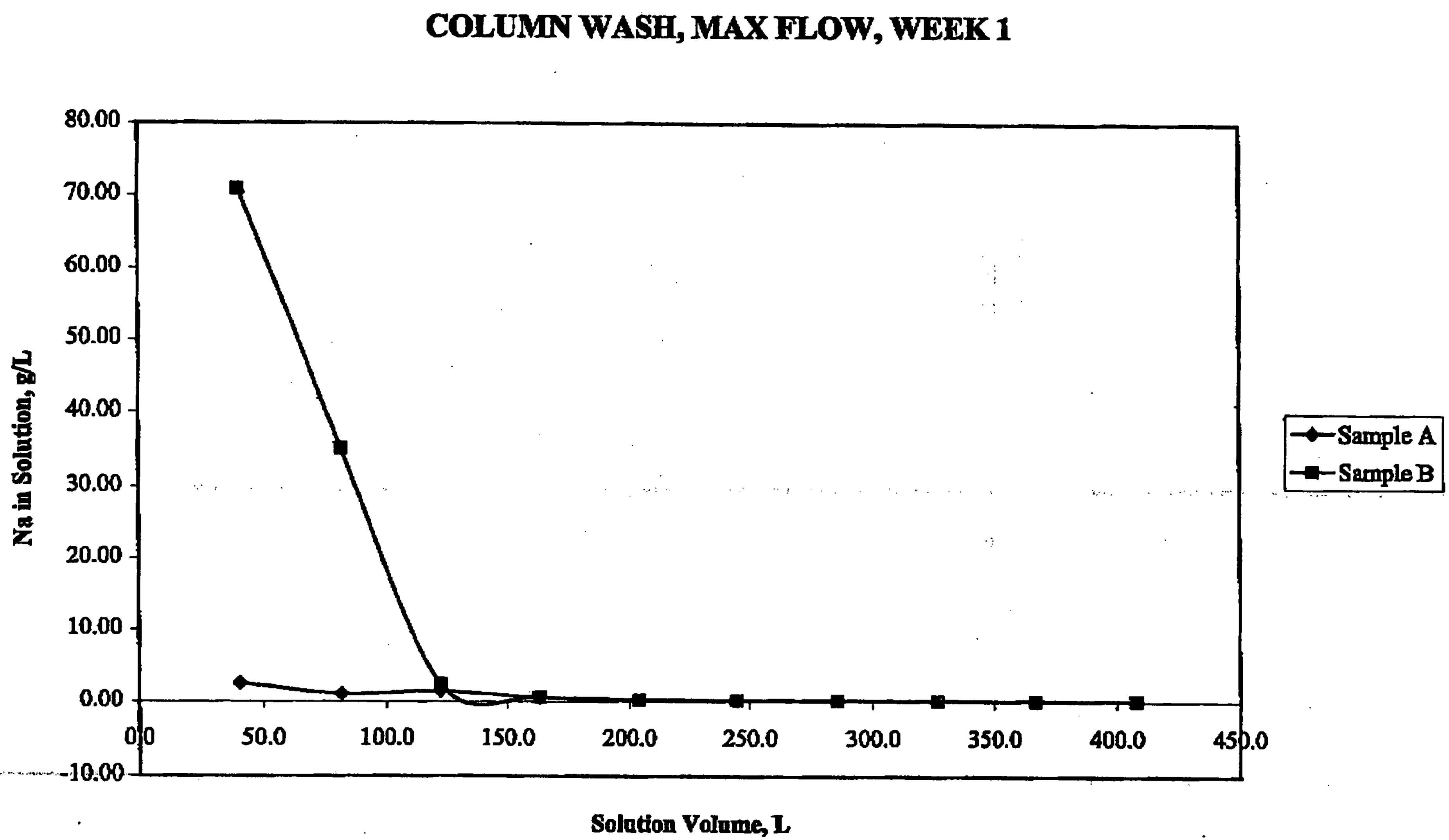
Regards

P Capps

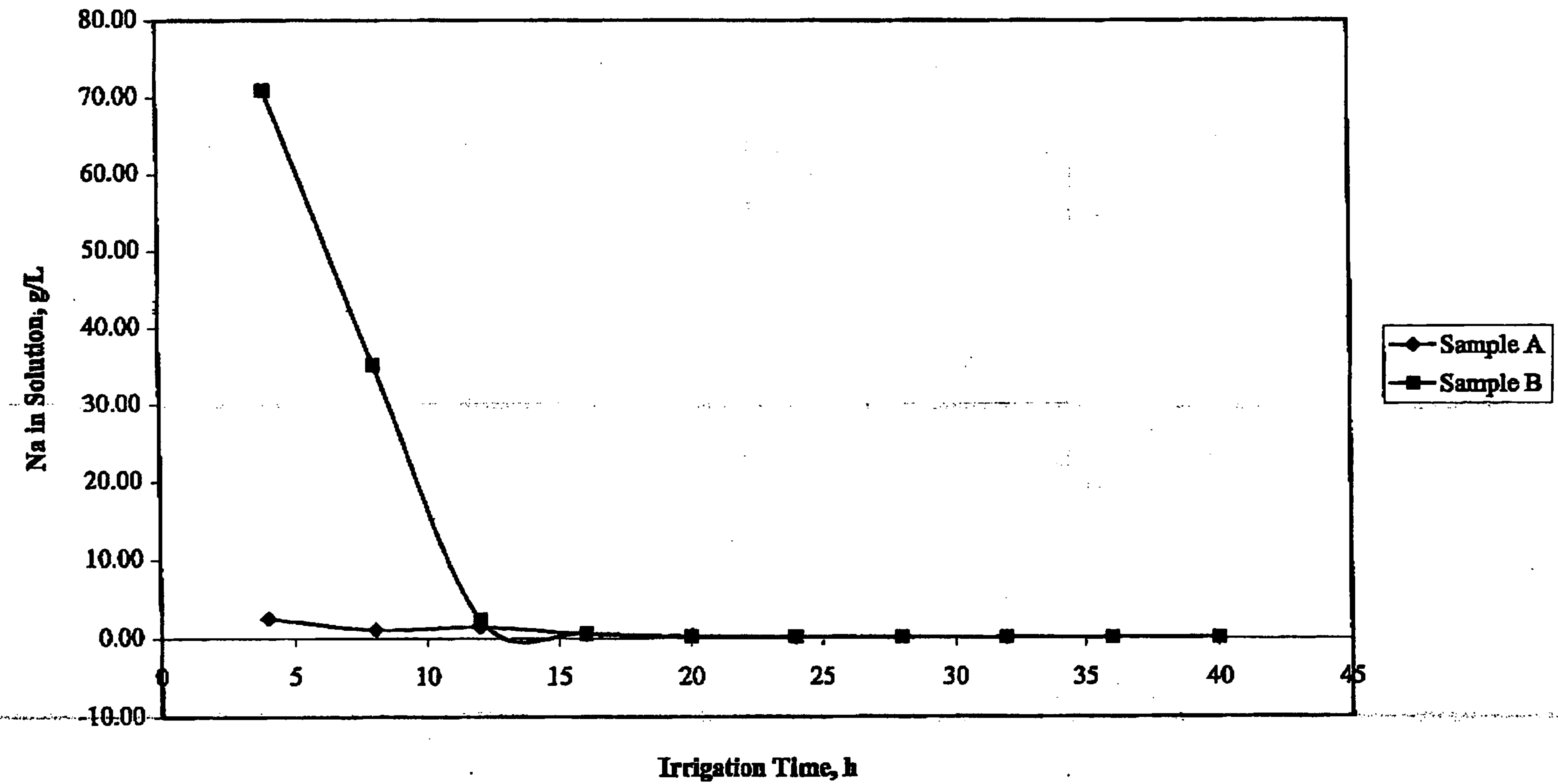
If there is a problem with this transmission please phone 08 8416 5257

COLUMN WASH - FRESH WATER, 42.5L/M^2/H (MAX FLOW) INTERMITTENT

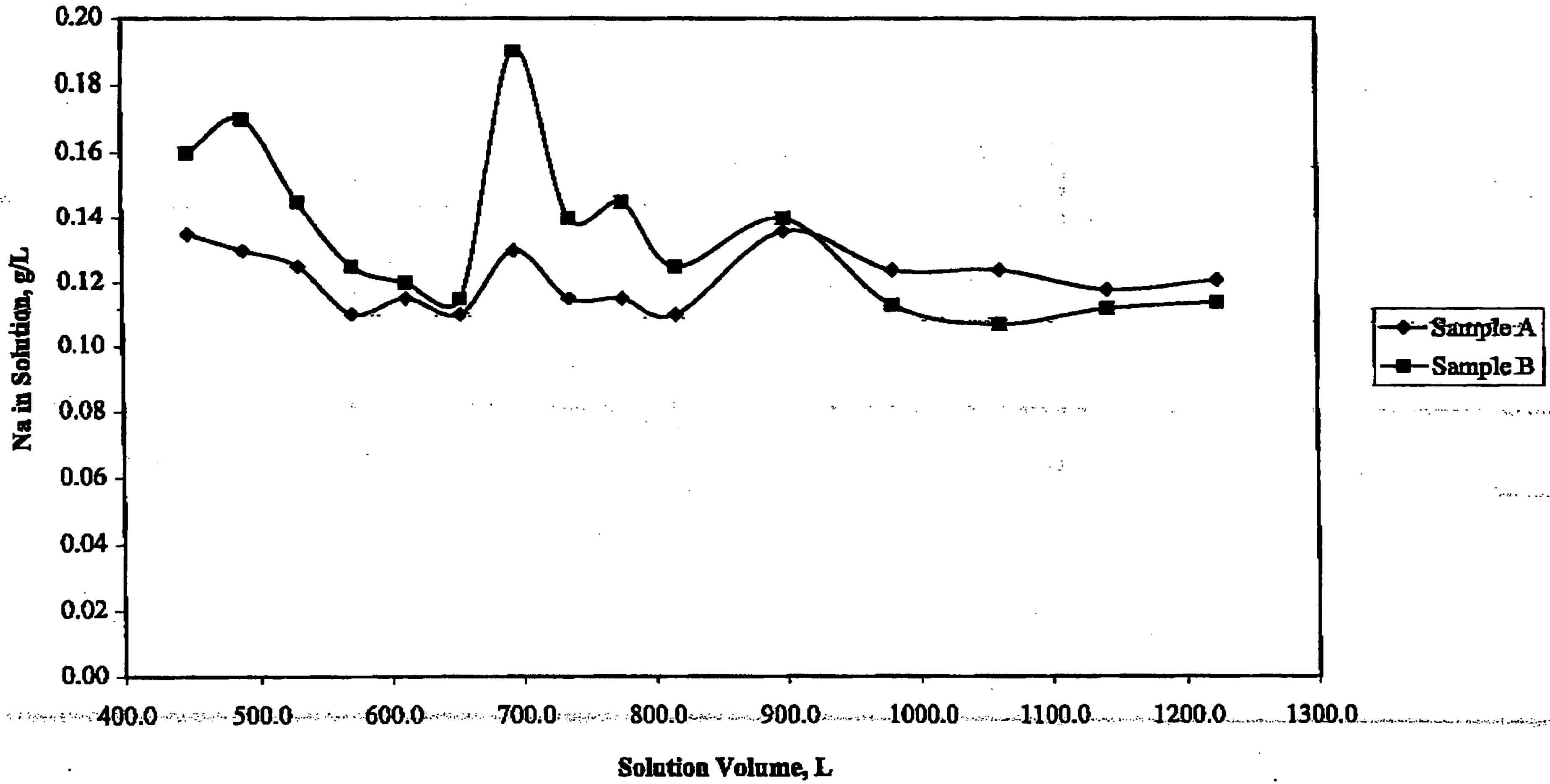
Date	Irrigation Time		Solution	Na in Solution, g/L	
	Days	Hours	Volume, L	Sample A	Sample B
9/03/98	1	4	40.8	2.55	70.90
		8	81.6	1.10	35.15
10/03/98	2	12	122.4	1.46	2.43
		16	163.2	0.55	0.59
11/03/98	3	20	204.0	0.31	0.23
		24	244.8	0.20	0.22
12/03/98	4	28	285.6	0.18	0.19
		32	326.4	0.14	0.18
13/03/98	5	36	367.2	0.14	0.17
		40	408.0	0.13	0.15
16/03/98	6	44	448.8	0.14	0.16
		48	489.6	0.13	0.17
17/03/98	7	52	530.4	0.13	0.15
		56	571.2	0.11	0.13
18/03/98	8	60	612.0	0.12	0.12
		64	652.8	0.11	0.12
19/03/98	9	68	693.6	0.13	0.19
		72	734.4	0.12	0.14
20/03/98	10	76	775.2	0.12	0.15
		80	816.0	0.11	0.13
23/03/98	11	88	897.6	0.14	0.14
24/03/98	12	96	979.2	0.12	0.11
25/03/98	13	104	1060.8	0.12	0.11
26/03/98	14	112	1142.4	0.12	0.11
27/03/98	15	120	1224.0	0.12	0.11

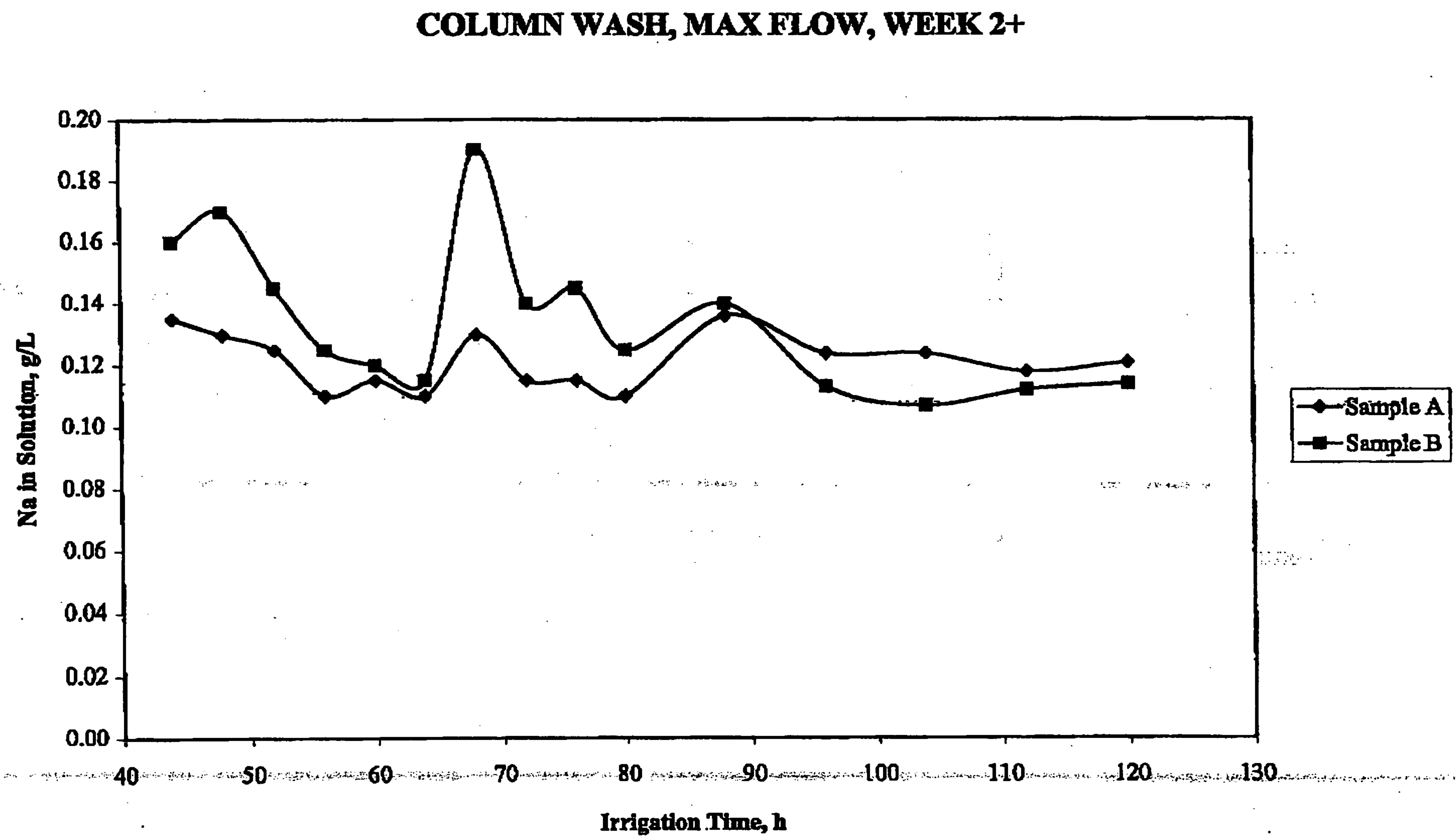

COLUMN WASH, MAX FLOW, WEEK 1
Na in Solution, g/L
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
Solution Volume, L
Sample A
Sample B

COLUMN WASH, MAX FLOW, WEEK 1



COLUMN WASH, MAX FLOW, WEEK 2+



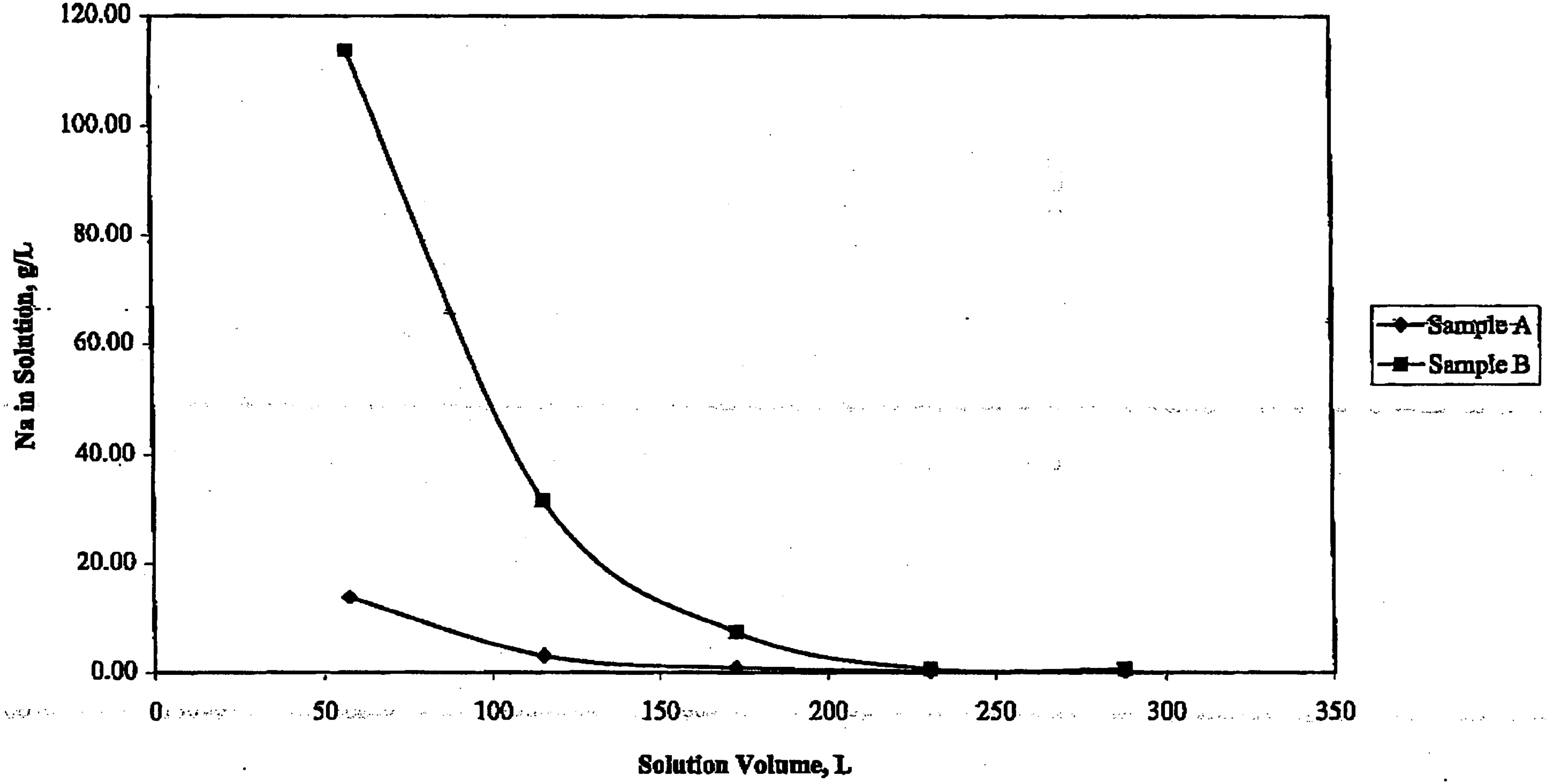


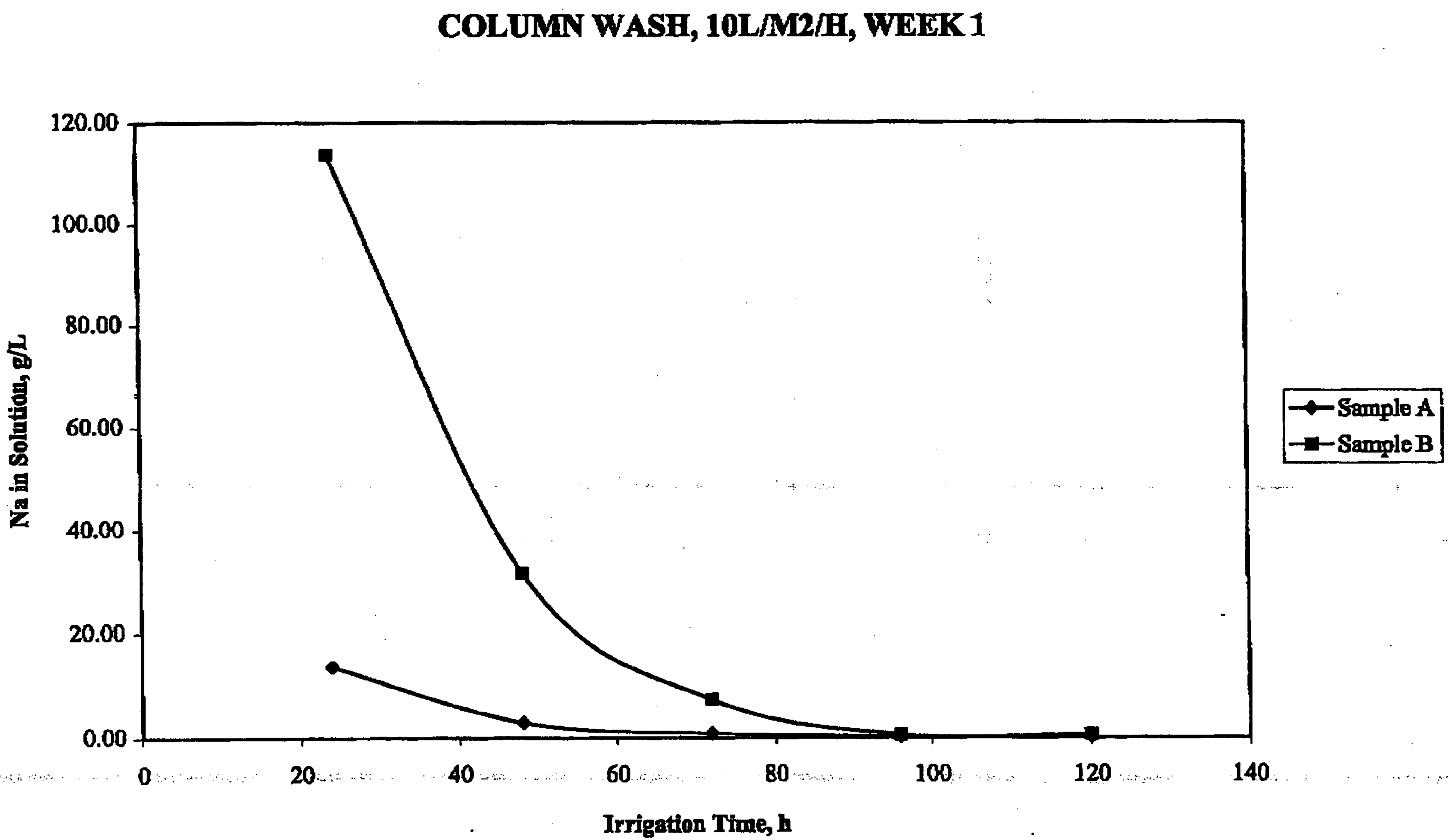
COLUMN WASH, MAX FLOW, WEEK 2+
Na in Solution, g/L
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
40
50
60
70
80
90
100
110
120
130
Irrigation Time, h
Sample A
Sample B

COLUMN WASH - FRESH WATER, 10L/M²/H CONTINUOUS

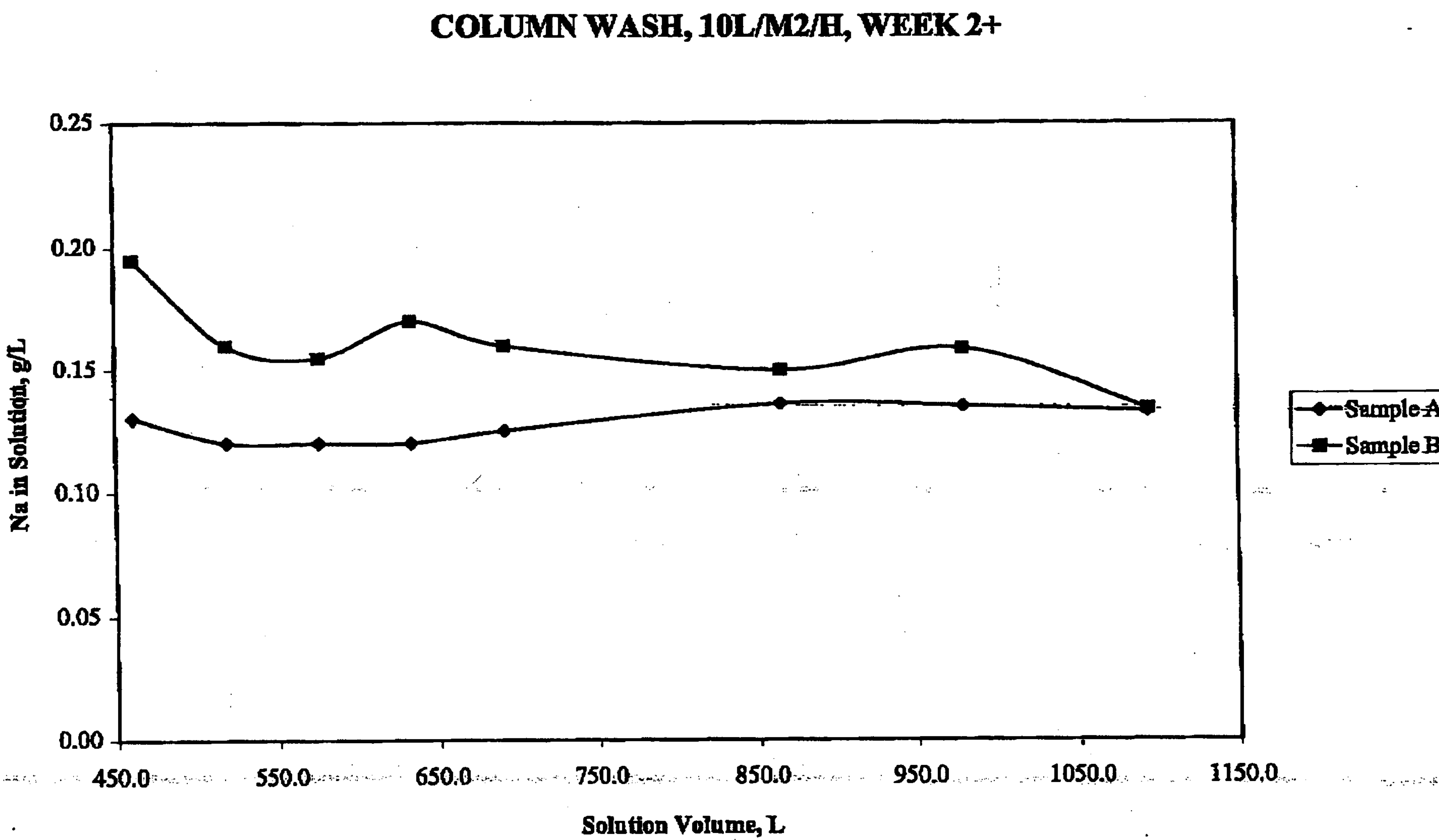
Date	Irrigation Time		Solution	Na in Solution, g/L	
	Days	Hours	Volume, L	Sample A	Sample B
9/03/98	1	24	57.6	13.70	113.50
10/03/98	2	48	115.2	2.95	31.55
11/03/98	3	72	172.8	0.86	7.35
12/03/98	4	96	230.4	0.22	0.62
13/03/98	5	120	288.0	0.19	0.60
16/03/98	8	192	460.8	0.13	0.20
17/03/98	9	216	518.4	0.12	0.16
18/03/98	10	240	576.0	0.12	0.16
19/03/98	11	264	633.6	0.12	0.17
20/03/98	12	288	691.2	0.13	0.16
23/03/98	15	360	864.0	0.14	0.15
25/03/98	17	408	979.2	0.14	0.16
27/06/98	19	456	1094.4	0.13	0.13

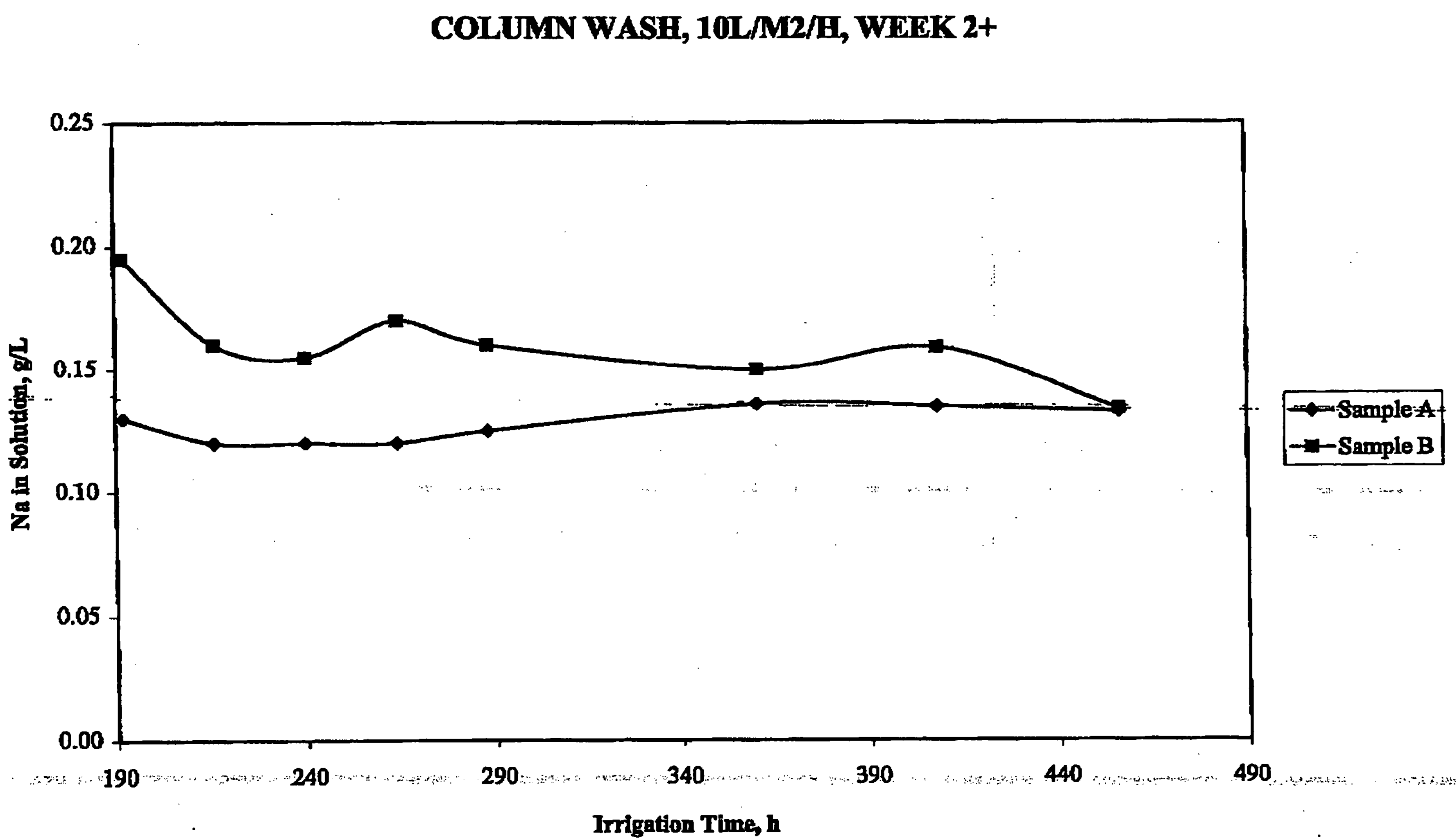
COLUMN WASH, 10L/M2/H, WEEK 1





COLUMN WASH, 10L/M2/H, WEEK 1
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Na in Solution, g/L
0
20
40
60
80
100
120
140
Irrigation Time, h
Sample A
Sample B

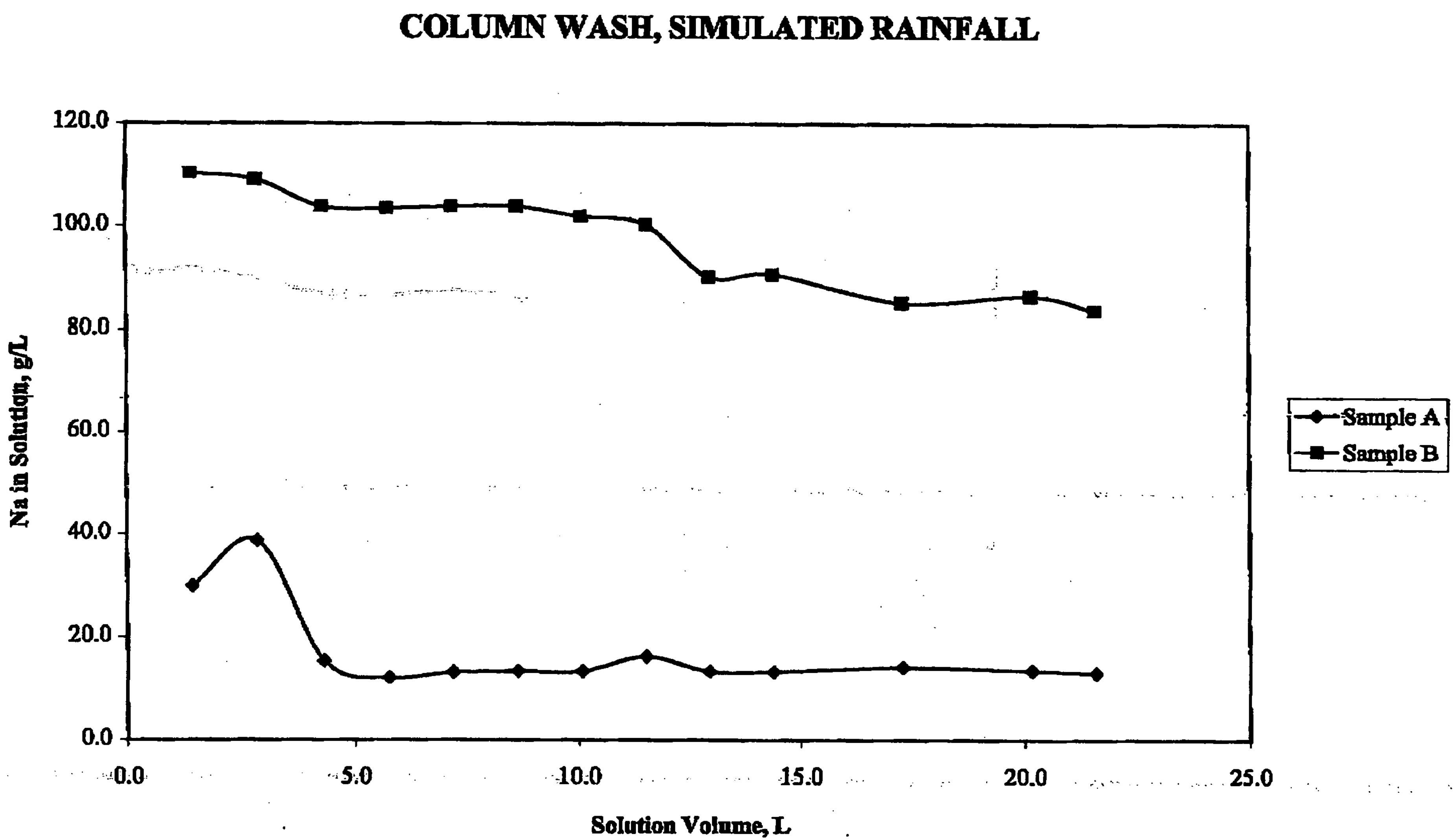

COLUMN WASH, 10L/M2/H, WEEK 2+
Na in Solution, g/L
0.25
0.20
0.15
0.10
0.05
0.00
450.0
550.0
650.0
750.0
850.0
950.0
1050.0
1150.0
Solution Volume, L
Sample A
Sample B

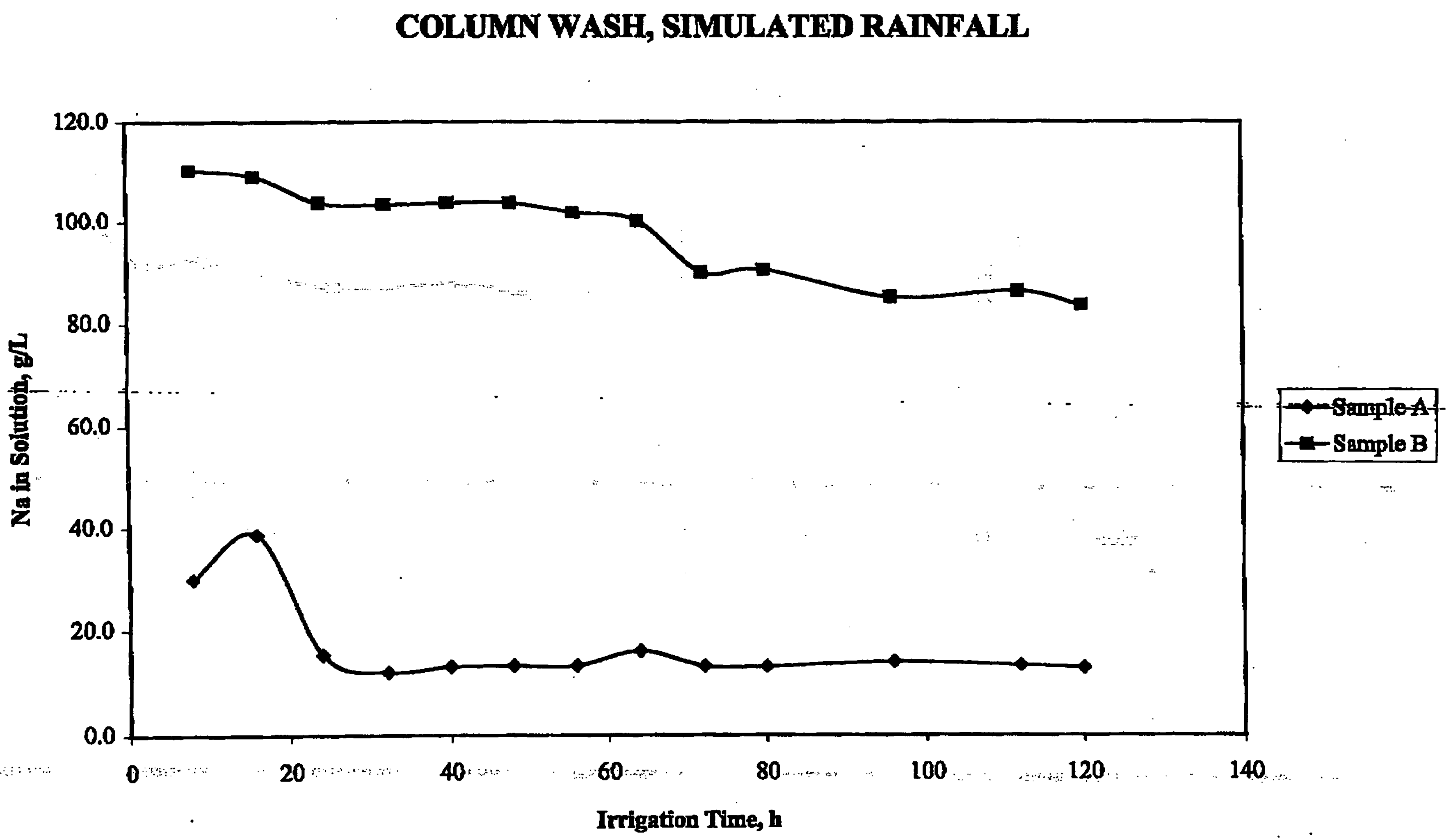


COLUMN WASH, 10L/M2/H, WEEK 2+
0.25
0.20
0.15
0.10
0.05
0.00
Na in Solution, g/L
190
240
290
340
390
440
490
Irrigation Time, h
Sample A
Sample B

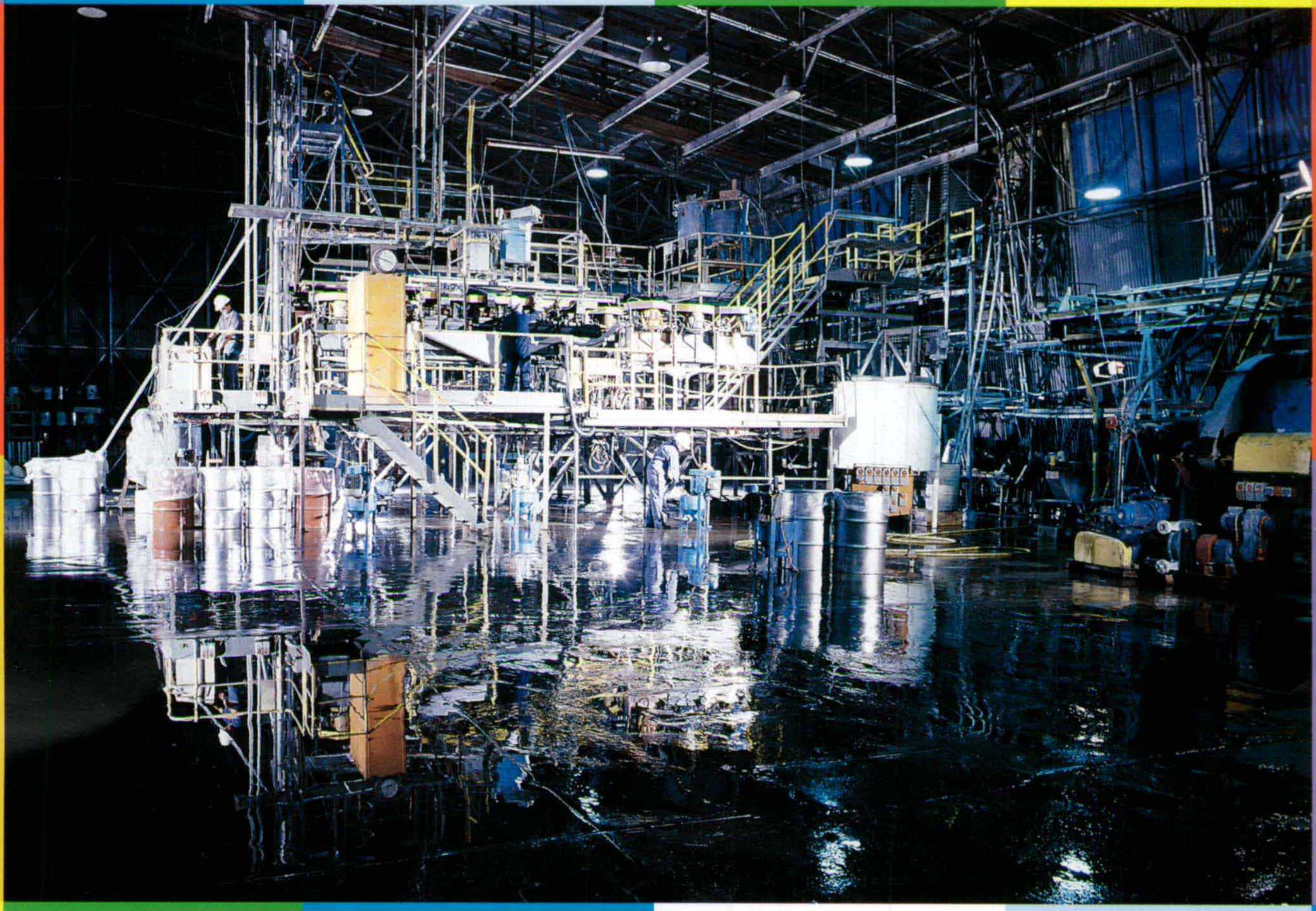
COLUMN WASH - FRESH WATER, SIMULATED RAINFALL

Date	Irrigation Time		Solution	Na in Solution, g/L	
	Days	Hours	Volume, L	Sample A	Sample B
9/03/98	1	8	1.4	29.9	110.3
10/03/98	2	16	2.9	38.7	109.0
11/03/98	3	24	4.3	15.3	103.8
12/03/98	4	32	5.8	12.1	103.5
13/03/98	5	40	7.2	13.1	103.8
16/03/98	6	48	8.6	13.3	103.8
17/03/98	7	56	10.1	13.3	101.8
18/03/98	8	64	11.5	16.1	100.2
19/03/98	9	72	13.0	13.3	90.2
20/03/98	10	80	14.4	13.2	90.7
24/03/98	12	96	17.3	14.1	85.3
26/03/98	14	112	20.2	13.4	86.5
27/03/98	15	120	21.6	13.0	83.8


COLUMN WASH, SIMULATED RAINFALL
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Na in Solution, g/L
0.0
5.0
10.0
15.0
20.0
25.0
Solution Volume, L
Sample A
Sample B


COLUMN WASH, SIMULATED RAINFALL
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Na in Solution, g/L
0
20
40
60
80
100
120
140
Irrigation Time, h
Sample A
Sample B

SCEALE BAY DEVELOPMENT CORP



GYPSUM WASHING TRIALS

Report No. P6117

23 September 1998

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REPORT P6117

GYPSUM WASHING TRIALS

EL 2489

Annual Tech Report

PE "18/2/99"

YOUR REFERENCE:	Fax 10-11-97, J Guiness
MATERIAL:	Gypsum
LOCATION:	South Australia
DATE RECEIVED:	14 January and 7 February 1998
PROJECT MANAGER:	P Capps PGC

P G Capps
Senior Metallurgist

CONTENTS

APPENDICES

1. INTRODUCTION

Sceale Bay Development Co is examining the exploitation of a gypsum deposit near Streaky Bay, South Australia. The gypsum resource is saturated in brine solution, so that any mined material will require washing to reduce the salt content prior to sale.

Amdel was requested to design and undertake a program of testwork to examine several washing processes. Selection of the processes to be tested was influenced by the facts that fresh water for washing purposes would be difficult or expensive to obtain, that the annual rainfall for the region is low and that, due to the extremely high salt content of 'as mined' material, washing with seawater was known to achieve a significant reduction in salt content.

2. SAMPLES TESTED

The sample initially provided for testing (delivered to Amdel on 14 January 1998) was contained in bulka-bags and weighed approximately 10 tonnes. The total sample was blended using a front-end loader prior to splitting out the samples required for the intended test program as well as smaller samples for head assay. The head assay results showed that this initial sample, designated Sample A, contained considerably less salt than was expected (3960ppm, 0.396% NaCl based on Cl assay) and that the salt level in the sample was not reduced by seawater washing in laboratory tests (see Section 2.1).

Sceale Bay Development subsequently arranged for delivery to Amdel of a second sample of approximately 6 to 8 tonnes. This sample was designated Sample B and was received on 7 February 1998. Particular care was taken during transport of the sample to ensure that brine saturating the material in-situ was retained with the sample, and was only allowed to drain away after being emptied onto the floor at Amdel. A sample of gypsum plus brine taken during mining of the bulk sample and contained in a 20L bucket was also delivered to Amdel.

2.1 Head Assays

Assays for total and water soluble Na, Cl and Mg for the two bulk samples are shown in the following table:

ASSAYS OF HEAD SAMPLES

	Total, ppm			Water Soluble, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Sample A						
As received (1)	1500	2400	1100	1400	2000	90
As received, duplicate (1)	1500	3000	1400	1400	3000	130
Lab seawater washed (2)	1600	2200	1400	1500	2000	110
Lab fresh water washed (3)	300	<100	1300	100	<100	40
Sample B						
As mined, with brine (4)	20500	31900	2300	20200	31000	1950
As mined, drained (5)	8450	13600	1850	8400	13600	800
As received (1)	8850	15500	1650	8750	14900	800
Lab seawater washed (2)	1450	1750	1200	950	1800	160
Lab fresh water washed (3)	250	100	1150	100	100	60

(1) Samples taken from the drained stockpile of bulk sample and dried prior to assay.
(2) Samples of 250g of as received material agitated in 5L of seawater for 8 hours, solids filtered, washed with seawater on the filter and dried prior to assay.
(3) As for item (2) but using fresh water instead of seawater.
(4) Sample saturated in brine was dried prior to assay; the assay sample therefore retained salt from evaporation of the brine.
(5) Sample saturated in brine was filtered to remove excess free brine prior to drying and assaying.

The results indicate that virtually all Na and Cl was present in water soluble form, while relatively little of the Mg was water soluble. The theoretical ratio of Na:Cl in NaCl is approximately 1:1.5. The assays in the above table are generally around this ratio, suggesting that both elements are present in the gypsum as the NaCl salt and not associated with other ions.

2.2 Seawater Washed and Untreated Samples

The results in Section 2.1 show that washing the 'as received' samples with seawater resulted in levels of approximately 4,000ppm NaCl. These levels represented substantial reductions for Sample B, demonstrating the potential benefit of this process for high salt material. However, Sample A in 'as received' form contained considerably lower levels of salt, such that seawater washing was ineffective in reducing the salt content. In fact, the salt content of Sample A was virtually identical to that of the seawater washed Sample B material.

In the light of the similarity between salt levels in Sample A and seawater washed material, Sample A was used in the majority of the test program to represent gypsum which had been seawater washed prior to further processing.

Sample B was used to represent gypsum which had received no treatment between mining and processing, other than the removal of brine by natural drainage in a stockpile.

3. SCRUBBER WASHING

3.1 Plant Description

Gypsum was fed from a variable speed belt feeder. Timed samples of feed were taken regularly during operation and weighed to establish the feed rate. The belt speed was adjusted manually to maintain the selected feed rate.

A conveyor transported gypsum from the belt feeder to a rotating drum scrubber of 915mm inside diameter and 2440mm length, operating at 26 rpm. The scrubber contained three internal lifters of 50mm height and was fitted with a discharge trommel of 1mm aperture mesh. The scrubber had an operating volume of approximately 100L. Water, either seawater or fresh water, was fed via a rotameter to the feed chute of the scrubber. Fine product (-1mm, slurry) passed through the trommel mesh while coarse product (+1mm) was discharged as drained solids from the end of the trommel.

3.2 Seawater Washing of Sample A

Approximately 4 tonnes of Sample A gypsum were processed through the scrubber at a rate of 500kg/h with 500L/h of seawater, equating to a residence time of approximately 9 minutes in the scrubber. The +1mm and −1mm products were dewatered, then recombined, blended and allowed to drain in a stockpile. A sample of the combined product was dried and assayed for total and water soluble Na, Cl and Mg.

The total sample was then re-processed through the scrubber and the product assayed following the same procedure. Assays of the products from the two washing stages are summarised in the following table:

SEAWATER SCRUBBER WASHING OF SAMPLE A

	Product Assays					
	Total, ppm			Water Soluble, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Feed	1500	2400	1100	1400	2000	90
Stage 1 product	1950	4300	1200	1900	4300	150
Stage 2 product	1750	3500	850	1600	3500	120

The results show that seawater washing actually resulted in an increase in the salt level of Sample A rather than a decrease. In view of these results and the lower than expected salt content of the 'as received' Sample A, it was decided that a new bulk sample would be provided for further testing of seawater washing.

3.3 Seawater Washing of Sample B

Further seawater washing test were carried out on a new bulk sample with a salt content which was much closer to the normal level expected by the client (2.55% NaCl based on Cl assay of the 'as received' sample, see Section 2.1).

The washing procedure was changed for this and the fresh water tests. Gypsum was fed to the scrubber at a rate of 250kg/h. Seawater was added to the feed at a rate of 170L/h to give a slurry of 60% solids and a residence time of approximately 23 minutes in the scrubber. After 1 hour the scrubber discharge solids were sampled, dried and assayed.

The seawater addition rate was then increased to 250L/h (50% solids, 18 minutes residence time) and the above process repeated. Further tests were completed at seawater addition rates of 375L/h (40% solids, 13 minutes residence time) and 580L/h (30% solids, 9 minutes residence time).

Assays of the products from each washing test are summarised in the following table:

SEAWATER SCRUBBER WASHING OF SAMPLE B

	Product Assays					
	Total, ppm			Water Soluble, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Feed	8500	14800	2050	8600	15000	850
60% solids	2800	4200	1100	2800	3600	250
50% solid	2950	4300	850	2950	3900	230
40% solids	2250	3100	850	2200	2800	210
30% solids	2100	2900	850	2000	2600	210

Seawater washing achieved significant reductions in NaCl content even at 60 % solids, although higher water:solids ratios resulted in some further reductions to approximately 4,800ppm NaCl (as calculated from the Cl assay).

The NaCl levels achieved by seawater washing are similar to the NaCl content of the 'as received' Sample A, further confirming the validity of using Sample A to represent material which has been pre-washed in seawater.

3.4 Fresh Water Washing of Sample A

Laboratory seawater washing trials on Samples A and B resulted in salt concentrations similar to that of the 'as received' Sample A. As a result, and in view of its low initial salt content, Sample A was used to examine fresh water washing of a seawater washed product.

The procedure used was as described in Section 3.3, with Adelaide tap water used instead of seawater. Assays of the products from the tests are shown below:

FRESH WATER SCRUBBER WASHING OF SAMPLE A

	Product Assays					
	Total, ppm			Water Soluble, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Feed	2050	3700	1100	2000	3800	130
60% solids	500	900	800	420	900	70
50% solid	350	600	1000	290	550	65
40% solids	300	400	1100	220	400	65
30% solids	150	200	750	150	200	55

The results show that lower salt levels were achieved as the quantity of water relative to solids was increased (i.e., lower % solids), even though the increase in water resulted in a decrease in the washing time (i.e., scrubber residence time).

The product with the lowest salt content of 330ppm NaCl (as calculated from the Cl assay) was achieved using 30% solids or 2.3kL of water per tonne of gypsum. However, a product containing 990ppm NaCl (based on Cl assay) was achieved using a much reduced water addition rate of only 1kL per tonne of solids.

3.5 Fresh Water Washing of Sample B

Similar fresh water washing tests were carried out using Sample B as material representative of material from which excess brine had been allowed to drain but which had not received a pre-wash.

The procedure used was as described in Section 3.3, with Adelaide tap water used instead of seawater. Assays of the products from the tests are shown below:

FRESH WATER SCRUBBER WASHING OF SAMPLE B

	Product Assays					
	Total, ppm			Water Soluble, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Feed	8500	14800	2050	8600	15000	850
60% solids	1550	2800	1350	1500	2900	120
50% solid	1000	1500	1400	900	1500	95
40% solids	550	900	1000	500	900	70
30% solids	550	900	1250	550	900	70

The product of lowest salt content (900ppm Cl, equivalent to 1500ppm NaCl) was achieved using both 40% and 30% solids (1.5kL and 2.3kL of water per tonne of gypsum respectively).

However, the salt content of the best product was higher than was achieved by fresh water washing of seawater washed material (see Section 3.4), regardless of the water to solids ratio. Laboratory washing tests of the head samples (see Section2.1) produced similar salt contents from the two samples (A and B), which suggests that the differences salt contents between the scrubber washing products are not due to differences in sample characteristics. It is therefore considered that seawater washing prior to fresh water washing would provide a benefit both in terms of final salt content and in the quantity of fresh water required.

4. COLUMN WASHING, FRESH WATER

4.1 Procedure

Samples of approximately 500kg were split from the Sample A and B bulk samples and loaded into columns of 560mm diameter and 1800mm height. Fresh water was pumped at the required rate onto the surface of material in each column. The position of the irrigation line was changed daily to ensure an even distribution of the water through the column. Water was sampled on exit from the column and assayed for Na to track salt removal.

When salt removal was complete, the columns were emptied and the gypsum separated into top, middle and bottom layers. Samples of each layer were split out, dried and assayed for total and water soluble Na, Cl and Mg.

Each test condition was applied to both Sample A and B to assess the performance of pre-washed (Sample A) and untreated (Sample B) material.

4.2 Test Description and Results

4.2.1 Heap Irrigation

These tests were carried out using an irrigation rate equivalent to $10L/m^2/h$. Such an irrigation rate is at the upper end of rates used in heap leaching applications (e.g., gold copper) and was selected to represent an operation in which water was sprayed onto free-standing heaps of gypsum.

Irrigation was continuous throughout the test period.

Results of the tests are contained in Appendix 1.

Exit solution assays showed salt removal from Sample A to be completed within approximately 200 hours of irrigation (Na concentration of 0.13g/L, approximately equal to the concentration in Adelaide tap water). Salt removal from Sample B (higher salt content) was initially rapid, but required a total of approximately 440 hours irrigation to achieve exit solution assays of the same level as achieved for Sample A.

These irrigation times translate to water usages of 1kL per tonne of gypsum for Sample A (pre-washed) and 2.2kL per tonne of Sample B (untreated).

Average washed product grades were 250ppm NaCl for Sample A (based on Cl assay) and 330ppm NaCl for Sample B. There is a considerable discrepancy between total and water soluble Na levels in the solids, suggesting that all Na was not present as NaCl. This is further supported by the fact that the Na:Cl ratio was in excess of 1:1 compared to the theoretical ratio of 0.6:1 if all Na was present as NaCl.

The product grade for Sample B was elevated by the high assay determined for the top layer of product, with middle and bottom layers being of the same grade as Sample A product. The high grade of the top layer appears to be anomalous, and it is considered probable that washing of both pre-washed and untreated material would achieve a similar NaCl content.

4.2.2 Maximum Flow Irrigation

Two column wash tests (Samples A and B) were undertaken using an irrigation rate at or close to the maximum flow rate possible for the columns. At the commencement of testing the irrigation rate was set at 125L/m^2/h and the solution discharge rates from each column measured. The maximum flow rates were measured thus at 100L/m^2/h for Sample A (pre-washed) but only 45L/m^2/h for Sample B (untreated).

Both tests were carried out using an irrigation rate equivalent to 42.5L/m^2/h, this being the highest flow rate that could be sustained for both columns. Such an irrigation rate would be excessive for use in heap leaching applications but could possibly be used in an operation in which water was pumped into drained vats containing the gypsum.

The columns were irrigated for 8 hours per day, 5 days per week throughout the test period.

Results are contained in Appendix 2.

Salt removal was rapid, with exit solutions of 0.13g/L Na (Adelaide tap water concentration) achieved with 40 hours irrigation for Sample A and 56 hours for Sample B.

These irrigation times translate to water usages of 0.8kL per tonne of gypsum for Sample A (pre-washed) and 1.1kL per tonne of Sample B (untreated).

Average washed product grades were 215ppm NaCl for Sample A (based on Cl assay) and 165ppm NaCl for Sample B. There is a considerable discrepancy between total and water soluble Na levels in the solids, suggesting that all Na was not present as NaCl. This is further supported by the fact that the Na:Cl ratio was in excess of 1:1 compared to the theoretical ratio of 0.6:1 if all Na was present as NaCl.

Salt levels were reasonably uniform for the gypsum from the top, middle and bottom layers.

4.2.3 Simulated Rainfall

Two column wash tests (Samples A and B) were undertaken using an irrigation rate to represent washing by rainfall at the site.

The annual rainfall at the site is approximately 350mm. The columns were irrigated at a rate of 0.75L/m^2/h for 8 hours per day, 5 days per week throughout the test period. This rate provided the equivalent of the annual rainfall in a period of 12 weeks

Irrigation was not continued to completion due to time constraints. However, the columns were irrigated for a total of 26 weeks, equivalent to approximately 2.2 years of average rainfall at the site.

Results are contained in Appendix 3. Although washing of the gypsum as indicated by the solution assays was not taken to completion, assays of the washed gypsum products showed them to contain $<$165ppm NaCl and 250ppm NaCl (based on Cl assays) for Samples A and B respectively.

Solution assays from the Sample A (representing pre-treated material) had, after approximately half of the test period, decreased to Na levels similar to those from Sample B (untreated material) at the completion of the test. This suggests that only 1 year of average rainfall would be sufficient to wash gypsum which had been pre-washed with seawater, although the effectiveness of rainwater washing will be dependent on the pattern of rainfall.

Without pre-washing with seawater, the results indicate that at least 2 years of average rainfall would be necessary.

5. COLUMN WASHING AFTER SEAWATER PRE-WASH

5.1 Procedure

Samples of approximately 500kg were split from the Sample B bulk sample and loaded into four columns of 560mm diameter and 1800mm height. Seawater was pumped onto the surface of material in each column at a rate equivalent to $10L/m^2/h$. The position of the irrigation line was changed daily to ensure an even distribution of the water through the column.

After 2 weeks pre-washing, seawater irrigation to two columns was terminated and the columns allowed to drain. One of the columns was emptied and the gypsum separated into top, middle and bottom layers. Samples of each layer were split out, dried and assayed for total and water soluble Na, Cl and Mg.

The second column was irrigated with fresh water at a rate of $10L/m^2/h$. Samples of the discharge water were taken periodically for Na assay. When salt removal was complete, the columns were emptied and the gypsum separated into top, middle and bottom layers. Samples of each layer were split out, dried and assayed for total and water soluble Na, Cl and Mg.

After 4 weeks pre-washing, seawater irrigation to the remaining two columns was terminated and the columns processed as described above

5.2 Results

Results are contained in Appendix 4.

The assays of column residues after the seawater pre-wash phase were similar for the 2 week and 4 week tests, showing that there was no benefit extending the pre-wash beyond 2 weeks. It is possible that a shorter time of less than 2 weeks would be sufficient, although this has not been tested.

The Na assays of exit solutions during the fresh water wash phase show that removal of residual salt was initially rapid. However, approximately 350 to 400 hours irrigation was required to achieve complete washing (as indicated by Na assays). Water requirement to achieve complete washing was approximately 1.6 to 2kL of water per tonne of gypsum.

The final washed gypsum contained similar salt levels of approximately 165ppm NaCl (as indicated by Cl assays) as was achieved by the other washing processes tested.

6. CONCLUSIONS

The various processes tested in this project can be compared on the basis of:

- capital and operating costs (outside the scope of this project)
- residual NaCl in washed product
- processing time
- fresh water usage

A table is shown below which summarises the comparative data relating to the last three items above, as generated by the testwork. Unless otherwise stated, the data shown relates only to processing of the Sample B representing material which had not received any pre-treatment.

It is possible that processing times in the field will be longer than those shown for the pilot scale tests.

SUMMARY OF PROCESS PARAMETERS

Process	Residual NaCl ppm	Process Residence Time		Fresh Water Usage kL/tonne
		Pre-Wash	Fresh Water Wash	
Scrubbing	1500	0	13 minutes	1.5
Column, 10L/m^2/h	330	0	440 hours	2.2
Column, 10L/m^2/h	165	360 hr	350 hours	1.6
Column, 42.5L/m^2/h	165	0	56 hours	1.1
Column, rainfall	250		2 to 3 years	0
Column, rainfall	<165	360 hr (1)	1 to 2 years	0

(1) Based on results for Sample A and assuming the same pre-wash time required for column pre-wash at 10L/m2/h

Sample A was taken as representing pre-washed material during the course of the test program. However, when similar tests were carried out on Sample A and Sample B after pre-washing (e.g., column washing at 10L/m^2/h), salt removal was more rapid from Sample A. In view of the apparent differences in washing characteristics and the fact that the reasons for the low salt content of Sample A are not known, it is probably advisable to place more reliance on the results achieved for Sample B. Sample A results were generally not included in the above summary table for this reason.

The column tests at high water flow rate resulted in the most efficient salt removal in terms of both processing time and fresh water requirement. However, it is possible that such a high irrigation rate could not be applied to free-standing heaps of gypsum without slumping of the heaps occurring. The use of maximum irrigation rates would then require the construction of re-useable vats to contain the gypsum during washing.

Column tests simulating irrigation of free-standing heaps at 10L/m^2/h achieved similar salt content of washed products as the high flow rate column tests, although over considerably longer processing periods. Pre-washing with seawater extended the total processing period by this method but resulted in some reduction in freshwater requirement.

Scrubbing was the most rapid process and recorded a water usage similar to the pre-wash heap irrigation process, although the final product was of considerably higher salt content than the column wash products. Based on the results achieved for Sample A, it is possible that two-stage scrubbing with seawater pre-washing in the first stage would achieve a lower final salt content.

The simulated rainfall columns proved to be capable of producing washed gypsum of an acceptable salt content with zero use of additional fresh water. The washing kinetics could be considerably improved by pre-washing, but wash times of between 1 and 3 years at average rainfall are suggested from the testwork. Periods of drought or even average total rainfall with less than optimum frequency and type of showers (e.g., intermittent light rain which failed to saturate the gypsum heaps), would increase the process time further.

In addition to the process flowsheets tested in this project, a hybrid flowsheet could also be considered in which fresh gypsum was pre-washed with seawater in a scrubber prior to being pumped to specially prepared retaining areas for draining and washing by irrigation.

APPENDIX 1:

HEAP IRRIGATION COLUMN WASHING, FRESH WATER

COLUMN WASH - FRESH WATER, 10L/M^2/H CONTINUOUS

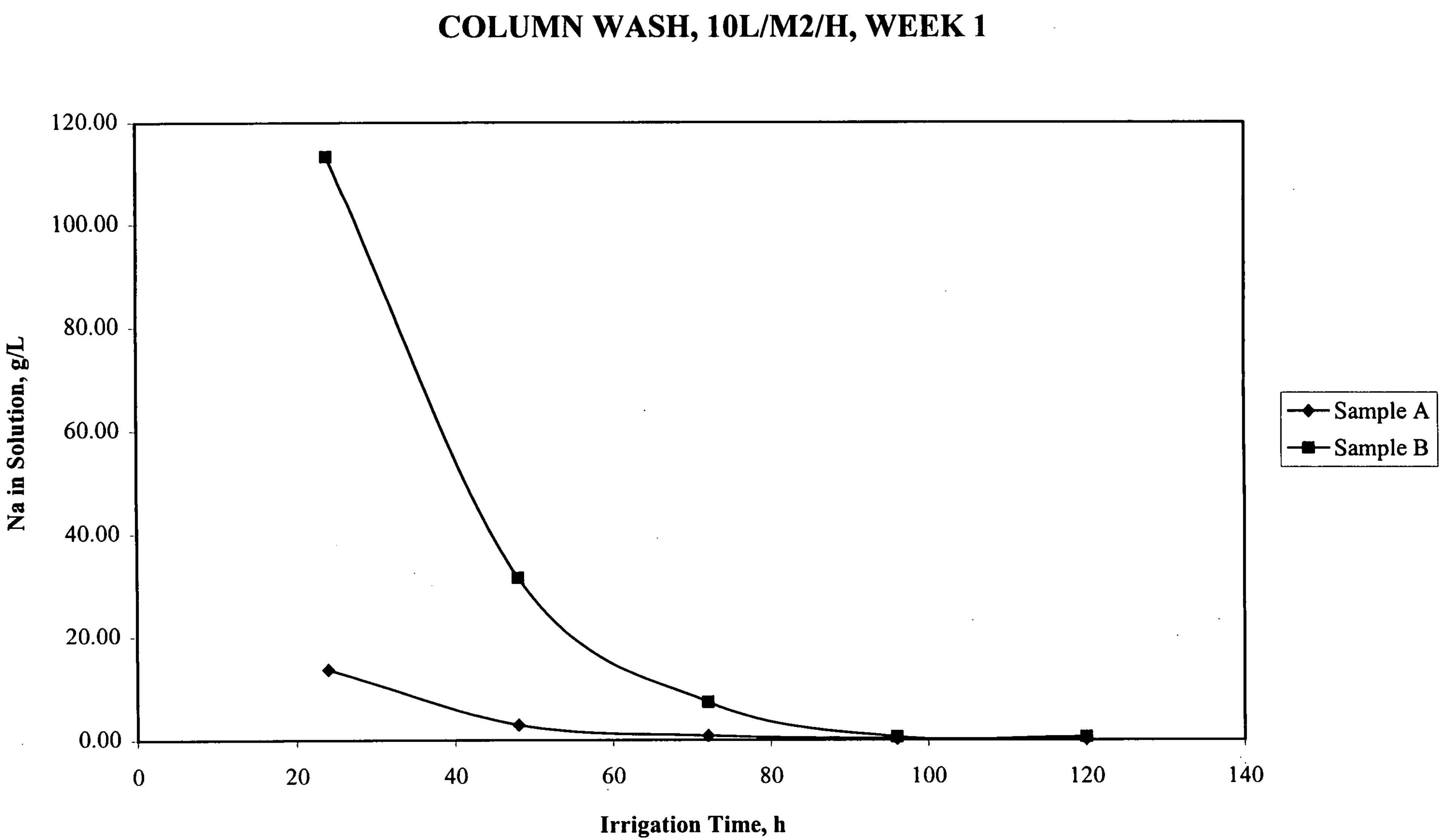
SOLUTION ASSAYS

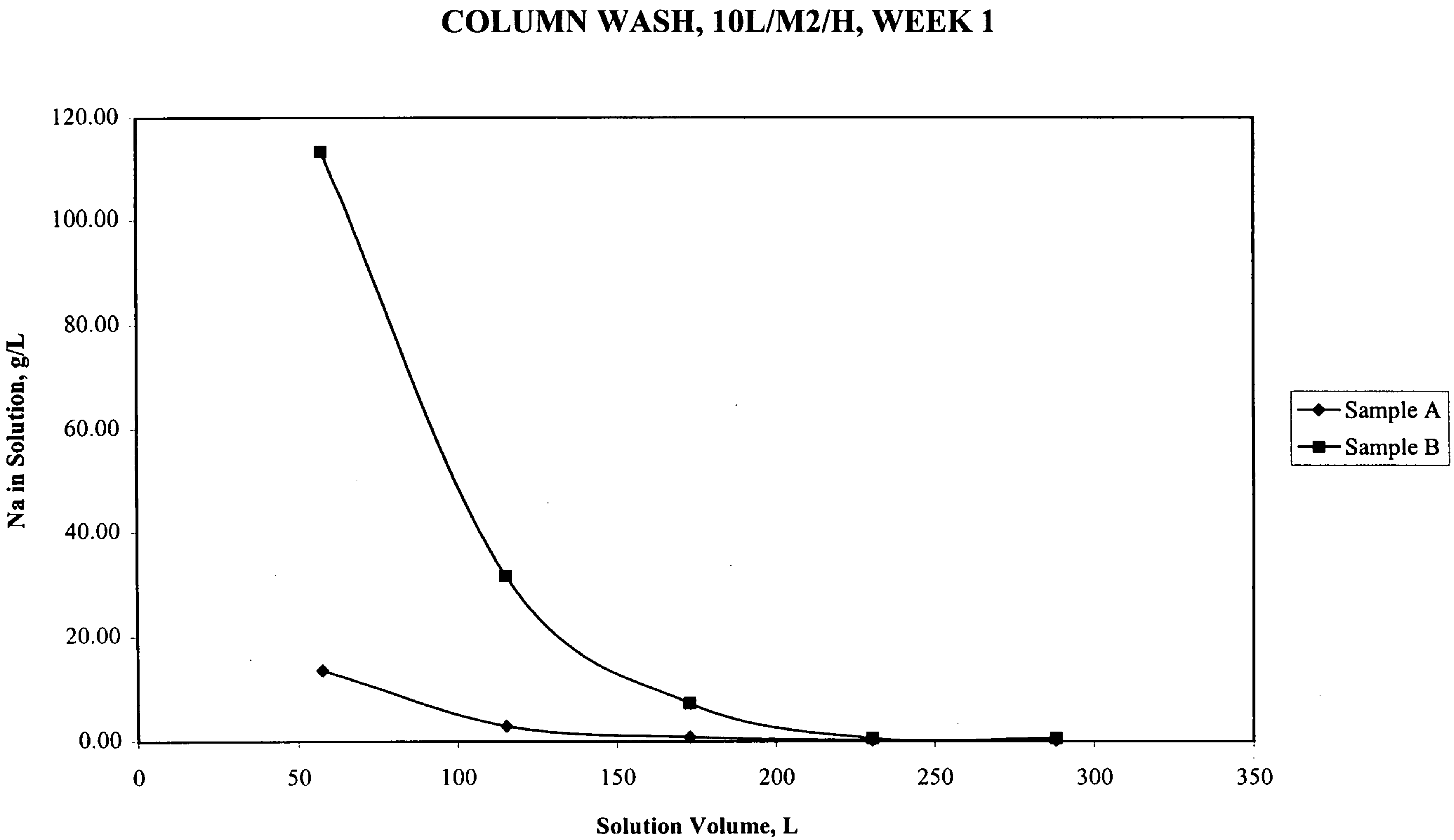
Date	Irrigation Time		Solution	Na in Solution, g/L	
	Days	Hours	Volume, L	Sample A	Sample B
9/03/98	1	24	57.6	13.70	113.50
10/03/98	2	48	115.2	2.95	31.55
11/03/98	3	72	172.8	0.86	7.35
12/03/98	4	96	230.4	0.22	0.62
13/03/98	5	120	288.0	0.19	0.60
16/03/98	8	192	460.8	0.13	0.20
17/03/98	9	216	518.4	0.12	0.16
18/03/98	10	240	576.0	0.12	0.16
19/03/98	11	264	633.6	0.12	0.17
20/03/98	12	288	691.2	0.13	0.16
23/03/98	15	360	864.0	0.14	0.15
25/03/98	17	408	979.2	0.14	0.16
27/03/98	19	456	1094.4	0.13	0.13
31/03/98	21	504	1209.6	0.12	0.13
2/04/98	23	552	1324.8	0.12	0.14

RESIDUE ASSAYS

Section	Sample A, ppm			Sample B, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Top	290(130)	150(110)	750(160)	500(410)	600(400)	850(140)
Middle	240(90)	150(140)	700(150)	280(150)	100(100)	600(90)
Bottom	250(105)	150(160)	900(160)	260(150)	150(100)	1050(100)
Average	260(110)	150(140)	780(160)	350(240)	280(200)	830(110)

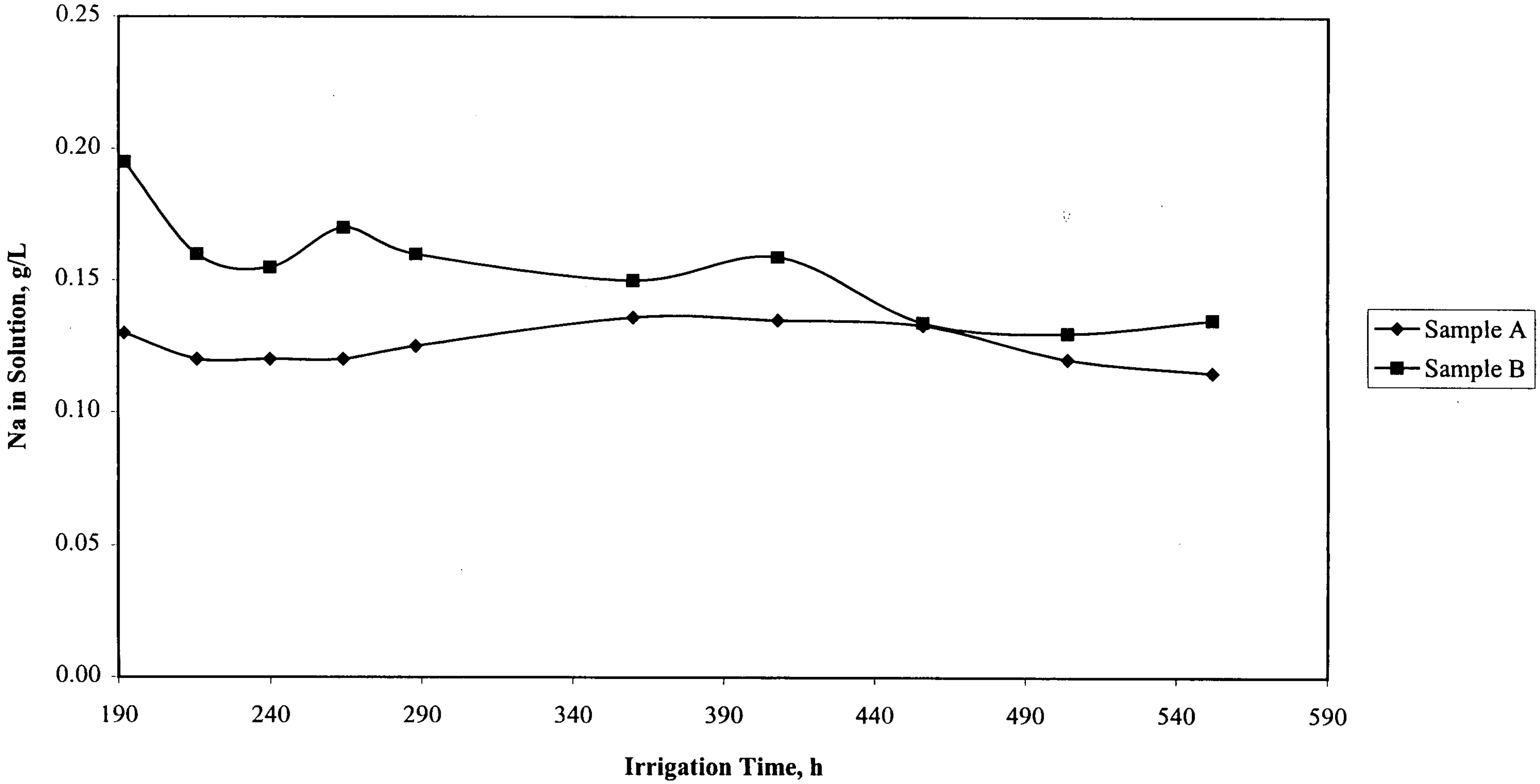
Water soluble assays in brackets

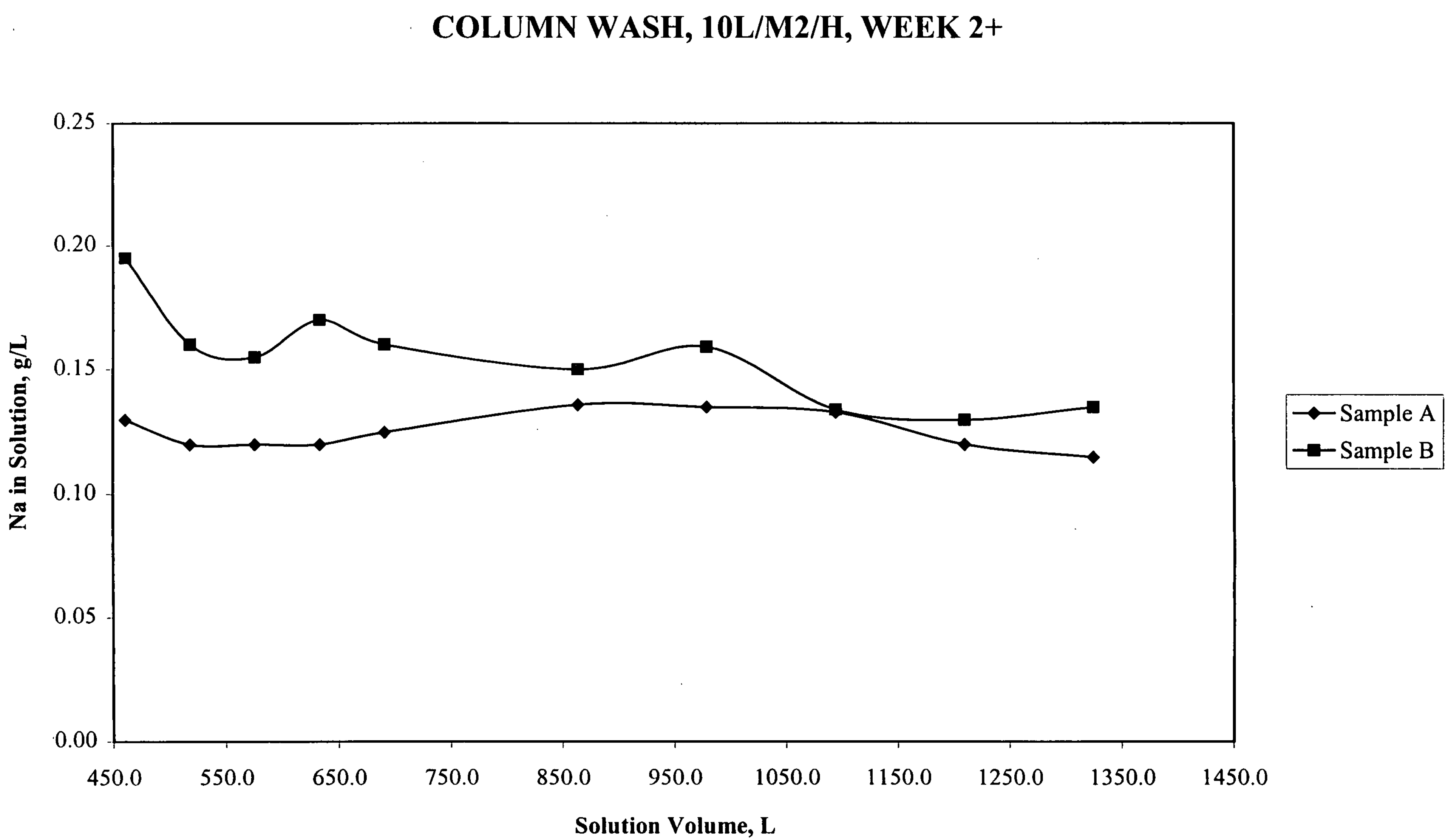

COLUMN WASH, 10L/M2/H, WEEK 1
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Na in Solution, g/L
0
20
40
60
80
100
120
140
Irrigation Time, h
Sample A
Sample B



COLUMN WASH, 10L/M2/H, WEEK 1
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Na in Solution, g/L
0
50
100
150
200
250
300
350
Solution Volume, L
Sample A
Sample B

COLUMN WASH, 10L/M2/H, WEEK 2+





COLUMN WASH, 10L/M2/H, WEEK 2+
0.25
0.20
0.15
0.10
0.05
0.00
Na in Solution, g/L
450.0
550.0
650.0
750.0
850.0
950.0
1050.0
1150.0
1250.0
1350.0
1450.0
Solution Volume, L
Sample A
Sample B

APPENDIX 2:

MAXIMUM FLOW IRRIGATION COLUMN WASHING, FRESH WATER

COLUMN WASH - FRESH WATER, 42.5L/M^2/H (MAX FLOW) INTERMITTENT

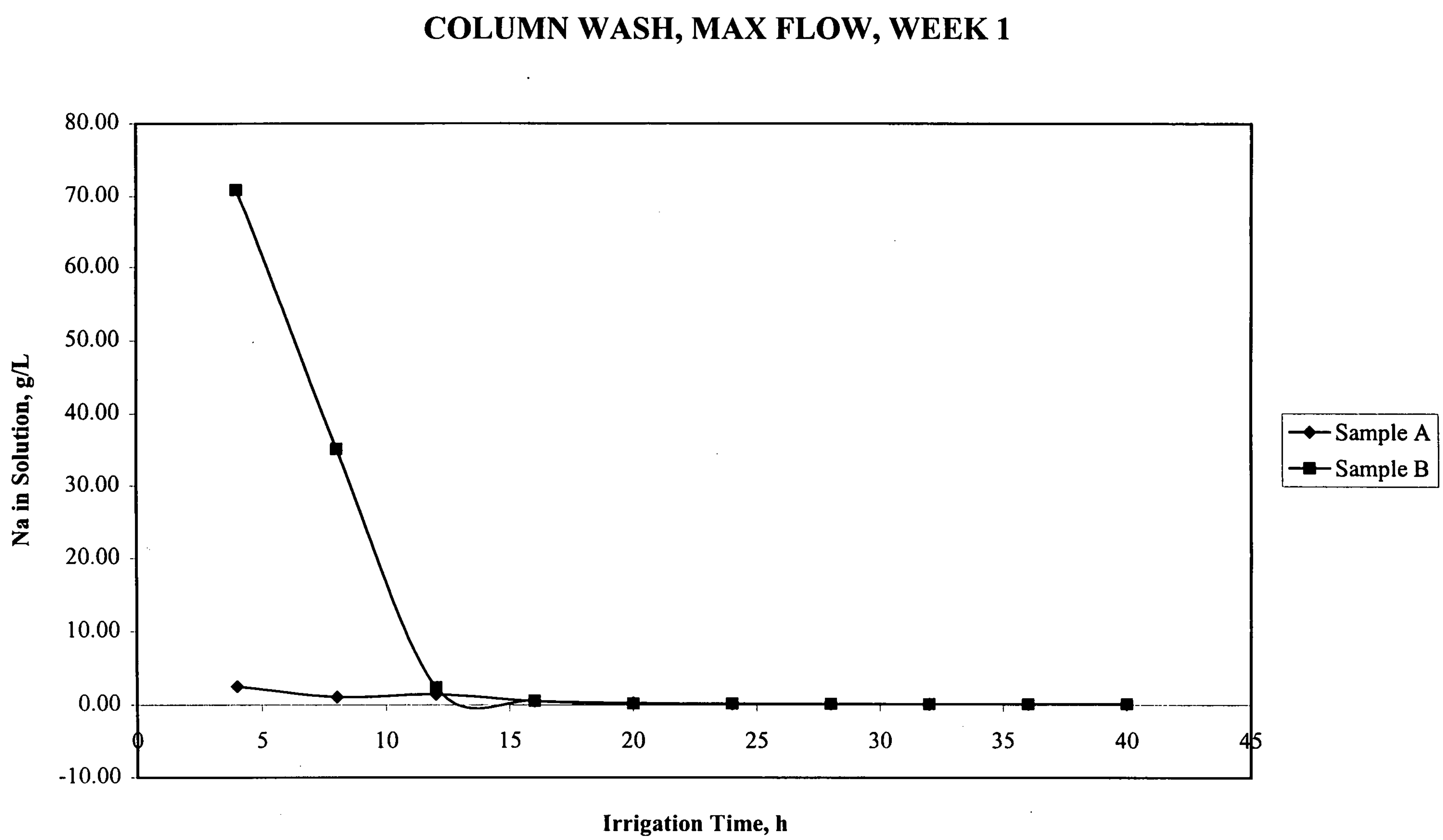
SOLUTION ASSAYS

Date	Irrigation Time		Solution	Na in Solution, g/L	
	Days	Hours	Volume, L	Sample A	Sample B
9/03/98	1	4	40.8	2.55	70.90
		8	81.6	1.10	35.15
10/03/98	2	12	122.4	1.46	2.43
		16	163.2	0.55	0.59
11/03/98	3	20	204.0	0.31	0.23
		24	244.8	0.20	0.22
12/03/98	4	28	285.6	0.18	0.19
		32	326.4	0.14	0.18
13/03/98	5	36	367.2	0.14	0.17
		40	408.0	0.13	0.15
16/03/98	6	44	448.8	0.14	0.16
		48	489.6	0.13	0.17
17/03/98	7	52	530.4	0.13	0.15
		56	571.2	0.11	0.13
18/03/98	8	60	612.0	0.12	0.12
		64	652.8	0.11	0.12
19/03/98	9	68	693.6	0.13	0.19
		72	734.4	0.12	0.14
20/03/98	10	76	775.2	0.12	0.15
		80	816.0	0.11	0.13
23/03/98	11	88	897.6	0.14	0.14
24/03/98	12	96	979.2	0.12	0.11
25/03/98	13	104	1060.8	0.12	0.11
26/03/98	14	112	1142.4	0.12	0.11
27/03/98	15	120	1224.0	0.12	0.11
31/03/98	16	128	1305.6	0.12	0.12
2/04/98	18	144	1468.8	0.12	0.12

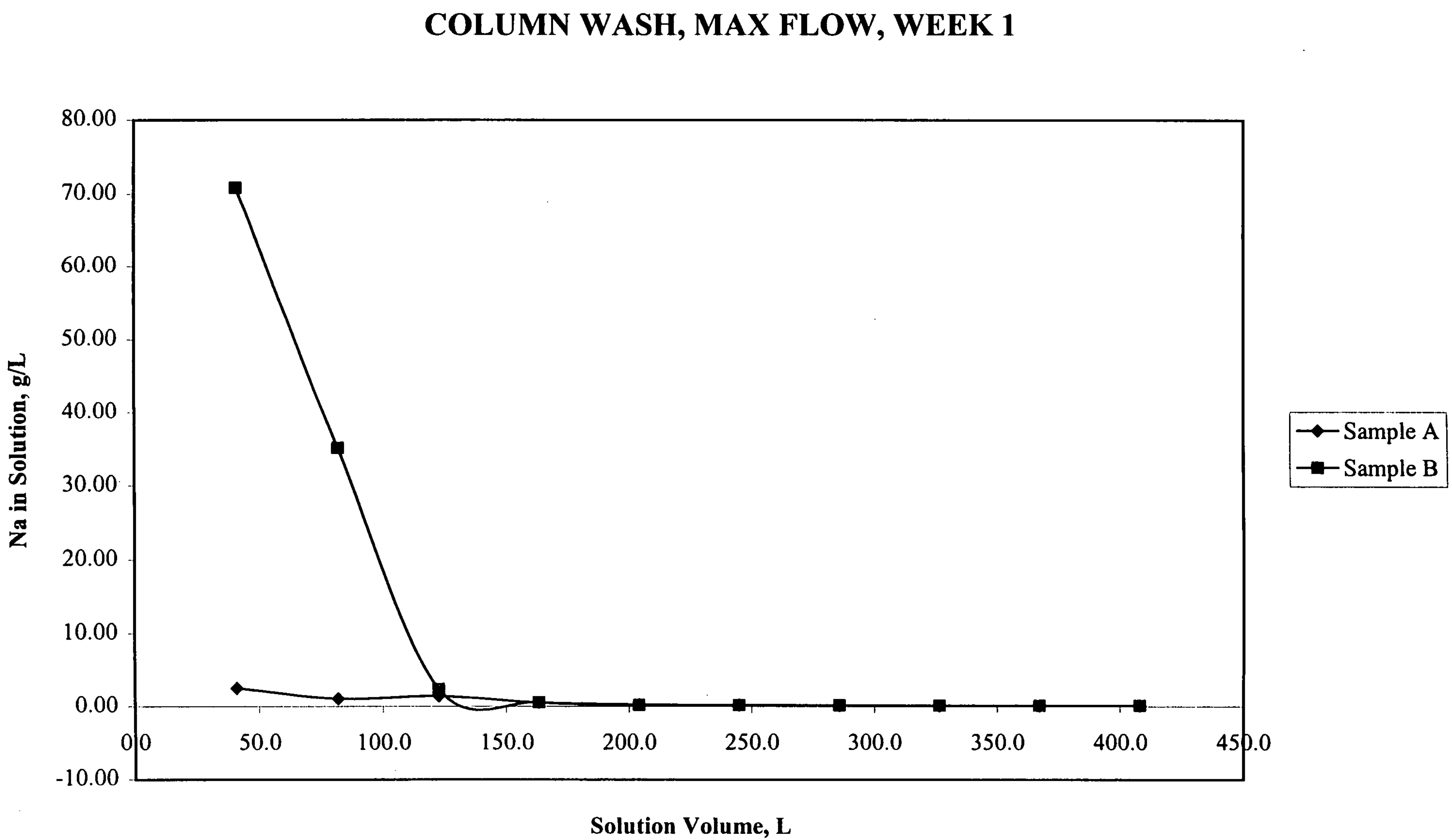
RESIDUE ASSAYS

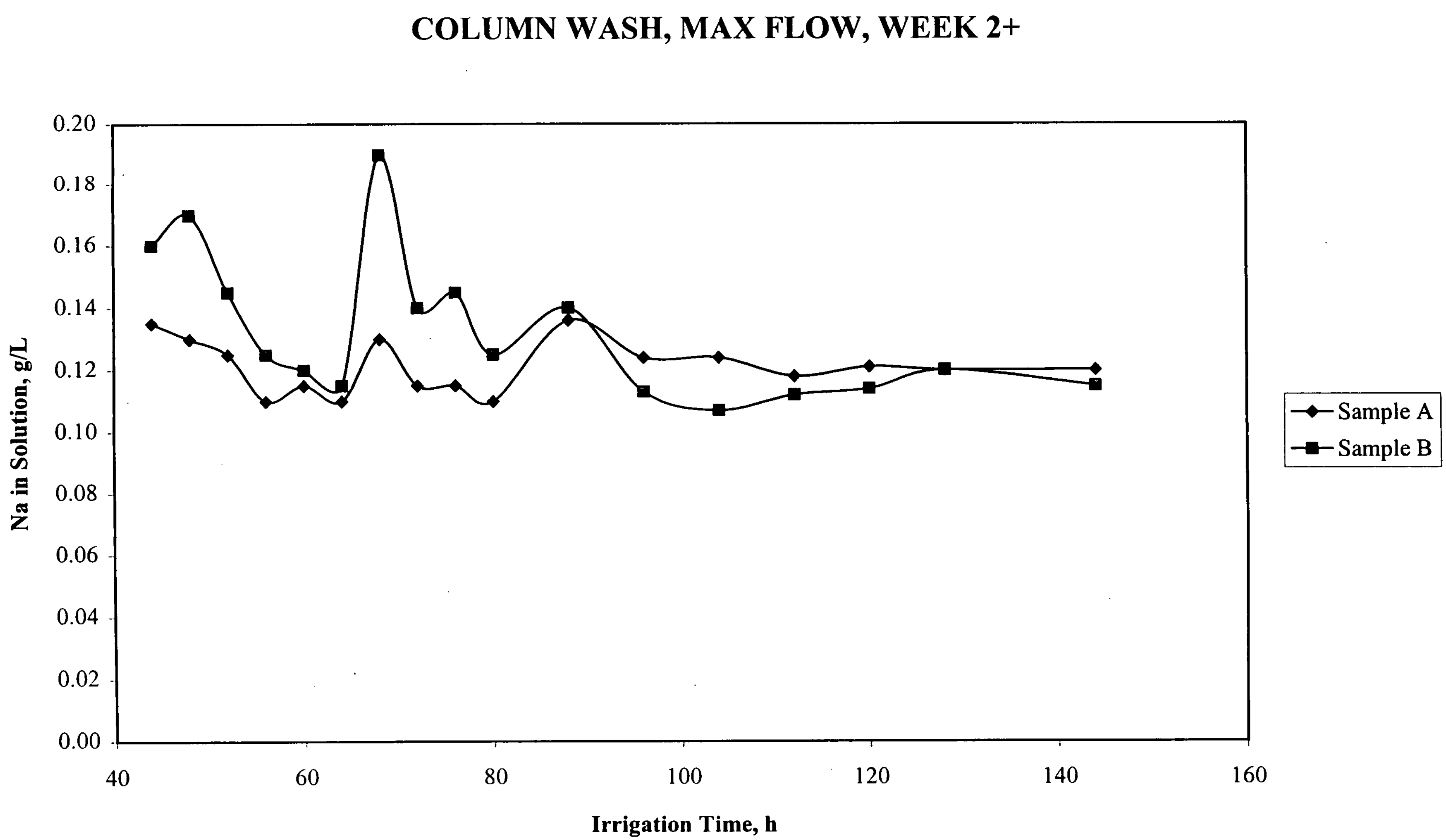
Section	Sample A, ppm			Sample B, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Top	280(190)	200(140)	700(150)	240(100)	100(120)	650(85)
Middle	270(140)	100(80)	750(140)	270(110)	100(100)	700(130)
Bottom	300(270)	100(120)	950(140)	270(110)	100(120)	1200(130)
Average	280(160)	130(110)	800(140)	260(110)	100(110)	850(120)

Water soluble assays in brackets

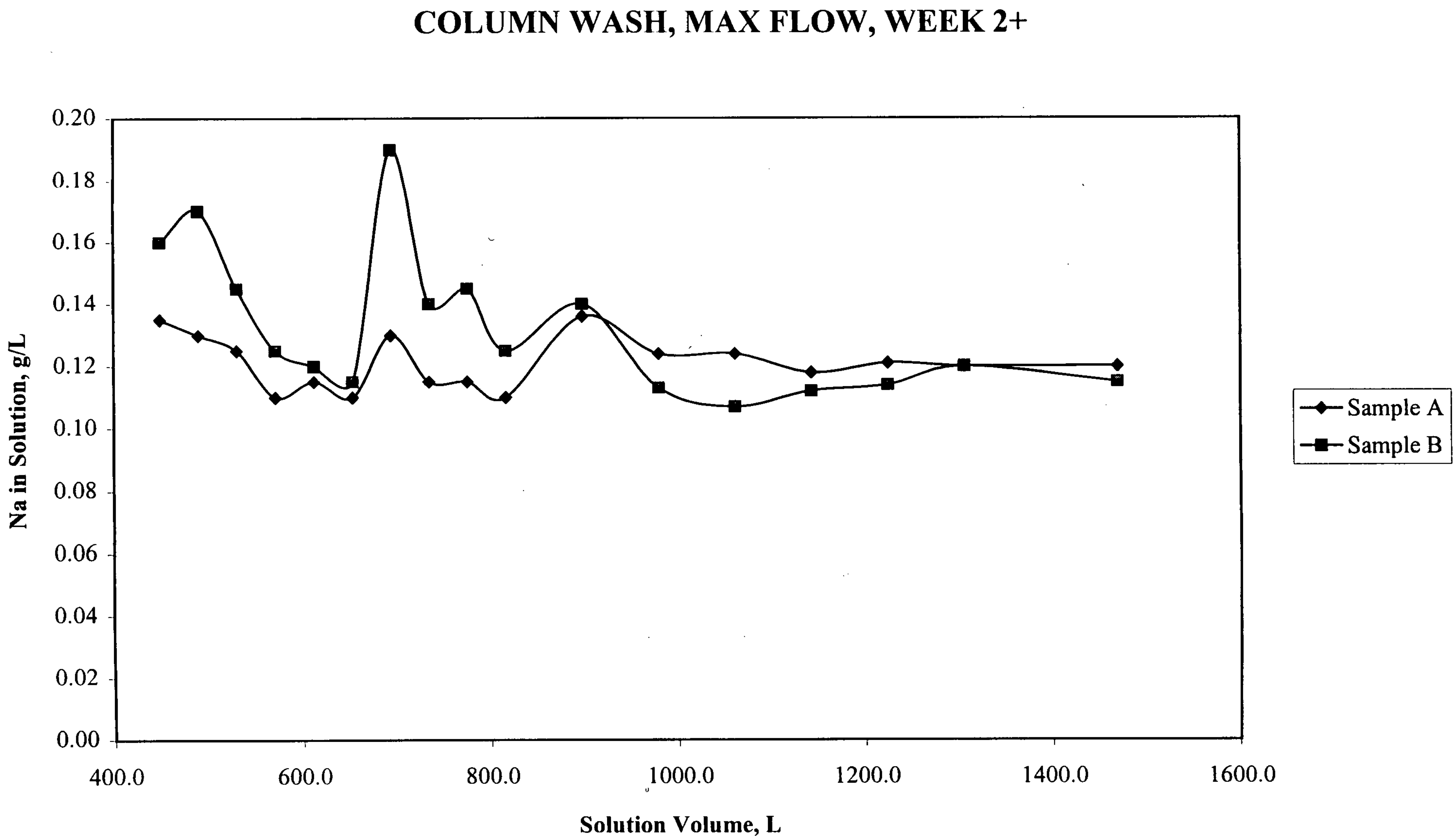


COLUMN WASH, MAX FLOW, WEEK 1
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
Na in Solution, g/L
0
5
10
15
20
25
30
35
40
45
Irrigation Time, h
Sample A
Sample B


COLUMN WASH, MAX FLOW, WEEK 1
Na in Solution, g/L
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
Solution Volume, L
Sample A
Sample B



COLUMN WASH, MAX FLOW, WEEK 2+
Na in Solution, g/L
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
40
60
80
100
120
140
160
Irrigation Time, h
Sample A
Sample B



COLUMN WASH, MAX FLOW, WEEK 2+
Na in Solution, g/L
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Solution Volume, L
Sample A
Sample B

APPENDIX 3:

SIMULATED RAINFALL COLUMN WASHING

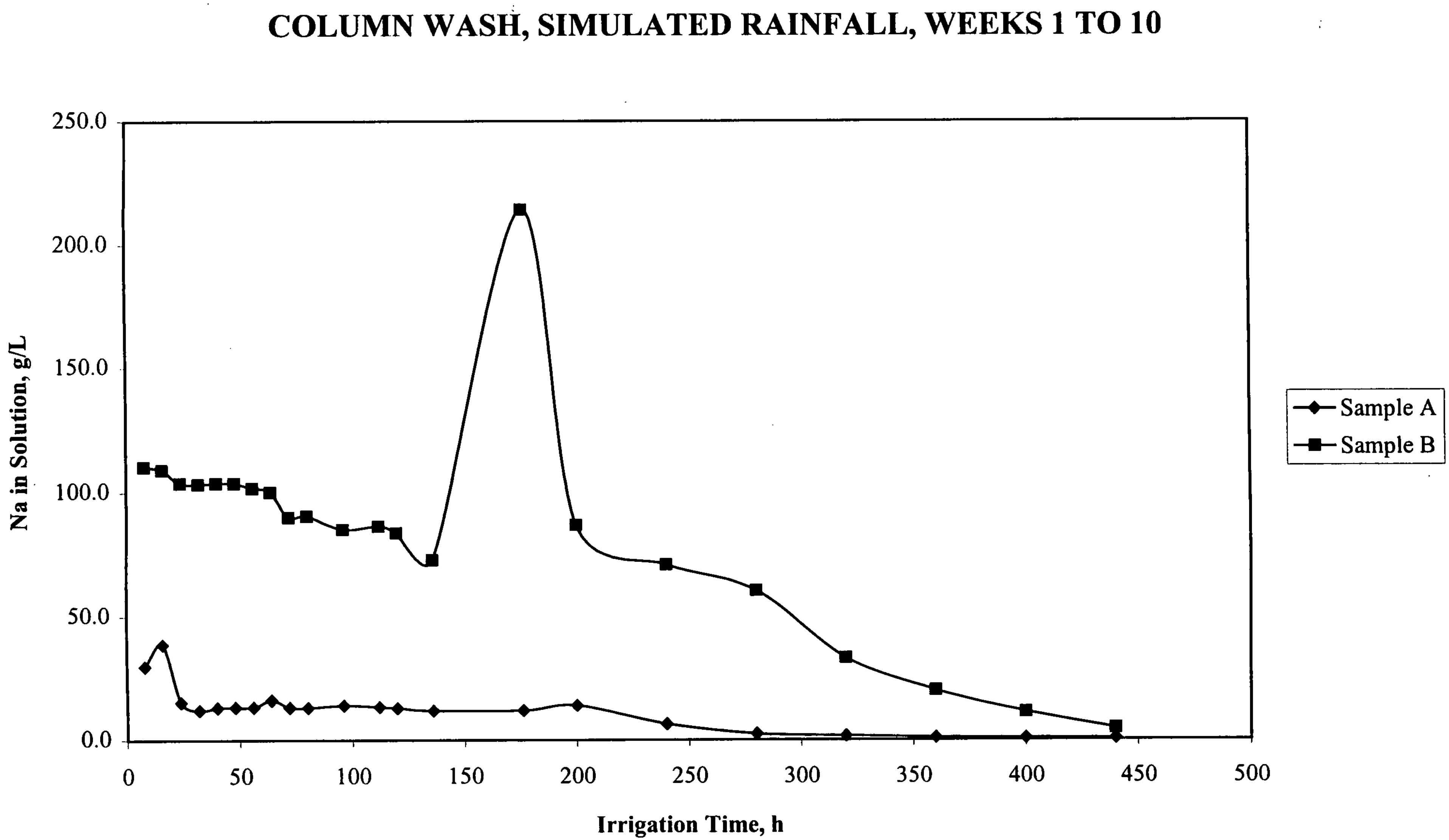
COLUMN WASH - FRESH WATER, SIMULATED RAINFALL

Date	Irrigation Time		Solution	Na in Solution, g/L	
	Days	Hours	Volume,	Sample A	Sample B
9/03/98	1	8	1.4	29.9	110.3
10/03/98	2	16	2.9	38.7	109.0
11/03/98	3	24	4.3	15.3	103.8
12/03/98	4	32	5.8	12.1	103.5
13/03/98	5	40	7.2	13.1	103.8
16/03/98	6	48	8.6	13.3	103.8
17/03/98	7	56	10.1	13.3	101.8
18/03/98	8	64	11.5	16.1	100.2
19/03/98	9	72	13.0	13.3	90.2
20/03/98	10	80	14.4	13.2	90.7
24/03/98	12	96	17.3	14.1	85.3
26/03/98	14	112	20.2	13.4	86.5
27/03/98	15	120	21.6	13.0	83.8
1/04/98	17	136	24.5	11.9	73.0
8/04/98	22	176	31.7	12.0	214.0
15/04/98	25	200	36.0	14.0	87.0
22/04/98	30	240	43.2	6.3	71.0
29/04/98	35	280	50.4	2.4	60.5
6/05/98	40	320	57.6	1.7	33.2
13/05/98	45	360	64.8	1.0	20.0
20/05/98	50	400	72.0	0.80	11.2
27/05/98	55	440	79.2	0.60	4.70
3/06/98	60	480	86.4	0.54	3.24
10/06/98	65	520	93.6	0.48	2.62
17/06/98	70	560	100.8	0.34	1.76
24/06/98	75	600	108.0	0.30	1.54
1/07/98	80	640	115.2	0.42	1.54
8/07/98	85	680	122.4	0.49	1.50
15/07/98	90	720	129.6	0.45	1.30
29/07/98	100	800	144.0	0.33	1.32
6/08/98	105	840	151.2	0.30	1.10
12/08/98	109	872	157.0	0.28	1.06
20/08/98	115	920	165.6	0.25	0.88
26/08/98	119	952	171.4	0.23	0.95
3/09/98	125	1000	180.0	0.19	0.80
9/09/98	129	1032	185.8	0.16	0.73

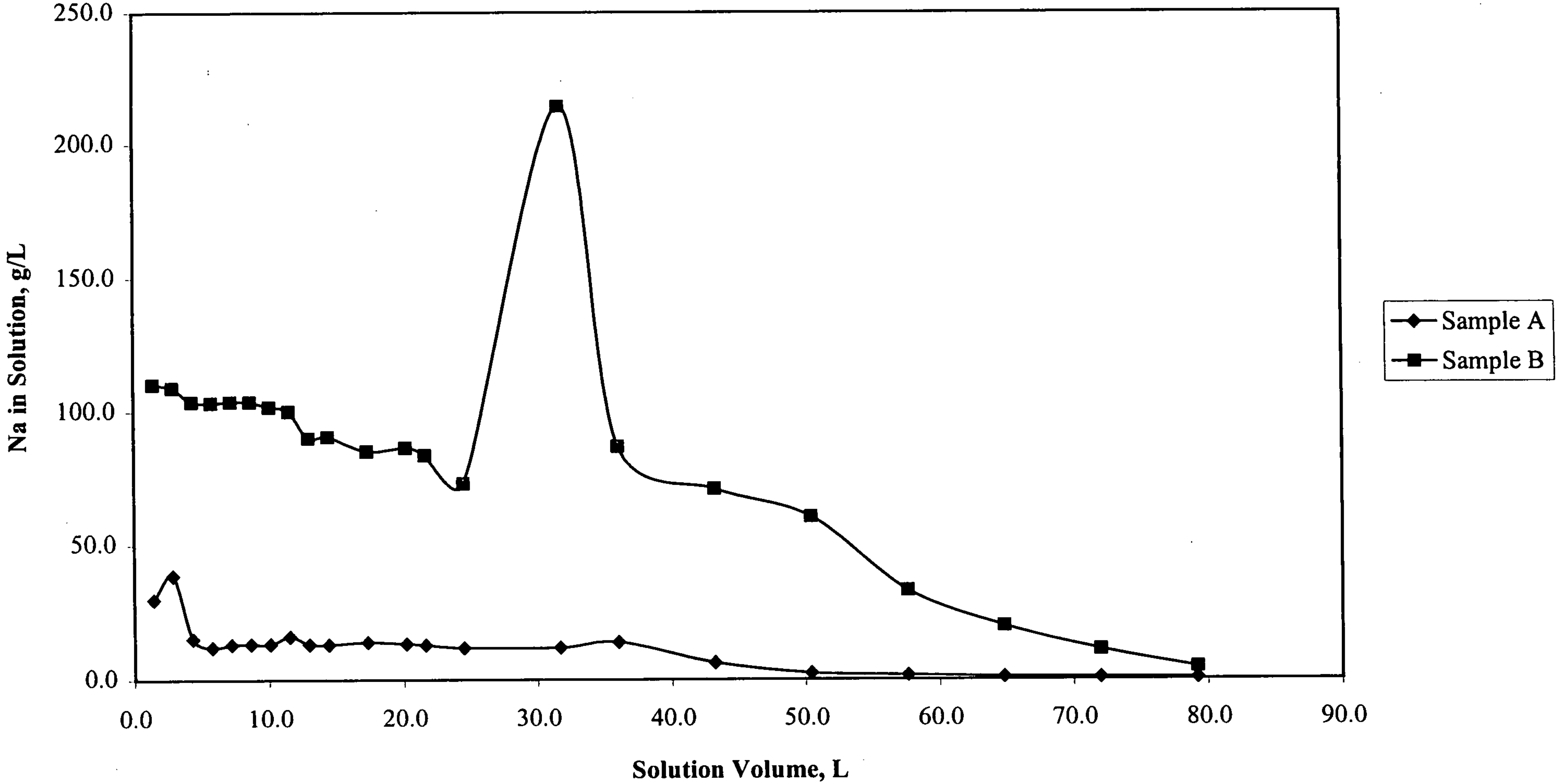
RESIDUE ASSAYS

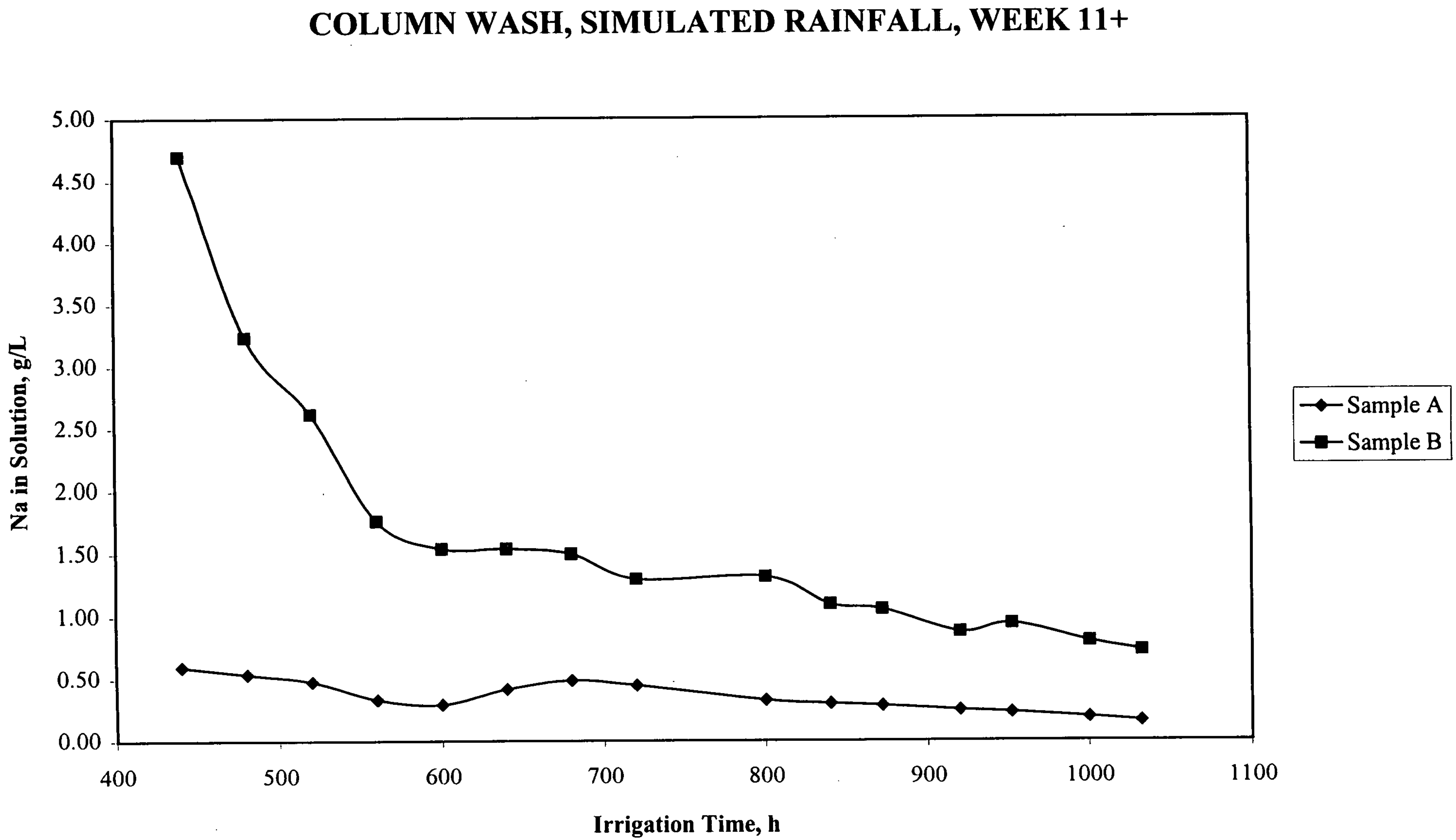
Section	Sample A, ppm			Sample B, ppm		
	Na	Cl	Mg	Na	Cl	Mg
Top	200(75)	<100(<10)	650(70)	230(130)	150(<10)	600(80)
Middle	180(50)	<100(<10)	700(75)	200(125)	150(100)	800(90)
Bottom	500(75)	<100(<10)	950(90)	580(160)	200(100)	1100(110)
Average	290(70)	<100(<10)	750(80)	340(140)	150(70)	950(95)

Water soluble assays in brackets

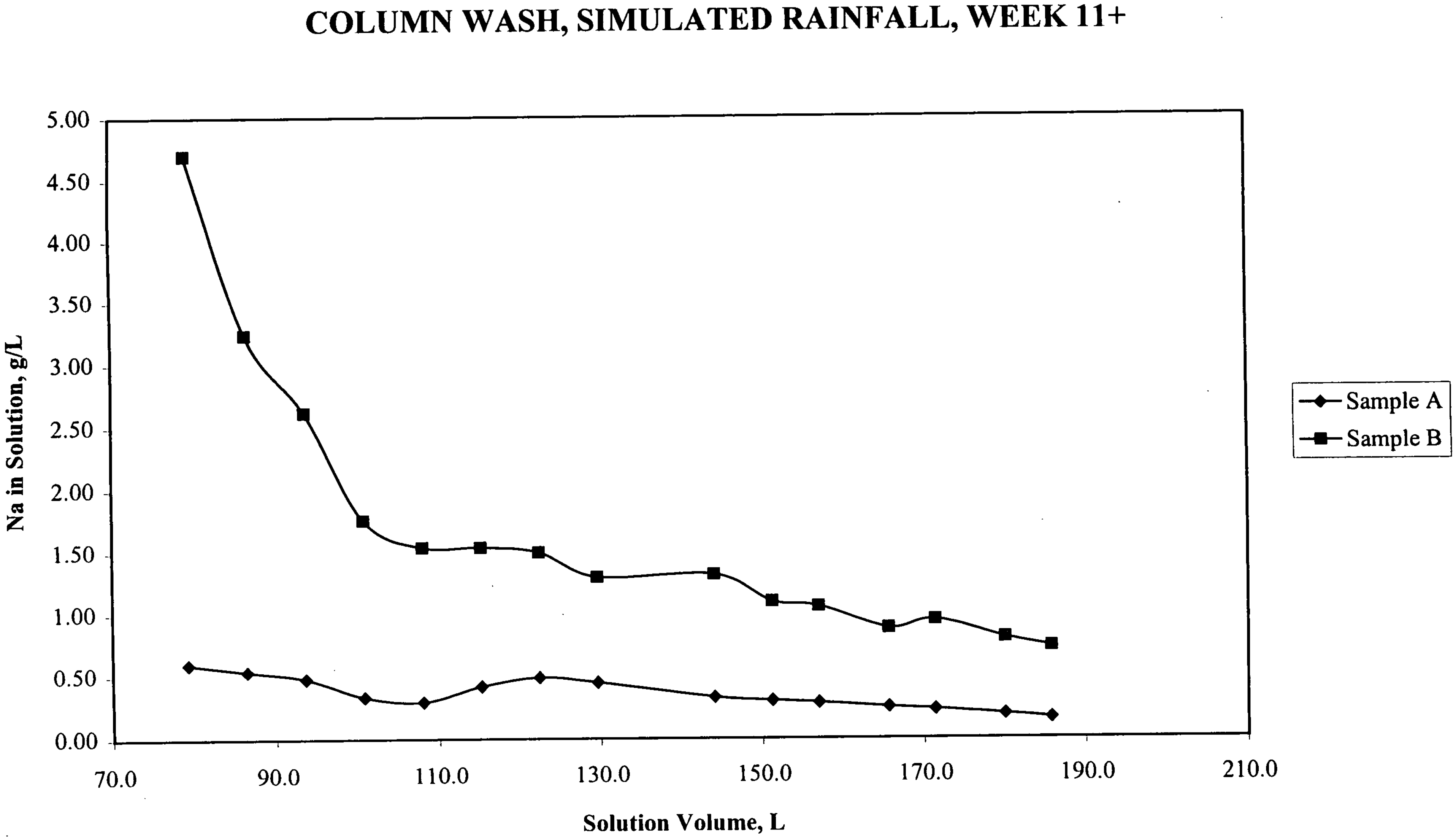

COLUMN WASH, SIMULATED RAINFALL, WEEKS 1 TO 10
Na in Solution, g/L
250.0
200.0
150.0
100.0
50.0
0.0
0
50
100
150
200
250
300
350
400
450
500
Irrigation Time, h
Sample A
Sample B

COLUMN WASH, SIMULATED RAINFALL, WEEKS 1 TO 10





COLUMN WASH, SIMULATED RAINFALL, WEEK 11+
Na in Solution, g/L
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
400
500
600
700
800
900
1000
1100
Irrigation Time, h
Sample A
Sample B


COLUMN WASH, SIMULATED RAINFALL, WEEK 11+
Na in Solution, g/L
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
70.0
90.0
110.0
130.0
150.0
170.0
190.0
210.0
Solution Volume, L
Sample A
Sample B

APPENDIX 4:

COLUMN WASHING AFTER SEAWATER PRE-WASH

COLUMN WASH - SEAWATER/FRESH WATER, 10L/M^2/H

SOLUTION ASSAYS

Date	Irrigation Time		Solution	Na in Solution, g/L	
	Days	Hours	Volume, L	2wk Pre-Wash	4wk Pre-Wash
20/07/98	3	72	172.8	0.19	2.19
22/07/98	5	120	288.0	0.17	0.21
24/07/98	7	168	403.2	0.15	0.16
27/07/98	10	240	576.0	0.13	0.12
29/07/98	12	288	691.2	0.18	0.11
31/07/98	14	336	806.4	0.12	0.09
3/08/98	17	408	979.2	0.11	0.10
5/08/98	19	456	1094.4	0.10	0.10
10/08/98	24	576	1382.4	0.09	
12/08/98	26	624	1497.6	0.10	
14/08/98	28	672	1612.8	0.10	

RESIDUE ASSAYS

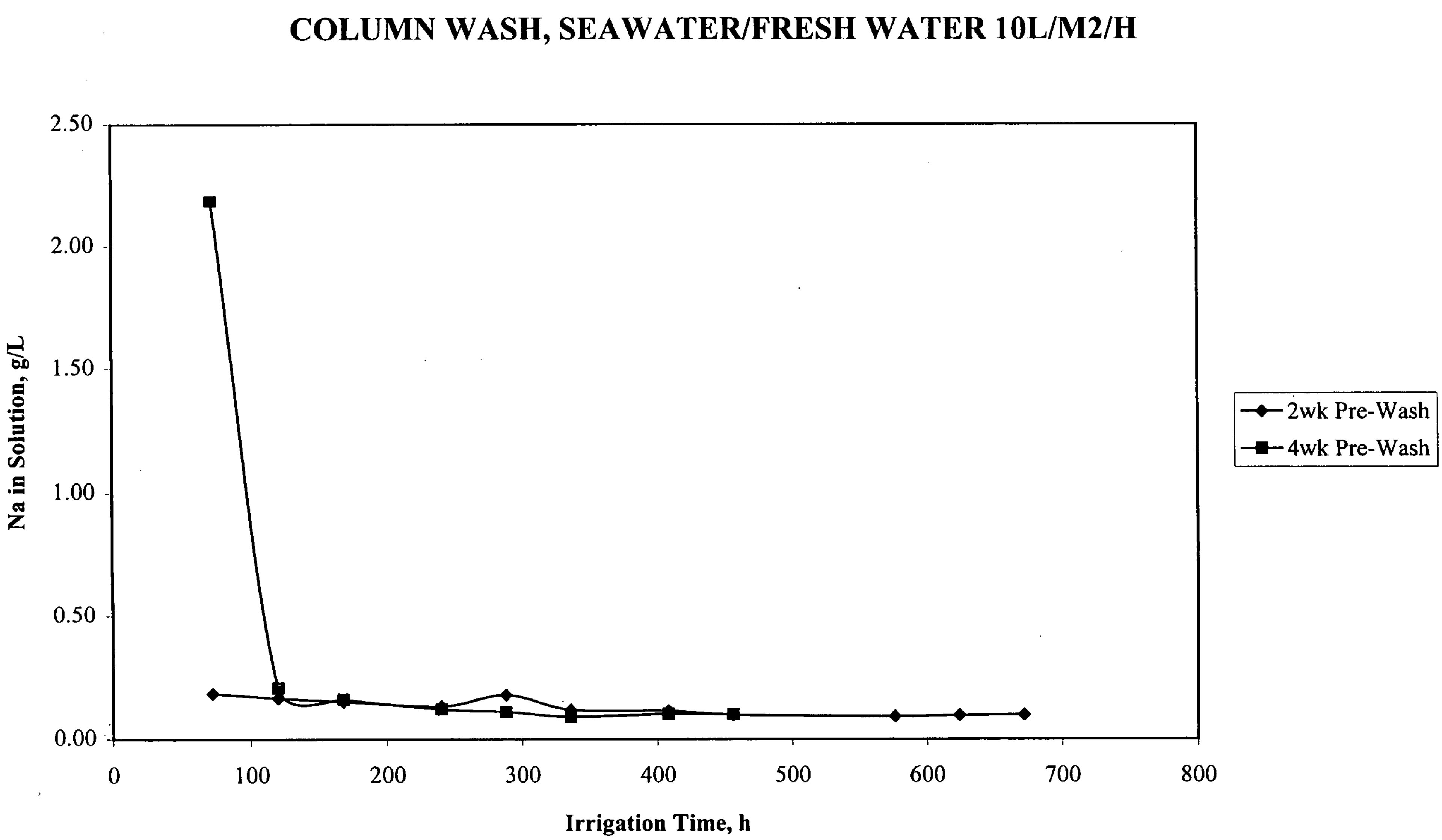
Residues After Seawater Pre-Wash Stage

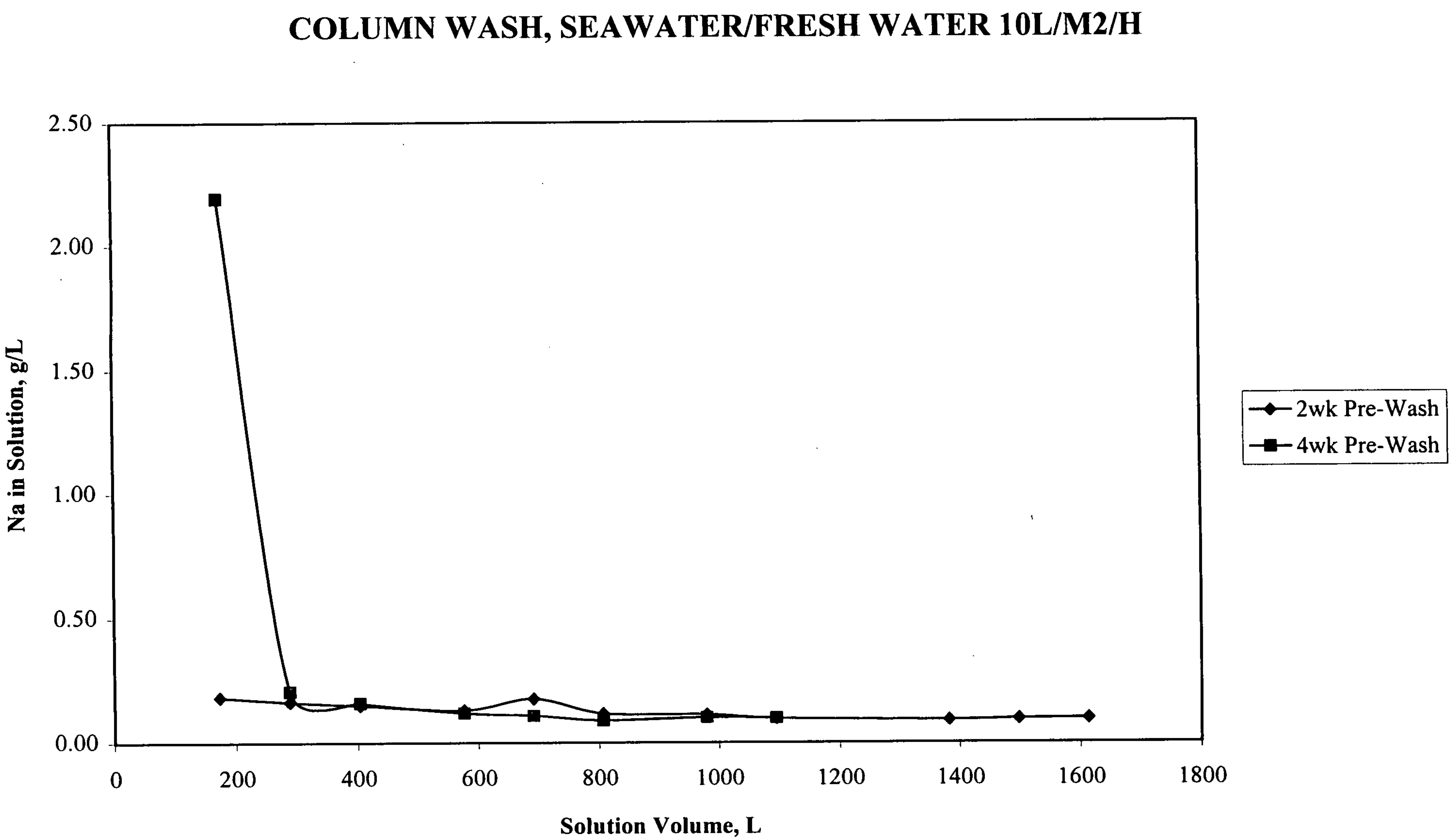
Section	2wk Pre-Wash			4wk Pre-Wash		
	Na	Cl	Mg	Na	Cl	Mg
Top	1150(950)	1700(1400)	1300(270)	1000(850)	2400(1400)	1350(250)
Middle	1150(1050)	2000(2000)	1300(290)	1150(850)	1600(1500)	1350(250)
Bottom	2050(1550)	2300(1900)	1950(340)	1900(1550)	3000(2800)	1600(340)
Average	1450(1150)	2000(1800)	1500(300)	1350(1050)	2300(1900)	1450(280)

Residues After Fresh Water Wash Stage

Section	2wk Pre-Wash			4wk Pre-Wash		
	Na	Cl	Mg	Na	Cl	Mg
Top	370(20)	<100(<10)	1600(25)	270(20)	100(<10)	1400(25)
Middle	350(20)	<100(<10)	1450(25)	380(20)	<100(<10)	1450(25)
Bottom	440(30)	100(<10)	1450(25)	340(20)	100(<10)	1350(25)
Average	390(20)	<100(<10)	1500(25)	330(20)	100(<10)	1400(25)

Water soluble assays in brackets


COLUMN WASH, SEAWATER/FRESH WATER 10L/M2/H
Na in Solution, g/L
2.50
2.00
1.50
1.00
0.50
0.00
0
100
200
300
400
500
600
700
800
Irrigation Time, h
2wk Pre-Wash
4wk Pre-Wash



COLUMN WASH, SEAWATER/FRESH WATER 10L/M2/H
Na in Solution, g/L
2.50
2.00
1.50
1.00
0.50
0.00
0
200
400
600
800
1000
1200
1400
1600
1800
Solution Volume, L
2wk Pre-Wash
4wk Pre-Wash

AZTEC

PROPOSED

GYPSUM LOADING FACILITY
TRACTOR BEACH, CORVISART BAY

Prepared for

TENNANT LTD

By

AZTEC ANALYSIS

June 1997

Job No A970106

20th June 1997

Job No: A970106

GYPSUM LOADING FACILITY

INTRODUCTION

Tennant Ltd have commissioned Aztec Analysis to carry out preliminary investigations into the feasibility of establishing a Gypsum loading facility in the Streaky Bay district. The results of this work are summarised below.

SITE

Four possible sites were identified after a site visit, and discussions with local fisherman Trevor Gilmore. Generally, protection from the SW was considered essential as this is the prevailing weather.

- Tractor Beach, near the Dreadnaughts in Corvisart Bay
- Off the beach in the middle of Sceale Bay
- Point Westall
- Cape Blanche, Sceale Bay

Refer to Figure 1.

Tractor Beach was selected as the most suitable for the following reasons;

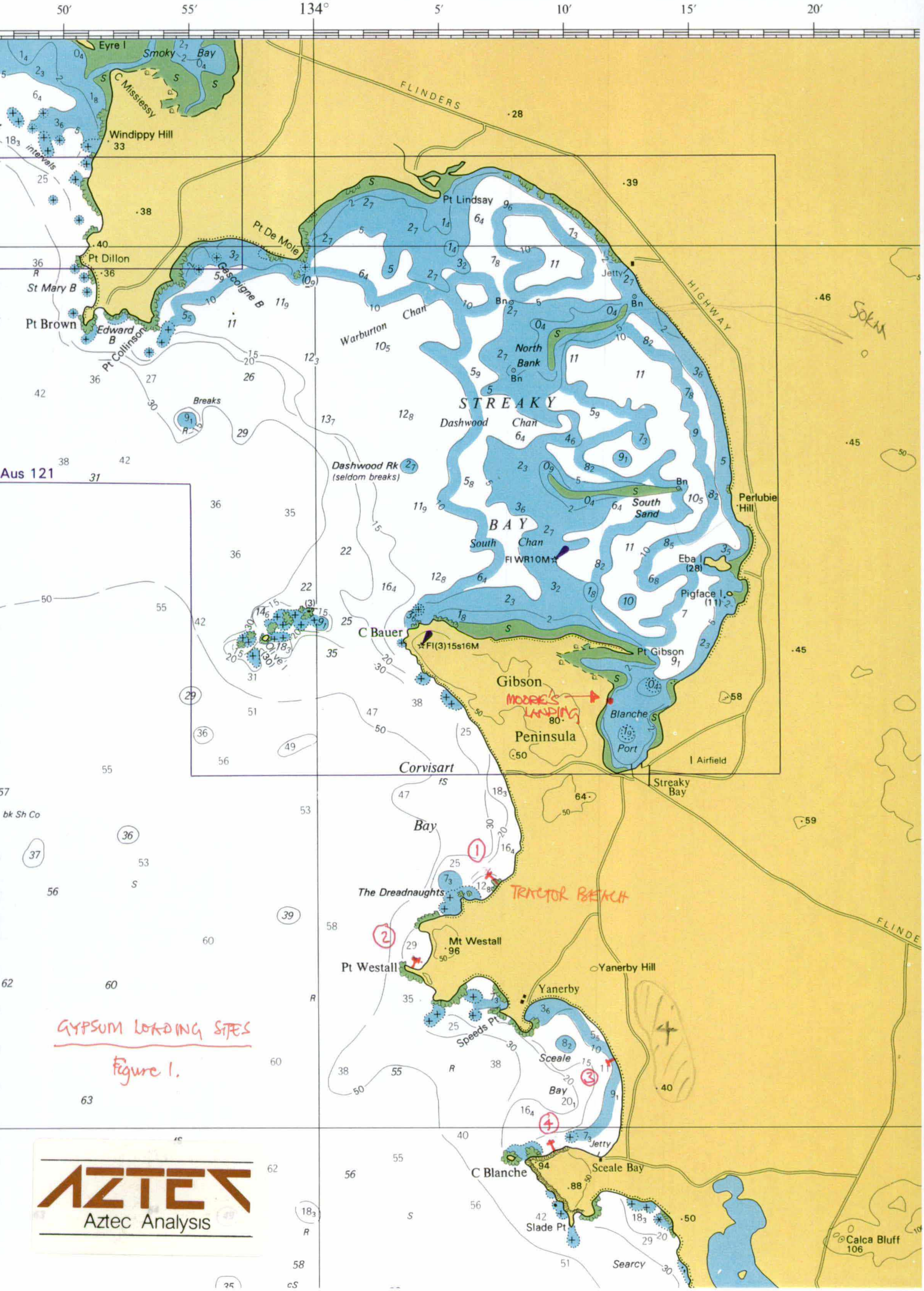
- Point Westall has insufficient protection and manoeuvring space. The area is scenic. Stockpiling and infrastructure would be highly visible on top of the plateau.

- Cape Blanche, Sceale Bay has deep water but access to a loading jetty would be via a high cliff. The civil engineering works would be extensive and highly visible.

- The beach site at Sceale Bay is unprotected from the weather and Mr Gilmore says that the charts indicating deep water close in are unreliable. There would be no real advantage in constructing here.

- The Tractor Beach site has protection from the SW. Deep water relatively close by. A reef extending half way out would make piling of that section easier. The site itself is of low scenic interest, with a low hill behind the beach and low lying land behind that.

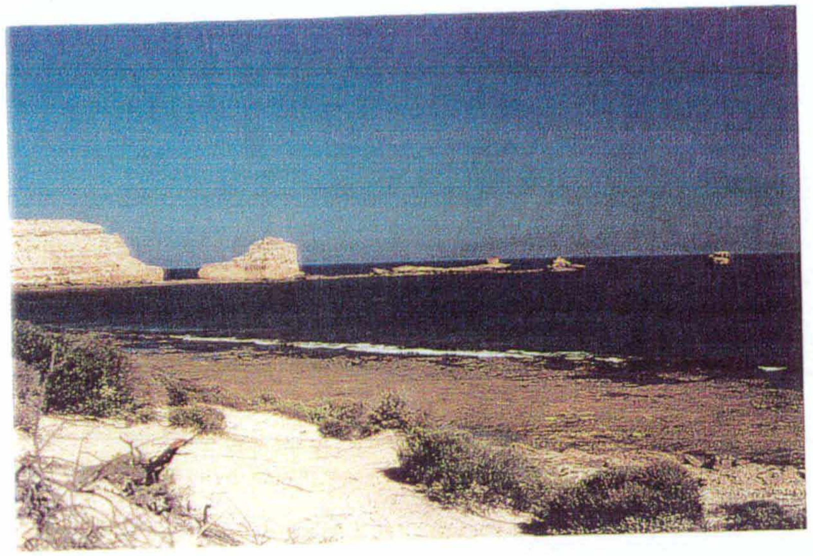
Refer to Figure 2 for the site showing the proposed jetty layout.



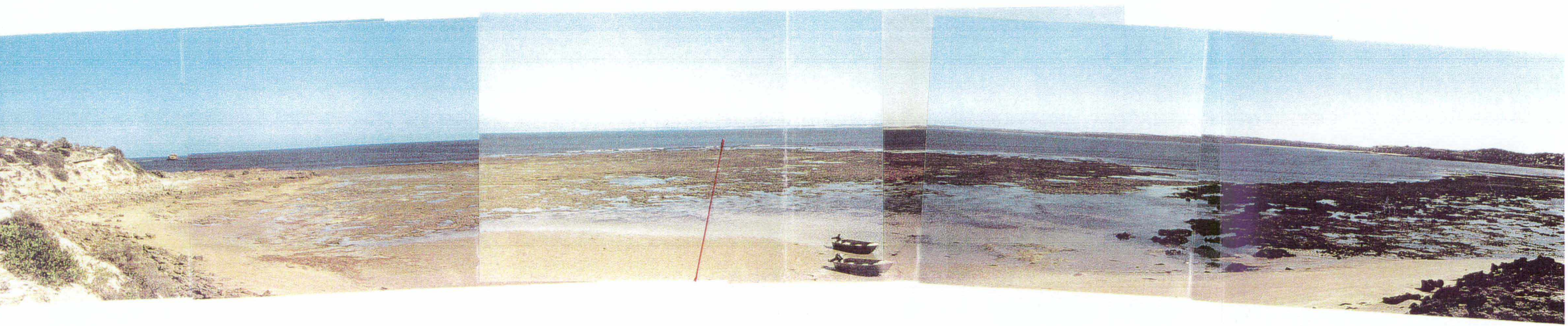
GYPSUM LOADING SITES

Figure 1.

AZTEC
Aztec Analysis



VIEW FROM SITE
LOOKING TOWARDS THE DREADNAUGHTS.



TRACTOR BEACH SITE

CORVISART BAY.

Aztec Analysis

GENERAL ARRANGEMENT

Refer to the attached drawings for the proposed arrangement for the facility.

VESSELS

It has been agreed to allow for maximum 40,000 DWT vessels. Typically these would be 190m x 30m x 11m draft. Seatech (see later) recommend a water depth of 13.1m below LW at the berth and 10m below LW for the approach for such vessels.

TRESTLE

The simplest jetty consists of a conveyor plus walkway. This is similar to the BHP dolomite loading facility at Ardrossan which manages without a roadway to the berth.

LOADING

This work has been based on 1000 tonnes per hour loading rate with a fixed ship loader at the berth. Ships have to be moved along the berth to permit loading of all the holds. Our instructions are to assume 1 million tonnes per annum loading.

BERTHING & MOORING ARRANGEMENT

Fixed (piled) dolphin structures have been nominated. While these are expensive they are considered more reliable than mooring buoys. Seatech's report bears this out.

LIMITING CONDITIONS

(a) Berthing without tugs

Seatech suggest limiting winds of 30km/hour, providing the seabed will hold an anchor and currents are less than 0.5 knots. For AM berthing, the occurrence of limiting winds reaches 10% during the months of July to October.

(b) At berth

Seatech estimate the occurrence of limiting waves to be about 15%. If these are exceeded, a ship would have to leave the berth and wait offshore.

TUG ASSISTANCE

Subject to the limiting conditions discussed above, Seatech believe it is safe to berth without tugs. They do however point out that "usual practice for 40,000 DWT ships is to berth with 2 tugs each of about 30T bollard pull". Further, it should be remembered that the nearest tugs are at Port Lincoln, 200 nautical miles away. Thevenard has one small, old workboat of only 10 tonnes bollard pull and is still 8 hours away.

For 25 vessels per year, each in port for say 2-3 days, the berth utilisation would be around 20%, and would therefore make it difficult to justify the cost of the tugs.

SUPPORTING VESSELS

As a minimum, a mooring boat will be required, with an engine of about 200hp and 2 man crew.

In addition a small barge to assist with maintenance of the berth should be considered.

MOORING

Seatech strongly recommend a simulation study be carried out on the mooring system as the long period swell can cause serious surge and sway motions. Such a study would be carried out by specialist consultants.

STEELWORK AND PILING

For the purposes of this study, pile and steelwork sizes have been estimated by comparing to our recent similar design at Port Stanvac, South Australia for Mobil.

Lawson and Treloar's report indicates that the crest of the design wave at the berth could be 13 metres above LW. As this estimate is based on very limited data, it is considered to be conservative. The preliminary design has set the steelwork 10 metres above LW.

WATER DEPTHS

Trevor Gilmore has carried out initial seabed soundings and these have been used to lay out the berth.

LOADING SITE

The design assumes material is stockpiled on site, directly inland of the jetty, and loaded via a hopper with front end loaders.

To minimise the visual impact on the coastline it is proposed that the conveyor pass through a tunnel (or culvert) in the hill to get from the loading hopper to the trestle.

Services required will be power and water.

EARLY CASH FLOW

The attached drawings show an optional loading facility at Moore's Landing, Streaky Bay. Because of water depth limitations, one would load barges and ferry the material to the ship anchored offshore in deeper water. Assume a loading rate of 600 tph is achievable. Ships would load using their own grabs.

Such a facility could be constructed in 3 months and provide an early cash flow. Unit loading rates per tonne would be high and the barges may be difficult to hire, although river barges, designed for calmer waters, are not uncommon. Two self-powered barges of, say, 5000 tonnes capacity would be required. This option would probably be considered as a short-term option while the main facility is under construction.

LAWSON & TRELOAR

Lawson and Treloar, Coastal, Ocean and Water Resources Consulting Engineers, have carried out a preliminary study to identify the tide, wind, wave and current climate at the site. Refer to Appendix B for the full report.

SEATECH

Seatech Consultants (Captain Ian Wright) have reviewed the operational aspects of the project and confirmed the arrangement and orientation of the berth. Refer to Appendix C for the full report.

COST ESTIMATE

We have estimated the cost to establish the loading/stockpiling site and the marine facility to be $19.87m.

The estimates contain generous contingencies to allow for the present uncertainties and should be considered to be an upper limit.

Not included are:

-	Provision of services to the site }	Est $1.656m
-	Upgrading of the road to the site (20km) }	
-	Tugs	Est $2.5m each (s/hand)
-	Mooring Boat	$750,000 (s/hand)
-	Barge	Est $0.1m (s/hand)
-	Cost of preparing an EIS if this should be required	Est $0.25m
-	Land acquisition costs	
-	Optional facility at Moore's Landing	Est $0.429m
-	Transfer barges	Est $0.85m each (s/hand)

OPERATING COSTS

Assuming that loading of the material is subcontracted separately, the operating costs for the initial 5 years should be low, say;

Caretaker/harbourmaster	$100,000
Casual crew/labour	$ 75,000
Maintenance	$ 50,000
Light, power, phone, water	$ 25,000
	$250,000 p.a.

ADDITIONAL COST OPTIONS

Apart from the tugs and barge noted above, future feasibility work should address the need for an access roadway along the jetty to facilitate maintenance works.

FEASIBILITY STUDY

The next stage in this project should be a feasibility study which would extend the work in this report.

Areas to address would be;

- Confirm site.
- Confirm vessel size and loading rate.
- Confirm viability of Moore's Landing option.
- Increase accuracy of wave data, particularly size and height of design wave (Lawson & Treloar).
- Review design, investigate options.
- Review operations (Seatech).
- Sample and probe seabed to confirm its composition.
- Bathymetric survey to confirm contours and to extend the area covered.
- Land survey to establish levels.
- Mooring simulation analysis.
- Planning requirements - in particular the need for an EIS.
- Preliminary design of all engineering work.
- Optimise the cost of the project.
- Estimate the cost of the project (± 5%).

This would take 2 months. The fee has been included in the cost estimate.

PROGRAM

Assuming a reasonably smooth planning approval process, we envisage the following program;

Pre-feasibility	:	Complete
Review	:	1 month
Feasibility	:	2 months
Review	:	1 month
Planning Approval	:	6 months
Design	:	4 months
Tender	:	2 months
Construction	:	12 months
		28 months

With a fast-track approach, it may be possible to complete the project in 18 months.

The Moore's Landing facility could be completed in 3 months.

POTENTIAL FOR COST REDUCTIONS

Areas for investigation to reduce cost would be;

- Pre-fabricated caissons in lieu of dolphins. These would be floated to location and ballasted down. No piling.
- Mooring buoys in lieu of mooring dolphins. Penalty would be greater down-time.
- Shallower water, ie smaller ships.
- Travelling ship loader (shorter berth). Straight line layout.
- Construction Management: By subcontracting packages of work rather than using a single Head Contractor, savings of over 10% can be made.

These would all be addressed in the Feasibility Study.

PLANNING/APPROVAL PROCESS

The Planning issues for this site are sensitive and we suggest they be handled in conjunction with the Department of Mines & Energy. Key issues will be;

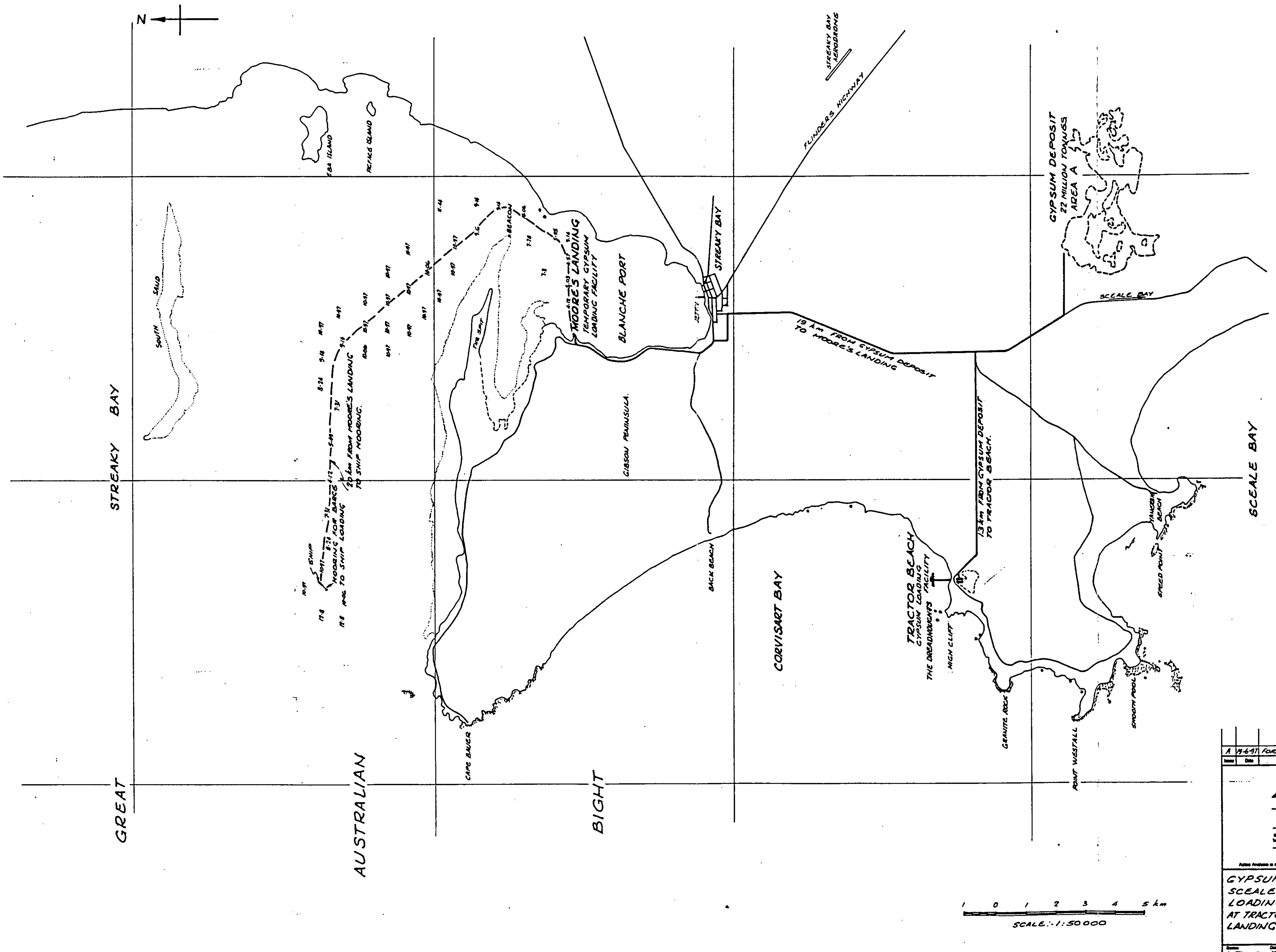
- Environmental Heritage
- Aboriginal Heritage
- Native Vegetation
- Coastal Protection
- Title to land

Attach:

Appendix A; Drawings
Appendix B; Lawson & Treloar Report
Appendix C; Seatech Report
Appendix D; Cost Estimate

SMG:apc

APPENDIX A : DRAWINGS



A	19-6-97	FOR CLIENT REVIEW	RFF	
Issue	Date	Description	Draft.	Eng.

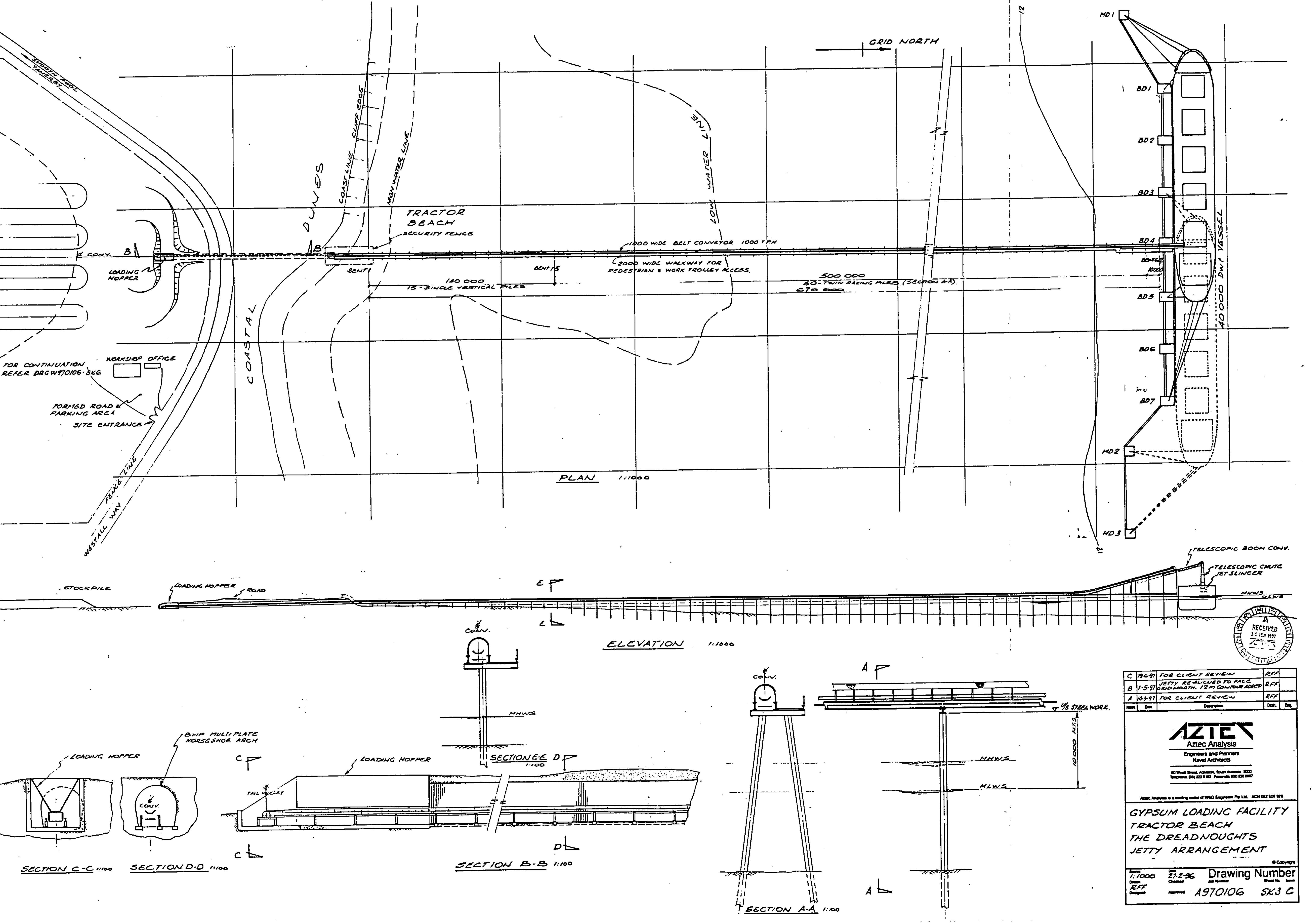
AZTEC
Aztec Analysis
Engineers and Planners
Naval Architects

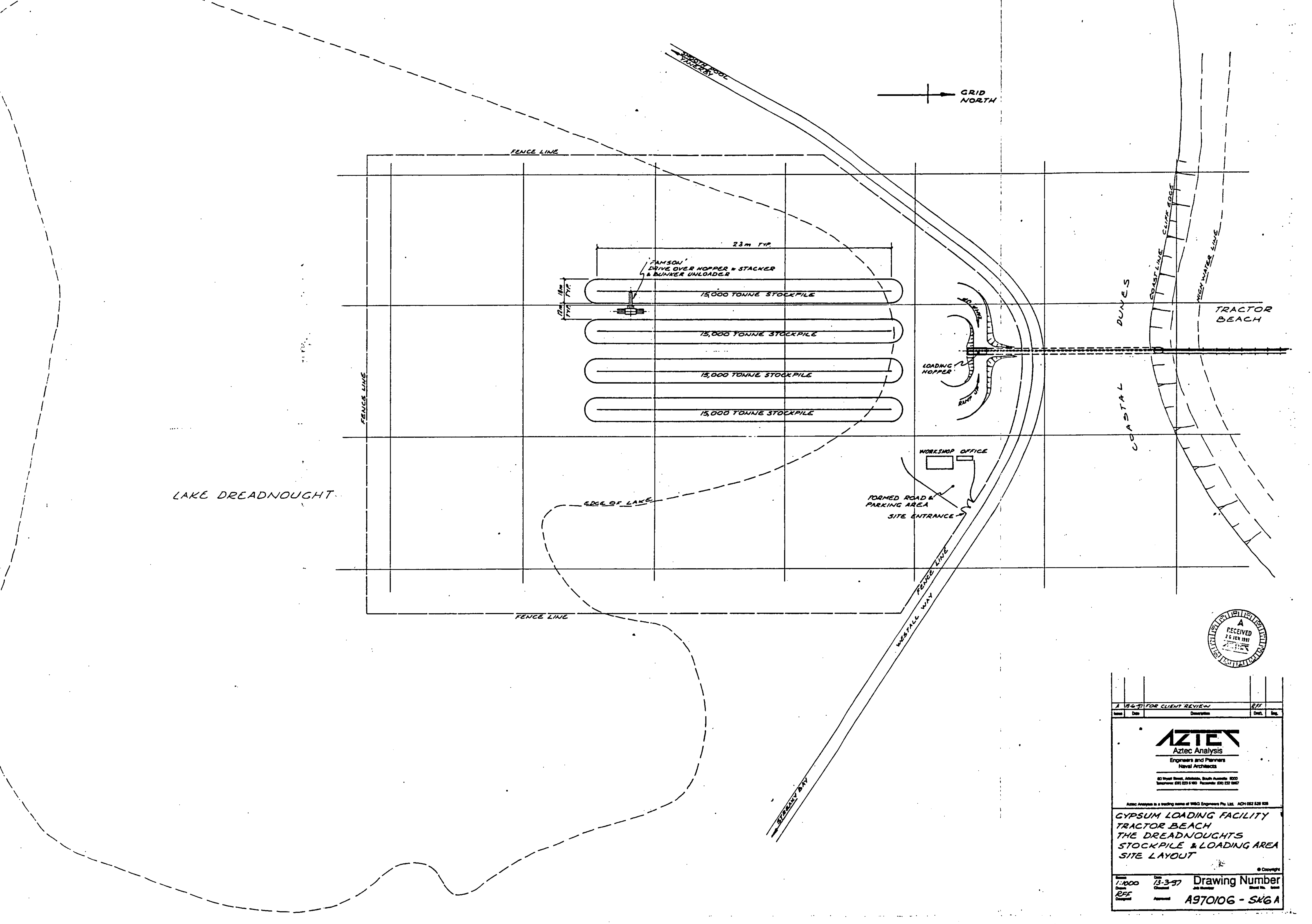
60 Wyatt Street, Adelaide, South Australia 5000
Telephone (08) 223 5180 Facsimile (08) 232 0967

Aztec Analysis is a trading name of W&G Engineers Pty. Ltd. ACN 052 639 939

GYPSUM LOADING FACILITY
SCEALE BAY DEPOSITS
LOADING FACILITY LOCATIONS
AT TRACTOR BEACH & MOORE'S
LANDING

Scale 1:50000 Date 10-3-97 Drawing Number
Drawn RFF Checked Job Number A970106 Sheet No. SK5 Issue A
Designed Approved


GRID NORTH
TRACTOR BEACH
SECURITY FENCE
DUNES
COASTAL
COAST LINE
CLIFF EDGE
HIGH WATER LINE
LOW WATER LINE
LOADING HOPPER
1000 WIDE BELT CONVEYOR 1000 T.P.H
2000 WIDE WALKWAY FOR PEDESTRIAN & WORK TROLLEY ACCESS.
BENT 1
BENT 15
140 000
15 - SINGLE VERTICAL PILES
500 000
50 - TWIN RAKING PILES (SECTION A-A)
670 000
40 000 DWT VESSEL
MD1
MD2
MD3
BD1
BD2
BD3
BD4
BD5
BD6
BD7
FOR CONTINUATION REFER DRGW970106-SK6
WORKSHOP OFFICE
FORMED ROAD & PARKING AREA
SITE ENTRANCE
FENCE LINE
WESTALL WAY
PLAN 1:1000
STOCKPILE
LOADING HOPPER
ROAD
TELESCOPIC BOOM CONV.
TELESCOPIC CHUTE
JET SLINGER
MHWS
ELEVATION 1:1000
RECEIVED
SECTION E-E 1:100
MHWS
U/S STEELWORK.
10 000 MIN.
MLWS
SECTION A-A 1:100
BHP MULTI PLATE HORSESHOE ARCH
LOADING HOPPER
TAIL PULLEY
SECTION C-C 1:100
SECTION D-D 1:100
SECTION B-B 1:100
C | 19-6-97 | FOR CLIENT REVIEW | RFF
B | 1-5-97 | JETTY RE-ALIGNED TO FACE GRID NORTH. 12m CONTOUR ADDED | RFF
A | 10-3-97 | FOR CLIENT REVIEW | RFF
Issue | Date | Description | Draft. | Eng.
Aztec Analysis
Engineers and Planners
Naval Architects
GYPSUM LOADING FACILITY
TRACTOR BEACH
THE DREADNOUGHTS
JETTY ARRANGEMENT
© Copyright
Scale 1:1000
Date 27-2-96
Drawing Number
Drawn RFF
A970106 SK3 C



Issue	Date	Description	Draft.	Eng.
A	19-6-97	FOR CLIENT REVIEW	RFF	

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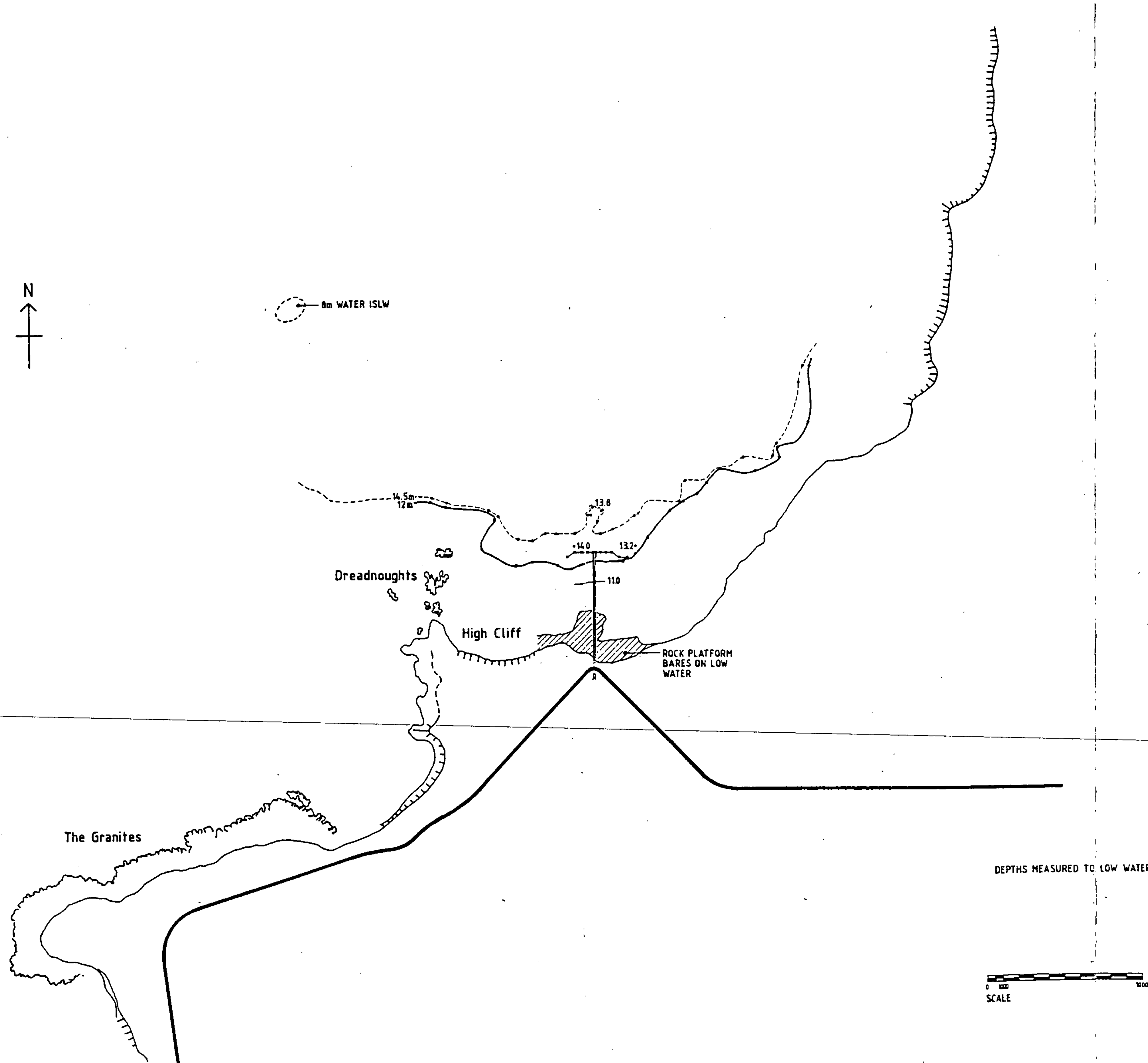
GYPSUM LOADING FACILITY
TRACTOR BEACH
THE DREADNOUGHTS
STOCKPILE & LOADING AREA
SITE LAYOUT

Scale: 1:1000 | Date: 13-3-97 | Drawn: RFF
Drawing Number: A970106 - SK6 A



Rev	Date	Description	Drn	Eng

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GYPSUM LOADING FACILITY
TRACTOR BEACH
COASTLINE & SOUNDINGS

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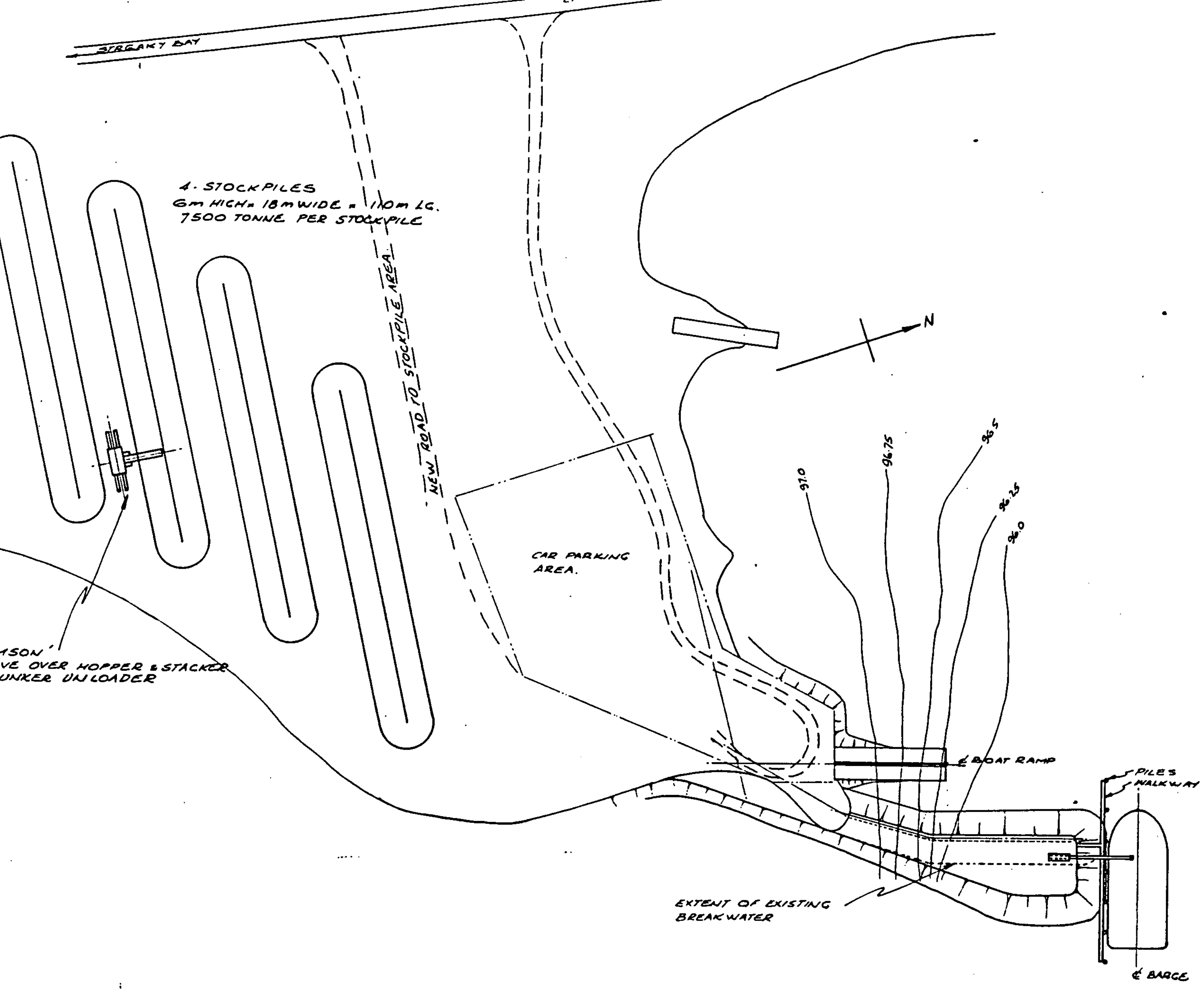
Scales 1:125000 | Date 6.6.97 | Drawn ARF | Checked | Designed NBC | Approved

Drawing Number: A970106 SK8 B



PLAN

ELEVATION

Issue	Date	Description	Drftr.	Eng.
B	19-6-97	FOR CLIENT REVIEW	RFF	
A	10-3-97	FOR CLIENT REVIEW	RFF	

RECEIVED 26 JUN 1997 AZTEC

AZTEC
Aztec Analysis
Engineers and Planners
Naval Architects

CYPSUM LOADING FACILITY
MOORE'S LANDING BOAT RAMP
STREAKY BAY
BREAKWATER EXTENSION &
LOADING FACILITY

© Copyright

Scale 1:7500 | Date 6-3-97 | Drawing Number
Drawn RFF
A970106 SK4 A

APPENDIX B : LAWSON & TRELOAR REPORT

LAWSON AND TRELOAR PTY LTD

Coastal, Ocean and Water Resources Consulting Engineers

Directors
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15 May, 1997

Aztec Analysis
60 Wyatt Street
Adelaide SA 5000

Our Ref: J1558/L6886
Attn: Mr Mark Gilbert

Dear Sirs,

RE: Streaky Bay Gypsum Loadout Facility

Preamble

Following instructions from Sceale Bay Development Corporation Pty Ltd issued to us by Tennant Limited, we have undertaken a preliminary analysis of design wave crest levels in accordance with our facsimile submission of 14 March, 1997. Additionally, we provide some information on likely weather conditions at the site. You should note that we have not included any wave propagation modelling and so breaking wave limitations have been adopted. The results will provide a likely upper limit to wave crest levels.

Offshore Wave Data

Tables 1 and 2 present wave height–period and wave height–direction joint occurrence probability matrices for offshore Southern Ocean Waves. This data is based on two years of hindcast wave data prepared by the British Meteorological Office. It is available at six hour intervals and includes winds and waves – significant wave height (H_s), average zero crossing wave period (T_z) and wave direction. L&T have compared BMO hindcast data with data recorded by a Waverider buoy system in deep water offshore from Jervis Bay, NSW and found good agreement.

Both tables show that offshore wave heights greater than 7m were hindcast over this short period and it is likely that much larger waves will occur during major storms. Importantly the data shows that the wave periods (T_z) associated with the larger waves occur in the range of 9 to 11 seconds which is very long. Therefore peak wave periods during major storms are likely to be in the range of 12.5 to 15.5 seconds. Table 2 shows that the largest waves will generally propagate from the south to west sector.

The proposed jetty site is on the southern end of Corvisart Bay. The rocky Dreadnought reef structure which stands to the west of the site will offer some protection from waves from the south to west sector. The alignment of the coastline to the north of Streaky Bay will restrict waves from the sector north of north-west. Therefore, from a natural wave sheltering point of view this site is appropriate. We can not comment on navigational and at-berth aspects, but point out that there is very little detail of The Dreadnoughts and their real impact on wave propagation available from Chart AUS 342. For final design it would be appropriate to undertake survey of The Dreadnoughts and seabed north-east and north-west of your jetty site. Combined with detailed wave modelling it would then be possible to define design wave parameters and operational wave conditions.

At this stage we can not comment on operational wave conditions at the proposed wharf, except that the alignment of the seabed contours would suggest that waves will most likely be quartering onto the berthed vessel and vessel motions may not be minimised by this layout. Also, because of the long period swell, long period waves may cause ship ranging – periods 30 seconds to 5 minutes. Long period wave activity typically occurs in areas having long period swell. It has been identified from Western Australia (Esperance, Cape Cuvier) to New South Wales (Port Kembla) and New Zealand (Westport), and at other international locations. Ship ranging (fore-aft movement) magnitudes of several metres may occur, but the problem can be overcome to some extent by mooring line and fender arrangements. Ship movement at-berth data from the Moore Landing facility should be obtained and reviewed for evidence of possible ship ranging there.

Annexure 1 provides monthly wind speed and direction data, morning and afternoon, from Streaky Bay. This data shows that the dominant wind directions are from the south to west sector with more southerly winds occurring in the summer and more south-westerly winds occurring during the winter. There is little difference between morning and afternoon wind structures.

Wave Crest Levels

Wave crest level statistical computations are in reality very complex. Each offshore storm will have a different (and time varying) wave direction, will occur with a different tide and a different storm surge. For the present analysis a design water level of 2.32m above MSL occurring at Thevenard with an average recurrence interval of 100 years forms the basis for design water level specification. This parameter was provided by the National Tidal Facility. The nearest tidal location included in the National Tide Tables is Blanche Port. The Mean Higher High Water tidal planes based on tide prediction datum at these locations are:-

Thevenard	1.6m
Blanche Port	1.7m

Mean Sea Level is 1.1m above tide datum (Chart Datum). Therefore we have adopted a design water level of 3.5m above tide datum. It is possible that storm surge is different at the proposed jetty site, but at this stage we can not be more definitive.

Breaking wave heights depend on seabed slope, water depth and wave period. For this study the wave breaking algorithm developed by Goda, Reference 1, has been adopted. This relationship defines the maximum breaking wave height – given wave period, water depth and seabed slope. The wave period most likely occurring with the breaking wave height was estimated using the Rayleigh Distribution.

Four depths, defined at Chart Datum, or tide prediction datum, were selected for analysis. A wave period, Tz, of 10.5 seconds was selected for analysis. Based on the local seabed survey plan provided by AZTEC Analysis (Dwg No. A970106 SK8/4), seabed slopes were estimated. These parameters are presented below.

Depth at CD (m)	**Seabed Slope (X:1)**
14.5	100
12	100
9	75
6	50

Having determined these breaking wave heights, H_b, crest heights, π, were then determined using Fenton's non-linear wave theory, Reference 2. The levels of these wave crests were then calculated and are presented below.

Depth at CD (m)	**Breaking Wave Height (m)**	**π (m)**	**Crest Level (m CD)**
14.5	12.7	10.6	14.1
12	11.2	9.5	13.0
9	9.3	8.1	11.6
6	7.4	6.6	10.1

These results show that the deck level could be reduced in the shoreward direction. Depending on the extent of protection provided by The Dreadnoughts, these deck levels may reduce following a detailed wave climate study, preceded by more extensive seabed survey. However, a breaking wave height of 12.7m (see above), in a water depth of 17m (14.5m+2.5m), is equivalent to an H_s of 7.5m.

Given that the offshore 100 years average recurrence interval wave height is likely to be in the order of 12m, then The Dreadnoughts and seabed bathymetry would need to cause an average wave coefficient of less than 7.5/12 = 0.63 to enable a reduction in deck levels. A further reduction could arise by adopting a lower storm tide level, but a reduction arising from this parameter would be less than 1m.

We hope that this information is useful and suits your present needs. Should you have any questions I would be pleased to address them.

Yours faithfully,
Lawson and Treloar Pty Ltd

P D Treloar

References

1. Goda, Y (1975): Irregular Wave Deformation in the Surf Zone. Coastal Engineering in Japan.

2. Fenton, J D (1988): The Numerical Solution of Steady Water Wave Problems. Computers and GEO Sciences, Vol. 14, No. 3, pp 357–368.

	Significant Wave Height (m)										
Tz (seconds	0.0–1.0	1.0–2.0	2.0–3.0	3.0–4.0	4.0–5.0	5.0–6.0	6.0–7.0	7.0–8.0	8.0–9.0	9.0–10.0	Total
2.5–3.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.5–4.5	0.45	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
4.5–5.5	0.41	12.04	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.21
5.5–6.5	0.14	12.76	19.31	0.89	0.00	0.00	0.00	0.00	0.00	0.00	33.10
6.5–7.5	0.03	4.56	14.31	10.26	1.06	0.00	0.00	0.00	0.00	0.00	30.22
7.5–8.5	0.00	1.03	6.11	3.4	3.22	0.82	0.00	0.00	0.00	0.00	14.58
8.5–9.5	0.00	0.10	2.02	2.44	0.27	0.58	0.38	0.00	0.00	0.00	5.80
9.5–10.5	0.00	0.03	0.34	0.55	0.48	0.10	0.07	0.07	0.00	0.00	1.65
10.5–11.5	0.00	0.03	0.03	0.14	0.1	0.00	0.00	0.00	0.00	0.00	0.31
11.5–12.5	0.00	0.00	0.03	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.14
12.5–13.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13.5–14.5	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.07
14.5–15.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.03	31.05	42.92	17.74	5.25	1.51	0.45	0.07	0.00	0.00	100.00
Cumulative	100.00	98.99	67.94	25.02	7.28	2.03	0.52	0.07	0.00	0.00	

Based on BMO Data (1995–1996)

Table 1: Offshore Southern Ocean Waves
Joint Wave Height – Period Occurrence (%)
Based on 2 Years BMO Data

	Significant Wave Height (m)										
Direction °TN	**0.0–1.0**	**1.0–2.0**	**2.0–3.0**	**3.0–4.0**	**4.0–5.0**	**5.0–6.0**	**6.0–7.0**	**7.0–8.0**	**8.0–9.0**	**9.0–10.0**	**Total**
N	0.10	0.48	0.96	0.27	0.00	0.00	0.00	0.000	0.00	0.00	1.82
NNE	0.03	0.14	0.10	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.34
NE	0.00	0.31	0.17	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.51
ENE	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
E	0.00	0.10	0.14	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.27
ESE	0.00	0.38	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
SE	0.00	1.58	2.33	0.38	0.00	0.00	0.00	0.00	0.00	0.00	4.29
SSE	0.03	1.44	0.72	0.10	0.07	0.00	0.00	0.00	0.00	0.00	2.37
S	0.03	1.51	1.61	0.96	0.10	0.07	0.03	0.00	0.00	0.00	4.32
SSW	0.03	2.61	4.49	1.85	0.17	0.07	0.00	0.03	0.00	0.00	9.26
SW	0.17	6.48	12.11	4.94	1.41	0.17	0.03	0.00	0.00	0.00	25.31
WSW	0.34	11.35	14.13	5.49	1.51	0.51	0.24	0.00	0.00	0.00	33.57
W	0.24	2.91	2.98	1.58	0.86	0.17	0.07	0.03	0.00	0.00	8.85
WNW	0.03	0.34	0.82	0.65	0.34	0.27	0.07	0.00	0.00	0.00	2.54
NW	0.00	0.65	0.69	0.48	0.34	0.10	0.00	0.00	0.00	0.00	2.26
NNW	0.00	0.72	1.13	0.89	0.45	0.14	0.00	0.00	0.00	0.00	3.33
Total	1.03	31.07	42.90	17.73	5.25	1.51	0.45	0.07	0.00	0.00	100.00
Cumulative	100.00	98.98	67.91	25.01	7.28	2.03	0.52	0.07	0.00	0.00	

Based on BMO Data (1995–1996)

Table 2: Offshore Southern Ocean Waves
Joint Wave Height – Direction Occurrence (%)
Based on 2 Years BMO Data

ANNEXURE 1

BUREAU OF METEOROLOGY

National Climate Centre
TEL: (03) 669 4082 FAX: (03) 6694515

BUREAU OF METEOROLOGY - SURFACE WIND ANALYSIS

PERCENTAGE OCCURRENCE OF SPEED VERSUS DIRECTION BASED ON 35 YEARS OF RECORDS

FIRST YEAR : 1957 LAST YEAR : 1993 NUMBER OF MISSING OBSERVATIONS (AS PERCENTAGE OF MAXIMUM POSSIBLE) : 15.45 %

STATION : 018079 STREAKY BAY POST OFFICE 32 48 S. 134 13 E 13.0 M ELEV

JANUARY 0900 HOURS LST

SPEED (KM/HR) — CALM 8

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	5	4	1	1				10
NE	3	2	1	*				6
E	2	4	4	*				11
SE	5	8	9	2	1	*		26
S	5	6	7	2	*	*		22
SW	3	4	3	1	*			12
W	1	1	1	*		*		4
NW	1	1	*	*				3
ALL	25	29	28	8	2	*		

NO. OF OBS. 979

FEBRUARY 0900 HOURS LST

SPEED (KM/HR) — CALM 8

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	4	2	1	*	*	*		8
NE	2	3	1	*				6
E	3	3	2	*	*			8
SE	8	12	11	3	1	*		35
S	5	7	6	2	1	*		21
SW	2	4	2	1	*			10
W	1	1	*	*	*			2
NW	1	1	*	*				3
ALL	24	33	25	7	3	*		

NO. OF OBS. 870

MARCH 0900 HOURS LST

SPEED (KM/HR) — CALM 7

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	5	3	1	*	*	*	*	10
NE	3	3	2	1	*			9
E	3	3	1	*				7
SE	8	10	8	3	*			29
S	6	7	5	1	1			20
SW	3	3	2	1	*			10
W	1	1	1		*			3
NW	1	1	1	*	*	*	*	4
ALL	30	30	23	7	2	*	*	

NO. OF OBS. 1005

APRIL 0900 HOURS LST

SPEED (KM/HR) — CALM 9

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	7	5	3	2	1	*	*	19
NE	5	3	3	1	*	*		13
E	4	3	1	*				8
SE	6	6	3	1	*	*		17
S	6	4	2	1				12
SW	3	3	2	2	*	*		10
W	2	1	2	1	*	*		6
NW	2	2	2	1	*	*		7
ALL	35	27	18	8	2	1	*	

NO. OF OBS. 945

JANUARY 1500 HOURS LST

SPEED (KM/HR) — CALM 2

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	2	1	*	*				4
NE	1	*	*	*				2
E	*	*	*	*	*			1
SE	*	1	4	3	1	1		9
S	1	5	10	9	2	1		28
SW	2	12	12	8	3	*	*	37
W	1	3	4	2	*	*		11
NW	1	2	1	*	*			5
ALL	9	26	31	22	6	2	*	

NO. OF OBS. 934

FEBRUARY 1500 HOURS LST

SPEED (KM/HR) — CALM 2

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	3	1	*					4
NE	*	*	*				*	1
E	1	*	1					2
SE	1	2	4	2	1	1		10
S	1	6	10	10	4	*		31
SW	3	10	13	8	2	*	*	36
W	1	2	3	1	*			8
NW	1	2	1	*	*		*	5
ALL	11	24	33	22	7	1	*	

NO. OF OBS. 845

MARCH 1500 HOURS LST

SPEED (KM/HR) — CALM 2

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	3	2	*					5
NE	1	1	*	*		*		2
E	*	*	1					1
SE	1	2	4	2	1	*		9
S	2	4	13	6	2	*		28
SW	3	10	14	5	1	*	*	33
W	2	4	4	1	*	*	*	12
NW	2	3	2	*	*	*		7
ALL	14	25	38	14	4	2	*	

NO. OF OBS. 975

APRIL 1500 HOURS LST

SPEED (KM/HR) — CALM 6

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	6	3	1	1	*	*	*	11
NE	2	1	*	*	*	*		3
E	1	*	*					2
SE	1	2	2	1	*			6
S	2	5	6	1	*	*		14
SW	4	8	10	3	1	*		26
W	4	7	6	2	1	*	*	20
NW	3	4	2	1	1	*	*	11
ALL	23	29	29	9	3	1	1	

NO. OF OBS. 898

* OCCURRED BUT LESS THAN 0.5 PERCENT

PRODUCED BY M.I.S.S. 30/ 3/94

BUREAU OF METEOROLOGY

National Climate Centre
TEL: (03) 669 4082 FAX: (03) 6694516

BUREAU OF METEOROLOGY - SURFACE WIND ANALYSIS

PERCENTAGE OCCURRENCE OF SPEED VERSUS DIRECTION BASED ON 35 YEARS OF RECORDS

FIRST YEAR : 1957 LAST YEAR : 1993 NUMBER OF MISSING OBSERVATIONS (AS PERCENTAGE OF MAXIMUM POSSIBLE) : 15.45 %

STATION : 018079 STREAKY BAY POST OFFICE 32 48 S. 134 13 E 13.0 M ELEV

MAY 0900 HOURS LST

SPEED (KM/HR) — CALM 14

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	7	5	5	3	2	*	*	23
NE	4	6	4	2	1	*	*	16
E	3	1	1		*			5
SE	5	3	1	*	*			9
S	6	2	1	*				8
SW	4	3	2	*	*	*		10
W	2	3	2	1	*	*	*	8
NW	2	2	2	1	1	1	*	8
ALL	31	24	17	7	4	2	1	

NO. OF OBS. 1020

JUNE 0900 HOURS LST

SPEED (KM/HR) — CALM 13

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	8	8	7	3	2	1	*	28
NE	5	6	3	2	1	*		17
E	1	2	1	*				4
SE	4	2	*					7
S	4	2	*	*				7
SW	3	2	1	*	*			8
W	2	2	1	1	*	*		7
NW	2	2	2	2	1	1	*	10
ALL	30	27	16	8	4	2	*	

NO. OF OBS. 973

JULY 0900 HOURS LST

SPEED (KM/HR) — CALM 13

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	7	6	5	4	2	1	*	26
NE	4	5	4	1	*	*	*	15
E	2	2	*	*				4
SE	2	2	*					4
S	3	2	*		*			6
SW	4	3	2	1	*	*		11
W	3	2	2	1	1	*	*	9
NW	2	2	3	3	2	1	*	13
ALL	26	24	18	10	5	2	1	

NO. OF OBS. 1021

AUGUST 0900 HOURS LST

SPEED (KM/HR) — CALM 10

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	7	6	5	4	2	1		25
NE	5	4	3	1	1	*		14
E	2	2	1					4
SE	2	2	1	*	*			5
S	3	2	1	*	*			6
SW	4	3	3	1	*	*	*	12
W	2	4	2	2	*	*	*	11
NW	1	2	4	3	1	1	*	13
ALL	27	24	18	11	5	3	*	

NO. OF OBS. 1014

MAY 1500 HOURS LST

SPEED (KM/HR) — CALM 7

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	9	6	3	1	1	*	*	19
NE	2	2	1	1	*	*		7
E	1	*	*		*	*		2
SE	2	2	2					6
S	2	4	3	*				9
SW	3	5	4	2	1	*		15
W	4	8	5	2	1	*	*	21
NW	2	3	4	2	1	1	*	14
ALL	26	31	21	9	4	1	1	

NO. OF OBS. 954

JUNE 1500 HOURS LST

SPEED (KM/HR) — CALM 7

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	11	6	4	3	*	*	*	24
NE	3	2	2	1	*	*	*	9
E	2	1	*					3
SE	2	2	1					5
S	2	2	2	*				6
SW	3	3	3	1	1	*		11
W	3	5	4	2	1	*	*	16
NW	3	4	5	3	1	2	1	19
ALL	28	26	21	9	4	2	1	

NO. OF OBS. 907

JULY 1500 HOURS LST

SPEED (KM/HR) — CALM 8

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	9	5	5	1	1	*		21
NE	2	2	1	*	*	*	*	7
E	1	1	1	*				3
SE	1	1	1	*				3
S	1	1	2	*	*	*		5
SW	2	4	4	2	1	*		13
W	3	6	5	2	1	1	1	17
NW	3	4	6	4	3	2	1	23
ALL	23	25	24	9	6	3	2	

NO. OF OBS. 964

AUGUST 1500 HOURS LST

SPEED (KM/HR) — CALM 7

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	7	5	3	1	1	*		17
NE	3	1	1	1	*			6
E	2	1	*					2
SE	1	1	1	*				3
S	1	2	2	*	*	*		6
SW	2	4	5	3	1	*	*	15
W	3	8	6	4	2	1	*	24
NW	2	4	5	4	3	2	1	20
ALL	21	25	23	13	7	3	1	

NO. OF OBS. 939

* OCCURRED BUT LESS THAN 0.5 PERCENT

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BUREAU OF METEOROLOGY - SURFACE WIND ANALYSIS

PERCENTAGE OCCURRENCE OF SPEED VERSUS DIRECTION BASED ON 35 YEARS OF RECORDS

FIRST YEAR : 1957 LAST YEAR : 1993 NUMBER OF MISSING OBSERVATIONS (AS PERCENTAGE OF MAXIMUM POSSIBLE) : 15.45 %

STATION : 018079 STREAKY BAY POST OFFICE 32 48 S. 134 13 E 13.0 M ELEV

SEPTEMBER 0900 HOURS LST

SPEED (KM/HR) — CALM 6

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	6	6	5	3	1	1	*	21
NE	4	4	4	2	1	*	*	15
E	2	4	1	1	*			8
SE	2	3	2	*				7
S	3	2	1	*	*			8
SW	5	4	3	2	1		*	15
W	2	3	3	1	1	1	1	12
NW	1	2	1	2	1	1	*	7
ALL	25	27	21	10	6	3	1	

NO. OF OBS. 947

OCTOBER 0900 HOURS LST

SPEED (KM/HR) — CALM 5

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	5	5	4	2	1	1	*	18
NE	4	3	2	2	1	*		13
E	2	4	3	*	*	*		10
SE	3	4	3	2	*	*		13
S	3	4	4	1	*			12
SW	2	5	5	2	1	*	*	15
W	1	2	3	1	1	*	*	9
NW	1	1	2	1	1	*	*	6
ALL	22	29	25	12	5	2	1	

NO. OF OBS.1042

NOVEMBER 0900 HOURS LST

SPEED (KM/HR) — CALM 8

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	5	4	2	2	1		*	13
NE	2	3	2	1	*		*	8
E	3	5	2	1	*	*		11
SE	4	6	5	1	*	*		16
S	4	5	4	2	*	*		14
SW	2	5	5	2	1	*	*	15
W	1	3	3	1	1	*		10
NW	1	2	1	*	*		*	4
ALL	22	32	24	9	4	1	*	

NO. OF OBS. 948

DECEMBER 0900 HOURS LST

SPEED (KM/HR) — CALM 9

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	5	3	2					10
NE	3	2	1	*	*			7
E	3	4	2	1	*			9
SE	4	7	5	2	*			19
S	6	7	5	2	1	*		20
SW	4	3	4	2	*	*		14
W	1	3	1	1	*	*		7
NW	2	1	1	*	*		*	5
ALL	28	30	22	8	2	1	*	

NO. OF OBS. 944

SEPTEMBER 1500 HOURS LST

SPEED (KM/HR) — CALM 4

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	7	2	1	*	*	*	*	12
NE	2	1	1	*	1	*	*	7
E	1	*	1	*				2
SE	1	1	1	*	*			4
S	1	3	4	1	*			10
SW	3	6	8	4	2	*	*	23
W	3	6	7	4	2	1	1	24
NW	3	2	2	3	1	1	1	13
ALL	22	24	26	13	6	3	2	

NO. OF OBS. 902

OCTOBER 1500 HOURS LST

SPEED (KM/HR) — CALM 4

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	4	3	2	1	*			10
NE	1	1	1	1	*		*	3
E	1	1	*	*				2
SE	1	1	3	1	*			6
S	1	4	5	3	1	*		15
SW	3	8	12	4	2	1	*	30
W	3	6	7	3	1	1	1	22
NW	2	1	2	1	1	1	*	8
ALL	15	25	32	14	5	3	2	

NO. OF OBS. 996

NOVEMBER 1500 HOURS LST

SPEED (KM/HR) — CALM 3

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	4	3	1	*	*	*		9
NE	1	1	1	*	*	*		3
E	1	1	*	*				2
SE	*	2	2	1	*			5
S	1	5	7	4	1	*	*	19
SW	3	8	14	6	2	1	*	33
W	1	5	6	3	1	1	1	19
NW	2	2	2	1	*	*	*	8
ALL	13	26	34	16	5	2	1	

NO. OF OBS. 916

DECEMBER 1500 HOURS LST

SPEED (KM/HR) — CALM 2

DIRN	1 TO 5	6 TO 10	11 TO 20	21 TO 30	31 TO 40	41 TO 50	51 & UP	ALL
N	3	1	*	*		*		5
NE	1	*				*		2
E	*	*						1
SE	1	2	3	1	*	*		7
S	2	5	11	6	3	*		26
SW	4	13	13	6	2	*		38
W	2	5	4	2	2	*		15
NW	1	2	1	*	*	*		4
ALL	14	28	32	16	7	2		

NO. OF OBS. 913

* OCCURRED BUT LESS THAN 0.5 PERCENT

PRODUCED BY M.I.S.S. 30/ 3/94

APPENDIX C : SEATECH REPORT

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Port Investigation and Feasibility Studies
Shiphandling, Pilotage, Berthing
Mooring Systems, Navigation Aids
'Portsim' Ship Simulation Studies

All correspondence to:
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BALWYN NORTH,
VICTORIA 3104

12th June 1997

Mr S M Gilbert
Aztec Analysis
60 Whyatt Street
Adelaide S.A. 5000

Dear Mark

Gypsum Loading Facility

We have pleasure in enclosing our review of the preliminary design with respect to ship operations and safety. The main findings are:

(a) It should be possible to berth ships of 40000 Dwt at the wharf without tugs, provided:

- ships can use their anchors (i.e. sand or similar sea bed)
- wind speeds are less than 30 km/hr
- currents are less than 0.5 kts

(b) Weather down time is likely to be high, particularly in the winter months. We estimate the occurrence of limiting waves to be about 15%.

(c) The berth alignment is satisfactory, but the berth should be sited in not less than 13.1m at chart datum, to accommodate a 40000 Dwt ship.

(d) It may be possible to optimise the arrangement of dolphins.

(e) The use of mooring buoys is not recommended at this location.

(f) The berth and approaches should be surveyed to determine the type of sea bed and to define the 10m contour (the limiting contour for ships approaching in ballast).

Yours sincerely

I. M. Wright

Ian Wright
SEATECH CONSULTANTS PTY LTD

GYPSUM LOADING FACILITY - TRACTOR BEACH

REVIEW OF SHIP OPERATIONS
AND SAFETY ISSUES

Prepared for :

SCEALE BAY DEVELOPMENT CORPORATION
c/o AZTEC ANALYSIS
60 WHYATT STREET
ADELAIDE S.A. 5000

By:

SEATECH CONSULTANTS PTY LTD
6 TIVEY PARADE
BALWYN
VICTORIA

12th June 1997

1. INTRODUCTION

1.1 Project Background

Tennant Ltd is investigating the construction of a ship loader on behalf of Sceale Bay Development Corporation Pty Ltd. The facility, to be located at Tractor Beach, on the southern end of Corvisart Bay, would be used to load bulk gypsum into ships of up to approximately 40,000 Dwt. The proposed loading facility will comprise a fixed loader, seven berthing dolphins and four mooring dolphins. During loading, the ship's winches will be used to warp the ship along the wharf so as to place the cargo holds under the loader.

The site is sheltered from NE through south to SW but is generally exposed to wind and waves from other directions. The nearest port at which tugs are based is Port Lincoln, some 200 nautical miles distant, therefore if feasible, the ships will need to be berthed without tug assistance. Provided that currents at the berth are weak (less than 0.5 kts) and that the ships can use their anchors, berthing of ships up to Handymax size should be feasible in light winds without the use of tugs.

The objective of this report, prepared by Seatech Consultants Pty Ltd, is to review the preliminary design with respect to ship operations and safety, including berthing, mooring and departure from the wharf.

Unless otherwise stated, manoeuvres and operating limits discussed in this report are based on the assumption that there are no tugs available.

1.2 References

1. Lawson & Treloar "Streaky Bay Gypsum Loadout Facility" 15/5/97.

2. DESIGN PARAMETERS

2.1 Site Conditions

2.1.1. Water Depth

Aztec Analysis Drawings A970106 SK5 and SK8A show the berth sited on the 12m contour, on an east-west alignment. As discussed in section 2.4, the berth should be sited in about 13.1m to accommodate a 40000 Dwt ship. The ship should preferably be berthed port side to, so as to face the predominant sea and swell waves. The soundings indicate that there will be ample room to the west for loaded ships to clear the berth on departure. The limiting depth for ships arriving in ballast will be approximately 10m. Although depths below 12m are not shown to the NE of the berth, the general trend of the shoreline and 12m contour suggest that there will be sufficient sea-room for ships to make a safe approach from this direction.

2.1.2 Wind

The site is exposed to the wind from SW through west to NE. The limiting wind speed for berthing is estimated as approximately 16 kts (30 km/hr). The occurrence of wind speeds exceeding 30 km/hr is shown in Table 2.1 below for Streaky Bay. The AM percentages are quite low, indicating that a ship will usually be able to berth in the early morning, however the occurrence of limiting AM wind speeds reaches 8-10% during the months July to October.

Table 2.1
Surface Wind Analysis - Streaky Bay

Percentage Occurrence Of Wind Speeds Greater Than 30 km/hr.

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
AM	2.5	3.5	3.0	3.5	7.0	6.5	8.0	8.5	10.0	8.0	5.5	3.5
PM	8.5	8.5	6.5	5.0	6.0	8.0	11.0	11.0	11.0	10.0	8.0	9.0

Source: Bureau of Meteorology

2.13 Tide

Tidal levels for Blancheport, the nearest station, are similar to those at Port Lincoln, with approximate heights of: MHHW 1.5m MLLW 0.5m.

A scan of a years tide heights at Port Lincoln showed the lowest height to be 0.3m.

2.1.4 Sea and Swell Waves

Experience of other exposed berths indicates that the limiting wave height for ships of this size to remain alongside will be in the range Hs 1.5m to 1.8m. In long period swell or in waves near the beam, the limiting height may be lower; in short period seas or waves near the bow, the limits may be higher. Allowing for possible refraction, the berth will be exposed to waves approaching from directions between SW and NW, with possibly some shelter provided by the Dreadnoughts to the west of the berth. Table 2, Ref 1, shows the following percentage wave occurrences:

Waves of Hs ≥ 2.0m, all directions	67.9%
Waves of Hs ≥ 2.0m, NW - SW sectors	33.9%

If waves of Tz < 6.5sec are excluded as being unlikely to force a significant response from the moored ship, the occurrence of limiting waves is about 15%.

Lawson & Treloar in Ref.1 note the possible occurrence of long waves associated with the swell. The effect of long waves on mooring is discussed in section 3.3.

2.1.4 Currents

It is not known whether or not a tidal current flows at the berth site. If a current velocity of 0.5 kts or more occurs, other than in line with the berth, it may impose an additional constraint on berthing.

2.2 Sea Bed Material

The sea bed material at the berth and its approaches is not yet known, however it may have a significant impact on ship berthing through its effect on anchoring. If tugs are not available, a ship often needs to use its anchors when berthing. The anchors are most effective in sand and least effective on a rocky bottom. The Dreadnoughts and the reef inshore of the berth indicate a possibility of rock outcrops or reefs which could prevent safe use of the anchors. In this case it would probably be necessary to reduce the limiting wind speed for berthing to about 25 km/hr.

2.3 Design Ship Dimensions

Dimensions and load drafts of some typical bulk carriers are shown below:

Name	Year Built	Dwt. tonnes	LOA	Beam	Draft
Mosdeep	1981	48500	190	32.2	12.1
Tetien	1984	40045	190	28.9	11.3
Tasson N.	1986	39630	190	29.6	10.8
Azteca 1	1987	39072	181	30.5	10.9
Ocean Trader	1987	39804	191	30.0	11.0
Lilac Wave	1991	39400	187	29.9	11.0

The maximum draft of these ships when in ballast will be about 8.0m. The deadweight of the Mosdeep, when part-loaded at drafts of 11.0m and 10.5m respectively, is 42670t and 40020t.

2.4 Underkeel Clearance (UKC) and Depth at Berth

If the facility is to handle ships of 40000 Dwt., it must accept a design draft of about 11.0m. Assuming a limiting wave height at the berth of 1.8m, the recommended UKC is 2.4m, made up as follows:

Heave (0.5 x wave ht.)	0.9m
Pitch/roll allowance	0.8m (1^0 pitch or 3^0 roll)
Safety margin	0.7m
Total	2.4m

The recommended berth depth at chart datum is 13.1m comprising:

Design Draft	11.0m
+ UKC	2.4m
- Tide ht. at low water	0.3m
Total	13.1m

3.0 OPERATIONAL PROCEDURES AND REQUIREMENTS

3.1 Berthing

Assuming no tug is available, the ship will approach the berth from the north-east, keeping outside of the 10m contour and gradually reducing speed. The final approach will depend upon the wind direction and possibly on the tidal current, however the aim will be to land the ship, port side to, on the fenders at a small angle to the berth line. The ship will usually drop its starboard anchor on a short length of chain and allow it to drag along the bottom to obtain a 'brake' effect, particularly when arriving in an on-berth wind. A mooring boat should be provided to carry the first lines to the wharf so that the ship can use its mooring winches to haul itself alongside.

The mooring boat should be solidly built and seaworthy, with an engine of about 200 hp. It should be manned by a crew of 2, comprising a coxswain and a deck hand.

3.2 Unberthing

The outer berthing dolphins will be shaped and fendered to allow the ship to pivot on them by heaving on mooring lines led to an adjacent mooring dolphin. For example, the ship may back into position to pivot on BD7. It will heave on lines to MD2 and MD3 until the bow is angled about 30^0 to the wharf. It will then go ahead on the engines, using some port rudder to lift the stern clear of the berth. A similar manoeuvre can be used at BD1, pulling the bow in towards MD1, then going astern on the engine to leave the berth. The 12m contour trends to the north about 7 km west of the berth. The proposed alignment of 270^0 allows ample room for the ship to turn to starboard after leaving the berth, to clear this contour.

3.3 Mooring and Shifting Ship

Ships at the berth will respond to wave forces with vertical and horizontal motions which will cause dynamic loads in the mooring lines and the berth fenders. In limiting wave conditions there will be a risk of mooring line breakage. There will also be a risk of a mooring breakout in more normal waves when shifting ship under the loader, as at this time the wind and wave forces will be resisted by the minimum number of lines. When shifting, most of the lines must be slackened down and it is often necessary to carry a line or lines from one dolphin to the next. Capstans should be provided at the dolphins to speed up the transfer of mooring lines.

The amplitude of the ship motions and the limiting wave heights at which the moorings may be overloaded are best determined by computer simulations. It is strongly recommended that an appropriate simulation study be carried out with the following objectives:

- Determine the limiting conditions for ships securely moored at the berth.
- Determine thence the likely annual downtime for the berth
- Determine the limiting conditions for ships at the berth when shifting.
- Determine the need for any special additional moorings to be provided by the berth operator.

Long Wave Effects

Lawson & Treloar in Ref.1 note the possible occurrence of long waves associated with swell. Long waves can give rise to very serious surge and sway (longitudinal and lateral) motions. Long waves of amplitude 0.12m x Tp 62.5sec were measured at Port Stanvac, South Australia, in 1988. These waves are believed to be capable of inducing surge motions of 2-2.5m in a moored 40000 Dwt tanker. There is a strong possibility that similar waves will occur at times at the Tractor Beach berth.

3.4 Survey

A site survey should be carried out to determine the type of sea bed in the berth approaches. The depth of sand or other cover over any rock should be determined with bores or probes. The location of the 10m contour should also be determined and charted as an aid to ships approaching the berth in ballast.

3.5 Tugs

The usual practice when berthing 40000 Dwt ships is to use 2 tugs, each of about 30t bollard pull. It must be accepted that downtime whilst awaiting suitable berthing conditions may be quite high if no tugs are provided.

4.0 BERTH LAYOUT AND OPTIMISATION

Dolphin Arrangement

The provisional layout comprises 7 berthing dolphins on 39m centres. It may be possible to reduce the number of berthing dolphins from 7 to 5, by shifting each of the outer dolphins inwards about 10m and relocating the others. This arrangement would not affect the mooring or loading operations of the 40000 Dwt design ships, however it may not be practicable if smaller bulk carriers (less than approximately 30000 Dwt) are to be berthed.

As it is probable that ships will always be moored facing one way, the mooring dolphins do not have to be arranged symmetrically. The layout can be optimised by constructing only one mooring dolphin at the western end of the berth and two at the eastern end, as shown in Figure 1.

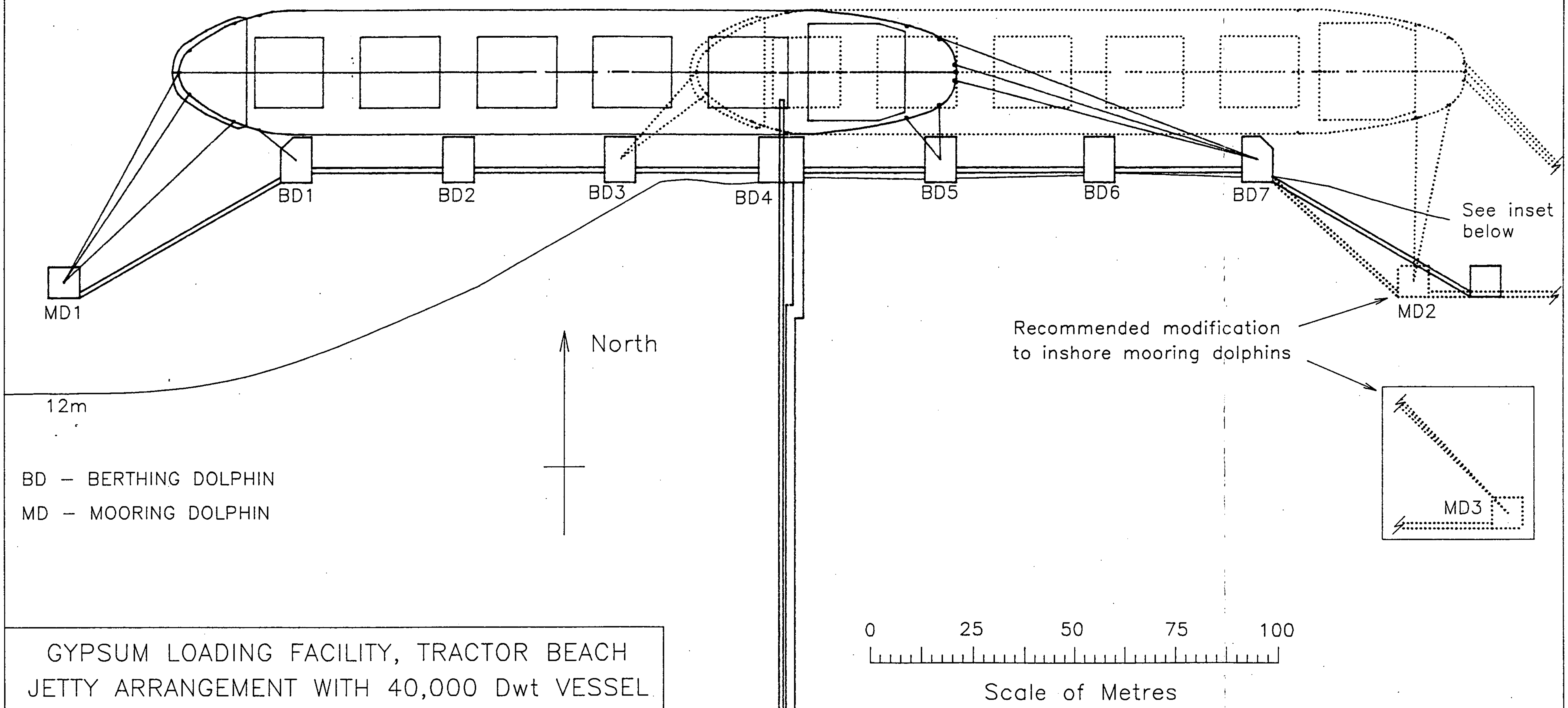
Head and Stern Buoys

Mooring buoys are sometimes laid at fixed loader berths in place of mooring dolphins. The main advantage of using buoys instead of dolphins is their much lower capital cost. Disadvantages are:

- Relatively high maintenance and replacement cost of mooring chains if in an exposed environment
- Lines can only be run and secured with the aid of a mooring boat
- A mooring boat is usually needed to let go buoy lines. The limiting wave height for safe operation of the mooring boat may be lower than the limit for ships to remain at the berth.

In view of the likely weather and sea conditions it is not recommended that buoys be used at the Tractor Beach facility.

Seatech Consultants Pty Ltd
Melbourne, 11th June 1997



GYPSUM LOADING FACILITY, TRACTOR BEACH
JETTY ARRANGEMENT WITH 40,000 Dwt VESSEL

SEATECH CONSULTANTS Pty Ltd MELBOURNE, AUSTRALIA	CLIENT: TENNANT Ltd
DATE: 10/06/97	SCALE: 1/1000 AT A3

CADFILE: GYPSUM2

FIGURE 1

APPENDIX D : COST ESTIMATE

Streaky Bay
Gypsum Loadout Facility

COST ESTIMATE

Aztec Analysis
Job No: A970106
20/06/97

DESCRIPTION	ITEM	QUANTITY	UNIT RATE	SUBTOTAL	TOTAL
Main sea piling 610mm, 35m long 500m long jetty	Supply 100 off @ 6.75 tonne	675 tonne	$1,400	$945,000	
	Coating - 20m	3832.74 m^2	$20	$76,655	
	Jack Up Barge	110 days	$3,500	$385,000	
	Work Boat	110 days	$1,000	$110,000	
	Misc. Plant, Matls	110 days	$1,000	$110,000	
	Crew - 6x10hrx110days	6600 hrs	$50	$330,000	
	Mobilization/Demob.			$150,000	
	Fitout			$50,000	
	Weather Contingency	20 %		$431,331	
	SUBTOTAL			$2,587,986	$2,587,986
Reef piling 610mm, 25m long 140m long jetty	Supply 15 off @ 4.9 tonne	73.5 tonne	$1,400	$102,900	
	Coating - 10m	288 m^2	$20	$5,760	
	Pile Driving	18 days	$2,500	$45,000	
	Misc. Plant, Matls	18 days	$1,000	$18,000	
	Mobilization/Demob.			$50,000	
	Weather Contingency	20 %		$44,332	
	SUBTOTAL			$265,992	$265,992
Steelwork (excl. conveyor)	400WC212 Crossheads 65 off x 4.2m x .212 tonne	57.876 tonne	$1,500	$86,814	
	Connections etc.	8 tonne	$2,400	$19,200	
	Installation	65 off	$3,000	$195,000	
	310UB46 walkway stringer	33 tonne	$1,400	$46,200	
	Installation	65 off	$600	$39,000	
	Contingency	20 %		$77,243	
	SUBTOTAL			$463,457	$463,457

Streaky Bay
Gypsum Loadout Facility

COST ESTIMATE

Aztec Analysis
Job No: A970106
20/06/97

DESCRIPTION	ITEM	QUANTITY	UNIT RATE	SUBTOTAL	TOTAL
Walkway	2m wide mesh x 700m	1400 m^2	$200	$280,000	
	Installation	1400 m^2	$30	$42,000	
	Handrail	700 m	$100	$70,000	
	Contingency	20 %		$78,400	
	SUBTOTAL			$470,400	$470,400
Conveyor	Enclosed airtube incl. beams	800 m	$2,500	$2,000,000	
	Boom conveyor	20 m		$145,000	
	Telescopic chute & winch	1	$125,000	$125,000	
	Jetslinger	1	$100,000	$100,000	
	Support steel (land end) 150PFC 60off x .7m x .018	0.8 tonne	$2,500	$2,000	
	Contingency	20 %		$474,400	
	SUBTOTAL			$2,846,400	$2,846,400
Dolphins (piles 610mm, 43m long)	Supply 15 off per dolphin x 11 dolphins = 165 @ 8.3 T	1369.5 tonne	$1,400	$1,917,300	
	Coating - 20m	6324.02 m^2	$20	$126,480	
	Jack Up Barge	150 days	$3,500	$525,000	
	Work Boat	150 days	$1,000	$150,000	
	Misc. Plant, Matls	150 days	$1,000	$150,000	
	Crew - 6x10hrx150days	9000 hrs	$50	$450,000	
	Concrete, formwork, rebar	352 m^3	$500	$176,000	
	Weather Contingency	20 %		$698,956	
	SUBTOTAL			$4,193,736	$4,193,736

Streaky Bay
Gypsum Loadout Facility

COST ESTIMATE

Aztec Analysis
Job No: A970106
20/06/97

DESCRIPTION	ITEM	QUANTITY	UNIT RATE	SUBTOTAL	TOTAL
Fenders	Supply 6 off	6	$80,000	$480,000	
	Installation	6	$3,500	$21,000	
	Fender beam 400WC212	150 m	$382	$57,240	
	Installation	6	$4,000	$24,000	
	Contingency	20 %		$116,448	
	SUBTOTAL			$698,688	$698,688
Electrical	Conveyor, Instrumentation			$300,000	
	Cathodic protection			$300,000	
	SUBTOTAL			$600,000	$600,000
Land works	Loading hopper, feeders			$150,000	
	Tunnel - 75m long	75 m	$1,400	$105,000	
	Excavation, backfill			$75,000	
	Contingency	20 %		$66,000	
	SUBTOTAL			$396,000	$396,000
Contractor Margin	Supervision / Site overheads	15 %			
	Overheads / Profit	10 %			
	Contingency	5 %			
		30 %			$3,756,798
Fees	Bathymetric survey, Currents, Waves, Berthing, Mooring, Survey, Geotech, Engineering, Project management				$1,000,000
Scope Contingency		15 %			$2,591,919
TOTAL BUDGET					$19,871,375

EXCLUSIONS: Land acquisition
Legal, Statutory fees
Planning approval, Environmental Impact Statement
Workboat, Barges, Tugboat (see separate costings)

DESCRIPTION	ITEM	QUANTITY	UNIT RATE	SUBTOTAL	TOTAL
Moore's Landing	Piling	6 off		$80,000	
	Rocks	4500 m^3	$20	$90,000	
	Roadway			$30,000	
	Mobile Conveyor			$130,000	
	Labour & Contingency	30 %		$99,000	
	SUBTOTAL			$429,000	$429,000
Infrastructure	Power to Tractor Beach			$400,000	
	Water supply (process+drink)			$80,000	
	Road sealing / upgrade	20 km	$45,000	$900,000	
	Contingency	20 %		$276,000	
	SUBTOTAL			$1,656,000	$1,656,000
Boats	30T Tugboat - secondhand	1 off	$2,500,000	$2,500,000	
	Workboat - 200hp, 5T pull	1 off	$750,000	$750,000	
	Barge - 5000 T, powered	2 off	$850,000	$1,700,000	
	SUBTOTAL			$4,950,000	$4,950,000

10 July, 1997

TENNANT LIMITED

SCEALE BAY GYPSUM

PRE-FEASIBILITY STUDY REPORT

CONTENTS

Attachments

1. Map of South Australia
2. Map of Sceale Bay Site and Land Holdings
3. List of Gypsum Operations in South Australia
4. Olliver Geological Services Resource Report - AVAILABLE ON REQUEST
5. Results of Analysis of Lake Gypsum
6. Aztec Analysis Report on Proposed Gypsum Loading Facility - AVAILABLE ON REQUEST
7. Base Case Financial Model
8. Gypsum Process Diagram
9. Summary of Shiploader Cost Estimate

1. EXECUTIVE SUMMARY

SBDC has conducted a pre-feasibility study on the gypsum resources within the Sceale Bay area of South Australia. The study's objectives were to:-

- undertake further assessment of the gypsum resources;
- identify a development plan for the project;
- outline the key project risks; and
- determine if the project should be the subject of a full feasibility assessment.

The pre-feasibility study has comprised:-

- a drilling and analysis programme over about 40% of the gypsum resource exploration area;
- preparation of capital and operating cost estimates for the extraction, stockpiling, leaching, transport and loading to ship of the gypsum product;
- desk research into the broad market parameters for gypsum within Australasia and South East Asia;
- determination of the main project risk areas; and
- economic evaluation of a base case and sensitivities to key parameters.

The pre-feasibility study has adopted what are intended to be conservative parameters. This is appropriate because of the significant number of uncertainties in the project and the preliminary nature of much of the data.

Despite the conservative approach adopted, the study has found that the project passes economic hurdle rates and merits development to the next stage. This would involve targeted analysis in key risk areas.

The study's main conclusions are:-

Resource

- the total measured and indicated gypsum resources are sufficient to support resource development;
- measured gypsum resources total 17 million tonnes, indicated resources outside the grid drilled area total 59 million tonnes;
- the gypsum's chemistry is consistent with other South Australian gypsum deposits; with the exception of sodium chloride levels all parameters should be broadly acceptable to end user markets;

- sodium chloride levels will need to be reduced by rain water leaching of stockpiles; while saleable product may be able to be produced within three years a longer-term leaching study will need to determine this;
- the gypsum resource is relatively easy to mine; some crushing and screening may be required for market purposes.

Operations and Infrastructure

- the FOB cash operating costs provide for reasonable operating margins;
- the project requires development of its own ship loading facility near the mine site;
- the current capital cost estimate of $20 million includes substantial scope and other contingencies. If the assumptions made in preparation of the estimate eventuate the capital cost should be able to be significantly reduced, perhaps by as much as $3 million to $5 million;
- alternative, lower cost, ship loading methods are available, but potentially with higher down times; these require consideration during the next phase of the study;
- as the Yanerby calcium carbonate deposit is still being assessed, it has not formed a part of this study.

Statutory Issues

- the study has not identified significant statutory impediments to project development, with the exception of the possible impact of native title claims on the ship loader site which is seen as a timing risk; Government is generally supportive of the project;

Market

- there is a strategically attractive Australasian gypsum market of 400,000 tpa which is potentially available to SBDC; however this would be subject to strong competition by the incumbent supplier, Gypsum Resources Australia ("GRA") which is owned by Boral and CSR; GRA enjoys competitive advantages owing to their incumbent status, their delivery and distribution channels and likely commercial approach to competition;
- the South East Asia regional gypsum market is growing, but is under significant supply pressure because of Thai Government controls; the real price of gypsum has increased substantially over the last five years and a further US$2/t increase has been announced from 1 January, 1998; however artificial price controls generally are unstable and subject to sudden unpredictable changes;

- in view of the Thai supply situation, Sceale Bay gypsum should be strategically attractive to a number of end users, either as an insurance policy or as a means of diversifying supply;

- this study has made a number of assumptions about the product markets and penetration in South East Asia; considerable further work will need to be devoted to this area in the next stage of the project; this should include consideration of alternative regional supply sources especially China.

<u>**Economic Assessment and Sensitivities**</u>

- the project has an ungeared after tax NPV at 12% of $7.1 million;

- key base case assumptions include: sales achieve 1 mtpa, gypsum is leached for 3 years, export gypsum pricing is derived from Japanese plasterboard market price of US$30/t CIF; assumptions have been targeted to be realistic/conservative having regard for the remaining project uncertainties;

- the project is particularly sensitive to export pricing (+/- US$1/t alters NPV by $3.6 million), leaching time requirements (one extra year alters NPV by $2.3 million) and operating costs (+/- 10% alters NPV by $3.1 million); market penetration is also a very sensitive factor (+/- 10% production and sales rate alters NPV by $2.6 million);

- as a low value commodity the project's economics are very sensitive to relatively small movements in the elements of its cash margin; this leads to significant vulnerability for the project owing to the relatively high capital investment;

- the project's viability is also impacted by the relatively high product transport costs compared both to Thai gypsum and also the FOB value of Sceale Bay gypsum;

<u>**Next Steps**</u>

- a number of different studies are required to add certainty to key risk areas; these can be relatively lengthy, e.g. leaching studies, or require significant resources, e.g. ship loading methods and designs;

- the most effective way forward would be to seek project partners or purchasers which have a potential industry strategic interest in the resource; this will require a targeted and structured marketing campaign;

- the main considerations are the timing of introducing new equity based on the amount of value adding/risk reduction conducted prior to introducing the new equity and the level and ~~native~~ nature of project exposure which SBDC would seek to retain;

- it is recommended that a relatively modest program be conducted during the marketing campaign both for risk reduction purposes and to demonstrate continuing project commitment; the specific tasks will need to be determined over the next month or so;
- attention now should be given to the potential roles for government in assisting the statutory approval procedures and also the provision of infrastructure assistance.

2. INTRODUCTION AND PROJECT CONCEPT

Sceale Bay is located on the west coast of the Eyre Peninsula in South Australia (see Attachment 1). Gypsum resources were first identified in the area more than forty years ago. A series of exploration programmes and studies were conducted over the subsequent years. However, it was only with the formation of Sceale Bay Development Corporation Pty Ltd ("SBDC") in 1993 that more rigorous work commenced on the resource.

The gypsum resources have now been extensively drilled and analysed. The drilling programme focussed on two areas of Lake Purdilla. Measured gypsum resources in those areas total 17 million tonnes. Within the exploration area inferred resources total 59 million tonnes and total resources in all categories total 85 million tonnes. A programme has been conducted to determine the processing required to transform the run of mine gypsum to saleable product. The project design provides for run of mine gypsum to be stockpiled adjacent to the mining area where it will be washed by natural rainfall. This will reduce NaCl levels to acceptable levels for both plasterboard usage and cement manufacture.

Following leaching, the gypsum product will be transported about 16 kilometres by truck to a special purpose ship loading facility. The facility will comprise product stockpile areas with stacking and reclaiming capability feeding to a ship loader at the end of a jetty approximately 650 metres offshore. The jetty will permit vessels of up to 40,000 tonnes product capacity to be moored and loaded. Loading rates of approximately 1,000 tonnes per hour have been planned. The jetty is located in a sheltered area with allowance for vessels to berth and depart with work boat assistance. It is expected that the facility will be available for use all year round and in all weather conditions.

A process diagram is included at Attachment 8.

Consideration has also been given to an alternative ship loading arrangement involving the use of self-discharging barges for lighterage to vessels moored offshore. This would involve significant savings in infrastructure cost, but introduce some additional operating costs and risks. Lighterage might also be used as a temporary measure until sales tonnages justify expenditure on a jetty. This option is discussed in Section 7.4.

It is envisaged that gypsum will be sold to a range of customers in the plasterboard and cement industries. During the project development phase long term marketing contracts will be sought on the basis of offering an independent, long term supply of gypsum. Customers in the Australasian markets who do not have an in-house gypsum supply capacity will be targeted. In addition, customers in the high growth markets of Indonesia and Malaysia will be pursued. It is intended that long term supply contracts into selected Japanese markets will also be targeted.

The project's main marketing strengths are that it diversifies customers' supply opportunities, there is no conflict between being a gypsum supplier and customer, SBDC is solely focussed on the gypsum business and is able to support its customers technically, and the company is able to entertain innovative and flexible commercial arrangements. Gypsum supply reliability will be of a high level as the gypsum will be the sole product to be loaded through the ship loading facilities.

3. LAND AND STATUTORY ISSUES

3.1 Location and General Description

Sceale Bay is located on the west coast of the Eyre Peninsula in South Australia. It is approximately 700 kilometres by sealed road from Adelaide. To the north west the nearest town of size is Ceduna with its nearby port of Thevenard. Sceale Bay is part of the Streaky Bay District Council area.

The Streaky Bay area was first settled by Europeans in the 1850s and since then has been utilised primarily for grain production and sheep grazing. The town of Streaky Bay is also the base for a small fishing industry. The area is arid, sparsely vegetated and lightly populated. Streaky Bay's population is about 1,000, while the district population is around 1,900. The gypsum deposit is about 14kms south of the township.

Streaky Bay has a regular commuter airline service from Adelaide to the local sealed airstrip. The town is on the state electricity grid. Fresh water is obtained from a spring and is adequate only for residential and other low volume requirements. The area has very little industrial activity and the population has declined with a reduction in the number of people engaged in farming, rural activities and fishing. It is expected that there will be very strong support for the Sceale Bay gypsum development because of the investment, employment and diversity it will bring to the District.

3.2 Licences and Approval Process

The Sceale Bay gypsum deposit is covered by exploration licence EL 1821 issued by the South Australian Department of Mines and Energy. The licence extends over an area of about 385 square kilometres. It is renewed annually and the current licence is due for renewal on 18 February 1998. The licence can be converted to a mining lease upon application and approval of a suitable environmental impact statement.

The main regulatory/statutory issues associated with the development of the project are set out below. The activities would be coordinated and should largely occur simultaneously

- **Mining Lease Application (3-4 months)**

  Department of Mines and Energy of South Australia, regarding mine plan approval, environmental/rehabilitation requirements.

- **Port Application and Approvals**

  Department of Transport, regarding leases for seabeds and use of coastal Crown land (will involve Native Title resolution).

- **Environmental Impact Statement**

  Department of Environment and Natural Resources, regarding environmental and rehabilitation requirements for mine plan, erosion control of coastal environment and environmental issues and impacts not covered by mining lease application.

- **District Council of Streaky Bay**

  Regarding use of Council land and Council roads, zoning aspects, compulsory acquisition of land.

- **Economic Development Authority**

  Co-ordination of Government facilitation.

The South Australian Government and Streaky Bay Council are supportive of development projects in general and this project in particular. This should allow the statutory approvals to be fast-tracked and permit assistance in matters such as provision of site services, road surfacing and economic assistance.

3.3 Land Ownership

The gypsum resources are located on land held under lease by local occupants and used for sheep grazing. Most of the area which would be mined in the initial stages of the project is held under three perpetual Crown leases held by H. M. and C. K. Kammerman. The eastern part of the mine site area, in particular the southern portion of the gypsum deposit, is on land held under perpetual Crown lease by K. C. and S. W. Williams. Both land occupiers are supportive of the project. Compensation arrangements would need to be negotiated with them.

The area closest to the proposed ship loading site at the Dreadnoughts is also covered by a Crown Lease held by R. C. and C. E. Hill. The proposed stockpiling area for product awaiting ship loading would be located on this lease. Mr. Hill is understood to be opposed to the project. However, a number of strategies, including the possibility of compulsory acquisition of the necessary area, may be considered.

A plan indicating the land holdings of the mine site and ship loading area is included at Attachment 2.

There are a number of council roads which provide good access to the mine site and ship loading area. These roads are currently unsealed. However, it is likely that in the context of developing the gypsum project that local or state Government assistance for sealing the roads would be forthcoming.

The Kammerman property is bounded on the west by a road from Streaky Bay in the north to Sceale Bay in the south. A gypsum mine site access road would most likely need to be constructed from this road for the short distance into the mine site area. An unsealed public side road leads due west to the Dreadnoughts, the location of the ship loading facility.

3.4 Aboriginal Heritage Issues and Native Title

The issues of native title and Aboriginal heritage are covered by separate pieces of legislation. However, some Aboriginal groups are seeking to address the issues jointly in order to improve their negotiating position.

Aboriginal heritage is covered by the Aboriginal Heritage Act. In essence the Act places obligations on occupiers or users of land to avoid damaging Aboriginal sites of significance, sacred sites, etc. A series of procedures has emerged to deal with the Act's obligations. These provide for appropriate Aboriginal people to inspect areas and to advise if there are any heritage issues of concern. The appropriate Aboriginal group for providing the site clearance is nominated by the South Australian Aboriginal Heritage Council. While the Act provides for sites of significance to be registered, it is not necessarily the case that all sites are registered and in any event the specific locations of the sites are not necessarily detailed.

The procedure which is generally followed is to invite appropriate elders to tour the site accompanied by a company representative and to identify specific areas which might be of concern. This is then documented on a map which is confirmed by both parties. Additional or alternative procedures can be followed, such as consulting anthropologists familiar with the area.

Following a series of postponed or cancelled arrangements for obtaining Aboriginal Heritage clearance, the necessary site visit took place on 28 May, 1997. A group of three Aboriginal Community representatives and a representative of Biringa Aboriginal Inc., accompanied by the project's consultant geologist, toured the site and the potential ship loading areas in order to identify any sites of concern.

An Interim Site Clearance agreement was signed by the parties and a more detailed agreement is to be prepared by 30 June, 1997. All areas were cleared for gypsum exploration and investigation and the potential ship loading sites were also cleared. The detailed agreement is intended to cover mining operations.

The law concerning native title is still evolving. Unless native title has been extinguished on a particular piece of land, the South Australian legislation, the Mining (Native Title) Amendment Act, which follows the Commonwealth legislation, sets out certain procedures which need to be satisfied in order to obtain a mining lease. These require a mining lease applicant to identify any possible Native Title Claimants and then to negotiate access and/or compensation agreements with any and all Native Title parties identified.

SBDC has obtained legal advice on the status of the land surrounding the proposed mine sites. As noted above, this land is held under perpetual crown lease.

Each of the leases has been reviewed by SBDC's legal advisers and advice has also been sought from the South Australian Crown Law Office. SBDC's advice is that native title is most likely to have been extinguished on the perpetual crown lease land holdings. The Crown Law Office has informally concurred with the view, but is not in a position to formally provide an opinion. SBDC has been advised that mining leases have been issued in South Australia on land covered by similar crown leases without pursuing native title procedures.

The native title issues surrounding the ship loading jetty differ from those applying to the mine site area. SBDC's legal advice is that native title would not be extinguished in respect of those parts of the facilities extending beyond the shoreline. Accordingly, approval for construction of the ship loading facility would probably only be granted conditional upon compliance with native title legislation and the associated right to negotiate procedures. From a practical and pragmatic viewpoint, such negotiations may include discussion of the mine site area and a package arrangement might be entered into in order to forestall possible significant delays which could be brought about through legal action.

It should be noted that the Native Title claim has been lodged by the Barngala people over a substantial part of the Eyre peninsular including the gypsum leases and coastline.

4. GYPSUM RESOURCE

4.1 Geology and Resources

The geological investigations into the Sceale Bay gypsum deposit have been conducted by Mr. J. Olliver of Olliver Geological Services ("OGS"). The OGS report is included at Attachment 4.

Deposition of the gypsum can be broadly described as having originated as ground water lakes, which were flooded by seawater and resulted in saturated brine lakes. Ultimately, isolation from the sea causes the brine concentration to increase and gypsum to deposit. The deposits consist of deeper lake (consolidated) gypsum which passes gradationally into laminated seed gypsum and through to a cap of dune (flour) gypsum. Through natural leaching, the upper dune gypsum contains lower levels of salt content.

The deposits have been drilled and explored under a number of programmes since 1959. These include:-

- 1959 South Australian Department of Mines - drilling programme;
- 1969 Elcor (Australia) Pty Limited - drilling programme;
- 1997 SBDC/OGS - push tube sampling; and
- 1997 SBDC/OGS - drilling programme.

The resource analysis has been largely based on the most recent drilling programme, with supporting information from the earlier programmes. The 1997 programmes focussed on two areas of the gypsum deposit, one towards the north of the Lake Purdilla area and the other to the south. These two areas were drilled on a grid of between 200 metres and 300 metres. The total area drilled measures 6.1 square kms out of a total area of 22.7 square kms for Lake Purdilla and 9.6 square kms for Lake Toorna. Extensive sampling and analysis of the core intervals was undertaken.

The resource calculations use a cut-off resource thickness of 0.5 metres.

Measured resources have been calculated by OGS under the Australasian Code for Reporting of Identified Mineral Resources and Ore Reserves, July 1996.

The measured resources are set out below:-

		Run of Mine			
	Gypsum million tonnes	**Gypsum %**	**NaCl[1] %**	**Carbonate %**	**Silica %**
South drilled area	8.5	93	2.3	4.2	0.5
North drilled area	8.7	93	2.3	4.2	0.5
Total drilled area	17.2	93	2.3	4.2	0.5

(i) The reported NaCl levels are based on acid assays of run of mine material which has not been specifically drained of the surrounding brine. Accordingly, these differ from expected stockpile and product levels.

Total resources of all categories in EL1821 are 85 million tonnes comprising:-

	Million Tonnes			
Area	**Measured**	**Indicated**	**Inferred**	**Total**
Lake Purdilla	17	43	-	60
Lake Toorna		12	-	12
Peripheral Lakes	-	-	8	8
Dunes	-	5	-	5
Total	17	59	8	85

Within the Lake Purdilla area approximately 39% of the area has been drilled in the recent programme and approximately 28% of the in-situ resource is of measured status. It is important to note that the resource is relatively homogenous, thus giving enhanced confidence on the overall resource estimates. To upgrade the resources to measured status drillings work will be needed on a grid similar to the recent work.

4.2 Physical Characteristics

Lake gypsum samples were taken from the northern mine trench excavated in May 1997. The trenching showed the three graduated layers of gypsum based primarily on increasing levels of gypsum crystals with depth. An upper white friable gypsarenite overlies grey banded slightly cemental coarser gypsarenite which grades downwards into basal crystalline gypsum varying from a loose mass of crystals in brine to semi-cemented aggregates to completely cemented layers of rock gypsum.

Dune gypsum samples have been taken from a number of the dunes in the southern and northern lake areas. The dune gypsum comprises off-white granular gypsum and fine gypsum flour. In coarser particle phases the gypsum occurs as rounded particles ranging in size from 0.1mm to 1.5mm. The majority are off-white and contain coloured included materials. The finer flour gypsum consists of angular particles and is much cleaner with lower impurity levels than the coarser gypsum.

The dune gypsum also has traces of clay, iron oxides, carbonate and some opaques. The carbonate typically forms grey small inclusions in the gypsum. Opaques form liberated rounded particles generally between 0.1mm to 0.2mm.

Amdel has conducted sizing analyses of composites of the dune gypsum and on lake gypsum samples from the trench. Sizing analysis results are:-

Sample		% by Weight			
		Less than 0.2mm	0.2- 1.2mm	1.2 - 15.0mm	Greater than 15mm
Lake	- upper level	15	65	20	-
	- middle level	15	40	25	20
	- lower level	10	30	30	30
Dune		30	70	-	-

Typical sizing requirements for the cement and plasterboard industries are:-

Sizing	% by Weight	
	Plasterboard	Cement
Top size	50mm max.	75mm max.
12 - 25mm	20% max.	
2.4 - 12mm	20% min.	
+ 2.2mm	-	50% min.
+150 microns	70% min.	90% min.

The size distribution results obtained will allow gypsum to be supplied in accordance with typical sizing requirements of the cement and plasterboard industries. However, material blending may be required to achieve specific customer needs. Further, at this stage, crushing and screening has been assumed not to be required. Current indications are that mining would not be hampered by the physical characteristics of the gypsum, but customer requirements will need to be further addressed.

4.3 Chemical Characteristics

A large number of gypsum samples has been extensively analysed by Australian Laboratory Services ("ALS") on behalf of SBDC. SBDC also retained a gypsum industry consultant, Mr. Graeme Brown, who for 30 years was employed by Boral in its gypsum business. His roles with Boral included Chief Chemist and Research and Development Manager.

Graeme Brown has advised that, with the exception of the in-situ levels of sodium chloride (NaCl), the chemical composition of the gypsum resource makes it satisfactory for use in the cement and plasterboard industries. The impurities which have been tested are calcium carbonate ($CaCo_3$), magnesium carbonate ($MgCo_3$), silica (SiO_2), iron oxide (Fe_2O_3), magnesium sulphate ($MgSo_4$) and potassium chloride (KCl). The only chemical impurity which occurs at elevated levels is sodium chloride. Generally speaking the NaCl levels are similar to those found in other South Australian gypsum lake deposits, this being a feature of the way in which the deposits were formed from evaporated sea water.

By comparing the results of the different programmes and analyses, Graeme Brown has estimated an average sample analysis for typical run-of-mine lake gypsum and gypsum after leaching. These estimates are given below:-

	Typical Run-of-Mine	**Typical after Leaching**
Gypsum %	92.5	94.5
NaCl %	1.90	0.03
KCl %	0.08	0.00
$CaCo_3$ %	3.20	3.20
SiO_2 %	0.30	0.30
Fe_2O_3 %	0.05	0.05
Mg, Ca, Al, SiO2 clays %	1.50	1.50
$MgSo_4$	0.45	0.02

The results differ from these reported in the drilling program in a number of respects. In particular, the y are based on water soluble analysis and on gypsum from which the brine has been allowed to drain.

There is no specific pattern to the vertical or horizontal variations in the chemistry of the gypsum deposit and in particular the NaCl levels.

The Sceale Bay gypsum deposits have, as noted earlier, been the subject of a number of exploration programmes. The analytical results from the earlier programmes are broadly consistent with those obtained in the most recent (1997) exploration programme. However, details of the manner in which samples were taken, treated and analysed in the earlier programmes are not available. Accordingly, SBDC has predominantly relied upon the chemical analyses from its own programme.

During the course of SBDC's programme, refinements have been made to the analytical methodologies. In the initial sample taking from the drilling programme it is considered possible that the analyses may have overstated the NaCl levels present in the lake gypsum. This is because the gypsum is immersed in a brine solution containing in excess of 10% NaCl. The taking of the samples and their storage may have prevented the full drainage of the brine solution from the samples. For example, in some cases the moisture may have evaporated leaving residual NaCl behind. In any event, the results will perhaps have overstated the NaCl levels.

A further consideration involves laboratory analytical techniques. ALS has determined chemical composition using acid dilution of the samples. This results in the entire amount of chloride being released from the sample. However, from an industry viewpoint, the most significant level of chloride is the water soluble amount, i.e. that amount which is not bound into the crystal structure. In addition, ALS has assumed that all sodium present in the sample is present as sodium chloride. In fact sodium is also present as sodium sulphate.

On the advice of Graeme Brown, a number of composite samples have been analysed using water to dissolve impurities. The subsequent calculations have been based upon determining the NaCl present in the sample from the amount of chloride present in the sample. Owing to the relatively small number of samples analysed in this way and the level of variability that can exist between samples, it is not yet possible to draw firm conclusions from this recent work.

Comparisons of the results of the various analyses of lake gypsum are given in Attachment 5.

The chemical quality of the dune gypsum is higher than the lake gypsum. OGS advises that the results of 1996 and 1997 testing programmes of certain dunes adjacent to the drilled areas of lake gypsum are as follows:-

		Run - of - Mine		
	Gypsum (t)	**Gypsum %**	**NaCl %**	**Carbonate %**
Southern Area	440,000	96.8	0.4	2.3
Northern Area	700,000	97.6	0.5	1.9

5. MINING

5.1 Mining and Haulage Plan

The mining of the Sceale Bay gypsum deposit is a relatively conventional earthmoving activity. The few complexities introduced are caused by the winter rains making the ground relatively soft and the need to stockpile large amounts of material for long periods of time.

The Sceale Bay gypsum deposit is not difficult to access. While the material is more consolidated with depth, it is not rock gypsum. Accordingly it may be mined with conventional excavators.

SBDC requested Brambles Industrial Services to prepare an outline mining concept and budget costing. It should be stressed that the Brambles plan is based on their expertise as earth movers and contractors, rather than gypsum industry participants. Brambles has extensive earth moving and loading experience, including having operated the Lake McDonnell mining operations for 30 years and currently operating BHP's loading facility at Whyalla. Brambles visited the site twice in preparing their recommendations.

Aspects of the plan may need modification to meet the project's particular characteristics. The main area of possible modification is stockpile location. Brambles proposes to minimise haul distances and stockpile preparation costs by stockpiling most of the material on the lake on elevated stockpile areas. Experience at Bielemah indicates that capillary action reduces leaching effectiveness because the brine wicks up into the lower level of the stockpiles. The impact is reduced or eliminated through leaving the stockpile base in-situ. The issue is further considered in Section 6.

An alternative scenario is to construct large stockpile pads to the north of the lake and to transport run of mine gypsum there. This would have a significant cost impact. The area required for stockpiling under that scenario would be substantial. For example, stocking one million tonnes of gypsum in windrows 2.5 metres high, 10 metres wide and 500 metres long would require around 50 hectares after allowance for access roads, etc. Sufficient area is available to the north of the lake.

The mining plan proposed by Brambles is based upon mining 2 million tpa in years 1 and 2. In subsequent years mining rates are assumed to be 1 million tpa. In the initial period 0.5 mtpa of material mined would be dune gypsum not requiring leaching. The balance of the mined material would be stockpiled for leaching.

Brambles was requested to provide budget pricing for mining, stockpiling and haulage to loading site, using SBDC's production requirements and have taken into account: ground conditions; weather; physical gypsum characteristics from the different depths; stockpiling requirements (i.e. leach time and dimensions); and material handling techniques.

Brambles was present when the recent series of trenches were excavated as part of the leaching studies (referred to in Section 6), providing them with a detailed insight into the expected mining conditions. Trenching had confirmed results from the earlier extensive drilling program, revealing three graduated layers of gypsum based on increasing levels of gypsum crystals with depth. The layers below ground level are 1-1.5m of loosely consolidated crystal free gypsum, underlain by 1-1.5m of slightly more consolidated material with an increasing proportion of gypsum crystals, underlain by a third layer of more consolidated gypsum.

The presence of the crystals has however highlighted the potential need for screening and/or crushing in order to maximise available surface area to accelerate leaching at a minimum cost. It is likely, owing to the soft nature of the consolidation, that a simple roller crusher would suffice, if crushing was needed, although at this stage no screening and/or crushing has been assumed. Additional work is required to determine the need for such treatment. Crushing to the size fraction required by customers also needs considering.

Owing to the relatively homogenous quality of the gypsum and the total thickness of the gypsum deposit (which averages 3-3.5 metres), the deposit will be mined as one bench.

Brambles have suggested excavating gypsum for leaching on the lake, as is the practice at Lake McDonnell. This minimises the costs of removing material from the lake especially in the early years when stockpiles are being formed. It is planned to excavate to the full depth of the deposit a number of parallel 20 metre wide trenches and stockpile the material for leaching on the non-excavated lake section alongside each trench. Brambles have planned to leave the bottom 50cm of the stockpile remaining on top of the lake to be mined subsequently with the underlying lake section for later stockpiling off the lake, at Brambles' proposed site on Purdilla island.

Lake Purdilla would be used for holding stockpiles ready for transport to the ship loading facility and for stockpiling material mined from year three and later. While this introduces double handling, it avoids access problems for road trains on the lake surface.

Brambles plans to establish a number of 10m wide feeder roads by compacting a 75cm thick gypsum base across the lake surface, which will be excavated when no longer required. The feeder roads will also allow access to the dune gypsum. The dunes will be cleared of any vegetation and mined by front end loader before being hauled direct to the loading site. The area cleared following mining of the dunes will be used for stockpiling lake gypsum.

The most economical way of moving product from the mine site to the ship loading stockpile is by road train. Brambles has proposed using 50t bottom dumping trucks. At the ship loading site, the road trains would bottom dump into a hopper/mobile stacker for stockpile emplacement.

Two Streaky Bay councillors have suggested there would be no problem with Council granting permission to use 75t road trains. Currently Lake McDonnell operations have material carted to the rail head by 90t side dumping trucks (with one trailer), whilst Lake MacLeod uses 120t trucks. In both cases the vehicles are not used on public roads. Brambles advise that 75t loads may not significantly reduce costs, but would introduce safety, public liability and regulatory difficulties.

A Ceduna based haulier that currently conducts the salt cartage from Penong has also provided haulage estimates. The combination of Brambles as mining contractor and independent hauliers is likely to offer significant cost savings.

Currently Streaky Bay council maintains the local public roads, with the stretch between mine site and ship loading site usually graded once annually. The road is made of a 3-4 inch compacted limestone/calcrete base, which is mostly sitting on a reasonably competent base, through to The Dreadnoughts. Water has only a minor affect on the roads and for insignificant periods due to the low rainfall. Council has been lobbying for bitumen on the stretch between Streaky Bay and Pt Labatt (primarily to expand the tourist potential of what is the only seal breeding site and colony on the mainland). It is likely that the State Government or Council would consider assisting the project by upgrading all of the public roads used by the project.

Brambles has proposed the following main infrastructure and mobile equipment to conduct the complete excavation, stockpiling, site transport, road train loading and movement to the ship loader.

- Lake Purdilla site facilities, including office, crib, workshop, fuel and water facilities, genset and ancillary facilities.
- Access roads on Lake Purdilla and to public road.
- 2 x 30 tonne excavators with swamp tracks.
- 2 x front end loaders.
- 4 x 40 tonne articulated dump trucks (for on site movements)
- 1 grader.
- 1 D6 dozer.
- 1 water truck
- 4 x 50 tonne bottom dump road trains.

Operations would be conducted on extended day shift. In year three, road haulage would occur on two shifts.

5.2 Mining and Haulage Costs

Brambles has provided budget estimates for the full mining and haulage activities detailed above. The rates included components for the capital costs associated with the Lake Purdilla infrastructure and road construction, as well as maintenance. Capital has been written-off over five years in the operating cost rates.

SBDC has also approached Donald Equipment, the contractor used by Pioneer to operate the Bielemah trial. In addition, budget quotes have been obtained from a Ceduna-based road haulage contractor for the loading, transport and unloading of gypsum from Lake Purdilla to the ship loading facility at the Dreadnoughts. The costs provided by the various contractors are set out below:-

	Brambles	**Donald Equipment**	**Ceduna Bulkhaul**
Excavate and stockpile	$1.84 - $2.70/t [1]	$1.75 - $2.30/t	-
Stockpile to Port:			
- Load		-	$0.30 - $0.37/t
- Haul			$1.80/t
- Stack			$0.30 - $0.37/t
Total	$3.40/t [2]		$2.40 - $2.54/t [5]
Load Ship:			
- Reclaim		-	$0.25/t
- Ship load and belt walker			$0.10/t [4]
Total	$0.54 - $0.68/t [3]		$0.35/t
	$5.78 - $6.78/t	$4.50 - $5.19/t	

Notes:

(1) Includes capital charges for Lake Purdilla facility - $395,000.
(2) Includes capital charges for road construction - $500,000.
(3) Includes ship tie-up, loading belt, ship loading, belt walking and taking samples.
(4) Estimated.
(5) Excludes capital charges.

The financial evaluation has been based on Brambles' estimates for mining and stockpiling costs and contractor estimates for loading, hauling and unloading costs. Each contractor has noted that the project's efficiency is best served by the transport contractor also taking responsibility for reclaiming gypsum from the stockpile to load onto the ship loading conveyor. The transport contractor's cost estimate for this activity has also been included. Brambles has provided a cost estimate for the vessel tie-up, ship loading operation and belt walking/sample taking. The figures have been used to estimate the cost of ship loading and belt walking if conducted by an independent contractor.

6. STOCKPILING AND LEACHING

Run of mine gypsum will be trucked to a stockpiling area on higher ground in close proximity to the gypsum lake. A series of gypsum stockpiles will be established on a base of low grade gypsum. These will be rectangular and of a height of two to three metres. The top of the stockpile will be flat to allow the maximum possible percolation of rain water through the stockpile. Stockpile optimisation studies will form part of the detailed feasibility study and will be aimed at optimising stockpile dimensions, construction and management. The stockpiles will need to be established to avoid capillary action from drawing brine up into the stockpile.

Once the salt levels in the gypsum have been reduced to product specification levels, gypsum will be able to be reclaimed and transported by truck as required to the ship loading stockpile area.

During the detailed project design phase, consideration will be given to accelerating the leaching process by spraying stockpiles with seawater which has been pumped from Sceale Bay. This will assist the flushing out of the associated sodium chloride.

Field studies have been conducted to determine the rate at which the salt content of the gypsum may be reduced as well as determining the ultimate level of salt which may be achieved with the gypsum product. During May and June 1997, controlled tests and analyses were conducted. A series of trenches were excavated almost down to the base of the gypsum, with the extracted material being well blended onto stockpiles. The stockpiles were left to drain for two weeks. The purpose of this was to allow the briny water, which saturates the gypsum about 50cms or so below the surface, to drain away. It is important to note the NaCl level in the ground water was in excess of 10%.

Following the two week drainage period, two of the stockpiles constructed from material from one trench were separately treated. One stockpile was sprayed with salt water on a daily basis, while the other stockpile was sprayed with fresh water. The amounts of added water and the rainfall has been monitored. Samples are to be taken at various stages during the entire process and analysed to determine the rate of change of NaCl content with water applied. The stockpiles will continue to be monitored following the completion of this report.

Further support for the feasibility of the stockpile leaching process is derived from experience gained over many years at the Lake McDonnell gypsum deposit near Ceduna. Run of mine gypsum at Lake McDonnell has a similar salt content to Sceale Bay. A stockpiling and leaching process takes place which reduces the salt levels to market requirements within a reported average of three to four years. The average annual rainfall in Ceduna is 80% of the average annual rainfall at Sceale Bay, although Lake McDonnell rainfall is reported as similar to Sceale Bay.

Sceale Bay rainfall data has been collected for approximately 120 years. It shows an average annual rainfall of 380mm. The wettest months are May to August. Over the period 1985 to 1995 the average annual rainfall has varied from 207mm to 633mm.

In that period the average has been 385mm. Over the same period the annual average at Ceduna has been 284mm or 74% of the Streaky Bay average.

SBDC has been provided with a 1980 report prepared by GRA. It reinforces the need for careful stockpile construction and management to avoid capillary action causing reduced leaching effectiveness. Discussions have also been held with Pioneer Plasterboard which mined and stockpiled about 400,000 tonnes of gypsum at the Bielemah deposit near Lake McDonnell. Pioneer located the stockpile on the lake and experienced capillary action drawing briny water up into the stockpile causing increased leaching times to between four and six years for plaster grade gypsum. Pioneer's advice has placed emphasis on the stockpile base location and preparation as being a key issue. In addition, stockpile construction is important as well as the subsequent reclamation of saleable gypsum.

7. SHIP LOADING SITE AND INFRASTRUCTURE

7.1 Ship Loading Options

Gypsum is a relatively low value commodity. Accordingly, the nature, location, capital cost and operating cost of the transport infrastructure are key determinants of the project's financial viability.

The nearest deep water port to Sceale Bay is Thevenard, which is 3km from Ceduna the nearest town. Thevenard is approximately 110kms north-west of Streaky Bay. It is used by GRA for exporting gypsum from Lake McDonnell and is also used for grain exports. Thevenard has draft limitations of 8.2 metres which limit vessel size to a maximum 30,000 tonnes. Shipments in excess of 20,000 tonnes are limited.

Thevenard's port facilities including a bulk loading plant owned and operated by Ports Corp South Australia, a statutory corporation. The terminal gypsum storage facilities are owned by GRA, the grain storage facilities are owned by SA Co-operative Bulk Handling ("SACBH"). Gypsum loading rates are a maximum 900 tonnes per hour. Average Ports Corp loading costs are estimated to be below $2 per tonne. In addition, GRA incurs storage and reclaim costs. The total cost to load a vessel has been estimated by the local Con Aust agent to be $3.45 to $3.85/tonne.

The South Australian Government is planning the sale of its Ports Corp bulk handling facilities, including Thevenard's conveyor and loader. There is much current controversy over the sale and the purchaser or purchasing consortium. Under consideration is sale of the assets to SACBH. GRA is actively trying to influence the outcome, which could result in cost increases to them. However, Ports Corp advise the sale to SACBH will be completed at the end of July, 1997.

There have been a number of studies of grain shipments from South Australia. These have reviewed port development options and issues. Thevenard is not regarded as a suitable, necessary or desirable upgrade option by the grain industry. The main reasons for this are:

- it has a relatively low tonnage catchment; peak exports of 330,000 tonnes in 1990/91 have declined significantly to less than 100,000 tonnes in 1993/94 and 1994/95;
- the channel limitations of 8.2m would require significant expenditure to be increased to a depth which would allow 40,000 tonne vessels to be loaded.

Gypsum transport to Thevenard might be a short term transport option, but it is not suitable for the long term development of Sceale Bay gypsum. This is because of the additional trucking transport costs, the limitations on vessel size which would translate to higher shipping transport rates and limitations on the ability to load significant tonnages through the port in excess of those currently being handled. It is estimated that trucking from the gypsum mine to Thevenard would cost approximately $10 per tonne.

A further key consideration which makes Thevenard an unsuitable ship loading site for SBDC is land availability. It is understood that much of the land close to the ship loader is owned by Boral. Pioneer owns land which could be used for stockpiling, albeit with environmental difficulties. The stockpiling area would need to be constructed and a conveyor built to connect with the portion of the ship loading conveyor owned by Ports SA. A capital cost of $1m to $2m has been estimated for the various facilities.

Accordingly, SBDC proposes the development of a dedicated ship loading facility located close to the gypsum mine site.

Consideration has also been given to a lighterage system involving the use of self-discharging barges or barges unloaded by ships grabs. This is described in more detail in Section 7.4 below. During the full feasibility study this option should be explored in more detail as a possible short-term arrangement while sales tonnages are relatively low, as well as a possible long-term option. Barging would present some relative advantages over a jetty based ship loader:-

- significantly lower initial capital costs;
- ability to develop relatively quickly; and
- lower capital charges over the lower initial sales tonnages.

7.2 Ship Loading Site Location

A ship loading site location has been selected at the Dreadnoughts, an area to the south of the Streaky Bay township and directly west of the northern mine site area. Site selection has been based heavily on local knowledge. The coastline does have a reputation for very bad weather conditions, particularly in the winter months. Accordingly a site with some protection from the south-west and westerly directions is particularly important.

The Dreadnoughts presents the best protected site near to the mine site area, is topographically suited for product stockpile areas and has reasonable water depth for berthing vessels. Because of the lie of the land, it should also minimise any adverse impact on coastal views. Accordingly, it has been agreed to base the ship loading infrastructure design and costing on the Dreadnoughts site. However, during the project's detailed design stage other locations will need to be assessed.

7.3 Ship Loading Infrastructure and Costing

SBDC commissioned Aztec Analysis to conduct a preliminary concept design and costing for a ship loading facility close to the Sceale Bay gypsum deposit. Aztec Analysis are a firm of consulting engineers and planners with a particular focus on naval architecture, design and engineering.

Aztec's brief was to:

- investigate possible load site locations;
- prepare a concept design for a stockpile and ship loading facility;
- prepare capital and operating cost estimates for the design; and
- identify the key issues associated with the design.

The basic parameters for the study were: maximum vessel size 40,000 tonnes; load rate 1,000 tonnes per hour; fixed ship loader; annual throughput 1 million tonnes; and minimise the potential requirement for the use of tugs.

In conjunction with Aztec, SBDC commissioned three additional studies to provide supporting information for the Aztec design and costing. A local experienced fisherman, Trevor Gilmore, with an appropriately equipped boat carried out an initial seabed sounding survey to assist in determining water depths and the location of the berth.

Lawson & Treloar, a firm of coastal, ocean and water resources consulting engineers, undertook a preliminary analysis of design wave crest levels to provide a likely upper limit for design purposes.

Seatech Consultants, a marine consultancy organisation, reviewed aspects of the preliminary ship loading design in respect of ship operations and safety.

The recommendations of the consultants were incorporated in Aztec's report. Aztec has proposed a relatively simple jetty structure, comprising a conveyor with walkway alongside. Fixed (piled) dolphin structures have been nominated for the berthing and mooring arrangement. The design assumes gypsum is stockpiled on site at the Dreadnoughts directly inland of the jetty and loaded onto the jetty conveyor through a hopper using front-end loaders. The conveyor carries the gypsum approximately 800 metres (including travel overland) along the jetty to a fixed ship loader. Ships would be moved along the berth to permit loading of all holds. Aztec advise that a full feasibility, review, design, tender and construction programme would take approximately 18 months on a fast-track approach assuming planning approvals take six months. It is likely that a number of the activities in Aztec's plan could be conducted simultaneously, thus reducing total construction time.

Aztec's preliminary budget cost estimate for the facility is $19.9 million and this has been used in the financial evaluation in this report. The estimates contain generous contingencies to allow for a number of current uncertainties. Aztec regards the estimate as an upper limit. A summary of the cost estimate is included as Attachment 9.

The estimates are also conservative in a number of design and management respects as identified by the Aztec report. For example, costs may be reduced by the use of pre-fabricated caissons, in lieu of dolphins. These would be floated to the location and eliminate the need for piling. Alternatively mooring barges might be used in lieu of dolphins. Construction management is an area offering significant potential savings. Aztec has proposed a very conventional arrangement involving the calling of tenders. Alternative approaches might be a turnkey contract basis or using a single head contractor, who would sub-contract packages of work. These and other such opportunities would be addressed in a full feasibility study.

The main limiting conditions which impact on the operation of the facility are:-

- berthing would require winds less than 30 km/hr. These are exceeded ~~occur~~ 10% of the time for berths between July and October; and
- waves in excess of limiting heights are estimated to have a probability of 15%. If these are exceeded ships would have to leave the berth and wait offshore.

Seatech has advised that within the design and operational parameters they believe it is safe to berth vessels without the use of tugs and no allowance for them has been made in this study. However, it is conventional for 40,000 tonne vessels to berth with two tugs. Some associated issues of commercial risk and management would need to be addressed during the design stage.

Aztec's full report is attached.

7.4 Barge Lighterage Option

A ship loading option which has, at this stage, only been briefly considered is to utilise barges as lighters for transporting the gypsum from a ship loader to moored vessels. In concept a relatively simple loading facility would be constructed at Sceale Bay, most likely at the northern end near Yanerby. The jetty would not need to extend a great distance offshore, nor would it need to be a massive structure. This is because the depth grades down relatively quickly, the barges to be loaded have a significantly reduced draft compared to sea-going vessels and the forces exerted on the jetty are significant lower than for higher tonnage vessels.

Loaded barges would be towed out to moored vessels, approximately 2 kms offshore. Vessels would be moored to a single point mooring in relatively deep water. The barges would be self-discharging and by means of an excavator system would load directly into the ships' holds. While discharging, a second barge would be loading at shore to be ready to be towed out when the first barge had discharged.

Barges of about 8,000 to 12,000 tonne capacity could be considered. Discharge rates up to 2,000 tonnes per hour are achievable.

Aztec has suggested a short-term rapid-construction option would be to redevelop the current facility at Moores Landing, Streaky Bay. Barges would be loaded at relatively high unit rates and either towed or use their own power out to waiting vessels. These would need to unload the barges using their own gear. Aztec has estimated the facility upgrade would cost $0.43 million and 5,000 tonne second hand barges $0.85 million each. No doubt various short-term rental arrangements could be obtained.

Lighterage is used in a number of locations in Australia and overseas, e.g. Cape Flattery in Queensland commenced operations this way and a lead/zinc operation in WA is adopting a similar system. Self-discharging barges are also commonly in use. Such barges have also been considered for trans-shipment of grain between ports in South Australia.

There are a number of operating risks associated with the system in addition to those applying to the system described in Section 7.3. The bad weather risks are higher, as severe weather would prevent operations. In addition, swell is a very important issue as it can give rise to different oscillation periods in the ship and barge. However, it should be stressed that the system is not unproven. It might prove suitable for the initial period of operation at lower annual tonnages if suitable commercial arrangements could be achieved and if no significant infrastructure inefficiencies were introduced.

SBDC has obtained an indicative barging cost of $3.50 to $4.50/tonne on the basis of a long-term lighterage system using self-discharging barges. The quote was provided by a South Australian company, Gulf Grain, which has been attempting to introduce a system for grain handling in South Australia. The price should be treated with some caution, as there has been a palpable lack of detail in the discussions to date.

The concepts should be further considered during the feasibility study.

7.5 Shipping Costs

SBDC has obtained detailed shipping budget costs through Tennant Limited. The rates were obtained from Western Bulk Carriers, which undertakes a significant amount of bulk cargo shipping from Australia to Asian ports. These shipping rates have been used to determine FOB prices which would achieve market acceptable delivered gypsum prices into various Asian destinations.

All rates are based on 40,000 tonne vessels with +/- 10% tolerance on loads. Load rates of 1,000 tph have been assumed to equate to 20,000 tpd to allow for ship movements to load each hold. The loader is self-trimming. Discharge rates have been assumed at 5,000 tpd using shore based grabs.

Freight Rates (US$/tonne)

Single Destination

Japan - Yokohama/Kobe	US$17.00
Korea - Busan	US$17.00
Indonesia - Jakarta/Surabaya	US$13.75
Malaysia - Pt Kelang	US$14.75

Two Port Discharge

Japan and Korea	US$18.50
Indonesia (Jakarta and Surabaya)	US$15.75
Indonesia and Malaysia	US$16.50

Potential customers have limitations on stockpile capacities at their plants and also wish to avoid excess working capital levels. Accordingly, this pre-feasibility study has used shipping rates based on two port discharge.

A key freight rate for comparing Sceale Bay's competitive position is from Thailand to Japan. This shipping route is handled by a large range of vessels and relatively small tonnages are economically and commonly carried. An indicative rate is US$10/tonne. This figure has been used for determining competitive FOB costs at Sceale Bay. For comparison purposes, indicative shipping costs of US$20/tonne have been obtained from Mexico to Japan.

Current Australian and trans-Tasman shipping rate estimates for 25,000 tonne cargoes are:-

	A$/tonne
Sydney	22
Melbourne	18
Auckland	29

8. MARKETING

8.1 Gypsum Markets

The primary market for gypsum is manufacture of plasterboard, which has been estimated to consume up to 95% of the world's annual production of natural gypsum of around 100 million tonnes. Plasterboard competes with a number of other board products in various applications such as fibre cement, fibre based boards, etc.

The second most common use of gypsum is in cement where it acts as a setting retardant. In both applications, but particularly in cement, natural gypsum competes with by-product gypsum which is derived from a number of industrial processes such as the manufacture of phosphoric acid, power station flue gas desulphurisation (FGD) treatment, etc. There are environmental/OH&S concerns with the use of by-product gypsum in plasterboard.

Low quality gypsums are also used for soil treatment.

Because gypsum is a relatively low value, high bulk commodity with a worldwide distribution of deposits, international trade forms a relatively small proportion of production, around 18%. Further, trading tends to be on a relatively local or regional level.

Typical product specification requirements for plaster and cement usage are set out below:-

		Plaster Use	Cement Use
Gypsum purity (%)		92 - 96	90 - 95 (but more flexibility than for plaster)
Sodium Chloride (%)		0.01 - 0.03 max.	0.2 - 0.4 max.
Free Water (%)		6 max.	3 max.
Sizing:-	top size	below 50mm	75mm
	- 12 - 25mm	20% max.	
	- 2.4 - 12mm	20% min.	
	- + 150 micron	70% min.	90% min.

Plaster markets have tight specifications because of the complexity of the manufacturing process and the performance requirements of the plasterboard. Consistency of product is essential.

SBDC commissioned CSIRO to conduct calcination of samples of Sceale Bay gypsum. In general the gypsum samples either met or were assessed to have the potential to meet the requirements for making casting plasters under the requirements of AS2592 Australian Standard. AS2592 sets out performance criteria for Gypsum Plaster for Building Purposes. At a later stage it will be necessary to conduct tests on the manufacture of plasterboard.

A sample of the same material used in the CSIRO tests was supplied to a Japanese plasterboard manufacturer. The conclusion reached by the manufacturer was that the gypsum could meet its requirements for the use of the gypsum in the manufacture of board with the exception of chloride content. The test evaluated fineness, pH, water requirements, strength, setting time, bonding, etc. SBDC proposes to reduce chloride levels through stockpile leaching.

8.2 Australasian Market - Demand

The Australasian market for gypsum is dominated by the plasterboard industry. In Australia the plasterboard market is almost entirely supplied by CSR, Boral and Pioneer. Pioneer entered the market about four years ago in a 60/40 joint venture with Lafarge, a substantial international building materials company with plasterboard activities. The sole domestic New Zealand plasterboard manufacturer is Winstone Wallboards, a subsidiary of Fletcher Challenge.

There is no significant trans-Tasman plasterboard trade. There are low levels of imports to both countries from South East Asia. Occasional reports of new entrants to the local market have, so far, not eventuated. The barriers to entry are very significant. The board companies have strong ties with/ownership of the board distributors and installers thus preventing easy entry without establishing a new distribution chain. Pioneer established its own Plastamasta franchise chain as part of its market entry. The manufacturers have significant excess production capacity and the market is not seen as having high growth. This also provides a strong position for resisting new entrants.

The estimated capacities and gypsum requirements of the plasterboard companies are set out below.

	Board Capacity (million m^2)	Gypsum Usage	Plant Locations (tpa)
CSR)	75 (est.) (CSR and Boral combined)		Sydney, Melbourne, Brisbane
Boral)			Sydney, Melbourne, Brisbane, Adelaide
Pioneer	25	160,000	Sydney, Melbourne
Total Australia	**100 (est.)**		

Winstone (Fletcher Challenge)	36	150,000	Auckland, Christchurch

There is some supply of product between the companies. For example, CSR supplies cornices, mouldings, etc. to Pioneer.

The Australasian cement industry has a few participants and joint ownership arrangements additional to those in the plasterboard industry. The industry ownership, capacity and gypsum usage is set out below. Typically the cement industry adds gypsum at a ratio of 3% to 5% of total production.

	Cement Capacity (tpa)	**Gypsum** [1, 2] **Usage** (tpa)	**Plant Locations**
Australia			
Australian Cement Holdings (50/50 CSR/Pioneer)	1,450,000	72,000 (est.)	Tasmania, Kandos NSW
Blue Circle Southern Cement (Boral)	2,000,000	100,000 (est.)	Waurn Pond VIC, Berrima NSW
Adelaide Brighton Limited:			
- Northern Cement	200,000	6,000	Darwin NT
- Sunstate Cement (ABL 50%, Boral 50%)	1,000,000	30,000 (est.)	Brisbane
Adelaide Brighton Cement Ltd (ABL 51%/Australian Cement Holdings 49%)	1,700,000	70,000	Adelaide SA, Angaston SA, Geelong VIC, Swan WA
Queensland Cement & Lime (Holderbank)	1,700,000	70,000	Brisbane, Gladstone
Total Australia	**8,050,000**	**348,000**	
New Zealand			
Golden Bay Cement (Fletcher Challenge)	400,000	20,000	
Milburn (50% Holderbank)	340,000	17,000	
Total New Zealand	**740,000**	**37,000**	

Notes:

(1) The figures above are based on 5% gypsum usage where actual figures are not known.

(2) Gypsum usage at full capacity. Current utilisation is 80% - 85%, or around 6.4 mt.

8.3 Australasian Market - Supply

The major domestic gypsum supplier is Gypsum Resources Australia (GRA), a joint venture company of CSR and Boral. The joint venture comprises the gypsum leases at Lake McDonnell, about 60kms from Ceduna in South Australia, the Lake McDonnell to Thevenard railway, operated by Australian National, and gypsum storage and reclaim facilities at Thevenard of 160,000 tonnes. Boral manages the mining activities, CSR manages the shipping, generally using self-discharging vessels which transport gypsum (and other products) to Australia and New Zealand.

GRA currently supplies all of CSR, Boral, Pioneer and Winstone's gypsum requirements, with the balance exported. Pioneer initially purchased Thai gypsum before switching to GRA in 1995. GRA has indicated it does not have additional contractual supply capacity. GRA mines approximately 1.3 mtpa. It is estimated about 700,000 tonnes are used for Australian plasterboard manufacture, 350,000 tonnes are used in Australian cement manufacture and about 150,000 tonnes are exported, mainly to New Zealand.

The GRA resource has similar characteristics to Sceale Bay. It is a salt lake near the coast and the run of mine gypsum has NaCl levels which need to be reduced to produce saleable product. The leaching requirement for producing plaster grade material is about three to four years.

There are some other, small, operations and resources in South Australia. These are listed in Attachment 3.

In Western Australia there are some small gypsum producers and a local board manufacturer, HB Brady & Co. Currently total gypsum production is around 100,000 to 200,000 tonnes. Significantly higher tonnages were produced in the 1980s. GRA gypsum does not seem to be transported to WA. Prima Resources NL has tried to develop a large (90mt +) gypsum deposit north of Lake MacLeod, but now seems to have withdrawn.

Dampier Salt, a subsidiary of CRA, has now developed the Lake MacLeod gypsum project as an adjunct to its salt business at the lake. The project's capacity is estimated at 1.5 mtpa, salt production is of the same amount. Gypsum shipments are due to commence in July 1997. The reserves are substantially in excess of 300 mt. Dampier Salt has a deep water port already in operation at Cape Cuvier, 25kms distance. Ships up to 75,000 tonnes are loaded at a rate of 2,000 tph.

Lake MacLeod run-of-mine gypsum has high levels of NaCl. A high capital cost process is used involving washing with artesian water followed by washing with desalinated water. Cyclones are used to de-water the gypsum. The process allows a production cycle of six months. The project is capable of rapidly increasing production levels from the current planned levels.

The gypsum is described as suitable for wallboard and cement manufacture. It is understood that Dampier has entered supply contracts with Yoshino Gypsum, the largest Japanese board manufacturer, for 600,000 tpa and for 400,000 tpa to the cement industry. The Yoshino Gypsum supply is through Nissho-Iwai, a 10% shareholder in Dampier. The cement supply is through Kuksai. Both arrangements are, apparently, exclusive distributorships.

The project is targeted towards the Asian region. Lake MacLeod seems to be unlikely to seek to supply Australasian customers owing to their relatively small shipment sizes, the scale of the project and transport costs from WA.

In South Australia and Western Australia there are a number of very small, privately owned gypsum mines which supply local agricultural markets.

8.4 Australasian Market - Sceale Bay

The portion of the Australasian market which is not owned or controlled by CSR and Boral is potentially available for supply from Sceale Bay. The demand figures are set out below.

	Gypsum (000's tonnes)
Plasterboard:	
• Pioneer	160,000
• Winstone	150,000
Total Plasterboard	310,000
Cement:	
• QCL	70,000
• Golden Bay	20,000
• Milburn	17,000
Total Cement	107,000
Total	417,000

From an Australian customer's perspective, the relative advantages and disadvantages of supply from Sceale Bay compared to GRA are:-

Advantages

- supply independent from business competitor; and
- maintains higher level of supply competition;

Disadvantages

- not a proven supplier;
- significant delay for ship loading construction and leaching of initial product;
- risk of supply failure if business fails;
- GRA secure while it continues to supply its owners;
- GRA offers smaller more frequent deliveries, lower working capital; and
- GRA offers access to convenient wharves (some locations).

The above customers are supplied under term contracts by GRA. Although GRA's primary objective is to supply CSR and Boral's own gypsum requirements, there can be little doubt that GRA would make strong efforts to retain the business. GRA does have the incumbent's market advantage. Loss of all or a large proportion of the above business would require GRA to either scale back operations and raise unit costs or attempt to secure export markets.

GRA's economics are affected by:-

- an established operation;
- economies of scale;
- transport infrastructure depreciated;
- stockpiles of leaching material;
- own transport arrangements;
- shared shipping costs; and
- relatively small shipment sizes.

GRA has recently commissioned a new excavator at Lake McDonnell which will mine rock gypsum without the need for drilling and blasting. GRA intends to increase production levels with the new equipment. Following a three year leaching period, sales should increase in the year 2000 by around 250,000 tpa.

8.5 International Markets

SBDC has not conducted a study of the international market for gypsum, its projected supply and demand, and pricing.

For the purposes of this pre-feasibility study it is assumed that:-

- all SBDC saleable gypsum produced in excess of that supplied to Australasian markets will be exported;
- SBDC gypsum exported will be sold in South East Asian markets; and
- export gypsum will, on average, be priced at approximately US$1 below the current CIF price of Thai gypsum delivered to the same markets. (Note: This excludes the effect of the announced increase of US$2/tonne from 1998.)

The basis for these assumptions is that, when traded, gypsum is generally traded on a regional basis and, within South East Asia, Thailand is the dominant gypsum supplier.

Since the early 1990s the Thai gypsum industry has undergone significant change. Thailand has introduced a series of controls over the mining, export and pricing of gypsum, as well as incentives for domestic use of gypsum. As a result, the export FOB price of gypsum has increased from around US$12.50/tonne in 1994 to US$17/tonne currently. A further increase to US$19/tonne in 1998 has been announced. Export tonnages are currently around 4.5 million tonnes p.a. out of a total production of 6 million tonnes.

Within South East Asia these moves are placing considerable pressure on plasterboard manufacturers to secure alternative long-term supplies. This pressure is understood to be reinforced by continuing high levels of GDP growth leading to strong domestic construction and increased penetration of plasterboard usage. During the feasibility study these factors will require study.

Two recent examples of manufacturers moving to secure supply are the purchase contract between Yoshino Gypsum and Lake MacLeod and Chiyoda Ute's decision to take a trial shipment of Mexican gypsum.

9. FINANCIAL AND ECONOMIC EVALUATION

9.1 Key Assumptions

Financial and economic projections have been prepared for the Sceale Bay gypsum project. The projections have been based upon the data and assumptions largely detailed elsewhere in this report. However, for ease of reference the key assumptions and their rationale are noted below. It is important to note that a number of key assumptions, in particular those relating to gypsum sales and marketing, will require considerable additional work during the feasibility study in order to provide firm justification. Where uncertainty exists the overall thrust of the assumptions is to be conservative.

Project Element	Assumption, Rationale and Comments
Valuation Basis	Constant 1997 dollar values, no escalation of costs or prices.
Finance	All evaluation is ungeared to provide a clear indication of project economics. Project would be able to sustain a level of gearing which would improve financial efficiency and returns on equity.
Timing	Project feasibility study, statutory approvals, financing, etc. completed during 1997/98. Mining commences in 1998/99. Ship loader construction commences in 1998/99, is completed in 18 months ready for use at the start of Year 2000 when sales commence. Fast-tracking should allow start of construction to be delayed.
Production	Timed to co-ordinate with leaching requirements and ship loader timing. During feasibility cost/benefit of earlier shipping of dune material will need consideration.
Production Levels	Initial rate of 2 mtpa in 1998/99 and 1999/00, declining to 1 mtpa thereafter. Dune production rates commence at 250,000 tpa, achieve 500,000 tpa and cease in 2003/04. Production planning of dune and lake gypsum will be optimised during feasibility study. Additional dune resource available from southern area.

Leaching Time	On average 3½ years of leaching has been assumed for lake gypsum, ensuring exposure to three winter seasons. Dune gypsum is assumed not to require leaching, but will in the initial two years receive one year leaching as a result of the need to prepare stockpiles. Sales to the cement market will permit reduced leaching time for some material and so lengthen the available leaching period for the balance. Blending will be addressed during the feasibility study.
Sales Prices (FOB Sceale Bay)	
• Australasian plasterboard	Based on A$30/tonne CIF Eastern Australia (Pioneer target cost), less estimated domestic freight rate, giving A$12/tonne.
• Australasian cement	Based on QCL pricing data A$15/tonne.
• Export plasterboard	Derived from CIF Japan cost US$30/tonne for Thai gypsum. Using two port discharge freight rates, FOB rates derived. Projected US$2/tonne increase in Thai price not included.
• Export cement	Discount from plasterboard of US$2/tonne - requires further market research.
Sales Volumes	Conservative assumptions have been adopted in regard to sales penetration in Australasia and sales mix in South East Asia.
• Australasian plasterboard	Sales level 100,000 tpa assumes only one third of non-aligned market is penetrated at current pricing. As there are corporate relations between cement and plasterboard producers, there is upside on supply to the plasterboard market.
• Australasian cement	Sales level 100,000 tpa based on available non-aligned market.

• Export plasterboard	400,00 tpa to South East Asian markets spread evenly in Japan, Malaysia and Indonesia.
• Export cement	Commencing at 250,000 tpa and developing to 500,000 tpa in South East Asia.
Capital Costs	Mining and road infrastructure as proposed by Brambles. Opportunities exist to defer some expenditure and reduce general level. Ship loading facility costs as advised by Aztec and adjusted for small double counting error. Assumptions made that work boat cost may be reduced from Aztec estimate. Site services are assumed to be covered by State assistance. Substantial contingencies included and reductions should be identified during feasibility study.
Operating Costs	Mining and stockpiling costs as estimated by Brambles and include capital charge for equipment and site area. No provision is made for crushing and/or screening. Stockpile load-out, haulage to ship loader stockpile, emplacement and reclaim as estimated by Ceduna Bulkhaul. Ship loader operation cost as estimated by Brambles and Aztec. Road maintenance cost estimated by SBDC based on Brambles' data. Management, marketing and administration costs estimated by SBDC.
Exchange Rate	US$/A$ rate 0.75 constant.
Taxation	Constant company tax rate of 36% with no change to current tax loss carry forward provisions.
Project Duration and Terminal Value	The evaluation has been conducted over a 15 year period. In the initial two years, feasibility and construction work is conducted. Sales commence in year three

	(1999/00) and achieve full rate in year five (2001/02). A terminal value has been included equal to approximately three times the final year's discounted cash flow.
Discount Rate	A base case after tax discount rate of 12% has been incorporated.

9.2 Financial and Economic Projections

A base case financial model has been run using the assumptions outlined above. It is included as Attachment 6.

The main results are:-

DISCOUNT RATE	**12% ($m)**	**8% ($m)**	**10% ($m)**	**15% ($m)**
NPV	7.1	16.5	11.3	2.3
IRR	16.8%			

The project's average unit costs at full production are projected as follows:-

	$/t	
• Excavation, transport and loading	5.44	
• Management, administration and contingency	1.17	
Sub-total Cash Costs	6.61	
• Depreciation	1.77	
Total Unit Costs	**$8.37**	**per tonne**

Average unit revenue is projected at $15.50, giving a profit contribution before tax and interest of $7.13/tonne.

9.3 Project Sensitivities

A series of variations have been run from the base case to illustrate the project's sensitivities or exposure to alternative key assumptions. The summarised results are set out below:-

Sensitivity Case		NPV @ 12% $m	Change from Base $m	IRR %
BASE		7.1	-	16.8
Leaching time increased by 1 year		4.8	(2.3)	15.1
Sales Prices				
Export Prices	+ US$1/t	10.7	3.6	19.0
	- US$1/t	3.5	(3.6)	14.4
Australasian Prices	+ A$1/t	7.8	0.7	17.2
	- A$1/t	6.4	(0.7)	16.4
Exchange Rate US$/A$	0.70	10.2	3.1	18.7
	0.80	4.4	(2.7)	15.0
Production and Sales Tonnages				
+ 10%		9.7	2.6	18.2
- 10%		4.5	(2.6)	15.2
Capital Costs				
+ 10%		5.7	(1.4)	15.6
- 10%		8.5	1.4	18.0
Operating Costs				
+ 10%		4.0	(3.1)	14.7
- 10%		10.2	3.1	18.9

10. RISKS AND PROJECT COMPETITIVENESS

10.1 Key Project Risks

The key project risk areas identified during the pre-feasibility study are summarised in the following tables. They focus on project specific issues, rather than project management risks generally applicable to most development projects.
The risk rating is a subjective assessment of the uncertainty associated with the issue and its potential project impact. A ranking of 1 is low and 5 is high.

Risk Area	Issues, Impact and Rank	Risk Management
1. Ship loading Construction		
• Sea-bed conditions	• geotechnical difficulties 3 ⇒ could significantly increase piling and costs	• to be addressed at design stage
• Feasibility of swamp moorings and general design parameters	• relates to forces to be withstood 5 ⇒ reduce costs significantly	• preliminary wave study conducted
• Proximity and extent of adequate depths	• increase jetty length 2 ⇒ construction cost • adequacy of ship turning area 2 ⇒ extend jetty, relocate or need tugs	• preliminary berthing and mooring study conducted • preliminary depth survey conducted • further work at design stage
• Optimum location	• little data available 3 ⇒ could significantly increase costs ⇒ better site could be available	• possible sites very limited and easily reviewed against key criteria • conduct further work at design stage
• Weather during construction	• delayed construction 4 ⇒ increased costs ⇒ delay to first shipments	
2. Land and Lease		
• Native title	• uncertainty on extinguishment by Crown leases 2 • claim made over mine site and ship-loading site 4 ⇒ potential lengthy delays for negotiation ⇒ risk of unrealistic compensation claims	• Wik resolution may assist in clarifying land status • could involve Government in getting ship loading agreed • relatively small area involved and no local aborigines • need to treat as critical path issue • likely strong Government support

Risk Area	Issues, Impact and Rank	Risk Management
• Access to product stockpile site	• land owner at load site understood to be opposed 2 ⇒ may need compulsory acquisition ⇒ may delay construction/shipping	• establish contact with land owner • establish relations with council and state government
• Land access/rental/compensation agreements	• need to negotiate for access 2 ⇒ cost ⇒ delay	• establish relations with lease holders • seek Government assistance
• Mining lease	• environmental opposition to load site and stockpile site 3 • Government delays, additional 3 conditions and test results needed	• liaise with Government as soon as possible
• Public road access	• environmental 1 ⇒ restrictions on use	• seek road upgrade by Government
• Environmental management		
3. Resource		
• Quantity and quality	• significant variation from 2 exploration results	• detailed geological investigations and analysis
• Ongoing	• significant changes to gypsum 3 ore body during mining from rising salt water table	• quality managed through leaching
4. Operations - Mine Site		
• Mining	• insufficient local labour 1 ⇒ cost pressures • operating problems during wet 2 periods ⇒ timing delays, need for large stocks, possible stock-outs • unexpected level and ongoing 1 nature of repairs to public access and mine site roads • unsuitable operating equipment due to untested mining conditions 2 ⇒ cost and delay • delays to initial mining/stockpiling from poor weather 1 • poorly performing mining 1 contractor	• use of contractor • detailed mine planning and experienced contractor • as above • good selection process and management

Risk Area	Issues, Impact and Rank	Risk Management
• Crushing	• crushing and/or screening could be required **4** ⇒ increased operating costs ⇒ additional logistic complexities	• detailed mine planning • further geological assessment
• Stockpiling	• incorrect design **3** ⇒ poor leaching times ⇒ collapse ⇒ additional holding costs • stockpile site selection **4** ⇒ drainage - process and performance ⇒ risk of capillary action	• detailed leaching test work • mine survey and leach study • detailed test work and base preparation
• Leaching	• low/variable rainfall (particularly in early years **5** ⇒ extended leach time ⇒ contract supply problems ⇒ cash flow delays ⇒ reduced permeability • resource variation within stockpiles ⇒ variable leaching performance **2** • insufficient leaching data/ inaccurate analytical results **5** ⇒ underestimate leaching time ⇒ inaccurate saleable product estimates	• evaluate sea water leaching • use of dune gypsum • consider chemical additives • detailed resource investigation • mine operations • detailed chemical analysis • long-term trial stockpile monitoring
5. Operations - Loading Site		
• Weather/winds and storms	• area is prone to bad weather, storms, high winds, swell **5** ⇒ mooring and ship loading could be delayed ⇒ risk of damage to jetty facilities ⇒ pressure to provide tug service - high capital and operating costs	• conduct detailed weather, mooring and berthing studies • preliminary studies conducted

Risk Area	Issues, Impact and Rank	Risk Management
• Need for tug assistance	• tug use conventional, especially for large vessels 4 ⇒ pressure for tug assistance • difficult/constrained berthing/ turning area 2 ⇒ pressure for tug assistance • lack of tugs for mooring 4 ⇒ risk of jetty damage passed to jetty owner ⇒ cost or availability of jetty insurance ⇒ higher delays and demurrage costs ⇒ premium incorporated in shipping cost ⇒ requires conditions suitable for use of anchor ⇒ higher vessel insurance costs reflected in freight rates	• ensure mooring provides good access and turning areas • need detailed analysis of conditions • further sea bed condition studies
6. Market		
• Sales contracts	• need long-term sales contracts 5 ⇒ output increasing as leached product available ⇒ vertical integration barrier to new entrants ⇒ infrastructure cost needs committed tonnage to justify ⇒ long-term contract opportunities will take time to emerge • avoid dependency on few customers 3 ⇒ vulnerable to contract renegotiation ⇒ exposed because of high capital investment	• seek base committed tonnage from co-venturer • focus on strategic benefits of diversified supply • consider barge/lighterage as initial development • seek spread of customers • seek spread of markets • seek spread of contract terms
• Sales price	• price volatility 5 • change in Thai pricing and market controls 5	• maximise long term contracts • focus on non-aligned Australasian markets
• Shipping freight costs	• shipping is largest cost item 3 ⇒ project exposed to movements in freight rates ⇒ no bunkerage at Sceale Bay, but not seen as competitive disadvantage	• customers to seek long-term freight contracts • regular deliveries would reduce risk of volatility • seek opportunities for two-way vessel utilisation

Risk Area	Issues, Impact and Risk	Risk Management
• Increase in gypsum supply	• change in Thai export controls 5 • new competitive supply sources, e.g. China 4 • significant increases to Lake McDonnell and/or Lake MacLeod production levels 3 • SA Government undertakes expenditure commitment to upgrade Thevenard loading capabilities 1	• maximise long term contracts • seek customer equity participation • Lake MacLeod has distance and scale barriers for local markets • ensure good SBDC knowledge of grain industry
• Gypsum demand	• introduction of alternative products 2 • local cement market vulnerable to clinker imports 3 • GDP growth in target markets 3 • new technology; improvements in application of chemical gypsum, i.e. lower traded natural gypsum 3 • project exposed to plasterboard and cement demand 5	• need to conduct detailed international market study during design stage
• Sceale Bay physical/chemical properties differ from market preferred	5	• conduct detailed testing work

Market risks are the most significant because:-

- they are influenced by issues outside managerial control; and
- the project is economically more vulnerable than many other gypsum projects.

The issues requiring particular attention relate to:-

- the gypsum market is strongly influenced by Thai government controls over mining licences, export licences, export pricing and policy for increasing domestic value added through domestic plasterboard manufacture;
- government controls tend to be unsustainable if they seek to manipulate markets significantly away from their "natural" positions and/or if they lead to structural changes in markets;

- Thai gypsum controls will be under pressure in Asian markets because of their impact on domestic plasterboard producers and prices;
- additional sources of supply will emerge if high prices are sustained; and
- there is the potential for supply to emerge from China and this may be at artificially competitive prices.

A significant proportion of the project's sales will be targeted at the non-aligned Australasian market. This represents approximately 30% of GRA's sales and will produce a vigorous competitive response. A careful entry strategy will need to be developed, perhaps targeting the customers of lowest significance to GRA, to establish a foothold and a reputation. However, the response to new entrants by Australian building materials oligopolies has always been based on price competition and a determination to maintain volume.

These factors combined with Sceale Bay's competitive position lead to:-

- the need to secure strategic/equity relationships with customers;
- the requirement for the project to be backed by long term take or pay type sales contracts with formula based pricing; and
- the need to focus on a full-service approach to domestic customers, emphasising SBDC's strategic benefits.

10.2 Project Competitiveness

Low value added commodity projects depend upon being low cost producers. With no product differentiation, Sceale Bay's gypsum delivered costs must be competitive and robust enough to withstand the inevitable fluctuations in market pricing.

The need for low cost positioning is reinforced by the highly competitive markets for plasterboard and cement. Particularly in the case of plasterboard, as demand grows new entrants will be attracted and production efficiencies will be vigorously sought.

This study has not addressed the project's cost ranking. It will be necessary to do this during a full feasibility study. However, a number of issues will adversely impact on Sceale Bay in respect to Asian markets.

1. As a new entrant, SBDC will need to displace current suppliers as well as seek new markets.
2. The project's location leads to relatively high shipping costs and the need to ship in large quantities to minimise freight rates.

3. Freight rates may be as high as 50% to 70% of CIF value. It is unlikely that freight rates will be significantly reduced on a sustained basis over the life of the project.

4. The project requires significant infrastructure development. The project's economics require the cost to be amortised over a large tonnage. This will make the project vulnerable in negotiations for contract extensions, take-up of tonnage options, etc.

5. Owing to the gypsum's run-of-mine salt levels, stockpiling/leaching is assumed to be required for three years. This represents a significant working capital investment, especially in the early years. At a hurdle rate of 12% after tax (18.75% before tax), an additional 18.75% of "cost" is added each year to the cost of mining and stockpiling.

As noted in Section 8, Australasia will be a key target market for SBDC, perhaps accounting for 400,000 tpa or 40% of sales. In the initial years a lower tonnage will be achievable.

SBDC's competitive position in Australasia differs significantly from its Asian position in the following respects:-

1. Customers will see strategic benefits in obtaining supply from an independent supplier who is not competitive with their businesses.

2. GRA at Lake McDonnell has higher land transport costs to get product to the port. GRA's gypsum is railed to Thevenard at an estimated cost of $3.60/tonne, although rates below this level should be achievable. Reclaim and ship loading costs are estimated by ConAust to be in the range of $3.45 - $3.85/tonne, although it is likely they are lower. Total ex-mine costs of $6.00 - $7.00/tonne should be achievable for GRA, although current costs are likely to be higher.

3. CSR has its own vessels for shipping gypsum to Sydney, Melbourne and New Zealand. It is able to deliver to its own wharf in Melbourne. In making deliveries to Sydney and Melbourne, cargoes can be split between the three plasterboard manufacturers, thus reducing raw materials holding costs and increasing supply flexibility. With a relatively frequent shipping schedule, supply risk is reduced and the possibility increased of customers assisting each other in case of supply difficulties.

4. Australian coastal shipping rates are internationally uncompetitive. There is some prospect of rate reductions over the medium-term as shipping structural reform is implemented.

11. NEXT STEPS

This pre-feasibility study of the Sceale Bay gypsum project has indicated the potential viability of the project. In order to add further value to the project, a series of tasks will need to be undertaken focussing on the current key risk areas of:-

- market;
- ship loading infrastructure cost;
- resource; and
- leaching and quality.

Detailed feasibility activities would be required to remove uncertainties in these areas. In view of the significant costs of the feasibility work at the need to start to secure a market position for the project, it is recommended that SBDC seeks a senior gypsum industry related partner to manage the technical and industry related aspects of the project. A structured project marketing activity will be required to achieve this:-

- identify potential partners and their potential levels and types of interest in the project, focus on those with a perceived strategic rationale for involvement, e.g. resource security;
- prepare a summary marketing document for the project; and
- approach the identified target companies and seek their potential levels of interest.

The time required to successfully achieve an agreement could be in excess of six months. Large, capital intensive organisations are slow decision makers. Their speed is further reduced if the project involves geographic risk for them. Accordingly, to maximise the chances of early success a structured approach is essential and a number of organisations needs to be approached simultaneously.

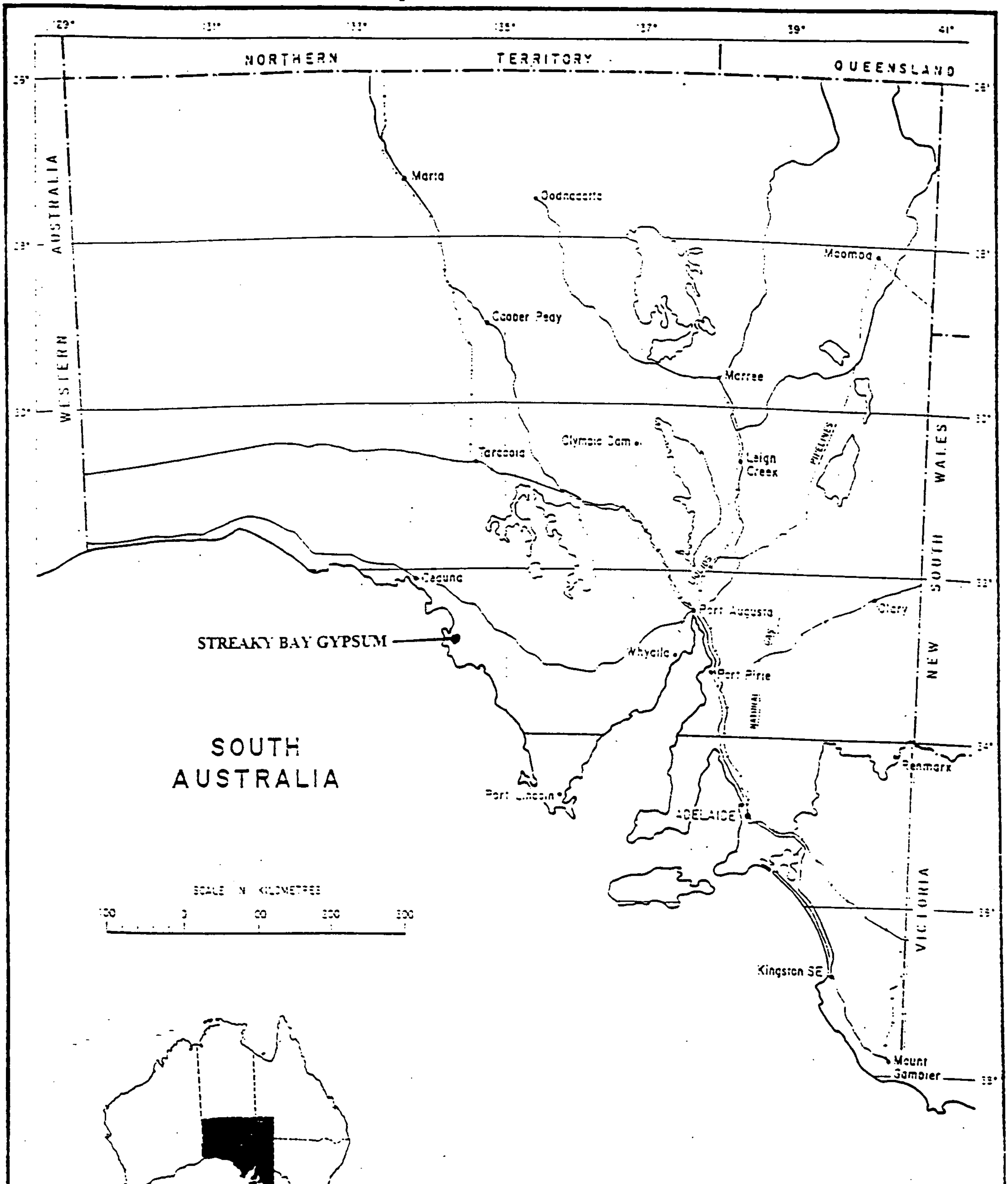
Simultaneously with the marketing program a relatively modest program should be considered which focuses on the key project risk areas. These could include, for example, some further expenditure on the shiploader to try to identify areas of significant cost savings. Other activities would include continuation of a leach testing program, commencement of Native Title discussions and exploration of areas of government project facilitation.

LIST OF ATTACHMENTS

Attachment 1	Map of South Australia
Attachment 2	Map of Sceale Bay site and land holdings
Attachment 3	List of gypsum operations in South Australia
Attachment 4	Olliver Geological Services Resource Report - AVAILABLE ON REQUEST
Attachment 5	Results of Analysis of Lake Gypsum
Attachment 6	Aztec Analysis Report on Proposed Gypsum Loading Facility AVAILABLE ON REQUEST
Attachment 7	Base Case Financial Model
Attachment 8	Gypsum Process Diagram
Attachment 9	Summary of Shiploader cost Estimate

ATTACHMENT 1

Map of South Australia



STREAKY BAY GYPSUM

LOCALITY PLAN
SOUTH AUSTRALIA

FIG 1

The Dreadnoughts
Dreadnought Lake
The Granites
Point Westall
Smooth Pool
Speed Point
Yanerby
Lake Larson
Yanerby Hill
AMEY CL526-84
AMEY CL527-94
AMEY CL528-3
AMEY 1437-77
SUBDIVIDED FOR SALE
KAMMERMAN CL527-53
KAMMERMAN CL526-83
KAMMERMAN
AREA A
22 mill tonnes
Av 2 3m thick
92 7% Gypsum
2 0% Salt
4 2% Carb
N SITE TONNES
Purdilla Island
Paddy's Lake
Lake Purdilla
Seagull Lake
AREA C
18 mill tonnes
Av 2 6m thick
87 0% Gypsum
2 3% Salt
8 9% Carb
S SITE ? 10 MILL TONNES
MINE SITE
7 mill tonnes
Av 3 0m thick
92 0% Gypsum
6.0% Carb
CW Cons Pk
Sceale Bay
AREA B
8 mill tonnes
Av 1.9m thick
83 6% Gypsum
2 1% Salt
13.0% Carb
AREA D
10 mill tonnes
Av 1 9m thick
85 9% Gypsum
2 3% Salt
10 7% Carb
Lake Toorna
0 1 2
km
STREAKY BAY GYPSUM
1 40 000
LAND TENURE
FIG

ATTACHMENT 3

Small Scale Gypsum Operations In South Australia

Location	Ownership	Details
Blanchetown	David Linke Contractor P/L	Production 60,000 tpa Reserves 10mt Supplies Adelaide Brighton Cement in SA with 30,000 tpa
Spider Lake	Boral (Waratah Gypsum P/L)	Low production, supplies Boral in Adelaide for plaster
Marion Lake Lake Fowler	Adelaide Brighton Cement Adelaide Brighton	
Bielemah (near Lake McDonnell)	Pioneer	Approx. 500,000 tonnes stockpiled for leaching. After 5 years salt is still too high. Pioneer does not seem to intend pursuing.
Cooke Plains	Paterson Bulk Transport	Agricultural use, 2 mt reserves.

ATTACHMENT 5

Results of Analysis of Lake Gypsum

Case	1 [(1)]	2 [(1)]	3 [(1)]	4 [(1) (2)]	5 [(1) (2)]
Source of Gypsum:	205 drill hole samples, from 65 drill holes not specifically drained	Five composites selected from north drill hole samples not specifically drained	Composite from trench, not specifically drained	Composite from trench, not specifically drained	Composite from trench stockpile, drained for two weeks
Analytical Method:	ALS Standard (acid soluble)	Water soluble	ALS Standard (acid analysis)	Water soluble	Water soluble
Gypsum %	92.2	93.8	95.5	95.2	93.0
NaCl %	2.05	1.89	1.08	1.37	1.69
KCl %	0.07	0.08	0.04		
$CaCo_3$ %	3.98	2.93	2.23		
$MgCo_3$ %	0.96	0.87	1.09		
Fe_2O_3 %	0.05	0.05	0.03		
Al_2O_3 %	0.04	0.04	0.05		

Notes:

(1) The above results are simple averages of individual analyses.

(2) These results have inconsistencies. Further samples over time will help to resolve.

CASE A
ASSUMPTIONS

PURPOSE
Financial forecasting of the SBDC project for internal planning purposes. All dollars are constant A$'000 unless specified

FINANCIAL ASSUMPTIONS

Price esc July '99	0%
Cost esc July '99	0%
US$/A$ Ex Rate	$0.75
Company Tax Rate	36%

ECONOMICS 15 Years

NPV 8%	16,477
NPV 12%	7,102
Payback	7.91
IRR	16.8%

SALES PRICES AND VOLUMES ASSUMPTIONS - CEMENT

	Japan(US$/t)	Malaysia(US$/t)	Indonesia (US$/t)	Australasia (A$/t)	Ex Lake	Ex Dune
FOB Price	$9.50	$11.50	$12.25	$15.00		
Year 1	0	0	0	0	0%	0%
Year 2	50,000	100,000	100,000	50,000	0%	100%
Year 3	100,000	150,000	150,000	100,000	0%	100%
Year 4	100,000	200,000	200,000	100,000	0%	100%
Year 5	100,000	200,000	200,000	100,000	0%	100%
Year 5+	100,000	200,000	200,000	100,000	100%	0%

SALES PRICES AND VOLUMES ASSUMPTIONS - PLASTER/BOARD

	Japan(US$/t)	Malaysia (US$/t)	Indonesia (US$/t)	Australasia (A$/t)	Ex Lake	Ex Dune
FOB Price	$11.50	$13.50	$14.25	$12.00		
Year 1	0	0	0	0	0%	0%
Year 2	0	0	0	0	0%	0%
Year 3	0	0	0	0	0%	0%
Year 4	100,000	100,000	100,000	100,000	100%	0%
Year 5	100,000	100,000	100,000	100,000	100%	0%
Year 5+	100,000	100,000	100,000	100,000	100%	0%

SHIPPING COST AND SIZE ASSUMPTIONS

	Japan(US$/t)	Malaysia (US$/t)	Indonesia (US$/t)	Australasia (A$/t)
Freight	$0.00	$0.00	$0.00	$0.00
Shipsize	25,000	35,000	40,000	20,000

PRODUCTION COST ASSUMPTIONS

	Mining Cost (A$/t)	Screen/Crushing Cost (A$/t)	Loading Cost (A$/t)	Haulage Cost (A$/t)	Unload Cost (A$/t)	Road Repair (A$/t)
Year 1	$1.90	$0.00	$0.00	$0.00	$0.00	$0.00
Year 2	$1.90	$0.00	$0.37	$1.80	$0.37	$0.10
Year 3	$2.70	$0.00	$0.37	$1.80	$0.37	$0.10
Year 4	$2.70	$0.00	$0.30	$1.80	$0.30	$0.10
Year 5	$2.70	$0.00	$0.30	$1.80	$0.30	$0.10
Year 5+	$2.70	$0.00	$0.30	$1.80	$0.30	$0.10

PRODUCTION ASSUMPTIONS

	Mining Rate (Tonnes/Hour)	Operating Hours (Hours/day)	Lake Operations (Days/Year)	Dune Operations (Days/Year)	Lake - Mined (Tonnes/Year)	Dune - Mined (Tonnes/Year)
Year 1	500	12.50	280	40	1,750,000	250,000
Year 2	500	12.50	280	40	1,750,000	250,000
Year 3	250	12.50	160	160	500,000	500,000
Year 4	250	12.50	160	160	500,000	500,000
Year 5	250	12.50	160	160	500,000	500,000
Year 5+	250	12.50	320	0	1,000,000	0

PRE DEVELOPMENT COSTS

Analysis	$50	1
Leach Work	$30	1
Market Samples	$50	1
Licence, EIS	$80	10
Feasibility Study	$250	10
Contingency	15.0%	10

DEVELOPMENT & CAPITAL COSTS (NOT DEPRECIABLE)

Land acqusition	$50	0

DEVELOPMENT & CAPITAL COSTS - MINE

Site Preparation	$0	10
Haulage Road	$400	10
Salt Water Pump	$0	10
Contingency	15.0%	10

DEVELOPMENT & CAPITAL COSTS - PORT

Design, Engineering	$1,000	10
Site Preparation	$396	10
Civil Works	$0	10
Sea/Reef Piling	$2,854	10
Steel/Walkways	$934	10
Dolphins/Fenders	$4,403	10
Workboat	$489	10
Loading Conveyors	$3,446	10
Construction Mgt	$3,757	10
Contingency	15.0%	10

MGMT, MARKETING & ADMIN COSTS

General Manager	$120
Marketing Manager	$80
Site Supervisor	$60
Accounts Person	$40
On Costs	$100
Couriers	$10
Computers	$5
Land lease, rates	$25
Legal/Accounting	$30
Vehicles	$60
Postage	$10
Print, Stationary	$20
Phone, Fax	$20
Consultants	$50
Insurance	$50
Travel	$100
Contingency	10.0%
Sample Analysis (A$/t)	$0.05
Royalty (A$/t)	$0.10

LOADING ASSUMPTIONS AND COSTS

Operating Expense/t	$0.35
Workboat Costs	$20
Jetty Maintenance	$75
5 Year Overhaul	$100

CASE A
SUMMARY

		1997/98 Year 0	1998/99 Year 1	1999/00 Year 2	2000/01 Year 3	2001/02 Year 4	2002/03 Year 5	2003/04 Year 6	2004/05 Year 7	2005/06 Year 8	2006/07 Year 9	2007/08 Year 10	2008/09 Year 11	2009/10 Year 12	2010/11 Year 13	2011/12 Year 14	15 Years
Gross revenue	A$'000	0	0	4,550	7,517	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	182,933
Operating costs	A$'000	0	4,658	5,695	5,223	6,653	6,653	6,753	6,653	6,653	6,653	6,653	6,753	6,653	6,653	6,653	88,959
Assets																	
Assets at beginning of period	A$'000	0	529	11,357	18,644	16,571	14,498	12,425	10,352	8,279	6,206	4,133	2,060	50	50	50	0
Capital expenditure	A$'000	529	11,021	9,361	0	0	0	0	0	0	0	0	0	0	0	0	20,910
Depreciation	A$'000	0	193	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,010	0	0	0	20,860
Assets at end of period	A$'000	529	11,357	18,644	16,571	14,498	12,425	10,352	8,279	6,206	4,133	2,060	50	50	50	50	50
ROM Stockpile Valuation	A$'000	0	3,800	7,030	8,494	8,782	9,011	9,459	9,820	10,113	10,349	10,539	10,693	10,818	10,918	10,999	10,999
Liabilities																	
Debt at start of period	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Current period borrowings	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest on Loan	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayments - Principal	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayments - Interest	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Debt at end of period	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Inflows																	
Equity	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borrowings	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Revenue	A$'000	0	0	4,550	7,517	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	182,933
Total Cash Inflows	A$'000	0	0	4,550	7,517	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	182,933
Cash Outflows																	
Capital expenditure	A$'000	529	11,021	9,361	0	0	0	0	0	0	0	0	0	0	0	0	20,910
Operating costs	A$'000	0	4,658	5,695	5,223	6,653	6,653	6,753	6,653	6,653	6,653	6,653	6,753	6,653	6,653	6,653	88,959
Debt servicing	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tax payable	A$'000	0	0	0	215	2,554	2,533	2,576	2,581	2,556	2,536	2,519	2,493	3,242	3,233	3,226	30,263
Proceeds (Net Cashflow)	A$'000	(529)	(15,679)	(10,506)	2,079	6,326	6,347	6,204	6,299	6,325	6,345	6,361	6,288	5,639	5,647	5,654	42,801
Total Cash Outflows	A$'000	0	0	4,550	7,517	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	182,933
Terminal Value	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11,308	11,308
Cashflows																	
Project Cashflow	A$'000	(529)	(15,679)	(10,506)	2,079	6,326	6,347	6,204	6,299	6,325	6,345	6,361	6,288	5,639	5,647	16,963	54,110
Cumulative Project Cashflow	A$'000	(529)	(16,208)	(26,713)	(24,634)	(18,308)	(11,961)	(5,756)	543	6,868	13,212	19,573	25,861	31,500	37,147	54,110	54,110
Payback	Yrs	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.91

Economics		0%	5%	8%	10%	12%	15%	20%	IRR
NPV 15 years	A$'000	54,110	26,744	16,477	11,291	7,102	2,248	(3,194)	20.7%

CASE A
CAPITAL COSTS

CAPITAL COSTS		1997/98 Year 0	1998/99 Year 1	1999/00 Year 2	2000/01 Year 3	2001/02 Year 4	2002/03 Year 5	2003/04 Year 6	2004/05 Year 7	2005/06 Year 8	2006/07 Year 9	2007/08 Year 10	2008/09 Year 11	2009/10 Year 12	2010/11 Year 13	2011/12 Year 14	15 Years
CAPITAL COSTS																	
Pre Development																	
Analysis	$A'000	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Leaching studies	$A'000	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
Market samples	$A'000	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Licence, EIS, legals	$A'000	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80
Feasibility Study	$A'000	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250
Contingency	$A'000	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69
Pre Development	$A'000	529	0	0	0	0	0	0	0	0	0	0	0	0	0	0	529
Non Depreciable																	
Land acquisition	$A'000	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Mine																	
Site Preparation	$A'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private Haulage Road	$A'000	0	400	0	0	0	0	0	0	0	0	0	0	0	0	0	400
Salt Water Pumping	$A'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contingency	$A'000	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0	60
Mine	$A'000	0	460	0	0	0	0	0	0	0	0	0	0	0	0	0	460
Port																	
Design, Engineering	$A'000	0	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0	1,000
Site Preparation	$A'000	0	198	198	0	0	0	0	0	0	0	0	0	0	0	0	396
Civil Works	$A'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sea/Reef Piling	$A'000	0	1,427	1,427	0	0	0	0	0	0	0	0	0	0	0	0	2,854
Steel/Walkways	$A'000	0	467	467	0	0	0	0	0	0	0	0	0	0	0	0	934
Dolphins/Fenders	$A'000	0	2,202	2,202	0	0	0	0	0	0	0	0	0	0	0	0	4,403
Workboat	$A'000	0	245	245	0	0	0	0	0	0	0	0	0	0	0	0	489
Loading Conveyors	$A'000	0	1,723	1,723	0	0	0	0	0	0	0	0	0	0	0	0	3,446
Construction Management	$A'000	0	1,878	1,878	0	0	0	0	0	0	0	0	0	0	0	0	3,757
Contingency	$A'000	0	1,371	1,221	0	0	0	0	0	0	0	0	0	0	0	0	2,592
Port	$A'000	0	10,511	9,361	0	0	0	0	0	0	0	0	0	0	0	0	19,871
Total Capital	$A'000	529	11,021	9,361	0	0	0	0	0	0	0	0	0	0	0	0	20,910
DEPRECIATION CALCULATIONS																	
Pre Development																	
Analysis	$A'000	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Leaching studies	$A'000	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	30
Market samples	$A'000	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Licence, EIS, legals	$A'000	0	8	8	8	8	8	8	8	8	8	8	0	0	0	0	80
Feasibility Study	$A'000	0	25	25	25	25	25	25	25	25	25	25	0	0	0	0	250
Contingency	$A'000	0	7	7	7	7	7	7	7	7	7	7	0	0	0	0	69
Pre Development	$A'000	0	170	40	40	40	40	40	40	40	40	40	0	0	0	0	529
Mine																	
Site Preparation	$A'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private Haulage Road	$A'000	0	20	40	40	40	40	40	40	40	40	40	20	0	0	0	400
Salt Water Pumping	$A'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contingency	$A'000	0	3	6	6	6	6	6	6	6	6	6	3	0	0	0	60
Mine	$A'000	0	23	46	46	46	46	46	46	46	46	46	23	0	0	0	460
Port																	
Design, Engineering	$A'000	0	0	100	100	100	100	100	100	100	100	100	100	0	0	0	1,000
Site Preparation	$A'000	0	0	40	40	40	40	40	40	40	40	40	40	0	0	0	396
Civil Works	$A'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sea/Reef Piling	$A'000	0	0	285	285	285	285	285	285	285	285	285	285	0	0	0	2,854
Steel/Walkways	$A'000	0	0	93	93	93	93	93	93	93	93	93	93	0	0	0	934
Dolphins/Fenders	$A'000	0	0	440	440	440	440	440	440	440	440	440	440	0	0	0	4,403
Workboat	$A'000	0	0	49	49	49	49	49	49	49	49	49	49	0	0	0	489
Loading Conveyors	$A'000	0	0	345	345	345	345	345	345	345	345	345	345	0	0	0	3,446
Construction Management	$A'000	0	0	376	376	376	376	376	376	376	376	376	376	0	0	0	3,757
Contingency	$A'000	0	0	259	259	259	259	259	259	259	259	259	259	0	0	0	2,592
Port	$A'000	0	0	1,987	1,987	1,987	1,987	1,987	1,987	1,987	1,987	1,987	1,987	0	0	0	19,871
Total Depreciation	$A'000	0	193	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,010	0	0	0	20,860
CLOSING WRITTEN DOWN VALUE																	
Pre Development																	
Analysis	$A'000	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leaching studies	$A'000	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Market samples	$A'000	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Licence, EIS, legals	$A'000	80	72	64	56	48	40	32	24	16	8	0	0	0	0	0	0
Feasibility Study	$A'000	250	225	200	175	150	125	100	75	50	25	0	0	0	0	0	0
Contingency	$A'000	69	62	55	48	41	35	28	21	14	7	0	0	0	0	0	0
Pre Development	$A'000	529	359	319	279	239	200	160	120	80	40	0	0	0	0	0	0
Mine																	
Site Preparation	$A'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private Haulage Road	$A'000	0	380	340	300	260	220	180	140	100	60	20	0	0	0	0	0
Salt Water Pumping	$A'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contingency	$A'000	0	57	51	45	39	33	27	21	15	9	3	0	0	0	0	0
Mine	$A'000	0	437	391	345	299	253	207	161	115	69	23	0	0	0	0	0
Port																	
Design, Engineering	$A'000	0	1,000	900	800	700	600	500	400	300	200	100	0	0	0	0	0
Site Preparation	$A'000	0	165	158	317	277	238	198	158	119	79	40	0	0	0	0	0
Civil Works	$A'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sea/Reef Piling	$A'000	0	1,189	1,142	2,283	1,998	1,712	1,427	1,142	856	571	285	0	0	0	0	0
Steel/Walkways	$A'000	0	389	374	747	654	560	467	374	280	187	93	0	0	0	0	0
Dolphins/Fenders	$A'000	0	1,835	1,761	3,523	3,082	2,642	2,202	1,761	1,321	881	440	0	0	0	0	0
Workboat	$A'000	0	204	196	391	342	294	245	196	147	98	49	0	0	0	0	0
Loading Conveyors	$A'000	0	1,436	1,379	2,757	2,412	2,068	1,723	1,379	1,034	689	345	0	0	0	0	0
Construction Management	$A'000	1,878	1,565	1,503	3,005	2,630	2,254	1,878	1,503	1,127	751	376	0	0	0	0	0
Contingency	$A'000	1,371	1,167	1,112	2,074	1,814	1,555	1,296	1,037	778	518	259	0	0	0	0	0
Port	$A'000	3,249	8,951	8,524	15,897	13,910	11,923	9,936	7,949	5,961	3,974	1,987	0	0	0	0	0
ROM Stockpile - Mine	$A'000	0	3,800	7,030	8,494	8,782	9,011	9,459	9,820	10,113	10,349	10,539	10,693	10,818	10,918	10,999	10,999
Total WDV	$A'000	3,778	13,547	16,264	25,016	23,231	21,386	19,761	18,050	16,269	14,432	12,549	10,693	10,818	10,918	10,999	10,999

CASE A
PRODUCTION

		1997/98 Year 0	1998/99 Year 1	1999/00 Year 2	2000/01 Year 3	2001/02 Year 4	2002/03 Year 5	2003/04 Year 6	2004/05 Year 7	2005/06 Year 8	2006/07 Year 9	2007/08 Year 10	2008/09 Year 11	2009/10 Year 12	2010/11 Year 13	2011/12 Year 14	15 Years
PRODUCTION																	
ROM Production Days																	
Lake	#	0	280	280	160	160	160	320	320	320	320	320	320	320	320	320	261
Dune	#	0	40	40	160	160	160	0	0	0	0	0	0	0	0	0	37
Production Days	#	0	320	320	320	320	320	320	320	320	320	320	320	320	320	320	299
ROM Production																	
Lake	t	0	1,750,000	1,750,000	500,000	500,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	14,000,000
Dune	t	0	250,000	250,000	500,000	500,000	500,000	0	0	0	0	0	0	0	0	0	2,000,000
Total Produced	t	0	2,000,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	16,000,000
Deliveries																	
Lake	t	0	0	0	0	400,000	400,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	9,800,000
Dune	t	0	0	300,000	500,000	600,000	600,000	0	0	0	0	0	0	0	0	0	2,000,000
Total Delivered	t	0	0	300,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	11,800,000
INVENTORIES																	
Lake - Open	t	0	0	1,750,000	3,500,000	4,000,000	4,100,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	0
Dune - Open	t	0	0	250,000	200,000	200,000	100,000	0	0	0	0	0	0	0	0	0	0
Mine Site - Open	t	0	0	2,000,000	3,700,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	0
Lake - Production	t	0	1,750,000	1,750,000	500,000	500,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	14,000,000
Dune - Production	t	0	250,000	250,000	500,000	500,000	500,000	0	0	0	0	0	0	0	0	0	2,000,000
Mine Site - Production	t	0	2,000,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	16,000,000
Lake - Sales	t	0	0	0	0	400,000	400,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	9,800,000
Dune - Sales	t	0	0	300,000	500,000	600,000	600,000	0	0	0	0	0	0	0	0	0	2,000,000
Mine Site - Sales	t	0	0	300,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	11,800,000
Lake - Close	t	0	1,750,000	3,500,000	4,000,000	4,100,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000
Dune - Close	t	0	250,000	200,000	200,000	100,000	0	0	0	0	0	0	0	0	0	0	0
Mine Site - Close	t	0	2,000,000	3,700,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000	4,200,000
Lake - Open	A$'000	0	0	3,325	6,650	8,000	8,519	9,011	9,459	9,820	10,113	10,349	10,539	10,693	10,818	10,918	0
Dune - Open	A$'000	0	0	475	380	494	263	0	0	0	0	0	0	0	0	0	0
Mine Site - Open	A$'000	0	0	3,800	7,030	8,494	8,782	9,011	9,459	9,820	10,113	10,349	10,539	10,693	10,818	10,918	0
Lake - Production	A$'000	0	3,325	3,325	1,350	1,350	1,350	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	35,000
Dune - Production	A$'000	0	475	475	1,350	1,350	1,350	0	0	0	0	0	0	0	0	0	5,000
Mine Site - Production	A$'000	0	3,800	3,800	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	40,000
Lake - Sales	A$'000	0	0	0	0	831	858	2,252	2,338	2,408	2,464	2,509	2,546	2,576	2,600	2,619	24,001
Dune - Sales	A$'000	0	0	570	1,236	1,581	1,613	0	0	0	0	0	0	0	0	0	5,000
Mine Site - Sales	A$'000	0	0	570	1,236	2,412	2,472	2,252	2,338	2,408	2,464	2,509	2,546	2,576	2,600	2,619	29,001
Lake - Close	A$'000	0	3,325	6,650	8,000	8,519	9,011	9,459	9,820	10,113	10,349	10,539	10,693	10,818	10,918	10,999	10,999
Dune - Close	A$'000	0	475	380	494	263	0	0	0	0	0	0	0	0	0	0	0
Mine Site - Close	A$'000	0	3,800	7,030	8,494	8,782	9,011	9,459	9,820	10,113	10,349	10,539	10,693	10,818	10,918	10,999	10,999
Lake - Open	A$/t	0.00	0.00	1.90	1.90	2.00	2.08	2.15	2.25	2.34	2.41	2.46	2.51	2.55	2.58	2.60	0.00
Dune - Open	A$/t	0.00	0.00	1.90	1.90	2.47	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mine Site - Open	A$/t	0.00	0.00	1.90	1.90	2.02	2.09	2.15	2.25	2.34	2.41	2.46	2.51	2.55	2.58	2.60	0.00
Lake - Production	A$/t	0.00	1.90	1.90	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.50
Dune - Production	A$/t	0.00	1.90	1.90	2.70	2.70	2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50
Mine Site - Production	A$/t	0.00	1.90	1.90	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.50
Lake - Sales	A$/t	0.00	0.00	0.00	0.00	2.08	2.15	2.25	2.34	2.41	2.46	2.51	2.55	2.58	2.60	2.62	2.45
Dune - Sales	A$/t	0.00	0.00	1.90	2.47	2.63	2.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50
Mine Site - Sales	A$/t	0.00	0.00	1.90	2.47	2.41	2.47	2.25	2.34	2.41	2.46	2.51	2.55	2.58	2.60	2.62	2.46
Lake - Close	A$/t	0.00	1.90	1.90	2.00	2.08	2.15	2.25	2.34	2.41	2.46	2.51	2.55	2.58	2.60	2.62	2.62
Dune - Close	A$/t	0.00	1.90	1.90	2.47	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mine Site - Close	A$/t	0.00	1.90	1.90	2.02	2.09	2.15	2.25	2.34	2.41	2.46	2.51	2.55	2.58	2.60	2.62	2.62

CASE A
SALES

		1997/98 Year 0	1998/99 Year 1	1999/00 Year 2	2000/01 Year 3	2001/02 Year 4	2002/03 Year 5	2003/04 Year 6	2004/05 Year 7	2005/06 Year 8	2006/07 Year 9	2007/08 Year 10	2008/09 Year 11	2009/10 Year 12	2010/11 Year 13	2011/12 Year 14	15 Years
PRICES																	
FOB Prices - Cement																	
Japan	A$/t	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
Malaysia	A$/t	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33
Indonesia	A$/t	16.33	16.33	16.33	16.33	16.33	16.33	16.33	16.33	16.33	16.33	16.33	16.33	16.33	16.33	16.33	16.33
Australasia	A$/t	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
FOB Prices - Plaster																	
Japan	A$/t	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33	15.33
Malaysia	A$/t	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Indonesia	A$/t	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00
Australasia	A$/t	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
VOLUMES																	
Sales - Cement																	
Japan	t	0	0	50,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,250,000
Malaysia	t	0	0	100,000	150,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	2,450,000
Indonesia	t	0	0	100,000	150,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	2,450,000
Australasia	t	0	0	50,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,250,000
Total Sales - Cement	t	0	0	300,000	500,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	7,400,000
Sales - Plaster																	
Japan	t	0	0	0	0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,100,000
Malaysia	t	0	0	0	0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,100,000
Indonesia	t	0	0	0	0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,100,000
Australasia	t	0	0	0	0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,100,000
Total Sales - Plaster	t	0	0	0	0	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	4,400,000
Total Sales																	
Japan	t	0	0	50,000	100,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	2,350,000
Malaysia	t	0	0	100,000	150,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	3,550,000
Indonesia	t	0	0	100,000	150,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	3,550,000
Australasia	t	0	0	50,000	100,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	2,350,000
Total Sales		0	0	300,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	11,800,000
SOURCE																	
Lake	t	0	0	0	0	400,000	400,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	9,800,000
Dune	t	0	0	300,000	500,000	600,000	600,000	0	0	0	0	0	0	0	0	0	2,000,000
Mine Site	t	0	0	300,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	11,800,000
REVENUE																	
Revenue - Cement																	
Japan	A$'000	0	0	633	1,267	1,267	1,267	1,267	1,267	1,267	1,267	1,267	1,267	1,267	1,267	1,267	15,833
Malaysia	A$'000	0	0	1,533	2,300	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	3,067	37,567
Indonesia	A$'000	0	0	1,633	2,450	3,267	3,267	3,267	3,267	3,267	3,267	3,267	3,267	3,267	3,267	3,267	40,017
Australasia	A$'000	0	0	750	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	18,750
Total Sales - Cement	A$'000	0	0	4,550	7,517	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	112,167
Revenue - Plaster																	
Japan	A$'000	0	0	0	0	1,533	1,533	1,533	1,533	1,533	1,533	1,533	1,533	1,533	1,533	1,533	16,867
Malaysia	A$'000	0	0	0	0	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	19,800
Indonesia	A$'000	0	0	0	0	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	1,900	20,900
Australasia	A$'000	0	0	0	0	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	13,200
Total Sales - Plaster	A$'000	0	0	0	0	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	70,767
Total Revenue																	
Japan	A$'000	0	0	633	1,267	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	32,700
Malaysia	A$'000	0	0	1,533	2,300	4,867	4,867	4,867	4,867	4,867	4,867	4,867	4,867	4,867	4,867	4,867	57,367
Indonesia	A$'000	0	0	1,633	2,450	5,167	5,167	5,167	5,167	5,167	5,167	5,167	5,167	5,167	5,167	5,167	60,917
Australasia	A$'000	0	0	750	1,500	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	31,950
Total Sales	A$'000	0	0	4,550	7,517	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	182,933
SHIPMENTS																	
Japan	#	0	0	2	4	8	8	8	8	8	8	8	8	8	8	8	94
Malaysia	#	0	0	3	4	9	9	9	9	9	9	9	9	9	9	9	101
Indonesia	#	0	0	3	4	8	8	8	8	8	8	8	8	8	8	8	89
Australasia	#	0	0	3	5	10	10	10	10	10	10	10	10	10	10	10	118
Total Sales	#	0	0	11	17	35	35	35	35	35	35	35	35	35	35	35	402

CASE A

OPERATING COSTS

		1997/98 Year 0	1998/99 Year 1	1999/00 Year 2	2000/01 Year 3	2001/02 Year 4	2002/03 Year 5	2003/04 Year 6	2004/05 Year 7	2005/06 Year 8	2006/07 Year 9	2007/08 Year 10	2008/09 Year 11	2009/10 Year 12	2010/11 Year 13	2011/12 Year 14	15 Years
TOTAL COSTS																	
Mining Costs																	
Mining	A$'000	0	3,800	3,800	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	40,000
Screening/Crushing	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining Cash Costs	A$'000	0	3,800	3,800	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	40,000
Depreciation	A$'000	0	193	86	86	86	86	86	86	86	86	86	23	0	0	0	989
Stock Movement	A$'000	0	(3,800)	(3,230)	(1,464)	(288)	(228)	(448)	(362)	(292)	(236)	(191)	(154)	(124)	(100)	(81)	(10,999)
Total Production Costs	A$'000	0	193	656	1,322	2,498	2,558	2,338	2,424	2,494	2,550	2,595	2,569	2,576	2,600	2,619	29,990
Loading	A$'000	0	0	111	185	300	300	300	300	300	300	300	300	300	300	300	3,596
Haulage	A$'000	0	0	540	900	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	21,240
Unloading	A$'000	0	0	111	185	300	300	300	300	300	300	300	300	300	300	300	3,596
Road Maintenance	A$'000	0	0	30	50	100	100	100	100	100	100	100	100	100	100	100	1,180
Mine to Port Costs	A$'000	0	0	792	1,320	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	29,612
Total @ Port Costs	A$'000	0	193	1,448	2,642	4,998	5,058	4,838	4,924	4,994	5,050	5,095	5,069	5,076	5,100	5,119	59,602
Loading Costs																	
Operating Expenses	A$'000	0	0	105	175	350	350	350	350	350	350	350	350	350	350	350	4,130
Workboat Costs	A$'000	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	260
Jetty Maintenance	A$'000	0	0	75	75	75	75	75	75	75	75	75	75	75	75	75	975
5 Year Overhaul	A$'000	0	0	0	0	0	0	100	0	0	0	0	100	0	0	0	200
Loading Cash Costs	A$'000	0	0	200	270	445	445	545	445	445	445	445	545	445	445	445	5,565
Depreciation	A$'000	0	0	1,987	1,987	1,987	1,987	1,987	1,987	1,987	1,987	1,987	1,987	0	0	0	19,871
Total Loading Costs	A$'000	0	0	2,187	2,257	2,432	2,432	2,532	2,432	2,432	2,432	2,432	2,532	445	445	445	25,436
Mgmt, Admin & Sales																	
General Manager	A$'000	0	120	120	120	120	120	120	120	120	120	120	120	120	120	120	1,680
Marketing Manager	A$'000	0	80	80	80	80	80	80	80	80	80	80	80	80	80	80	1,120
Site Supervisor	A$'000	0	60	60	60	60	60	60	60	60	60	60	60	60	60	60	840
Accounts Person	A$'000	0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	560
On Costs	A$'000	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	1,400
Couriers	A$'000	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10	140
Computers	A$'000	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	70
Leases, rates, taxes	A$'000	0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	350
Legal/Accounting fees	A$'000	0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	420
Vehicles	A$'000	0	60	60	60	60	60	60	60	60	60	60	60	60	60	60	840
Postage	A$'000	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10	140
Print & Stationary	A$'000	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	280
Phone, Fax	A$'000	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	280
Consultants	A$'000	0	50	50	50	50	50	50	50	50	50	50	50	50	50	50	700
Insurance	A$'000	0	50	50	50	50	50	50	50	50	50	50	50	50	50	50	700
Travel	A$'000	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	1,400
Contingency	A$'000	0	78	78	78	78	78	78	78	78	78	78	78	78	78	78	1,092
Sub-total Mgmt, Admin	A$'000	0	858	858	858	858	858	858	858	858	858	858	858	858	858	858	12,012
Sample Analysis	A$'000	0	0	15	25	50	50	50	50	50	50	50	50	50	50	50	590
SA Govt Royalty	A$'000	0	0	30	50	100	100	100	100	100	100	100	100	100	100	100	1,180
Mgmt, Admin & Sales Costs	A$'000	0	858	903	933	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	13,782
Total FOB Costs	A$'000	0	1,051	4,538	5,832	8,438	8,498	8,378	8,364	8,434	8,490	8,535	8,609	6,529	6,553	6,572	98,820
Sea Freight Costs																	
Japan	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malaysia	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indonesia	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Australasia	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sea Freight Costs	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total CIF Costs	A$'000	0	1,051	4,538	5,832	8,438	8,498	8,378	8,364	8,434	8,490	8,535	8,609	6,529	6,553	6,572	98,820
UNIT COSTS																	
Mine Cash Costs/t Produced	A$/t	0.00	1.90	1.90	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.50
Mine Costs/t Sold	A$/t	0.00	0.00	1.90	2.47	2.41	2.47	2.25	2.34	2.41	2.46	2.51	2.55	2.58	2.60	2.62	2.48
+ To Loading	A$/t	0.00	0.00	2.64	2.64	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.51
+ Loading	A$/t	0.00	0.00	0.67	0.54	0.45	0.45	0.55	0.45	0.45	0.45	0.45	0.55	0.45	0.45	0.45	0.47
+ Mgmt, Admin & Sales	A$/t	0.00	0.00	3.01	1.87	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.17
Total FOB	A$/t	0.00	0.00	8.22	7.52	6.36	6.42	6.31	6.29	6.36	6.42	6.46	6.60	6.53	6.55	6.57	6.61
+ Sea Freight	A$/t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Cash Costs	A$/t	0.00	0.00	8.22	7.52	6.36	6.42	6.31	6.29	6.36	6.42	6.46	6.60	6.53	6.55	6.57	6.61
+ Depreciation	A$/t	0.00	0.00	6.91	4.15	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.01	0.00	0.00	0.00	1.77
Total Costs	A$/t	0.00	0.00	15.13	11.66	8.44	8.50	8.38	8.38	8.43	8.49	8.54	8.61	6.53	6.55	6.57	8.37

CASE A
FINANCIALS

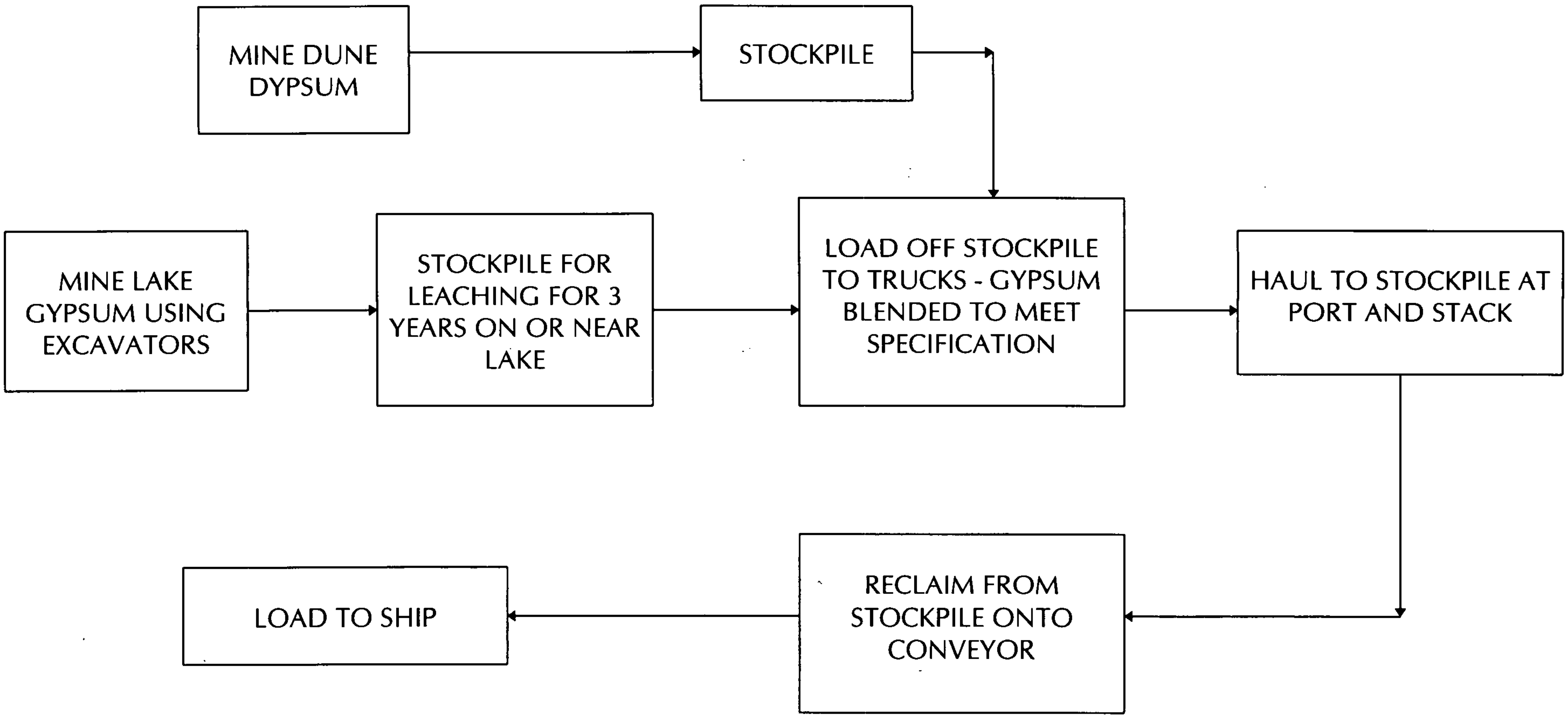
		1997/98 Year 0	1998/99 Year 1	1999/00 Year 2	2000/01 Year 3	2001/02 Year 4	2002/03 Year 5	2003/04 Year 6	2004/05 Year 7	2005/06 Year 8	2006/07 Year 9	2007/08 Year 10	2008/09 Year 11	2009/10 Year 12	2010/11 Year 13	2011/12 Year 14	15 Years
PROFIT & LOSS																	
Key Statistics																	
Total Produced	t	0	2,000,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	16,000,000
Total Delivered	t	0	0	300,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	11,800,000
Income																	
Sales - Cement	A$'000	0	0	4,550	7,517	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	112,167
Sales - Plaster	A$'000	0	0	0	0	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	70,767
Sale Receipts	A$'000	0	0	4,550	7,517	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	182,933
Expenses																	
ROM Prod Costs	A$'000	0	3,800	3,800	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	40,000
Stock Adjustment	A$'000	0	(3,800)	(3,230)	(1,464)	(288)	(228)	(448)	(362)	(292)	(236)	(191)	(154)	(124)	(100)	(81)	(10,999)
Mine Costs	A$'000	0	0	570	1,236	2,412	2,472	2,252	2,338	2,408	2,464	2,509	2,546	2,576	2,600	2,619	29,001
Haulage	A$'000	0	0	792	1,320	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	29,612
Loading	A$'000	0	0	200	270	445	445	545	445	445	445	445	545	445	445	445	5,565
Mgmt, Admin & Sales	A$'000	0	858	903	933	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	13,782
Non Depreciable Capex	A$'000	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Sea Freight	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBITD	A$'000	0	(908)	2,085	3,758	9,168	9,109	9,228	9,242	9,173	9,116	9,071	8,934	9,005	8,981	8,961	104,924
Depreciation	A$'000	0	193	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,010	0	0	0	20,860
NPBT	A$'000	0	(1,101)	12	1,685	7,095	7,036	7,155	7,169	7,100	7,043	6,998	6,924	9,005	8,981	8,961	84,063
Tax Expense	A$'000	0	(396)	4	607	2,554	2,533	2,576	2,581	2,556	2,536	2,519	2,493	3,242	3,233	3,226	30,263
NPAT	A$'000	0	(705)	8	1,078	4,541	4,503	4,579	4,588	4,544	4,508	4,479	4,431	5,763	5,748	5,735	53,800
UNIT COSTS PER TONNE SOLD																	
Mine Cost/t	A$/t	NA	NA	1.90	2.47	2.41	2.47	2.25	2.34	2.41	2.46	2.51	2.55	2.58	2.60	2.62	2.46
+ Mine to Load/t	A$/t	NA	NA	2.64	2.64	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.51
+ Load+Depr/t	A$/t	NA	NA	7.58	4.69	2.52	2.52	2.62	2.52	2.52	2.52	2.52	2.56	0.45	0.45	0.45	2.24
+ Other/t	A$/t	NA	NA	3.01	1.87	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.17
Total FOB Cost/t	A$/t	NA	NA	15.13	11.66	8.44	8.50	8.38	8.36	8.43	8.49	8.54	8.61	6.53	6.55	6.57	8.38
+ Sea Freight/t	A$/t	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Cost/t	A$/t	NA	NA	15.13	11.66	8.44	8.50	8.38	8.36	8.43	8.49	8.54	8.61	6.53	6.55	6.57	8.38
Receipts/t Delivered	A$/t	NA	NA	15.17	15.03	15.53	15.53	15.53	15.53	15.53	15.53	15.53	15.53	15.53	15.53	15.53	15.50
TAX CALCULATIONS																	
NPBT	A$'000	0	(1,101)	12	1,685	7,095	7,036	7,155	7,169	7,100	7,043	6,998	6,924	9,005	8,981	8,961	84,063
Less Loan Interest	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taxable Income - PL	A$'000	0	(1,101)	12	1,685	7,095	7,036	7,155	7,169	7,100	7,043	6,998	6,924	9,005	8,981	8,961	84,063
Tax Expense	A$'000	0	(396)	4	607	2,554	2,533	2,576	2,581	2,556	2,536	2,519	2,493	3,242	3,233	3,226	30,263
Tax Losses Carried forward	A$'000	0	(1,101)	(1,089)	0	0	0	0	0	0	0	0	0	0	0	0	0
Tax Losses Brought forward	A$'000	0	0	(12)	(1,089)	0	0	0	0	0	0	0	0	0	0	0	(1,101)
Taxable Income - CF	A$'000	0	0	0	596	7,095	7,036	7,155	7,169	7,100	7,043	6,998	6,924	9,005	8,981	8,961	84,063
Tax Paid	A$'000	0	0	0	215	2,554	2,533	2,576	2,581	2,556	2,536	2,519	2,493	3,242	3,233	3,226	30,263
CASHFLOW																	
Cash Inflows																	
Sales - Cement	A$'000	0	0	4,550	7,517	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	9,100	112,167
Sales - Plaster	A$'000	0	0	0	0	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	6,433	70,767
Total Sales Revenue	A$'000	0	0	4,550	7,517	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	15,533	182,933
Cash Outflows																	
Mining	A$'000	0	3,800	3,800	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	40,000
Haulage	A$'000	0	0	792	1,320	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	29,612
Loading	A$'000	0	0	200	270	445	445	545	445	445	445	445	545	445	445	445	5,565
Mgmt, Admin & Sales	A$'000	0	858	903	933	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	13,782
Sea Freight	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Costs	A$'000	0	4,658	5,695	5,223	6,653	6,653	6,753	6,653	6,653	6,653	6,653	6,753	6,653	6,653	6,653	88,959
Operating Cashflow	A$'000	0	(4,658)	(1,145)	2,294	8,880	8,880	8,780	8,880	8,880	8,880	8,880	8,780	8,880	8,880	8,880	93,974
Pre Development Capex	A$'000	529	0	0	0	0	0	0	0	0	0	0	0	0	0	0	529
Non Depreciable Capex	A$'000	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Development Capex - Mine	A$'000	0	460	0	0	0	0	0	0	0	0	0	0	0	0	0	460
Development Capex - Port	A$'000	0	10,511	9,361	0	0	0	0	0	0	0	0	0	0	0	0	19,871
Tax Paid	A$'000	0	0	0	215	2,554	2,533	2,576	2,581	2,556	2,536	2,519	2,493	3,242	3,233	3,226	30,263
Net Cashflow	A$'000	(529)	(15,679)	(10,506)	2,079	6,326	6,347	6,204	6,299	6,325	6,345	6,361	6,288	5,639	5,647	5,654	42,801
Terminal Value	A$'000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11,308	11,308
Project Cashflow	A$'000	(529)	(15,679)	(10,506)	2,079	6,326	6,347	6,204	6,299	6,325	6,345	6,361	6,288	5,639	5,647	16,963	54,110
Cashflows																	
Cumulative Project Cashflow	A$'000	(529)	(16,208)	(26,713)	(24,634)	(18,308)	(11,961)	(5,756)	543	6,868	13,212	19,573	25,861	31,500	37,147	54,110	54,110

ECONOMICS

		0%	5%	8%	10%	12%	15%	20%	IRR
NPV Project Cashflow	A$'000	54,110	26,744	16,477	11,291	7,102	2,248	(3,194)	16.8%

ATTACHMENT 8

GYPSUM PROCESS DIAGRAM



ATTACHMENT 9

Summary of Aztec Analysis Shiploader Cost Estimate

	$000's	Note
Main Sea Piling (500 metres)	2,588	1
Reef Piling (140 metres)	266	1
Steelwork excluding conveyor	463	1
Walkway	470	1
Conveyor (Enclosed, 800 metres)	2,846	1
Dolphins (11, piled)	4,193	1
Fenders (6)	699	1
Electrical (Instrumentation, cathodic protection)	600	
Land works (Hopper, tunnel, civils)	396	1
Contractor (margin 10%, overheads 15%, contingency 5%)	3,757	
Fees (Survey, design, specialist services, project management)	1,000	
Scope Contingency (15%)	2,592	
	$19,870	

Note 1 - Includes 20% contingency for bad weather.

ref: sbgyrep3

STREAKY BAY GYPSUM DEPOSITS

EL1821

1997 REAPPRAISAL OF GYPSUM RESOURCES

by

Jeffrey G Olliver

July 1997

CONTENTS

Plans

1. EXECUTIVE SUMMARY

At Streaky Bay on Eyre Peninsula South Australia, machine auger drilling in 1997 has delineated total **measured resources** of **17.2 million tonnes** of lake gypsum at two potential open cut sites.

In situ grade averages 93% gypsum, 4.2% carbonate, 0.5% silica and 2.3% salt. Once leached by rainwater, a high quality gypsum concentrate with a minimum of 95% $CaSO_4 \cdot 2H_2O$ will be produced.

An upper white friable gypsarenite overlies grey banded slightly cemented coarser gypsarenite which grades downwards into basal crystalline gypsum varying from a loose mass of crystals in brine to semi-cemented aggregates to completely cemented layers of rock gypsum.

Hand auger drilling at the two drilled areas has delineated total **indicated resources** of **1.14 million tonnes** of unconsolidated sand-sized dune gypsum. In situ grade averages 96-98% gypsum, 1.9-2.3% carbonate, 0.5% silica and 0.4-0.5% salt.

For the first time since investigations began in 1959, in-situ Identified Mineral Resources for all categories within Exploration Licence 1821 have been compiled and total **85 million tonnes** comprising

Lake Purdilla	**- measured**	**17**
	- indicated	**43**
	sub total	***60***
Lake Toorna	**- indicated**	**12**
Peripheral Lakes	**- inferred**	**8**
Dunes	**- indicated**	**5**
Total		***85***

2. INTRODUCTION

Sceale Bay Development Corporation Pty Ltd (SBDC) is seeking to develop the Streaky Bay gypsum deposits, one of the largest unmined gypsum resources in Australia, 12 km to 27 km south of Streaky Bay on the western coast of Eyre Peninsula, South Australia (fig 1).

Olliver Geological Services Pty Ltd (OGS) was commissioned by SBDC to provide a detailed reappraisal of gypsum resources held by SBDC.

Previous estimates of resources had varied from 35 million tonnes (Forbes, 1959) to 69.2 million tonnes (Warren, 1985) mostly in Lake Purdilla and Lake Toorna.

Two potential mine sites on Lake Purdilla were selected to be grid drilled in 1997 to provide high quality data as the basis to recalculate resources to **measured** status.

Resource Information Group, Dept of Environment & Natural Resources has approved use of aerial photography in compiling fig 4, 5, 6 and 13.

Colour Plates 1-20 illustrate field operations during January - May 1997.

3. MINERAL TENURE

Exploration Licence (EL) 1821 was granted to Olliver Geological Services Pty Ltd on 19 February 1993 for a period of one year. EL1821 was transferred to SBDC in December 1993, has been renewed and is due to expire on 18 February 1998.

4. RESOURCES OF LAKE GYPSUM

4.1 Previous Investigations

Following drilling of 135 holes in Lakes Purdilla and Toorna in 1959 by South Australian Department of Mines, Forbes (1959) calculated **reserves (sic.)** in Lake Purdilla of 35 million tonnes at average of 91% gypsum using a cut-off of 90% gypsum.

In 1969, Elcor Ltd drilled 31 holes in the southern half of Lake Purdilla from which Hall et al (1970) calculated 30.1 million tonnes at average grade of 84.5%.

In unpublished data not included in his thesis, Warren (pers comm, 1985) recalculated a total of 69.2 million tonnes at average grade 88.5% for Lake Purdilla and Lake Toorna combined.

As part of the reappraisal by SA Department of Mines and Energy into the States gypsum deposits, Olliver et al (1985 and 1988) subdivided the gypsum lakes on EL1821 into four areas and calculated total resources of lake gypsum at 58 million tonnes comprising

Lake Purdilla	Million tonnes	Percent Gypsum	Salt	Carbonate	Silica
Area A (north)	22	92.7	2.0	4.2	-
Area B (south west)	8	83.6	2.1	13.0	-
Area C (south east)	18	87.0	2.3	8.9	-
Sub total	**48**	**87.8**	**2.1**	**8.7**	**0.6**
Lake Toorna					
Area D	**10**	**85.9**	**2.3**	**10.7**	**0.5**

4.2 1997 Investigations

Under the **Australasian Code for Reporting of Identified Mineral Resources and Ore Reserves, July 1996**, Identified Mineral Resources are subdivided into three classes

- **inferred** - lowest level
- **indicated** - moderate level
- **measured** - highest level of geological data, knowledge and confidence

In situ gypsum in the two Drilled Areas is classified as **Measured Resources** based on parameters in Appendix A because of the high quality drilling data obtained in 1997.

4.3 Measured Resources

In order to upgrade part of the total resources within EL1821 to **measured resource** status, two separate potential mines areas from two of the previously subdivided areas of Lake Purdilla in Olliver et al (1985 & 1988) were selected and drilled on a grid pattern. This enabled a recalculation of resources in each area by more accurate data on thickness and grade of gypsum and subsequent extrapolation to the other areas that were not grid-drilled. The areas drilled as South and North are incorporated in Areas C and A respectively.

TABLE 1

MEASURED RESOURCES

	DRILLED AREA SOUTH	NORTH
Area sq km	2.44	3.69
Volume mill c.m.	6.47	6.61
Tonnes	**8.5**	**8.7**
Av. Thickness m	2.6	1.8
Grade %		
Gypsum	93.0	93.0
Salt	2.3	2.3
Silica	0.5	0.5
Carbonate	4.2	4.2
Theoretical Yield of salt-free gypsum		
Tonnes	8.4	8.5
Grade %	95.0	95.0

Resources may be increased by extending mining operations

- to the north west at North Drilled Area.
- To the north west, central west and south west at South Drilled Area.

4.4 Extrapolation

Following the 1997 grid-drilling program where 63 out of 65 drillholes reached the base of the gypsum, in contrast to many of the earlier drillholes which did not sample the lower part of the gypsum and hence true thickness was not recorded, the total in-situ measured and indicated resources at Lake Purdilla (Areas A, B and C) and Lake Toorna (Area D) have been re-evaluated.

The rationale has been to adjust the 1985 calculations on a pro rata basis to the areas grid-drilled in 1997 by applying of areas (i.e. area for 1985 estimate : area of 1997 grid-drilling) to the measured resources from 1997 grid-drilling results to provide new resource figures for each of the Areas A, B, C and D from Olliver et al (1985). In areas not drilled in 1997, the average increase has bee used.

The new resource estimates of lake gypsum are detailed in Table 2.

TABLE 2

ESTIMATION OF TOTAL LAKE RESOURCES

	1985	**1997**	
Area C		**South Drilled Area**	Ratio
area squ km	7.0	2.4	2.87
million tonnes	18.0	8.5	24:18 = 1.33
∴ **Total for Area C becomes 8.5 x 2.87 = 24 million tonnes**			
Area A		**North Drilled Area**	
area squ km	11.2	3.7	3.0
million tonnes	22	8.7	25:22 = 1.18
∴ **Total for Area A becomes 8.5 x 3.0 = 26 million tonnes**			
Area B			
area sq km	4.5	not tested	
million tonnes	8	-	1.25(assumed)*
∴ **Total for Area B becomes 8.0 x 1.25 = 10 million tonnes**			
Area D - Lake Toorna			
area sq km	9.6	not tested	1.25 (assumed)*
million tonnes	10.0	-	
∴ **Total for Area D becomes 10.0 x 1.25 = 12 million tonnes**			

* 1.25 assumed is the average of 1.33 and 1.14.

Summary	**Measured**	**Indicated**	**Total**
Lake Purdilla A+B+C	8.5+8.7=17.2	43	60
Lake Toorna D	nil	12	12
TOTAL	**17**	**54**	**71**

4.5 Peripheral Lakes

In October 1989, Mason & Compston (1990) drilled 209m in 144 holes in seven of the lakes (A-G) within the old EL1442 by hand driving steel rods. Thickness of gypsum was determined but samples could not be collected. In general, these lakes were reported to contain *mainly moderate to dense crystalline gypsum of high quality.*

Using the volumes calculated in 1989, **inferred resources** in Table 3 have been calculated using a bulk density of 1.32. Lake Larson and four other untested lakes (H-K) are included. Lakes F, L, H, I and L are shown on fig 4, Lakes A-E are to the north and Lakes J and K to the south.

TABLE 3

INFERRED RESOURCES, PERIPHERAL LAKES

Lake	Volume mill c.m.	mill tonnes
A	0.026	0.034
B	0.206	0.270
C	0.065	0.085
D	0.044	0.058
E	0.085	0.110
F Dreadnought	0.680	0.890
G	0.182	0.240
Sub Total	**1.292**	**1.687**
H Seagull		0.500
I		0.500
J		0.500
K		0.100
L Larson		5.000
Sub Total		**6.600**
	TOTAL	**8.287**
	Say	**8 million**

4.6 Summary of Lake Resources

TABLE 4

LAKE GYPSUM RESOURCES

	Measured	Indicated	Inferred	Total
Lake Purdilla	17	43	-	.60
Lake Toorna	-	12	-	12
Peripheral Lakes	-	-	8	8
Total	**17**	**55**	**8**	**80**

5. CHARACTERISTICS OF LAKE GYPSUM

5.1 Geological Sequence

The gypsum sequence reaches a maximum of 4.7m thick. A thin irregular surface of discoloured gypsite (flour gypsum) to a maximum of 0.08m overlies white unconsolidated fine to coarse gypsarenite (seed gypsum), laminated in places with occasional large crystals and layers of crystals. Thickness varies from 0.3 to 1.0m

The underlying grey coarse laminated gypsum, partly cemented in places with scattered large crystals and nests or layers of crystals. Thickness varies from 0.5 to 1.0m. This unit grades downwards into a grey mass of gypsum crystals in places partially recrystallised into aggregates and elsewhere completely recrystallised into layers of selenite (rock gypsum). This basal unit is absent near lake margins but is up to 2.7m thick in the deeper parts of the basin

The gypsum sequence is underlain by a thin white calcareous clay which was deposited on a hard calcrete surface.

5.2 Chemical Characteristics

5.2.1 Gypsum content

Evaporitic basins that produce mineable deposits of gypsum have pure carbonate margins usually narrow, shallow and asymmetrical which grade inwards as the basin deepens to progressively purer gypsum (Warren, 1980).

For 64 of the 65 1997 holes, gypsum content varied from
86.95% to 94.02% in the South Drilled Area
89.02% to 95.50% in the North Drilled Area

The only hole sited near an island was K32 in the North which intersected 77.80-79.30% gypsum has been deleted from resource calculations.

Weighted gypsum content for each drillhole in Appendix A is presented as contour plans (Figs 8 & 11).

However, to calculate average grade for a basin or proposed mine site, average metre-percent in Appendix A is used (Figs 9 & 12).

Chemical analysis in 1959 and 1969 is compatible with the 1997 results as in Appendix D Table 1. Holes from 1997 are used in preference to earlier holes at the same site because the geological data is superior.

5.2.2 Salt content

Salt content of the 113 samples of lake gypsum tested in 1959 varied from 0.31 to 3.75% with most recording less than 2.5%. Forbes (1959 & 1960) calculated an average of 2.5% NaCl for the top 1.5m.

Similarly, salt in the 1969 samples varied from 0.52 to 4.70%. Hall et al (1960) did not calculate an average grade.

However, in the 1985 reappraisal, Olliver et al (1985 & 1988) calculated an average of 2.1% salt for Lake Purdilla using the 1959 and 1969 data.

From the 1997 drillholes, salt content for each hole is summarised below from Appendix C and D

	From	To	Average
South Drilled Area	1.78	2.83	2.3
North Drilled Area	1.48	2.57	2.3

PVC tubing containing the pushtube samples are sealed at both ends by ducting tape when the tube is withdrawn from the lake sediment effectively enclosing 'loose' brine.

In contrast, machine auger samples wind up the auger flight, are collected at the surface and tipped into a calico bag. This bag was placed on the small trailer with a slotted wooden floor towed by the motor bike. When the trailer was full, samples were transferred to the 4WD Traytop thence to pallets at the freight depot for transport to Adelaide.

Four or five days elapsed before the samples were split and submitted for analysis. By then the brine has seeped out and the samples were dry.

In Appendix D Table 2, apart from the Hole K27, salt content in the machine auger samples is consistently lower than in the push tube samples varying
from K23 2.6% to 2.2% salt - decrease of 0.4% salt or 15% relatively
to K29 3.7% to 2.0% salt - decrease of 1.7% salt or 46% relatively.

Average decrease is 23% relatively, equivalent to about 0.8% salt.

5.2.3 Carbonate Content

Total carbonate content, Ca + $MgCO_3$, is inversely proportional to gypsum content.

5.2.4 Silica Content

In 1959, most of the 113 samples of lake gypsum recorded from 0.3 to 0.6% acid insolubles. A few were below 0.3% and four only were 1.0% or more viz 1.0, 1.6, 1.8 and 2.3% (Forbes, 1959)

In 1969, 52 samples of lake gypsum recorded acid insolubles from 0.04 to 0.9%.

Olliver et al (1985 & 1988) in their reappraisal calculated an average of 0.6%.

As the average content is less than 1%, the 1997 samples were not tested for acid insolubles or silica.

5.2.5 Iron & Alumina Content

Iron (Fe_2O_3) and Alumina (Al_2O_3) are insignificant.

5.3 Physical Characteristics

5.3.1 Bulk Density

Bulk density of lake gypsum is 1.32 tonnes/cubic metre (Appendix E).

5.3.2 Size Analysis

The three samples from K42 contained more coarse particles with depth as summarised below from Appendix E

B4 82.6% from 0.2-1.7mm with coarsest grains 13.2m
B5 52.3% from 0.2-1.7mm
and 18.7% from 15.0-25mm
B8 36.5% from 0.2-1.7mm
and 30.8% from 19.0-35mm

6. RESOURCES OF DUNE GYPSUM

6.1 Background

Hand auger drilling in 1996 confirmed the high gypsum content and low salt content of the gypsum dunes marginal to the **South Drilled Area**. **Indicated resources** of 440 000 tonnes were calculated by Olliver (1996) with an average grade for raw gypsum of 96.8% gypsum, 0.4% salt and 2.3% carbonate based on the following 66 hand auger holes.

Traverses 17-31	- 59.2m in 30 holes drilled in 1988 (Mason & Compston, 1990)
Traverses T101-T118	- 118.35m in 36 holes drilled in 1996.

Following the selection of an alternative lake mine site in the North Drilled Area, comparative data on the marginal dunes was required.

6.2 Gypsum Characteristics

Dune gypsum consists almost entirely of off white rounded to subrounded grains varying in size from fine 'flour' up to 2mm. Most of the composite sample from holes T119-T125 drilled in 1997 from the northern dunes ranges from 0.2 to 1.0mm grain size (Appendix E).

Gypsum and salt content are summarised in Table 4 from ALS Reports ST18803 and ST 18945 in Appendix D. Weighted average grade is higher than that from South Drilled Area. However, the calculated average of 98.3% gypsum has been corrected to 97.6% to balance the average salt and carbonate contents.

TABLE 5

CHEMICAL ANALYSIS

DUNE GYPSUM NORTH DRILLED AREA

Sample	Thickness (m)	% Gypsum	% Salt	% Carbonate
T86	2.3	96.9	1.25	1.71
T88	1.8	96.9	1.53	1.55
T90	1.7	97.9	0.56	1.54
T95	3.0	97.0	0.57	2.41
T96	3.7	98.0	0.74	1.22
T119	2.3	99.2	0.34	0.39
T120	3.0	99.1	0.21	0.65
T121	2.3	99.5	0.09	0.35
T122	2.0	98.5	0.12	0.35
T123	2.5	98.5	0.40	1.06
T124	2.5	99.1	0.27	0.60
T125	3.0	99.2	0.42	0.40
	Average	**98.3**	**0.5**	**1.9**
	Corrected	**97.6**		
	Southern Drilled Area	**96.8**	**0.4**	**2.3**

6.3 Indicated Resources

Forbes (1959) & 1960) calculated only 0.5 million tonnes of dune gypsum at Lake Purdilla and 0.17 million tonnes at Lake Toorna. This is a gross understatement.

Based on the 1988 hand auger holes and detailed 1:5 000 topographic contour plans, Mason & Compston (1990) calculated a **total of 5 million tonnes** at Lake Purdilla and Lake Toorna in dunes *up to 5 metres high but rarely higher than 3 metres*. This is incorrect. In June 1996 at the South Mine Site, nine significant dunes were measured with maximum heights varying from 4.5 to 9m which contain **indicated resources of 440 000 tonnes.**

From the 1997 data, **indicated resources** of dune gypsum at the Northern Mine Site are **700 000 tonnes** based on a bulk density of 1.3 tonnes/cubic metre.

The previous total of 5 **million tonnes** of dune gypsum within EL1821 is still considered reasonable and is classified as **indicated resources** but may well understate the situation.

7. CONCLUSIONS

Machine auger drilling and back hoe trenching at two drilled areas on Lake Purdilla during 1997 have confirmed **measured resources** of high grade lake gypsum amenable to simple open cut mining.

South Drilled Area contains **8.5 million tonnes** of lake gypsum averaging 93% gypsum, 2.3% salt, 4.2% carbonate and 0.5% silica.

North Drilled Area contains **8.7 million tonnes** at 93% gypsum, 2.3% salt, 4.2% carbonate and 0.5% silica.

At each drilled area, marginal lunette gypsum dunes also contain the following **indicated resources** of high grade unconsolidated sand-sized gypsum relatively low in salt.

South Mine Site	**440 000 tonnes** averaging 96.8% gypsum 0.4% salt, 2.3% carbonate and 0.5% silica.
North Mine Site	**700 000 tonnes** averaging 97.6% gypsum, 0.5% salt, 1.9% carbonate and 0.5% silica.

Total resources for all categories in EL1821 are **85 million tonnes** comprising

	measured	**indicated**	**inferred**	**Total**
Lake Purdilla	17	43	-	60
Lake Toorna	-	12	-	12
Peripheral Lakes	-	-	8	8
Dunes	-	5	-	5
Total	17	59	**8**	**85**

To upgrade these resources to measured status, machine auger drilling on a grid similar to the 1997 program is required for the lake gypsum.

Similarly, chemical analysis of the 1988 samples and hand auger drilling of untested zones are required for the dune gypsum.

JEFFREY G OLLIVER

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COLOUR PLATES

Plate 1: SOUTH MINE SITE January 1997

View north west from south eastern corner of old mineral claims.

Mine site is white area in right rear between the large white gypsum dunes at left and right.

Plate 2: SOUTH MINE SITE January 1997

View to south east. Large gypsum dune with scattered scrub forms boundary to mine site. Fence is property boundary between Kammerman (this side) and Williams (left rear).

Plate 3: SOUTH MINE SITE January 1997
View north along boundary fence. Red tape marks hole K21. PVC tube on ground is from completed push-tube holes.

Plate 4: SOUTH MINE SITE January 1997
View east at site of Hole K16 on boundary fence. Pegging of grid in progress

Plate 5: SOUTH MINE SITE January 1997
View north west from boundary fence. Site for hole K15 marked by white PVC in centre. Surface has moderate cover of gypsum crystal.

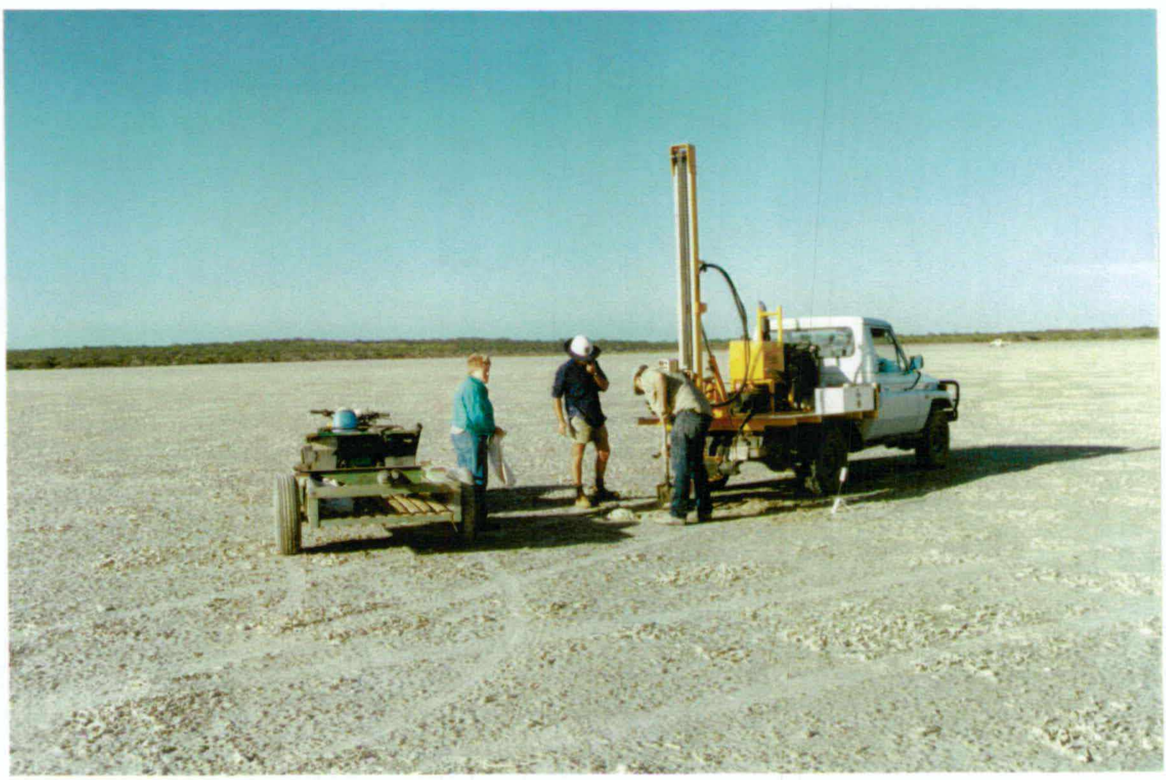

Plate 6: SOUTH MINE SITE February 1997
View south west at Hole K27. Sample of white gypsarenite being collected from 0-1m. Full sample bags are stacked on small trailer behind motor bike.

Plate 7: SOUTH MINE SITE February 1997
Machine auger rig after spudding in with white gypsarenite augering to the surface.

Plate 8: SOUTH MINE SITE February 1997
View west to Hole K18 on Williams property. Land cruiser, motor bike, trailer, and rig. Lake surface littered with large white gypsum crystals. Boundary fence in background.

Plate 9 NORTH MINE SITE 29 May 1997
Panoramic view east. K31 Stockpiles at left on edge of red-brown samphire. White K42 stockpile at far right.

Plate 10 NORTH MINE SITE 29 May 1997
Close up of K31 stockpiles. Lake surface with moderate samphire cover south of fence compared to very little north of fence.

Plate 11 NORTH MINE SITE 29 May 1997
Close up of K42 stockpile in centre.

Plate 12 NORTH MINE SITE 16 May 1997
View north of K31 stockpiles taken from K42. Ideal site for large stockpiles is cleared ground at left rear which slopes gently towards lake.

Plate 13 NORTH MINE SITE 16 May 1997
View west of K31 stockpiles with access track along fence. Water level in trench is at 1.6m

Plate 14 NORTH MINE SITE 29 May 1997
Same view as above with trench being fenced. Water level is at 0.43m

Plate 15 NORTH MINE SITE 16 May 1997
K31 Freshwater Stockpile (western). View south with sample sites (F1-F9) marked.

Plate 16 NORTH MINE SITE 29 May 1997
K31 Seawater Stockpile (Eastern). View east of sample being collected from S4.

Plate 17 NORTH MINE SITE 16 May 1997
Stockpile K42 being established on folded black agri pipe. View South

Plate 18

NORTH MINE SITE

16 May 1997

View east.
Backhoe near
bottom of trench

Plate 19 SOUTH MINE SITE 16 May 1997
Trenching in progress at drillhole K16. View south.

Plate 20 SOUTH MINE SITE 16 May 1997
View southwest of completed K16 stockpile.

APPENDIX A

RESOURCE CALCULATIONS FROM MICROMINE

by

P.P. Crettenden

PARAMETERS

Calculations are based on the following.

Tonnage - thickness from 1997 drillholes and selected earlier holes.

South - all 30 holes (K1-K30) from 1997 and 6 holes from 1959 and 6 from 1969.

North - 34 holes (K31, K33-K65) from 1997 and 10 holes from 1959.

- cut off of 0.5m
- areas were measured from contour plans fig 7 and 10 which were compiled by P.P. Crettenden, using MICROMINE software.
- volume was calculated by multiplying area between 0.5m contour lines by the average thickness of that interval.

Gypsum Content

- cut off was effectively 87% gypsum (Hole 20 in the South)
- metre-percent was used instead of gypsum content to statistically weight drillholes with respect to thickness and area of influence.
- areas were measured from contour plans fig 9 and 12 compiled using MICROMINE.
- volume-percent was calculated by multiplying area between 20 metre-percent contour lines by the average metre-percent of that interval. However MICROMINE proved to be unsuitable.

Salt Content - is not related to gypsum or carbonate content.

- average was calculated from weighted average for each hole assuming each hole is of equal significance.

Silica Content - assumed to be 0.5%.

Iron/Aluminium Content - negligible.

Carbonate Content -average is balance obtained by deducting other compounds.

TABLE 1

SOUTH MINE SITE, TONNAGE CALCULATIONS

Thickness (m) Range	Av	Area (sq.m)	Volume (cu.m)	S.G.	Tonnes
+ 0.5-1.0	0.75	257523	193142	1.32	254948
+ 1.0-1.5	1.25	229391	286739	1.32	378495
+ 1.5-2.0	1.75	218021	381537	1.32	503629
+ 2.0-2.5	2.25	227961	512912	1.32	677044
+ 2.5-3.0	2.75	360009	990025	1.32	1306833
+ 3.0-3.5	3.25	585355	1902404	1.32	2511173
+ 3.5-4.0	3.75	384656	1442460	1.32	1904047
+ 4.0-4.5	4.25	156813	666455	1.32	879721
+ 4.5-5.0	4.60	20342	93573	1.32	123517
	2.6	**2440071**	**6469247**		**8539407**

TABLE 2

SOUTH MINE SITE, METRE PERCENT

Metre-Percent Range	Av	Area (Sq m)	cu.m%
+ 100-120	110	201896	22208560
+ 120-140	130	129686	16859180
+ 140-160	150	131522	19728300
+ 160-180	170	118591	20160470
+ 180-200	190	119071	22623490
+ 200-220	210	110021	23104410
+ 220-240	230	125495	28863850
+ 240-260	250	143329	35832250
+ 260-280	270	227842	61517340
+ 280-300	290	229816	66646640
+ 300-320	310	279345	86596950
+ 320-340	330	222787	73519710
+ 340-360	350	149551	52342850
+ 360-380	370	109665	40576050
+ 380-400	390	81057	31612230
+ 400-420	410	39090	16026900
+ 420-440	430	21307	9162010
Total		**2440071**	**627381190**

$$\text{Average Grade} = \frac{\text{Cubic Metre-Percent}}{\text{Volume}} = \frac{627381190}{6469247}$$

$$= 97.0\%$$

TABLE 3

SOUTH MINE SITE - AVERAGE METRE-PERCENT

Hole no.	Easting	Northing	Depth (m)	Hole Average $CaSO_4(2H_2O)$	Metre % $CaSO_4(2H_2O)$	Hole Average NaK(Cl)	Metre % NaK(Cl)
K1	431730	8354652	4.0	93.48	373.90	1.92	7.67
K2	432020	6354652	3.0	92.83	278.50	2.06	6.19
K3	432270	6354652	3.0	92.37	277.10	2.38	7.13
K4	431730	6354415	3.0	92.70	278.10	2.04	6.12
K5	432030	6354415	4.1	93.29	382.48	1.99	8.14
K6	432270	6354415	4.5	92.56	416.50	1.78	8.02
K7	432530	6354415	3.0	90.67	272.00	2.21	6.63
K8	432780	6354415	2.3	90.30	207.69	1.83	4.21
K9	431470	6354160	3.5	91.54	320.40	2.39	8.36
K10	431730	6354160	3.1	93.33	289.32	1.98	6.14
K11	432030	6354170	4.7	93.61	439.95	1.94	9.11
K12	432280	6354170	3.4	92.72	315.26	2.31	7.85
K13	432530	6354175	3.3	92.92	306.64	2.24	7.39
K14	432780	6354175	3.0	91.23	273.70	2.08	6.24
K15	431480	6353905	3.6	92.47	332.90	1.80	6.48
K16	431730	6353920	4.2	92.72	389.44	2.09	8.77
K17	432035	6353920	3.3	93.93	309.97	2.32	7.64
K18	432280	6353930	2.9	94.02	272.66	2.62	7.60
K19	432530	6353930	2.7	92.67	250.22	2.22	5.99
K20	432780	6353930	2.4	91.25	219.00	2.44	5.85
K21	431190	6353660	3.6	91.76	330.34	1.99	7.17
K22	431440	6353660	3.4	92.46	314.38	2.20	7.48
K23	431735	6353660	4.0	92.43	369.70	2.11	8.42
K24	432035	6353665	2.6	93.04	241.90	2.40	6.23
K25	432290	6353650	2.6	91.76	238.58	2.16	5.62
K26	431200	6353390	4.0	93.28	373.10	2.27	9.07
K27	431450	6353400	4.0	90.75	363.00	2.58	10.30
K28	431745	6353400	4.0	92.65	370.60	2.47	9.89
K29	431210	6353200	1.3	92.07	119.69	2.15	2.79
K30	431440	6353200	1.7	91.78	119.32	2.83	3.63
E12A	430940	6353150	2.3	92.28	212.24	2.90	6.63
E13	431520	6353160	0.5	87.40	43.70	3.20	1.60
E15	430820	6353600	1.5	87.50	131.25	1.27	2.67
E18	432640	6354300	3.4	91.63	311.53	3.30	11.21
E20	432480	6354910	3.4	86.95	295.64	2.40	8.15
E21	432050	6354920	1.2	90.20	108.24	6.67	8.00
M21	431035	6353450	3.2	90.80	290.56	3.73	11.93
M22	431015	6353160	2.2	90.80	199.76	2.84	6.24
M25	431620	6354370	2.0	92.10	184.20	0.70	1.40
M26	431280	6354140	1.9	92.10	174.99	0.72	1.36
M28	431650	6354820	2.2	90.40	193.88	0.60	1.32
M37	432310	6354930	4.2	91.60	202.40	1.34	5.64
		TOTAL	**126.2**	**AV 91.82**	**11399.73** **AV 90.33**	**AV 2.29**	**TOTAL 279.56** **AV 2.20**

Holes omitted
M23 & M33 - outside limit
M35 only 2.8m deep - should have been 4.0m
M36 4.0m deep - should have been 2.5m
E17 - K5 used
M24 - K16 used
M34 - K18 used
E14 - K24 used
E14A - K25 used

TABLE 4

NORTH MINE SITE, TONNAGE CALCULATIONS

Thickness (m) Range	Av	Area (sq.m)	Volume (cu.m)	S.G.	Tonnes
+0.5-1.0	0.75	723836	542877	1.32	716598
+1.0-1.5	1.25	637750	797188	1.32	1052288
+1.5-2.0	1.75	845594	1479790	1.32	1953323
+2.0-2.5	2.25	810641	1823942	1.32	2407603
+2.5-3.0	2.75	444795	1223186	1.32	1614606
+3.0-3.5	3.25	146598	476444	1.32	628906
+3.5	3.7	67253	248836	1.32	328464
TOTAL		**3676467**	**6592263**		**8701788**

TABLE 5

NORTH MINE SITE, METRE PERCENT

NOT APPLICABLE

TABLE 6

NORTH MINE SITE - AVERAGE METRE-PERCENT

Hole no.	Easting	Northing	Depth (m)	Hole Average $CaSO_4(2H_2O)$	Metre % $CaSO_4(2H_2O)$	Hole Average NaK(Cl)	Metre % NaK(Cl)
K31	429170	6358740	2.3	92.53	212.81	1.90	4.38
K33	429795	6358780	1.7	92.20	156.74	2.02	3.44
K34	430090	6358795	1.6	93.20	149.12	2.21	3.53
K35	430395	6358805	1.8	92.99	167.38	2.29	4.13
K36	429180	6358450	2.9	94.83	275.01	1.77	5.14
K37	429480	6358470	2.8	94.48	264.54	1.86	5.21
K38	429810	6358580	3.0	95.13	285.40	1.56	4.67
K39	430105	6358440	1.8	94.44	170.00	1.63	2.93
K40	430410	6358510	2.5	89.02	222.55	1.95	4.88
K41	429190	6358100	2.8	93.31	261.28	1.92	5.37
K42	429490	6358170	3.0	94.10	282.30	2.03	6.09
K43	430120	6358150	1.6	93.40	149.44	1.92	3.07
K44	430420	6358160	2.4	93.97	225.52	1.65	3.95
K45	430720	6358170	2.4	90.15	216.36	2.19	5.26
K46	428980	6357790	2.0	91.60	183.20	2.30	4.59
K47	429200	6357800	2.0	92.85	185.70	1.96	3.91
K48	429495	6357915	1.6	93.26	149.22	1.76	2.82
K49	429790	6357930	2.0	94.35	188.70	1.83	3.66
K50	430130	6357850	2.8	93.82	262.70	1.82	5.10
K51	430470	6357840	2.0	93.40	186.80	2.30	4.60
K52	430780	6357850	3.0	93.57	280.70	1.48	4.44
K53	429210	6357500	1.5	91.80	137.70	2.09	3.14
K54	429850	6357430	2.6	93.61	243.38	2.57	6.67
K55	430145	6357550	3.6	93.77	337.58	2.25	8.10
K56	429380	6357180	3.9	94.94	370.28	1.57	6.12
K57	429510	6357320	2.4	92.40	221.76	2.15	5.15
K58	429860	6357225	4.0	89.88	359.50	2.22	8.86
K59	430155	6357230	3.5	93.47	327.15	2.32	8.13
K60	430490	6357250	2.4	90.96	218.30	2.00	4.80
K61	429525	6356910	1.7	89.56	152.25	2.42	4.11
K62	429880	6356920	2.0	90.80	181.60	2.45	4.90
K63	429520	6356510	2.0	92.15	184.30	2.01	4.02
K64	430195	6356740	3.0	91.40	274.20	2.07	6.21
K65	430510	6356660	3.0	92.27	276.80	2.25	6.74
M43	430615	6356410	2.7	93.30	251.91	2.63	7.11
M44	430240	6356450	2.7	92.80	250.56	3.57	9.63
M47	429700	6356660	2.3	91.20	209.76	4.51	10.37
M50	431025	6357820	2.7	94.60	255.42	3.07	8.30
M52	430690	6358300	2.1	93.70	196.77	3.18	6.68
M55	429960	6358740	2.5	95.50	238.75	3.20	7.99
M57	430070	6358290	2.8	89.50	250.60	3.35	9.38
M58	429860	6357760	2.2	94.70	208.34	1.40	3.08
M61	429370	6357480	2.4	92.40	221.76	3.61	8.66
M69	429740	6359050	2.2	94.80	208.56	2.70	5.95
		TOTAL	**108.2**	**AV 92.87**	**10052.70** **AV 92.91**	**AV 2.30**	**TOTAL 250.29** **AV 2.28**

Holes omitted
- K32, M45, M46, M51, M62-65, M68 - outside limit
- M49 3.1m deep - should have been 2.0m
- M56 - K31 used
  M59 - K42 used
  M60 - K46 used
  M49 - K51 used
  M48 - K59 used

AVERAGE GRADE

Calculated average grades from metre-percent using MICROMINE are marginally too high at 97.0% for South Mine Site and far too high at over 100% for North Mine Site.. Because there were no holes drilled in the marginal thin low grade zones, MICROMINE was unable to contour the lower values realistically and hence, calculations were biased to the thicker higher grade central zones. Hand contouring is able to cope with this situation.

At other lake gypsum deposits, average grade derived from metre-percent contours is marginally higher than grade calculated either arithmetically or from gypsum percent contour plans or by areas of influence.

Accordingly, a conservative average grade of 93.0% gypsum has been adopted for both mine sites as compared below.

South	Area C (Olliver et al 1985 & 1988)	87.0
	Mine site (1996)	92.0
	Hole average	91.8
	Metre-percent average	90.3
	MICROMINE	97.0
	ADOPTED	**93.0**
North	Area A (Olliver et al 1985 & 1988)	92.7
	Mine site (1996)	not calculated
	Hole average	92.9
	Metre-percent average	92.9
	MICROMINE	+100.0
	ADOPTED	**93.0**

APPENDIX B

DRILLING PROGRAMS

1. **SADM 1959**

During February-March 1959, SA Dept of Mines drilled 135 holes (designated M1-135) in Lakes Purdilla and Toorna with the Proline machine auger rig (Forbes, 1959 & 1960).

A chisel-shaped bit penetrated the wet lake sediments fairly readily but stopped at hard 'bedrock' limestone. A serious disadvantage was the inability to recover samples below about 2m. Hence, the recorded thickness of gypsum must be suspect. Hole M51 reached hard limestone at 4.3m but on checking with a hand auger the base of gypsum was 1.8m underlain by 2.5m of unconsolidated calcareous sediment.

2. **Elcor 1969**

During April-May 1969, Elcor drilled 31 holes (designated E1-31) in the southern half of Lake Purdilla by pushing NX-casing with a small diamond coring rig (Hall et al, 1970).

Many holes were completed without operating the rig. A number of days were wasted in recovery of the rig bogged in the southwestern portion of the lake. Total depth ranged from 0.6m in E13 to 5.2m in E17. Core recovery was generally satisfactory, although was moderate in the lower parts of each hole. Sludge samples were collected where core recovery was poor.

3. **Push-tube, 1997**

During January 1997, 30 holes (designated K1-30) were pegged on a 200-300m grid at the South Mine Site based on the north-south property boundary fence ensuring that several of the 1959 and 1969 holes were duplicated (Plates 1, 2, 3 & 4).

On 17 January 1997, the writer assisted by Susan Olliver, Colin Kammerman and Malcolm Kammerman commenced hand drilling by hammering 32mm PVC tube into the surface of the lake. This method has been used successfully to explore gypsum lakes elsewhere in South Australia. Maximum depth reached was 3.7m.

However, at the 8 sites attempted on Lake Purdilla, final depth varied from only 0.4m to a maximum of 1.49m well short of target depth (Plates 3 & 4).

The increasing abundance of large crystal aggregates with depth prevented penetration of the PVC tube. In fact, in the final hole the tube had been pinched and closed at 0.94m.

4. **Machine Auger, 1997**

During February 1997, a total of 65 holes were completed over 2.5 days, 30 holes (K1-K30) at South Mine Site and 35 holes (K31-K65) on a similar grid at North Mine Site (Plates 5, 6, 7 & 8).

A brand new Edson CP10 machine auger rig mounted on a 4WD Toyota Landcruiser Tray Top was operated by Jim McLeod (McLeod Field Services, Crystal Brook). Assistance was provided by Susan Olliver and Fred Crossman.

Auger flights were 2m long and 11.4cm in diameter. In general, samples were collected over 1m intervals. Care was taken to scrape all material adhering to the flights in the deeper, wetter sections. Occasionally, very little sample was obtained.

A star bit of 12.7cm diameter was used for day one but was replaced by a clay spiral bit for day two which produced a better sample.

Geological logs comprise Appendix C and hole locations are shown on figures 5 and 6.

For the machine auger holes, gypsum thickness varied

- from 1.3m in K30 to 4.7m in K11 - south
- from 1.5m in K53 to 4.0m in K58 - north

All holes reached the base of the gypsum except K14 and K64 which were stopped marginally higher.

The geological sequence from surface was as follows.

Thickness (m)	
0.0-0.08	discoloured gypsite - not present in many holes
0.3-1.0	white friable unlaminated to indistinctly laminated fine to coarse gypsarenite. Occasional layers and individual large gypsum crystals.
0.5-1.0	grey laminated coarse gypsarenite less friable, with red, black and white banding and layers of large gypsum crystals. Difficult to define base with underlying unit.
0.0-2.7	grey mass of gypsum crystals grading to crystal aggregates and layers of rock gypsum.
0.1-0.7	white calcareous clay, occasionally sand
base	hard calcrete, occasionally soft.

South Mine Site forms an elliptical sub-basin orientated northeast - southwest about 2.6km long, up to 1.6km wide with a maximum depth of about 5m (fig 5 and 7). There are no islands (fig 5, Plates 1-6). Much of the surface is littered with large gypsum crystals (Plates 4, 5, 6). Samphire is restricted to the north eastern margins.

North Mine Site forms a series of interconnected sub-basins about 3km north-south and 2.5km east-west (fig 10). There are two islands and a number of lunette gypsum dunes (fig 6, Plates 9-12).

Deepest zone of 3.5m to 4.0m forms an arc south of the islands linking holes K55, K56 and K58 (fig 10).

APPENDIX C

GEOLOGICAL LOGS

Push Tube Holes, January 1997

Machine Auger Holes, February 1997

PUSH TUBE HOLES

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K21			
0.0-0.60	white fine to coarse gypsarenite	91.40	2.52
0.60-0.94	grey coarse to very coarse gypsarenite	93.10	2.17
	EOH 0.94m - PVC tube pinched & closed.		
Hole no K22			
0.00-0.08	black to brown fine gypsarenite with large crystals at base	92.00	2.31
0.08-0.66	white fine gypsarenite with scattered large crystals to 0.13m	88.90	4.34
0.66-1.25	grey fine to coarse gypsarenite	92.30	2.27
	EOH 1.25m		
Hole no K23			
0.00-0.02	dark brown fine gypsarenite		
0.02-0.19	grey fine gypsarenite with large crystals	90.80	3.11
0.19-0.70	white fine to medium gypsarenite	91.90	2.55
0.70-1.40	grey fine to coarse gypsarenite with scattered large crystals especially at 1.0m	94.10	2.51
	EOH 1.40m Tube reached 1.45m but lost 0.05m of core		
Hole K26			
0.00-0.07	grey brown fine gypsarenite		
0.07-0.26	pale grey bedded coarse gypsarenite	92.50	3.26
0.26-0.54	white fine/med. gypsarenite	90.80	2.56
0.54-1.45	pale grey to grey fine/coarse gypsarenite with crystals	92.10	2.72
	EOH 1.45m		
Hole no K27			
0.00-0.20	grey banded fine gypsarenite	91.90	2.79
0.20-0.60	white fine/med gypsarenite	91.20	2.64
0.60-1.45	grey fine/coarse gypsarenite with scattered crystals	93.20	2.90
	EOH 1.45m Tube to 1.52m but lost 0.07m of core		
Hole no K28			
0.00-0.02	brown fine gypsarenite		
0.02-0.35	white fine/med gypsarenite	90.60	3.40
0.35-1.49	grey crystals	92.60	3.46
	EOH 1.49m Tube to 1.56m but lost 0.07m of core		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K29			
0.00-0.07	grey to pale brown fine gypsarenite with pink gastropods	90.70	3.64
0.07-0.37	white fine/med gypsarenite		
0.37-0.66	grey fine/coarse gypsarenite	91.30	3.83
	EOH 0.66m		
Hole no K30			
0.00-0.03	brown fine gypsarenite		
0.03-0.33	white coarse gypsarenite	88.60	3.66
0.33-0.35	grey coarse gypsarenite		
	EOH 0.35m Tube to 0.40m but lost 0.05m of core		

MACHINE AUGER HOLES

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K1			
0.00-1.00	white gypsarenite to 0.8m, grey below	94.00	1.90
1.00-2.00	grey gypsarenite, coarser with brown patches	92.10	2.35
2.00-4.00	wet gypsarenite - poor sample	93.90	1.71
	EOH 4.00m grey calcareous clay		
Hole no K2			
0.00-1.00	white gypsarenite	91.70	2.48
1.00-2.00	grey gypsarenite, coarser	92.80	2.02
2.00-3.00	wet gypsarenite - poor sample	94.00	1.69
	EOH 3.00m grey-white calcareous clay		
Hole no K3			
0.00-1.00	white gypsarenite to 0.9m, grey below	92.10	2.41
1.00-2.00	grey gypsarenite, coarser with large crystals	91.50	2.71
2.00-3.00	pale grey milled gypsum crystals	93.50	2.01
	EOH 3.00m grey-white calcareous clay		
Hole no K4			
0.00-1.00	White to grey gypsarenite	91.40	2.02
1.00-2.00	grey gypsarenite, coarser with large crystals and a few small pink gastropods	92.90	1.98
2.00-3.00	as above	93.80	2.12
	EOH 3.00m white-grey calcareous clay		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K5			
0.00-1.00	white gypsarenite, grey at base	92.30	1.87
1.00-2.00	grey gypsarenite, coarser	93.70	1.88
2.00-3.00	as above	94.40	1.75
3.00-4.10	wet - poor sample	92.80	2.40
	EOH 4.10m hard silicified calcrete		
Hole no K6			
0.00-1.00	white gypsarenite, grey below 0.9m	92.10	1.87
1.00-2.00	grey damp gypsarenite, coarser	93.40	1.89
2.00-3.00	as above	93.30	1.80
3.00-4.50	wet, grey gypsarenite - poor sample	92.20	1.64
	EOH 4.5m hard silicified calcrete		
Hole no K7			
0.00-1.00	white gypsarenite grey below 0.8m	90.90	2.40
1.00-2.00	grey gypsarenite, coarser	92.80	2.33
2.00-3.00	as above	88.30	1.90
3.00-3.90	wet, no sample	-	-
	EOH 3.90m hard ? calcrete		
Hole no K8			
0.00-1.00	white gypsarenite	89.00	1.82
1.00-2.00	grey gypsarenite, coarser	91.30	1.84
2.00-2.70	as above, minor contamination with underlying calcareous sand/clay - base of gypsum probably at 2.30m	85.10	1.82
	EOH 2.70m hard calcrete		
Hole no K9			
0.00-1.00	white gypsarenite	90.90	1.81
1.00-2.00	grey gypsarenite, coarser wet at 1.6m	90.50	2.39
2.00-3.00	as above, wet	92.70	1.93
3.00-3.50	grey gypsum crystals	92.60	2.34
	EOH 3.50m calcrete		
Hole no K10			
0.00-1.00	white gypsarenite, grey below 0.8m	92.20	2.02
1.00-2.00	grey gypsarenite, coarser	93.50	2.14
2.00-3.10	wet as above	94.20	1.80
	EOH 3.10m white calcareous clay		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K11			
0.00-1.00	white gypsarenite	92.70	2.05
1.00-2.00	grey gypsarenite, coarser hard crystalline layer at 1.6m	92.80	2.05
2.00-3.00	wet as above	95.50	1.81
3.00-4.70	wet grey gypsum crystals	93.50	1.88
	EOH 4.70m clay over hard calcrete		
Hole no K12			
0.00-1.00	white gypsarenite, grey below 0.8m	92.70	2.31
1.00-2.00	grey gypsarenite, coarser, minor brown	92.50	2.73
2.00-3.40	as above	92.90	2.01
	EOH 3.40m white clay		
Hole no K13			
0.00-1.00	white gypsarenite, grey below 0.8m	91.10	2.70
1.00-2.00	grey gypsarenite, coarser	92.30	2.48
2.00-3.00	as above	94.80	1.70
3.00-3.50	as above, contaminated with calcareous material. Base of gypsum probably 3.30m	80.90	2.22
	EOH 3.50m clay over hard calcrete		
Hole no K14			
0.00-1.00	white gypsarenite, grey at base	90.50	2.22
1.00-2.00	grey gypsarenite, coarser	91.70	1.86
2.00-3.00	as above	91.50	2.16
	EOH 3.00m still in gypsum, base probably at 3.10m		
Hole no K15			
0.00-1.00	white gypsarenite, grey below 0.9m	92.20	1.69
1.00-2.00	grey gypsarenite, coarser	92.00	1.97
2.00-3.00	as above	93.20	1.70
3.00-3.60	as above	92.50	1.86
	EOH 3.60m white-grey calcareous clay		
Hole no K16			
0.00-1.00	white gypsarenite	91.80	1.91
1.00-2.00	grey gypsarenite, coarser	92.10	2.04
2.00-3.00	wet grey gypsum crystals	94.30	1.89
3.00-4.20	wet large gypsum crystals	92.70	2.41
	EOH 4.20m grey calcareous clay over yellow clay		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K17			
0.00-1.00	white gypsarenite	89.90	2.37
1.00-2.00	grey gypsarenite, coarser	95.00	2.69
2.00-3.00	as above wet	96.00	2.07
3.00-3.30	as above	96.90	1.71
	EOH 3.30m hard calcrete		
Hole no K18			
0.00-1.00	white gypsarenite	92.90	2.91
1.00-2.00	grey gypsarenite, coarser	93.90	2.73
2.00-2.90	as above	95.40	2.18
	EOH 2.90m grey calcareous clay		
Hole no K19			
0.00-1.00	white gypsarenite, grey at base	92.10	2.67
1.00-2.00	grey gypsarenite with large gypsum crystals	94.40	1.90
2.00-2.70	as above	91.60	2.02
	EOH 2.70m hard calcrete		
Hole no K20			
0.00-1.00	white gypsarenite, grey below 0.7m	91.00	2.29
1.00-2.00	grey gypsarenite, coarser	92.00	2.63
2.00-2.60	as above, wet - minor calcareous contamination, base of gypsum at 2.40m	90.00	2.32
	EOH 2.60m calcareous sand/clay		
Hole no K21			
0.00-1.00	white gypsarenite, grey below 0.6m	91.90	1.84
1.00-2.00	grey gypsarenite, coarser	91.40	2.29
2.00-3.60	as above, wet	91.90	1.90
	EOH 3.60m clay on hard calcrete		
Hole no K22			
0.00-1.00	white gypsarenite, grey below 0.7m	92.00	2.11
1.00-2.00	grey gypsarenite, coarser	92.60	2.23
2.00-3.00	as above, wet	93.20	2.25
3.00-3.40	as above, wet	92.70	2.21
	EOH 3.40m grey clay on hard calcrete		
Hole no K23			
0.00-1.00	white gypsarenite to 0.8m, grey below	90.00	2.40
1.00-2.00	grey gypsarenite with hard crystalline layers	92.90	2.03
2.00-3.00	grey gypsarenite	93.70	2.11
3.00-4.00	grey gypsum crystals	93.10	1.88
	EOH 4.00m grey and white clay over calcrete		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K24			
0.00-1.00	white gypsarenite to 0.7m, grey below	92.20	2.50
1.00-2.00	grey gypsarenite, coarser	93.60	1.77
2.00-2.60	as above	93.50	1.96
	EOH 2.60m hard calcrete		
Hole no K25			
0.00-1.00	white gypsarenite	89.70	2.36
1.00-2.00	grey gypsarenite with large gypsum crystals	92.30	2.02
2.00-2.60	as above wet	94.30	2.07
	EOH 2.60m white clay		
Hole no K26			
0.00-1.00	white gypsarenite to 0.7m, grey below	93.70	2.11
1.00-2.00	grey gypsarenite	92.90	2.56
2.00-3.00	as above	93.90	2.26
3.00-4.00	as above	92.60	2.14
	EOH 4.00m hard calcrete		
Hole no K27			
0.00-1.00	white gypsarenite	91.40	2.49
1.00-2.00	grey gypsarenite, coarser hard gypsite layer at 2.00m	91.70	2.99
2.00-3.00	grey gypsarenite	87.20	2.17
3.00-4.00	as above, with hard crystalline layers	92.70	2.65
	EOH 4.00m grey calcareous clay		
Hole no K28			
0.00-1.00	white gypsarenite, wet & grey at base	93.10	2.70
1.00-2.50	grey gypsum crystals	90.90	2.37
2.50-4.00	as above	94.10	2.42
	EOH 4.00m hard calcrete		
Hole no K29			
0.00-1.00	white gypsarenite to 0.3m, wet & grey below	92.00	1.98
1.00-1.30	grey wet gypsum crystals	92.10	2.71
1.30-2.00	grey clay	-	-
	EOH 2.00m hard calcrete		
Hole no K30			
0.00-1.00	white gypsarenite to 0.4m, grey below	91.70	2.72
1.00-1.70	grey gypsarenite	91.90	2.98
	EOH 1.70m hard calcrete		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K31			
0.00-1.00	white gypsarenite to 0.8m, grey below	93.10	1.94
1.00-2.00	grey gypsarenite	91.90	1.92
2.00-2.30	as above	92.70	1.72
	EOH 2.30m Clay over silicified calcrete		
Hole no K32			
0.00-1.00	white gypsarenite to grey with brown calcareous layers	77.80	3.65
1.00-1.40	dark grey gypsarenite	79.30	2.96
	EOH 1.40m black sandy clay		
Hole no K33			
0.00-1.00	white to grey gypsarenite	92.20	1.83
1.00-2.00	grey gypsarenite with calcareous sand/clay at base of gypsum probably at 1.7m	71.00	2.30
	EOH 2.10m hard calcrete		
Hole no K34			
0.00-1.00	white gypsarenite	92.90	2.52
1.00-1.60	grey gypsarenite	93.70	1.73
	EOH 1.60m clay over hard calcrete		
Hole no K35			
0.00-1.00	white gypsarenite	92.90	2.67
1.00-1.80	grey gypsarenite	93.10	1.82
1.80-1.90	grey-black calcareous sand	-	-
	EOH 1.90m hard calcrete		
Hole no K36			
0.00-1.00	white gypsarenite	92.60	2.15
1.00-2.00	grey gypsum crystals, large	96.10	1.41
2.00-2.90	as above	95.90	1.76
2.90-3.00	grey calcareous clay	-	-
	EOH 3.00m hard calcrete		
Hole no K37			
0.00-1.00	white coarse gypsarenite	92.60	1.78
1.00-2.00	as above	95.30	1.92
2.00-2.80	grey coarse gypsum crystals	95.80	1.91
2.80-2.90	grey calcareous clay	-	-
	EOH 2.90m hard calcrete		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K38			
0.00-1.00	white coarse gypsarenite	93.90	1.69
1.00-2.00	grey coarse gypsum crystals	95.80	1.49
2.00-3.00	wet, gypsum crystals, minor gastropods - hardly any sample	-	-
	EOH 3.00m calcareous clay		
Hole no K39			
0.00-1.00	white coarse gypsarenite	94.00	1.70
1.00-1.80	grey coarse gypsarenite	95.00	1.54
1.80-2.20	grey/brown calcareous sand/clay	-	-
	EOH 2.20m hard calcrete		
Hole no K40 - above 0.2m above lake surface			
0.00-1.00	white gypsarenite, fine at top	90.60	2.15
1.00-2.00	grey gypsarenite	90.90	1.81
2.00-2.80	as above but with calcareous contamination - base of gypsum at 2.5m	82.10	1.84
2.80-3.00	soft limestone	-	-
	EOH 3.00m hard calcrete		
Hole no K41			
0.00-1.00	white fine to coarse gypsarenite	92.80	2.12
1.00-2.00	white to grey coarse gypsarenite	94.80	1.49
2.00-2.80	grey as above	92.10	2.20
2.80-3.00	soft limestone	-	-
	EOH 3.00m hard calcrete		
Hole no K42			
0.00-1.00	white gypsarenite	93.30	2.62
1.00-2.00	grey gypsarenite	94.50	1.50
2.00-3.00	grey gypsarenite	94.50	1.97
	EOH 3.00m grey calcareous clay		
Hole no K43			
0.00-1.00	white gypsarenite	93.10	1.92
1.00-1.60	pale grey with brown/orange gypsarenite	93.90	1.92
1.60-1.70	grey calcareous clay	-	-
	EOH 1.70 hard calcrete		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K44			
0.00-1.00	white gypsarenite	92.80	2.26
1.00-2.00	pale grey gypsarenite with large gypsum crystals	94.80	1.69
2.00-2.40	Crystalline gypsum, wet - hardly any sample	-	-
2.40-3.00	wet - calcareous clay	-	-
	EOH 3.00m clay		
Hole no K45			
0.00-1.00	white to pale brown gypsarenite	92.60	2.32
1.00-2.00	grey to white gypsarenite	88.40	1.81
2.00-2.80	as above but with calcareous contamination & black sand. Base of gypsum probably 2.40m	70.80	2.83
	EOH 2.80m hard calcrete		
Hole no K46			
0.00-1.00	white gypsarenite with large gypsum crystals	90.90	2.35
1.00-2.00	grey gypsum crystals	92.30	2.24
2.00-2.10	limestone	-	-
	EOH 2.10m hard calcrete		
Hole no K47			
0.00-1.00	white gypsarenite with large crystals to 0.8m, grey below	92.10	1.97
1.00-2.00	grey gypsum crystals, large	93.60	1.94
	EOH 2.00m clay over hard calcrete		
Hole no K48			
0.00-1.00	white gypsarenite with large crystals	91.20	1.91
1.00-1.60	grey gypsum crystals	96.70	1.51
	EOH 1.60m clay over hard calcrete		
Hole no K49			
0.00-1.00	white gypsarenite with large crystals	92.90	2.12
1.00-2.00	grey gypsum crystals	95.80	1.52
2.00-2.10	grey calcareous clay	-	-
	EOH 2.10m hard calcrete		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K50			
0.00-1.00	white gypsarenite to 0.9m, grey below with large crystals	91.80	1.98
1.00-2.00	grey gypsum crystals with hard crystalline layer at 1.8-2.0m	94.90	1.90
2.00-2.80	grey gypsum crystals, large	95.00	1.49
2.80-3.00	soft limestone/clay	-	-
	EOH 3.00m hard calcrete		
Hole no K51			
0.00-1.00	white to grey gypsarenite with large crystals at base	91.90	2.54
1.00-2.00	grey gypsum crystals, large	94.90	2.06
2.00-2.60	grey hard crystalline gypsum - hardly any sample	-	-
	EOH 2.60m hard calcrete		
Hole no K52			
0.00-1.00	White to grey gypsarenite	93.30	2.07
1.00-2.00	grey gypsum crystals, large	93.50	2.32
2.00-3.00	as above, no sample	-	-
	EOH 2.80m hard calcrete		
Hole no K53			
0.00-1.00	white gypsarenite	90.60	2.00
1.00-1.50	grey gypsarenite with large crystals	94.20	2.27
1.50-1.60	grey calcareous clay	-	-
	EOH 1.60m hard calcrete		
Hole no K54			
0.00-1.00	white gypsarenite	92.60	2.42
1.00-2.00	grey gypsarenite	94.50	2.52
2.00-2.60	grey gypsum crystals	93.80	2.89
2.60-2.80	grey calcareous clay	-	-
	EOH 2.80m hard calcrete		
Hole no K55			
0.00-1.00	white to pale grey gypsarenite	92.00	2.66
1.00-2.00	grey coarse gypsum crystals	93.90	2.24
2.00-3.60	as above - base of gypsum probably 3.40m	94.80	2.00
	EOH 3.60m hard calcrete		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K56 - on island			
0.00-1.00	brown fine gypsarenite to 0.5m, white below	97.40	1.53
1.00-2.00	off white - pale brown gypsarenite	94.80	1.92
2.00-3.00	grey gypsarenite	95.00	1.19
3.00-3.90	as above	92.20	1.64
3.90-4.00	grey calcareous clay	-	-
	EOH 4.00m hard calcrete		
Hole no K57			
0.00-1.00	white gypsarenite with large crystals	93.80	1.92
1.00-2.40	grey gypsum crystals	91.40	2.31
2.40-2.50	grey calcareous clay	-	-
	EOH 2.50m hard calcrete		
Hole no K58			
0.00-1.00	white gypsarenite to 0.5m, grey below	90.30	2.44
1.00-2.00	grey coarse gypsarenite	89.40	2.68
2.00-4.00	wet grey gypsum crystals - hardly any sample	89.90	1.87
4.00-4.10	no sample probably clay	-	-
	EOH 4.10m hard calcrete		
Hole no K59			
0.00-1.00	white gypsarenite, coarse grey at base	93.50	2.58
1.00-2.00	grey coarse gypsum crystals	94.90	2.53
2.00-3.50	as above	92.50	2.01
	EOH 3.5m hard calcrete		
Hole no K60			
0.00-1.00	white gypsarenite, grey and coarser at base	90.90	1.75
1.00-2.40	grey gypsum crystals	91.00	2.18
2.40-2.60	grey calcareous clay	-	-
	EOH 2.60m hard calcrete		
Hole no K61			
0.00-1.00	white gypsarenite	88.20	2.60
1.00-1.70	grey coarse gypsarenite	91.50	2.16
1.70-1.80	grey calcareous clay	-	-
	EOH 1.80m hard calcrete		

Interval (m)	Lithology	% Gypsum	%Salt
Hole no K62			
0.00-1.00	white gypsarenite, grey below 0.8m	89.80	2.57
1.00-2.00	grey coarse gypsum crystals with hard layer at 1.7m	91.90	2.33
2.00-2.30	as above - no sample hard at 2.1m	-	-
2.30-3.00	calcareous clay - no sample	-	-
	EOH 3.0m hard calcrete		
Hole no K63			
0.00-1.00	white gypsarenite	91.60	2.14
1.00-2.00	grey coarse gypsarenite	92.70	1.88
2.00-2.50	?calcareous clay - no sample	-	-
	EOH 2.50m hard calcrete		
Hole no K64			
0.00-1.00	brown gypsarenite to white to grey at base	89.90	2.44
1.00-2.00	grey coarse gypsarenite	92.10	2.08
2.00-3.00	grey coarse gypsum crystals	92.20	1.69
	EOH 3.00m gypsum crystals		
Hole no K65			
0.00-1.00	white gypsarenite	91.80	2.48
1.00-2.00	grey coarse gypsarenite	92.90	2.17
2.00-3.00	grey gypsum crystals with large pieces	92.10	2.09
3.00-3.30	grey calcareous clay	-	-
	EOH 3.30m hard calcrete		

APPENDIX D

CHEMICAL ANALYSIS

ALS Reports	ST18079	11/04/97
	AM18079	20/05/97
	ST18803	12/06/97
	ST18915	25/06/97
	ST18945	23/06/97

A total of 205 samples were submitted to Australian Laboratory Service Pty Ltd (ALS)

- 19 from pushtube holes
- 186 from machine auger holes

Samples were analysed as follows -

1. assay by acid digest.
2. samples are dried at 250°C.
3. gypsum ($CaSO_4 . 2H_2O$) is calculated from S content.
4. $CaCO_3$ is the stoichiometric excess of calcium after gypsum is calculated - expressed as carbonate.
5. $MgCO_3$ is magnesium, expressed as carbonate.
6. NaCl is sodium, expressed as chloride.
7. KCl is potassium, expressed as chloride.
8. Al_2O_3 is aluminium, expressed as oxide.
9. Fe_2O_3 is iron, expressed as oxide.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

ORDER No.: SAMPLE TYPE GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
K1 0-1		94.00	3.22	0.80	1.83	0.07	0.02
K1 1-2		92.10	4.50	0.95	2.20	0.15	0.06
K1 2-4		93.90	3.40	0.92	1.60	0.11	0.05
K2 0-1		91.70	4.51	1.20	2.32	0.16	0.06
K2 1-2		92.80	4.24	0.85	1.92	0.10	0.08
K2 2-3		94.00	3.27	0.94	1.60	0.09	0.05
K3 0-1		92.10	4.28	1.07	2.32	0.09	0.06
K3 1-2		91.50	4.39	1.28	2.61	0.10	0.06
K3 2-3		93.50	3.53	0.93	1.92	0.09	0.03
K4 0-1		91.40	5.49	0.95	1.91	0.11	0.05
K4 1-2		92.90	4.14	0.88	1.91	0.07	0.04
K4 2-3		93.80	3.08	0.95	2.05	0.07	0.03
K5 0-1		92.30	4.81	1.00	1.85	0.02	0.04
K5 1-2		93.70	3.39	0.77	1.86	0.02	0.04
K5 2-3		94.40	2.99	0.76	1.70	0.05	0.04
K5 3-4.1		92.80	3.47	1.07	2.33	0.07	0.04
K6 0-1		92.10	5.07	0.89	1.84	0.03	0.04
K6 1-2		93.40	3.84	0.77	1.84	0.05	0.05
K6 2-3		92.70	2.88	0.86	1.73	0.07	0.04
K6 3-4.5		92.20	4.47	0.86	1.54	0.10	0.04
K7 0-1		90.90	5.46	1.00	2.29	0.11	0.04
K7 1-2		92.80	3.88	0.95	2.30	0.03	0.04
K7 2-3		88.30	6.72	0.98	1.87	0.03	0.06
K8 0-1		89.00	7.65	1.35	1.73	0.09	0.08
K8 1-2		91.30	5.63	0.84	1.78	0.06	0.04
K8 2-2.7		85.10	9.45	1.14	1.70	0.12	0.07
K9 0-1		90.90	4.91	0.84	1.75	0.06	0.01
K9 1-2		90.50	5.65	1.03	2.28	0.11	0.03
K9 2-3		92.70	4.46	0.87	1.85	0.07	0.05
K9 3-3.5		92.60	3.74	0.91	2.13	0.11	0.06

COMMENTS:

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• Results apply to sample(s) as submitted by client

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
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Kalgoorlie Laboratory
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Perth Laboratory
Phone: (09) 249 2988 Fax: (09) 249 2942
Townsville Laboratory
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All pages of this report have been checked and approved for release.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaS04.2H20 % M290 0.01	CaC03 % M290 0.01	MgC03 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe203 % M290 0.01
K10 0-1		92.20	4.71	0.95	1.99	0.03	0.07
K10 1-2		93.50	3.48	0.84	2.09	0.05	0.06
K10 2-3.1		94.20	3.06	0.83	1.73	0.07	0.05
K11 0-1		92.70	4.34	0.88	1.99	0.06	0.04
K00 1-2		92.80	3.58	0.86	1.93	0.12	0.04
K11 2-3		95.50	1.85	0.70	1.77	0.04	0.09
K11 3-4.7		93.50	2.81	0.79	1.79	0.09	0.04
K12 0-1		92.70	4.00	0.93	2.19	0.12	0.04
K12 1-2		92.50	3.37	0.93	2.61	0.12	0.05
K12 2-3.4		92.90	3.81	0.82	1.86	0.15	0.05
K13 0-1		91.10	4.52	1.00	2.52	0.18	0.06
K13 1-2		92.30	4.17	0.88	2.29	0.19	0.07
K13 2-3		94.80	2.53	0.74	1.67	0.03	0.03
K13 3-3.5		80.90	12.51	1.18	2.09	0.13	0.12
K14 0-1		90.50	4.49	1.00	2.13	0.09	0.06
K14 1-2		91.70	4.50	0.94	1.76	0.10	0.06
K14 2-3		91.50	4.01	1.01	2.02	0.14	0.07
K15 0-1		92.20	4.19	0.81	1.65	0.04	0.06
K15 1-2		92.00	3.82	0.81	1.92	0.05	0.03
K15 2-3		93.20	3.69	0.81	1.64	0.06	0.05
K15 3-3.6		92.50	2.82	0.85	1.81	0.05	0.04
K16 0-1		91.80	4.18	0.86	1.81	0.10	0.04
K16 1-2		92.10	3.93	0.93	1.92	0.16	0.06
K16 2-3		94.30	2.87	0.78	1.73	0.16	0.07
K16 3-4.2		92.70	3.41	1.03	2.20	0.21	0.07
K17 0-1		89.90	4.78	0.91	2.14	0.23	0.06
K17 1-2		95.00	1.35	0.88	2.61	0.08	0.03
K17 2-3		96.00	1.08	0.82	1.99	0.08	0.04
K17 3-3.3		96.90	0.61	0.72	1.66	0.05	0.04
K18 0-1		92.90	2.57	0.90	2.80	0.11	0.05

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

ORDER No.:
SAMPLE TYPE GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
K18 1-2		93.90	2.12	0.93	2.66	0.07	0.04
K18 2-2.9		95.40	1.58	0.73	2.09	0.09	0.04
K19 0-1		91.70	3.54	0.91	2.59	0.09	0.02
K19 1-2		94.40	2.97	0.68	1.86	0.04	0.03
K19 2-2.7		91.60	5.24	1.03	1.98	0.04	0.04
K20 0-1		91.00	5.60	1.05	2.23	0.06	0.06
K20 1-2		92.00	4.32	0.94	2.55	0.08	0.04
K20 2-2.6		90.00	6.39	1.21	2.24	0.08	0.06
K21 0-1		91.90	4.66	0.81	1.81	0.03	0.03
K21 1-2		91.40	5.31	0.88	2.23	0.06	0.04
K21 2-3.6		91.90	4.92	0.88	1.84	0.06	0.06
K22 0-1		92.00	4.92	0.85	2.05	0.06	0.04
K22 1-2		92.10	3.65	0.84	2.23	<0.01	0.03
K22 2-3		93.20	2.98	0.88	2.20	0.05	0.03
K22 3-3.4		92.70	3.84	0.86	2.15	0.06	0.04
K23 0-1		90.00	6.35	1.10	2.32	0.08	0.06
K23 1-2		92.90	3.93	0.80	1.97	0.06	0.06
K23 2-3		93.70	3.37	0.78	2.06	0.05	0.05
K23 3-4		93.10	3.74	0.72	1.83	0.05	0.05
K24 0-1		92.20	4.38	0.82	2.47	0.03	0.03
K24 1-2		93.60	3.82	0.71	1.76	0.01	0.03
K24 2-2.6		93.50	3.43	1.03	1.91	0.05	0.05
K25 0-1		89.70	6.34	0.88	2.32	0.04	0.04
K25 1-2		92.30	4.47	0.72	1.99	0.03	0.05
K25 2-2.6		94.30	2.72	0.77	2.00	0.07	0.05
K26 0-1		93.70	3.38	0.76	2.08	0.03	0.03
K26 1-2		92.90	3.61	0.86	2.55	0.01	0.04
K26 2-3		93.90	2.69	1.05	2.23	0.03	0.05
K26 3-4		92.60	4.00	1.09	2.08	0.06	0.07
K27 0-1		91.40	4.74	0.84	2.43	0.06	0.06

COMMENTS:

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• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY
SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	$CaSO_4.2H_2O$	$CaCO_3$	$MgCO_3$	NaCl	KCl	Fe_2O_3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.01	0.01	0.01	0.01	0.01	0.01
K27 1-2		91.70	4.26	0.97	2.89	0.10	0.04
K27 2-3		87.20	8.16	1.12	2.07	0.10	0.10
K27 3-4		92.70	3.45	1.11	2.58	0.07	0.04
K28 0-1		93.10	3.30	0.84	2.63	0.07	0.04
K28 2.5-4		94.10	2.63	0.81	2.37	0.05	0.06
K29 0-1		92.00	4.30	1.06	1.87	0.11	0.15
K29 1-1.3		92.30	3.41	1.51	2.64	0.06	0.04
K30 0-1		91.70	4.48	0.99	2.58	0.14	0.05
K30 1-1.7		91.90	3.94	1.09	2.83	0.15	0.05
K31 0-1		93.10	3.41	1.45	1.86	0.08	0.06
K31 1-2		91.90	3.63	2.13	1.82	0.10	0.08
K31 2-2.3		92.70	3.46	1.95	1.64	0.08	0.10
K32 0-1		77.80	13.04	4.22	3.48	0.17	0.23
K32 1-1.4		79.30	12.27	3.76	2.79	0.17	0.18
K33 0-1		92.20	4.60	1.25	1.74	0.09	0.06
K33 1-2.1		71.00	24.49	2.00	2.23	0.07	0.07
K34 0-1		92.90	3.46	1.08	2.42	0.07	0.05
K34 1-1.6		93.70	3.37	1.15	1.71	0.02	0.03
K35 0-1		92.90	3.14	1.24	2.61	0.06	0.05
K35 1-1.8		93.10	2.87	1.49	1.78	0.04	0.04
K36 0-1		92.60	4.02	1.14	2.12	0.03	0.04
K36 1-2		96.10	1.34	0.92	1.39	0.02	0.03
K36 2-2.9		95.90	1.38	0.85	1.70	0.06	0.05
K37 0-1		92.60	3.68	0.80	1.73	0.05	0.06
K37 1-2		95.30	1.31	0.82	1.86	0.04	0.02
K37 2-2.8		95.80	1.44	0.75	1.83	0.08	0.02
K38 0-1		93.80	3.62	0.81	1.62	0.07	0.05
K38 1-2		95.80	1.62	0.74	1.46	0.03	0.02
K39 0-1		94.00	3.56	0.68	1.65	0.05	0.03
K39 1-1.8		95.00	2.28	0.70	1.50	0.04	0.02

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.01	0.01	0.01	0.01	0.01	0.01
K40 0-1		90.60	4.12	0.86	2.09	0.06	0.05
K40 1-2		90.90	4.85	0.86	1.74	0.07	0.06
K40 2-2.8		82.10	13.13	1.11	1.74	0.10	0.12
K41 0-1		92.80	3.49	0.80	2.05	0.07	0.05
K41 1-2		94.80	2.87	0.75	1.41	0.08	0.06
K41 2-2.8		92.10	4.05	1.01	2.10	0.10	0.06
K42 0-1		93.30	2.93	0.86	2.51	0.11	0.04
K42 1-2		94.50	2.13	0.66	1.44	0.06	0.03
K42 2-3		94.50	1.78	0.80	1.87	0.10	0.03
K43 0-1		93.10	3.33	0.74	1.84	0.08	0.04
K43 1-1.6		93.90	3.02	0.79	1.86	0.06	0.04
K44 0-1		92.80	4.01	0.85	2.19	0.07	0.03
K44 1-2		94.80	2.76	0.71	1.62	0.07	0.03
K45 0-1		92.60	4.04	0.84	2.17	0.15	0.05
K45 1-2		88.40	6.39	1.14	1.79	0.02	0.03
K45 2-2.8		70.80	22.34	2.09	2.72	0.11	0.08
K46 0-1		90.90	4.01	1.02	2.29	0.06	0.05
K46 1-2		92.30	2.74	0.96	2.18	0.06	0.04
K47 0-1		92.10	3.79	0.86	1.96	0.01	0.04
K47 1-2		93.60	2.20	0.80	1.91	0.03	0.03
K48 0-1		91.20	3.49	0.70	1.89	0.02	0.02
K48 1-1.6		96.70	1.09	0.63	1.51	<0.01	0.02
K49 0-1		92.90	4.15	0.78	2.12	<0.01	0.02
K49 1-2		95.80	1.82	0.67	1.52	<0.01	0.02
K50 0-1		91.80	4.63	0.78	1.98	<0.01	0.02
K50 1-2		94.90	1.53	0.74	1.90	<0.01	0.02
K50 2-2.8		95.00	1.61	0.73	1.49	<0.01	0.02
K51 0-1		91.90	4.24	0.91	2.51	0.03	0.03
K51 1-2		94.90	2.17	0.83	2.02	0.04	0.03
K52 0-1		93.30	3.38	0.82	2.03	0.04	0.03

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AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.01	0.01	0.01	0.01	0.01	0.01
K52 1-2		93.90	2.68	0.87	2.29	0.08	0.03
K53 0-1		90.60	5.36	0.90	1.96	0.04	0.04
K53 1-1.5		94.20	1.79	0.89	2.23	0.04	0.04
K54 0-1		92.60	3.22	0.91	2.36	0.06	0.02
K54 1-2		94.50	2.00	0.90	2.43	0.09	0.04
K54 2-2.6		93.80	1.23	0.96	2.80	0.09	0.06
K55 0-1		92.00	4.27	1.03	2.57	0.09	0.03
K55 1-2		93.90	1.74	0.88	2.12	0.12	0.03
K55 2-3.6		94.80	1.50	0.92	1.89	0.11	0.03
K56 0-1		97.40	0.18	0.33	1.53	<0.01	0.02
K56 1-2		94.90	1.20	0.45	1.89	0.02	0.02
K56 2-3		95.00	2.21	0.47	1.18	0.01	0.02
K56 3-3.9		92.20	2.63	0.86	1.59	0.05	0.03
K57 0-1		93.80	2.48	0.77	1.85	0.07	0.03
K57 1-2.4		91.40	3.23	0.94	2.22	0.09	0.04
K58 0-1		90.30	4.13	0.98	2.35	0.09	0.04
K58 1-2		89.40	3.00	1.00	2.59	0.09	0.03
K58 2-4		89.90	3.87	0.94	1.79	0.08	0.04
K59 0-1		93.50	1.95	0.90	2.52	0.06	0.02
K59 1-2		94.90	1.53	0.93	2.45	0.08	0.03
K59 2-3.5		92.50	1.83	0.84	1.94	0.07	0.03
K60 0-1		90.90	3.99	0.74	1.69	0.06	0.04
K60 1-2.4		91.00	2.87	0.84	2.06	0.12	0.04
K61 0-1		88.20	5.17	1.00	2.50	0.10	0.04
K61 1-1.7		91.50	3.61	0.89	2.08	0.08	0.04
K62 0-1		89.80	4.67	1.02	2.47	0.10	0.04
K62 1-2		91.80	2.30	0.90	2.25	0.08	0.02
K63 0-1		91.60	4.04	0.81	2.07	0.07	0.03
K63 1-2		92.70	3.33	0.98	1.81	0.07	0.03
K64 0-1		89.90	4.68	0.85	2.38	0.06	0.04

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
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DATE COMPLETED: 20/05/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
K64 1-2		92.10	3.00	0.80	2.05	0.03	0.03
K64 2-3		92.20	2.86	0.85	1.64	0.05	0.05
K65 0-1		91.80	3.21	0.85	2.44	0.04	0.04
K65 1-2		92.90	2.40	0.79	2.10	0.07	0.03
K65 2-3		92.10	2.77	0.93	2.02	0.07	0.05
K28 1-2.5		90.90	3.27	0.90	2.27	0.10	0.05

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AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	A1203 % M290 0.01
K1 0-1		0.03
K1 1-2		0.04
K1 2-4		0.03
K2 0-1		0.06
K2 1-2		0.02
K2 2-3		0.02
K3 0-1		0.02
K3 1-2		0.02
K3 2-3		0.03
K4 0-1		0.04
K4 1-2		0.03
K4 2-3		0.01
K5 0-1		<0.01
K5 1-2		<0.01
K5 2-3		0.02
K5 3-4.1		0.02
K6 0-1		0.02
K6 1-2		0.02
K6 2-3		0.02
K6 3-4.5		0.02
K7 0-1		0.05
K7 1-2		0.03
K7 2-3		0.06
K8 0-1		0.07
K8 1-2		0.04
K8 2-2.7		0.08
K9 0-1		<0.01
K9 1-2		0.03
K9 2-3		0.03
K9 3-3.5		0.05

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ANALYTICAL REPORT

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 / % / M290 / 0.01					
K10 0-1		0.03					
K10 1-2		0.02					
K10 2-3.1		0.03					
K11 0-1		0.04					
K00 1-2		0.05					
K11 2-3		0.02					
K11 3-4.7		0.05					
K12 0-1		0.04					
K12 1-2		0.03					
K12 2-3.4		0.04					
K13 0-1		0.06					
K13 1-2		0.06					
K13 2-3		0.02					
K13 3-3.5		0.23					
K14 0-1		0.06					
K14 1-2		0.07					
K14 2-3		0.07					
K15 0-1		0.04					
K15 1-2		0.02					
K15 2-3		0.06					
K15 3-3.6		0.03					
K16 0-1		0.04					
K16 1-2		0.05					
K16 2-3		0.05					
K16 3-4.2		0.05					
K17 0-1		0.08					
K17 1-2		0.02					
K17 2-3		0.03					
K17 3-3.3		0.02					
K18 0-1		0.02					

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ANALYTICAL REPORT

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ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT	A1203						
	UNIT	%						
	METHOD	M290						
	L.O.R.	0.01						
K18 1-2		0.03						
K18 2-2.9		0.02						
K19 0-1		0.03						
K19 1-2		0.02						
K19 2-2.7		0.05						
K20 0-1		0.05						
K20 1-2		0.04						
K20 2-2.6		0.06						
K21 0-1		0.02						
K21 1-2		0.05						
K21 2-3.6		0.05						
K22 0-1		0.03						
K22 1-2		0.03						
K22 2-3		0.03						
K22 3-3.4		0.05						
K23 0-1		0.11						
K23 1-2		0.04						
K23 2-3		0.03						
K23 3-4		0.05						
K24 0-1		0.03						
K24 1-2		0.03						
K24 2-2.6		0.03						
K25 0-1		0.04						
K25 1-2		0.03						
K25 2-2.6		0.04						
K26 0-1		0.02						
K26 1-2		0.03						
K26 2-3		0.04						
K26 3-4		0.06						
K27 0-1		0.07						

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ANALYTICAL REPORT

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CONTACT: MR J OLLIVER
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ADDRESS:
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MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Al203 % M290 0.01					
K27 1-2		0.04					
K27 2-3		0.17					
K27 3-4		0.04					
K28 0-1		0.01					
K28 2.5-4		0.01					
K29 0-1		0.07					
K29 1-1.3		0.03					
K30 0-1		0.06					
K30 1-1.7		0.07					
K31 0-1		0.10					
K31 1-2		0.11					
K31 2-2.3		0.10					
K32 0-1		0.25					
K32 1-1.4		0.24					
K33 0-1		0.08					
K33 1-2.1		0.08					
K34 0-1		0.05					
K34 1-1.6		0.03					
K35 0-1		0.05					
K35 1-1.8		0.05					
K36 0-1		0.04					
K36 1-2		0.03					
K36 2-2.9		0.04					
K37 0-1		0.09					
K37 1-2		0.03					
K37 2-2.8		0.05					
K38 0-1		0.06					
K38 1-2		0.03					
K39 0-1		0.03					
K39 1-1.8		0.04					

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AUSTRALIAN LABORATORY SERVICES P/L

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ANALYTICAL REPORT

LABORATORY: AMENDED
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SUB BATCH: 0
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CONTACT: MR J OLLIVER
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ORDER No.: SAMPLE TYPE: GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT	A1203					
	UNIT	%					
	METHOD	M290					
	L.O.R.	0.01					
K40 0-1		0.06					
K40 1-2		0.06					
K40 2-2.8		0.16					
K41 0-1		0.05					
K41 1-2		0.05					
K41 2-2.8		0.10					
K42 0-1		0.03					
K42 1-2		0.02					
K42 2-3		0.05					
K43 0-1		0.05					
K43 1-1.6		0.05					
K44 0-1		0.05					
K44 1-2		0.04					
K45 0-1		0.05					
K45 1-2		0.03					
K45 2-2.8		0.11					
K46 0-1		0.04					
K46 1-2		0.03					
K47 0-1		0.02					
K47 1-2		0.02					
K48 0-1		0.04					
K48 1-1.6		0.01					
K49 0-1		0.02					
K49 1-2		0.01					
K50 0-1		0.04					
K50 1-2		0.01					
K50 2-2.8		0.02					
K51 0-1		0.03					
K51 1-2		0.02					
K52 0-1		0.03					

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Phone: (09) 249 2988 Fax: (09) 249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 / % / M290 / 0.01					
K52 1-2		0.05					
K53 0-1		0.07					
K53 1-1.5		0.03					
K54 0-1		0.04					
K54 1-2		0.03					
K54 2-2.6		0.05					
K55 0-1		0.03					
K55 1-2		0.03					
K55 2-3.6		0.05					
K56 0-1		0.04					
K56 1-2		0.05					
K56 2-3		0.03					
K56 3-3.9		0.06					
K57 0-1		0.03					
K57 1-2.4		0.05					
K58 0-1		0.03					
K58 1-2		0.03					
K58 2-4		0.05					
K59 0-1		0.02					
K59 1-2		0.02					
K59 2-3.5		0.03					
K60 0-1		0.04					
K60 1-2.4		0.04					
K61 0-1		0.05					
K61 1-1.7		0.04					
K62 0-1		0.06					
K62 1-2		0.04					
K63 0-1		0.03					
K63 1-2		0.03					
K64 0-1		0.04					

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: AMENDED
BATCH NUMBER: AM18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/05/97
DATE COMPLETED: 20/05/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	A1203 % M290 0.01					
K64 1-2		0.03					
K64 2-3		0.05					
K65 0-1		0.03					
K65 1-2		0.02					
K65 2-3		0.05					
K28 1-2.5		0.03					

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY:	STAFFORD
BATCH NUMBER:	ST18079
SUB BATCH:	0
No. OF SAMPLES:	186
DATE RECEIVED:	19/03/97
DATE COMPLETED:	11/04/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: DUPLICATES PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
*** K3 2-3		93.50	3.53	0.93	1.92	0.09	0.03
Original Result		93.50	3.53	0.93	1.92	0.09	0.03
*** K6 2-3		93.90	3.34	0.84	1.74	0.06	0.06
Original Result		92.70	2.88	0.86	1.73	0.07	0.04
		93.5	2.77	0.85	1.72	0.06	0.05
*** K9 2-3		92.70	4.21	0.88	1.84	0.10	0.06
Original Result		92.70	4.46	0.87	1.85	0.07	0.05
			4.34	0.87	1.85	0.05	0.06
*** K16 1-2		92.20	3.18	0.88	1.89	0.09	0.04
Original Result		92.10	3.93	0.93	1.92	0.16	0.06
		92.2	3.96	0.90	1.91	0.13	0.05
*** K19 0-1		92.50	3.62	0.91	2.57	0.08	0.03
Original Result		91.70	3.54	0.91	2.59	0.09	0.02
		92.1	3.58		2.58	0.09	0.03
*** K22 1-2		93.00	3.80	0.85	2.24	0.01	0.03
Original Result		92.10	3.65	0.84	2.23	<0.01	0.03
		92.6	3.73	0.84	2.23		
*** K29 1-1.3		91.80	3.89	1.55	2.61	0.12	0.05
Original Result		92.30	3.41	1.51	2.64	0.06	0.04
		92.1	3.65	1.53	2.63	0.08	0.05
*** K34 0-1		92.90	3.37	1.09	2.47	0.07	0.05
Original Result		92.90	3.46	1.08	2.42	0.07	0.05
			3.42	1.08	2.45		
*** K38 0-1		93.90	3.51	0.81	1.60	0.08	0.05
Original Result		93.80	3.62	0.81	1.62	0.07	0.05
		93.90	3.57		1.61	0.08	
*** K48 0-1		91.20	3.68	0.71	1.87	0.04	0.03
Original Result		91.20	3.49	0.70	1.89	0.02	0.02
			3.59	0.70	1.88	0.03	0.03

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/03/97
DATE COMPLETED: 11/04/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: DUPLICATES
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
*** K52 1-2		93.10	2.97	0.86	2.24	0.03	0.03
Original Result		93.90	2.68	0.87	2.29	0.08	0.03
		93.5	2.83	0.86	2.26	0.06	
*** K56 1-2		94.60	1.26	0.45	1.89	0.03	0.01
Original Result		94.90	1.20	0.45	1.89	0.02	0.02
		94.5	1.23			0.03	0.02
*** K62 1-2		91.90	2.42	0.91	2.25	0.07	0.03
Original Result		91.80	2.30	0.90	2.25	0.08	0.02
		91.9	2.36	0.91		0.08	0.03

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ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/03/97
DATE COMPLETED: 11/04/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: DUPLICATES
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al203 / % / M290 / 0.01					
*** K3 2-3		0.03					
Original Result		0.03					
*** K6 2-3		0.01					
Original Result		0.02					
*** K9 2-3		0.03					
Original Result		0.03					
*** K16 1-2		0.04					
Original Result		0.05					
*** K19 0-1		0.03					
Original Result		0.03					
*** K22 1-2		0.02					
Original Result		0.03					
*** K29 1-1.3		0.03					
Original Result		0.03					
*** K34 0-1		0.05					
Original Result		0.05					
*** K38 0-1		0.06					
Original Result		0.06					
*** K48 0-1		0.02					
Original Result		0.04					

COMMENTS:

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ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18079
SUB BATCH: 0
No. OF SAMPLES: 186
DATE RECEIVED: 19/03/97
DATE COMPLETED: 11/04/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: DUPLICATES
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Al203 % M290 0.01
*** K52 1-2		0.02
Original Result		0.05
*** K56 1-2		0.04
Original Result		0.05
*** K62 1-2		0.05
Original Result		0.04

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18079
SUB BATCH: 1
No. OF SAMPLES: 19
DATE RECEIVED: 19/03/97
DATE COMPLETED: 11/04/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.01	0.01	0.01	0.01	0.01	0.01
K21 0-0.60		91.40	5.07	0.99	2.43	0.09	0.02
K21 0.60-0.94		93.10	2.99	0.73	2.11	0.06	0.02
K22 0-0.08		92.00	4.33	1.06	2.25	0.06	0.03
K22 0.08-0.66		88.90	3.55	1.64	4.20	0.14	0.09
K22 0.66-1.25		92.30	4.10	0.80	2.22	0.05	0.02
K23 0-0.19		90.80	3.51	1.35	2.98	0.13	0.06
K23 0.19-0.70		91.90	4.62	0.90	2.47	0.08	0.02
K23 0.70-1.40		94.10	2.66	0.72	2.43	0.08	0.03
K26 0-0.26		92.50	3.13	1.11	3.03	0.13	0.04
K26 0.26-0.54		90.80	5.62	1.02	2.46	0.10	0.02
K26 0.54-1.45		92.10	4.21	0.90	2.61	0.11	0.03
K27 0-0.20		91.90	3.24	0.92	2.67	0.12	0.02
K27 0.20-0.60		91.20	5.27	0.89	2.56	0.08	0.02
K27 0.60-1.45		93.20	2.96	0.91	2.85	0.05	0.03
K28 0-0.35		90.60	4.82	1.15	3.33	0.07	0.01
K28 0.35-1.49		92.60	2.92	0.94	3.37	0.09	0.06
K29 0-0.37		90.70	4.41	1.19	3.55	0.09	0.04
K29 0.37-0.66		91.30	3.70	1.14	3.73	0.10	0.04
K30 0-0.35		88.60	5.37	1.43	3.52	0.14	0.26

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All pages of this report have been checked and approved for release.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18079
SUB BATCH: 1
No. OF SAMPLES: 19
DATE RECEIVED: 19/03/97
DATE COMPLETED: 11/04/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	A1203 % M290 0.01					
K21 0-0.60		0.01					
K21 0.60-0.94		0.01					
K22 0-0.08		0.03					
K22 0.08-0.66		0.10					
K22 0.66-1.25		0.02					
K23 0-0.19		0.07					
K23 0.19-0.70		0.01					
K23 0.70-1.40		0.01					
K26 0-0.26		0.05					
K26 0.26-0.54		0.02					
K26 0.54-1.45		0.02					
K27 0-0.20		0.03					
K27 0.20-0.60		<0.01					
K27 0.60-1.45		0.01					
K28 0-0.35		<0.01					
K28 0.35-1.49		0.01					
K29 0-0.37		0.01					
K29 0.37-0.66		0.01					
K30 0-0.35		0.02					

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18079
SUB BATCH: 1
No. OF SAMPLES: 19
DATE RECEIVED: 19/03/97
DATE COMPLETED: 11/04/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: DUPLICATES
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	CaSO4.2H2O % M290 0.01	CaCO3 % M290 0.01	MgCO3 % M290 0.01	NaCl % M290 0.01	KCl % M290 0.01	Fe2O3 % M290 0.01
*** K26 0-0.26		92.10	3.08	1.10	3.07	0.10	0.04
Original Result		92.50	3.13	1.11	3.03	0.13	0.04
*** K26 0.26-0.54		90.80	5.65	1.02	2.44	0.08	0.02
Original Result		90.80	5.62	1.02	2.46	0.10	0.02

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

LABORATORY: STAFFORD
BATCH NUMBER: ST18079
SUB BATCH: 1
No. OF SAMPLES: 19
DATE RECEIVED: 19/03/97
DATE COMPLETED: 11/04/97

ORDER No.:
SAMPLE TYPE: DUPLICATES
PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Al2O3 % M290 0.01					
*** K26 0-0.26		0.05					
Original Result		0.05					
*** K26 0.26-0.54		0.02					
Original Result		0.02					

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18803
SUB BATCH: 0
No. OF SAMPLES: 8
DATE RECEIVED: 30/05/97
DATE COMPLETED: 12/06/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.1	0.01	0.01	0.01	0.01	0.01
T119 0-2.3M		99.2	0.30	0.09	0.32	0.02	0.02
T120 0-3.0M		99.1	0.57	0.08	0.20	0.01	0.02
T121 0-2.3M		99.5	0.29	0.06	0.08	0.01	0.01
T122 0-2.0M		98.5	1.24	0.11	0.12	<0.01	0.01
T123 0-2.5M		98.5	0.97	0.09	0.38	0.02	0.02
T124 0-2.5M		99.1	0.52	0.08	0.25	0.02	0.02
T125 0-3.0M		99.2	0.31	0.09	0.42	<0.01	0.02
B 4,5,7,8 COMP		97.0	1.11	0.49	1.37	0.04	0.02

COMMENTS:

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David [signature]

All pages of this report have been checked and approved for release.

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18803
SUB BATCH: 0
No. OF SAMPLES: 8
DATE RECEIVED: 30/05/97
DATE COMPLETED: 12/06/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
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MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.					
		A1203 % M290 0.01				
T119 0-2.3M		0.02				
T120 0-3.0M		0.03				
T121 0-2.3M		0.01				
T122 0-2.0M		0.06				
T123 0-2.5M		0.02				
T124 0-2.5M		0.02				
T125 0-3.0M		0.01				
B 4,5,7,8 COMP		0.01				

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

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ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18945
SUB BATCH: 0
No. OF SAMPLES: 5
DATE RECEIVED: 11/06/97
DATE COMPLETED: 23/06/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:

SAMPLE TYPE: GYPSUM

PROJECT:

SAMPLE NUMBER	ELEMENT	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.1	0.01	0.01	0.01	0.01	0.01
T86 0-2.3M		96.9	1.30	0.41	1.22	0.03	0.05
T88 0-1.8M		96.9	1.26	0.29	1.47	0.06	0.02
T90 0-1.7M		97.9	1.36	0.18	0.54	0.02	0.02
T95 0-3.0M		97.0	2.24	0.17	0.54	0.03	0.03
T96 0-3.7M		98.0	1.02	0.20	0.72	0.02	0.02

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18945
SUB BATCH: 0
No. OF SAMPLES: 5
DATE RECEIVED: 11/06/97
DATE COMPLETED: 23/06/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Al2O3 % M290 0.01					
T86 0-2.3M		0.06					
T88 0-1.8M		0.02					
T90 0-1.7M		0.02					
T95 0-3.0M		0.03					
T96 0-3.7M		0.01					

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.
• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

LABORATORY: STAFFORD
BATCH NUMBER: ST18915
SUB BATCH: 0
No. OF SAMPLES: 4
DATE RECEIVED: 11/06/97
DATE COMPLETED: 25/06/97

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT	CaSO4.2H2O	CaCO3	MgCO3	NaCl	KCl	Fe2O3
	UNIT	%	%	%	%	%	%
	METHOD	M290	M290	M290	M290	M290	M290
	L.O.R.	0.1	0.01	0.01	0.01	0.01	0.01
K 31		95.5	2.23	1.09	1.08	0.04	0.03
S1/S4/S7		93.6	3.07	1.76	1.33	0.07	0.06
F1/F4/F7		93.1	3.38	1.97	1.34	0.06	0.07
B4/B5/B6/B7		97.0	1.11	0.49	1.37	0.04	0.02

COMMENTS:

Calculation and analytical method as directed by Graeme Brown/ Jonathan Guinness.

• This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

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Orange Laboratory
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Phone: (09) 249 2988 Fax: (09) 249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

All pages of this report have been checked and approved for release.

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18915
SUB BATCH: 0
No. OF SAMPLES: 4
DATE RECEIVED: 11/06/97
DATE COMPLETED: 25/06/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.:
SAMPLE TYPE: GYPSUM
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 % M290 0.01	Cl- % ALS 0.01	NaCl % ALS 0.01	Na2SO4 % ALS 0.01	MgSO4 % ALS 0.01	CaSO4.2H2O % ALS 0.1
K 31		0.05	0.83	1.37	<0.01	0.23	95.2
S1/S4/S7		0.07	1.04	1.71	<0.01	0.31	93.2
F1/F4/F7		0.10	1.01	1.67	<0.01	0.28	92.7
B4/B5/B6/B7		0.01	1.06	1.75	<0.01	0.28	96.6

COMMENTS:

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AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST18915
SUB BATCH: 0
No. OF SAMPLES: 4
DATE RECEIVED: 11/06/97
DATE COMPLETED: 25/06/97

CONTACT: MR J OLLIVER
CLIENT: OLLIVER GEOLOGICAL SERVICES
ADDRESS:
PO BOX 24
MCLAREN VALE SA 5171

ORDER No.: SAMPLE TYPE: GYPSUM PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	CaCO3 % ALS 0.01					
K 31		2.42					
S1/S4/S7		3.33					
F1/F4/F7		3.61					
B4/B5/B6/B7		1.34					

COMMENTS:

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TABLE 1

COMPARISON OF 1959, 1969 & 1997 DRILLHOLES

1. SOUTH MINE SITE

1997 Drillhole

Interval (m)	% Gyp	% Carb	% Salt
Hole K4			
0.0-1.0	91.4	6.44	2.02
1.0-2.0	92.9	5.02	1.98
0.0-2.0	**92.2**	**5.7**	**2.0**
2.0-3.0	93.8	4.03	2.12
0.0-3.0	**92.7**	**5.2**	**2.0**
Hole K5			
0.0-1.0	92.3	5.81	1.87
1.0-2.0	93.7	4.16	1.88
0.0-2.0	**93.5**	**5.0**	**1.9**
2.0-3.0	94.4	3.75	2.40
3.0-4.1	92.8	4.54	1.87
0.0-4.1	**93.3**	**4.6**	**2.0**
Hole K16			
0.0-1.0	91.8	5.04	1.91
1.0-2.0	92.2	4.46	2.04
0.0-2.0	**92.0**	**4.8**	**2.0**
2.0-3.0	94.3	3.65	1.89
3.0-4.2	92.7	5.44	2.41
0.0-4.2	**92.7**	**4.8**	**2.1**
Hole K18			
0.0-1.0	92.9	3.47	2.91
1.0-2.3	93.9	3.05	2.73
0.0-2.0	**93.4**	**3.3**	**2.8**
2.0-2.9	95.4	2.31	2.18
0.0-2.9	**94.0**	**3.0**	**2.6**
Hole K24			
0.0-1.0	92.2	5.20	2.50
1.0-2.0	93.6	4.53	1.77
0.0-2.0	**92.7**	**4.9**	**2.1**
2.0-2.6	93.5	4.46	1.96
0.0-2.6	**93.0**	**4.8**	**2.1**
Hole K25			
0.0-1.0	89.7	7.22	2.36
1.0-2.0	92.3	5.19	2.02
0.0-2.0	**91.0**	**6.2**	**2.2**
2.0-2.6	94.3	3.49	2.07
0.0-2.6	**91.8**	**5.6**	**2.2**

Previous Drillhole

Interval (m)	% Gyp	% Carb	% Salt
Hole M25 - 120m to Southwest			
0.0-1.5	92.1	4.65	2.1
1.5-2.0 no sample			
Hole E17 - adjacent			
0.0-1.6	91.2	4.4	2.9
1.6-3.7	94.8	2.45	0.87
3.7-4.3		calcareous	
4.3-5.0	94.3	4.25	0.89
0.0-3.7	93.2	3.3	1.7
Hole M24 - adjacent			
0.0-1.5	91.9	4.0	2.8
1.5-4.2	not sampled		
Hole M34 - 80m to west			
0.0-2.2	92.7	4.1	2.7
2.2-3.5	not sampled		
Hole E14 - adjacent			
0.0-1.6	92.0	4.3	2.55
1.6-3.4	95.8	3.3	0.86
0.0-3.4	94.0	3.8	1.7
Hole E14A	- 40m to east		
0.0-1.5	92.5	4.25	2.70
1.5-3.4	92.2	6.9	0.87
0.0-3.4	92.3	5.7	1.7

2. NORTH MINE SITE

1997 Drillhole

Interval (m)	% Gyp	% Carb	% Salt
Hole K31			
0.0-1.0	93.1	4.86	1.94
1.0-2.0	91.9	5.76	1.92
2.0-2.3	92.7	5.41	1.72
0.0-2.3	**92.5**	**5.3**	**1.9**
Hole K42			
0.0-1.0	93.3	3.79	2.62
1.0-2.0	94.5	2.79	1.50
0.0-2.0	**93.9**	**3.3**	**2.1**
2.0-3.0	94.5	2.58	1.97
0.0-3.0	**94.1**	**3.1**	**2.0**
Hole K46			
0.0-1.0	90.9	5.03	2.35
1.0-2.0	92.3	3.70	2.24
0.0-2.0	**91.6**	**4.4**	**2.3**
Hole K51			
0.0-1.0	91.9	5.15	2.54
1.0-2.0	94.9	3.00	2.06
0.0-2.0	**93.4**	**4.1**	**2.3**
Hole K59			
0.0-1.0	93.5	2.85	2.58
1.0-2.0	94.9	2.46	2.53
0.0-2.0	**94.2**	**2.7**	**2.6**
2.0-3.5	92.5	2.67	2.01
0.0-3.5	**93.4**	**2.7**	**2.3**

Previous Drillhole

Interval (m)	% Gyp	% Carb	% Salt
Hole M56	- adjacent		
0.0-2.2	**94.8**	**2.7**	**1.7**
Hole M59	- 60m to southwest		
0.0-1.5	**93.9**	**3.2**	**1.7**
Hole M60	- 30m to north		
0.0-2.2	**94.3**	**2.9**	**1.8**
Hole M49	- 20m to southwest		
0.0-2.2	**93.7**	**3.2**	**2.1**
Hole M48	- 50m to northwest		
0.0-2.2	**93.9**	**3.3**	**2.1**

TABLE 2

COMPARISON PUSHTUBE AND MACHINE AUGER

PUSH TUBE				MACHINE AUGER			
Interval (m)	% Gyp	% Carb	% Salt	Interval (m)	% Gyp	% Carb	% Salt
Hole no K21							
0.00-0.60	91.4	6.06	2.52				
0.60-0.94	93.1	3.72	2.17				
0.00-0.94	**92.0**	**5.2**	**2.4**	0.0-1.0	91.9	5.5	1.8
Hole no K22							
0.00-0.08	92.0	5.39	2.31				
0.08-0.66	88.9	5.19	4.34				
0.66-1.25	92.3	4.90	2.27	0.0-1.0	92.0	5.8	2.1
0.00-1.25	**90.7**	**5.1**	**3.2**	1.0-2.0	92.6	4.6	2.2
Hole no K23							
0.00-0.19	90.8	4.86	3.11				
0.19-0.70	91.9	5.52	2.55				
0.70-1.40	94.1	3.38	2.51	0.0-1.0	90.0	7.5	2.4
0.00-1.40	**92.8**	**4.4**	**2.6**	1.0-2.0	92.9	4.8	2.0
Hole no K26							
0.00-0.26	92.5	4.24	3.26				
0.26-0.54	90.8	6.64	2.56				
0.54-1.45	92.1	5.11	2.72	0.0-1.0	93.7	4.1	2.1
0.00-1.45	**91.9**	**5.3**	**2.8**	1.0-2.0	92.9	4.5	2.6
Hole no K27							
0.00-0.20	91.9	4.76	2.79				
0.20-0.60	91.2	6.16	2.64				
0.60-1.45	93.2	3.87	2.90	0.0-1.0	91.4	5.6	2.5
0.00-1.45	**92.4**	**4.6**	**2.8**	1.0-2.0	91.7	5.2	3.0
Hole no K28							
0.00-0.35	90.6	5.97	3.40				
0.35-1.49	92.6	3.86	3.40	0.0-1.0	93.1	4.1	2.7
0.00-1.49	**92.1**	**4.4**	**3.4**	1.0-2.5	90.9	4.2	2.4
Hole no K29							
0.00-0.37	90.7	5.60	3.64				
0.37-0.66	91.3	4.84	3.83				
0.00-0.66	**91.0**	**5.3**	**3.7**	0.0-1.0	92.0	5.4	2.0
Hole no K30							
0.00-0.35	**88.6**	**6.8**	**3.7**	0.0-1.0	91.7	5.5	2.7

APPENDIX E

BULK DENSITY AND SIZE ANALYSIS

Amdel Report N8322 11 June 1997

amdel
A.C.N. 008 127 802

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INTERNATIONAL QUALITY MANAGEMENT SYSTEM
ISO 9001 NATA CERTIFIED

11 June 1997

Olliver Geological Services Pty Ltd
PO Box 24
McLAREN VALE SA 5171

Attention: Jeff Olliver

REPORT N8322

SIZE ANALYSES OF GYPSUM AND LIME SAND SAMPLES

YOUR REFERENCE:	Letter 27 May 1997
MATERIAL:	Gypsum samples (4) and lime sand sample (1)
LOCATION:	Lake Purdilla (gypsum) and Yanerby (lime sand)
DATE RECEIVED:	27 May 1997
PROJECT MANAGER:	P G Capps

Ric Phillips
Manager
Mineral Processing Services

PGC:msm1

1. INTRODUCTION

Mr Jeff Olliver submitted four samples of gypsum and one sample of lime sand to Amdel for dry size analysis. Two of the samples were also to be tested to determine their bulk densities (samples 4 and 5, see below).

The samples submitted were as follows:

(1)	Lake Purdilla	-	northern dunes composite
(2)	Lake Purdilla	-	backhoe trench K42, B4 (white)
(3)	Lake Purdilla	-	backhoe trench K42, B5 (grey)
(4)	Lake Purdilla	-	backhoe trench K42, B8 (crystals)
(5)	Yanerby lime sand		

2. PROCEDURE

The samples were initially dried at 110°C as they were damp in "as received" form.

After drying, sub-samples were riffled out for size analysis. The sub-samples were lightly brushed over a 75µm screen to break up agglomerate particles, then dry screened on a range of sieves to 38µm.

Results of the size analyses are contained in Appendix 1. It should be noted that the coarser particles contained in the Lake Purdilla samples were rocks, not large pieces of gypsum.

Samples of B8 and Yanerby lime sand were used to determine bulk densities by measuring the weight of sample contained in a cylinder of 700ml volume. Bulk densities thus determined were:

Lake Purdilla, B8	:	1.32 t/m^3
Yanerby lime sand	:	1.38 t/m^3

APPENDIX 1: DRY SIZE ANALYSES

SIZE DISTRIBUTION

Test No	1
Sample Tested	YANERBY LIME SAND
SCREEN SIZING	
Sample Weight , g	143.56

Screen Aperture	Weight Retained		Cumulative Weight	
mm	**g**	**%**	**% Retained**	**% Passing**
0.600	0.02	0.0	0.0	100.0
0.425	0.18	0.1	0.1	99.9
0.300	1.82	1.3	1.4	98.6
0.212	15.51	10.8	12.2	87.8
0.180	30.63	21.4	33.6	66.4
0.150	40.70	28.4	62.1	37.9
0.125	38.19	26.7	88.7	11.3
0.106	12.09	8.4	97.2	2.8
0.075	4.04	2.8	100.0	0.0
0.053	0.01	0.0	100.0	0.0
0.038	0.00	0.0	100.0	0.0
-0.038	0.00	0.0		
Total	143.19	100.0		
Wt Loss	0.37	0.26		

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SIZE DISTRIBUTION

Test No	2
Sample Tested	L PURD COMPOSITE NTH DUNES T119-125

SCREEN SIZING

Sample Weight , g 82.99

Screen Aperture	Weight Retained		Cumulative Weight	
mm	g	%	% Retained	% Passing
0.600	10.37	12.6	12.6	87.4
0.425	13.54	16.4	28.9	71.1
0.300	18.17	22.0	50.9	49.1
0.212	15.02	18.2	69.1	30.9
0.180	5.30	6.4	75.5	24.5
0.150	3.33	4.0	79.6	20.4
0.125	2.45	3.0	82.5	17.5
0.106	1.11	1.3	83.9	16.1
0.075	1.91	2.3	86.2	13.8
0.053	0.74	0.9	87.1	12.9
0.038	0.24	0.3	87.4	12.6
-0.038	10.44	12.6		
Total	82.62	100.0		
Wt Loss	0.37	0.45		

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SIZE DISTRIBUTION

Test No	4			
Sample Tested	SAMPLE B4			
SCREEN SIZING				
Sample Weight , g	359.89			
Screen Aperture	**Weight Retained**		**Cumulative Weight**	
mm	**g**	**%**	**% Retained**	**% Passing**
9.500	6.05	1.7	1.7	98.3
6.700	6.57	1.8	3.5	96.5
4.750	10.92	3.0	6.5	93.5
3.350	7.53	2.1	8.6	91.4
2.360	9.60	2.7	11.3	88.7
1.700	14.46	4.0	15.3	84.7
1.180	25.53	7.1	22.4	77.6
0.850	40.37	11.2	33.6	66.4
0.600	62.24	17.3	51.0	49.0
0.425	52.05	14.5	65.4	34.6
0.300	38.25	10.6	76.1	23.9
0.212	28.25	7.9	83.9	16.1
0.180	13.67	3.8	87.7	12.3
0.150	11.10	3.1	90.8	9.2
0.125	9.57	2.7	93.5	6.5
0.106	6.01	1.7	95.1	4.9
0.075	9.94	2.8	97.9	2.1
0.053	4.26	1.2	99.1	0.9
0.038	1.90	0.5	99.6	0.4
-0.038	1.43	0.4		
Total	359.70	100.0		
Wt Loss	0.19	0.05		

Gamdel	printed 03/06/97	**Comments**
	Job No. N8322	
SIZECALC V 4.1	Technician DS	
file ref : N8322ZO1(SZ04)	Test Date 3.5.97	

SIZE DISTRIBUTION

Test No	5
Sample Tested	SAMPLE B5
SCREEN SIZING	
Sample Weight . g	409.35

Screen Aperture	Weight Retained		Cumulative Weight	
mm	g	%	% Retained	% Passing
19.000	42.48	10.4	10.4	89.6
15.000	33.92	8.3	18.7	81.3
13.200	7.18	1.8	20.5	79.5
9.500	3.77	0.9	21.4	78.6
6.700	8.13	2.0	23.4	76.6
4.750	5.62	1.4	24.8	75.2
3.350	4.70	1.2	26.0	74.0
2.360	8.11	2.0	28.0	72.0
1.700	11.43	2.8	30.8	69.2
1.180	15.78	3.9	34.6	65.4
0.850	22.48	5.5	40.1	59.9
0.600	44.95	11.0	51.2	48.8
0.425	52.72	12.9	64.1	35.9
0.300	44.31	10.9	75.0	25.0
0.212	32.96	8.1	83.1	16.9
0.180	17.63	4.3	87.4	12.6
0.150	12.51	3.1	90.5	9.5
0.125	11.38	2.8	93.3	6.7
0.106	7.23	1.8	95.0	5.0
0.075	11.26	2.8	97.8	2.2
0.053	0.07	0.0	97.8	2.2
0.038	0.00	0.0	97.8	2.2
-0.038	8.92	2.2		
Total	407.54	100.0		
Wt Loss	1.81	0.44		

Gamdel SIZECALC V 4.1 file ref : N8322Z01(SZ05)	printed 03/06/97 Job No. N8322 Technician DS Test Date 3.5.97	Comments

SIZE DISTRIBUTION

Test No	3
Sample Tested	SAMPLE B8

SCREEN SIZING

Sample Weight, g 706.20

Screen Aperture	Weight Retained		Cumulative Weight	
mm	g	%	% Retained	% Passing
31.750	74.97	10.8	10.8	89.2
30.000	77.49	11.2	22.0	78.0
25.000	22.24	3.2	25.2	74.8
19.000	39.02	5.6	30.9	69.1
16.000	5.46	0.8	31.6	68.4
13.250	5.58	0.8	32.4	67.6
9.500	16.60	2.4	34.8	65.2
6.700	26.74	3.9	38.7	61.3
4.750	19.47	2.8	41.5	58.5
3.350	19.54	2.8	44.3	55.7
2.360	18.97	2.7	47.1	52.9
1.700	24.58	3.5	50.6	49.4
1.180	27.48	4.0	54.6	45.4
0.850	28.87	4.2	58.8	41.2
0.600	44.88	6.5	65.2	34.8
0.425	57.72	8.3	73.6	26.4
0.300	58.94	8.5	82.1	17.9
0.212	41.57	6.0	88.1	11.9
0.180	17.42	2.5	90.6	9.4
0.150	13.08	1.9	92.5	7.5
0.125	11.62	1.7	94.2	5.8
0.106	7.10	1.0	95.2	4.8
0.075	14.63	2.1	97.3	2.7
0.053	0.00	0.0	97.3	2.7
0.038	0.00	0.0	97.3	2.7
-0.038	18.69	2.7		
Total	692.66	100.0		
Wt Loss	13.54	1.92		

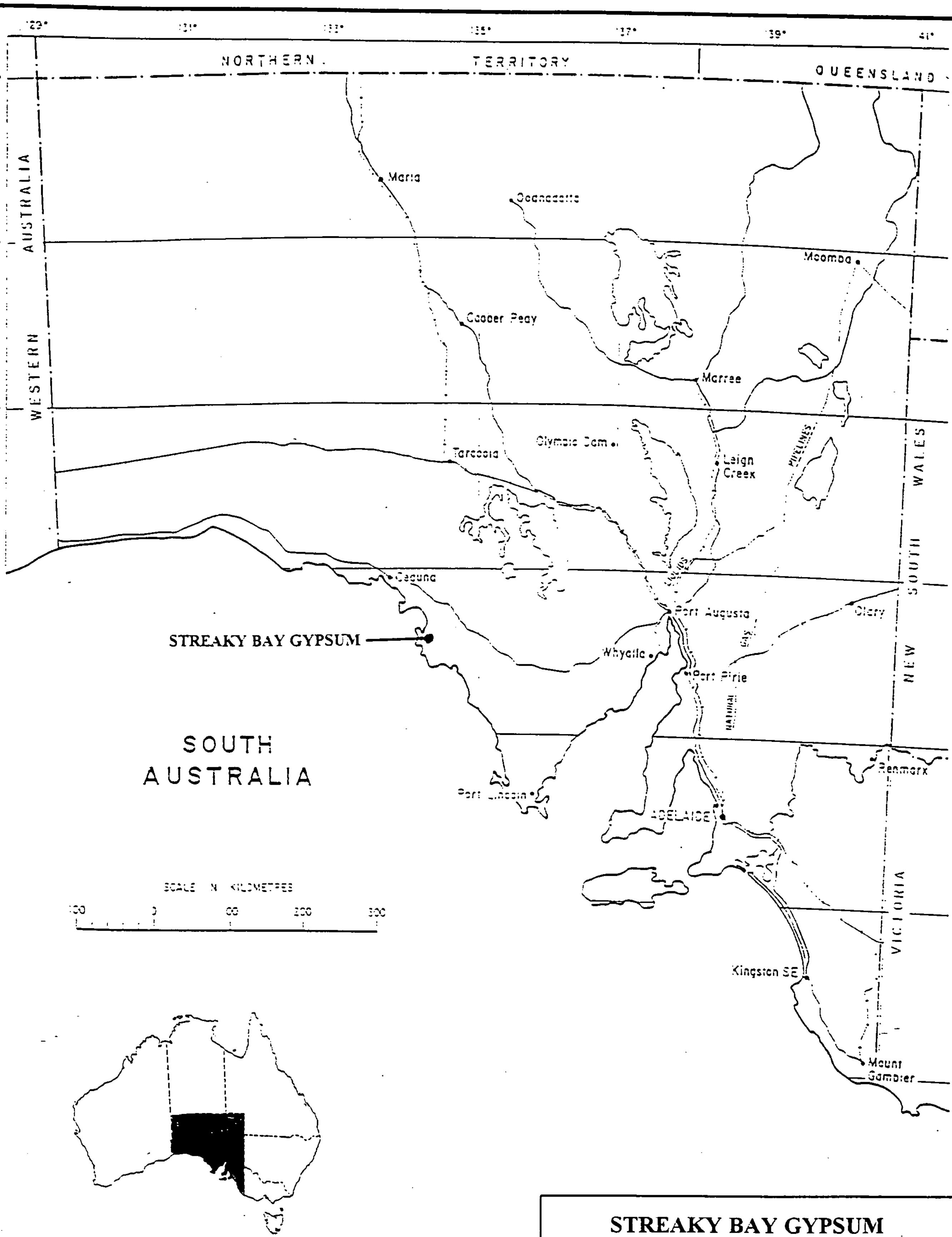
amdel SIZECALC V 4.1 file ref: N8322ZO1(SZ03)	printed 03/06/97 Job No. N8322 Technician DS Test Date 3.5.97	**Comments**

SIZE DISTRIBUTION

Test No	1
Sample Tested	YANERBY LIME SAND
SCREEN SIZING	
Sample Weight , g	143.56

Screen Aperture	Weight Retained		Cumulative Weight	
mm	g	%	% Retained	% Passing
0.600	0.02	0.0	0.0	100.0
0.425	0.18	0.1	0.1	99.9
0.300	1.82	1.3	1.4	98.6
0.212	15.51	10.8	12.2	87.8
0.180	30.63	21.4	33.6	66.4
0.150	40.70	28.4	62.1	37.9
0.125	38.19	26.7	88.7	11.3
0.106	12.09	8.4	97.2	2.8
0.075	4.04	2.8	100.0	0.0
0.053	0.01	0.0	100.0	0.0
0.038	0.00	0.0	100.0	0.0
-0.038	0.00	0.0		
Total	143.19	100.0		
Wt Loss	0.37	0.26		

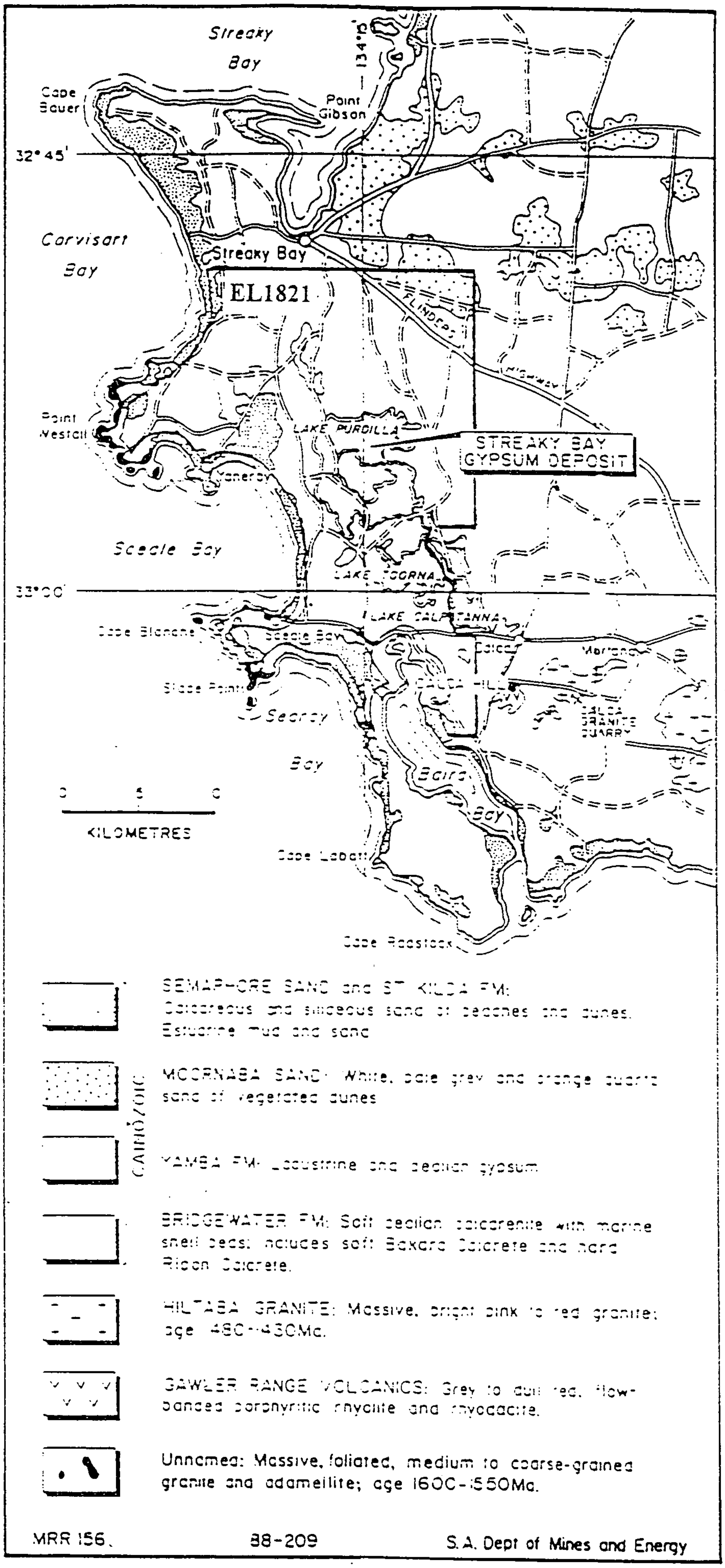
amdel SIZECALC V 4.1 file ref : N8322Z01(SZ01)	printed 11/06/97 Job No. N8322 Technician DS Test Date 2.5.97	Comments



STREAKY BAY GYPSUM

LOCALITY PLAN
SOUTH AUSTRALIA

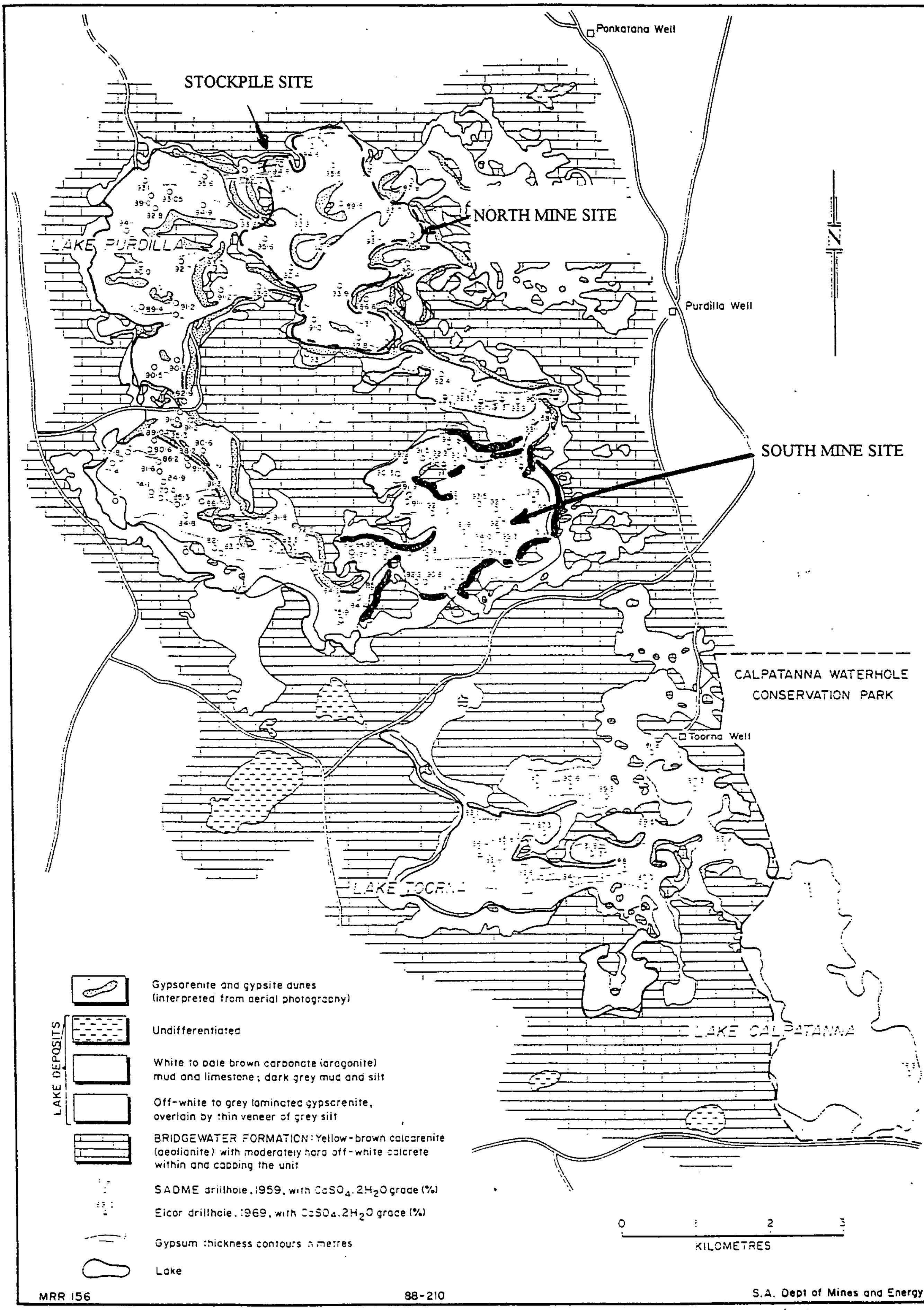
FIG 1



STREAKY BAY GYPSUM

REGIONAL GEOLOGY

FIG 2



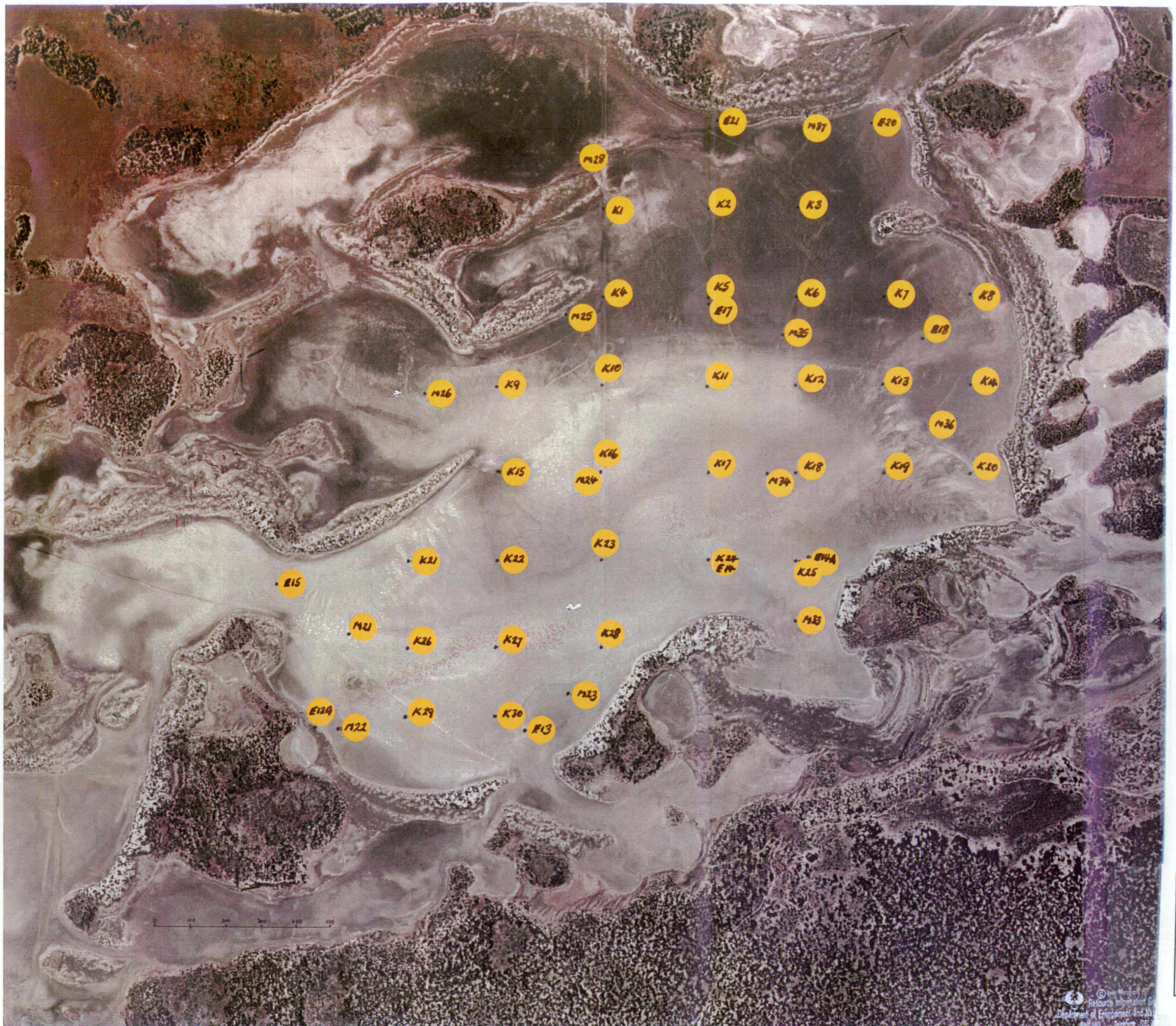
Adapted from Olliver, Dub owski and Barnes (1988)

STREAKY BAY GYPSUM

SITE GEOLOGY

FIG 3


The Dreadnoughts
SHIP LOADING SITE
Dreadnought Lake
STOCKPILE SITE
The Granites
int Westall
SHIP LOADING SITE
Smooth Pool
Speed Point
Yanerby
Lake Larson
Yanerby Hill
PROPOSED HAULAGE ROAD
AREA A
22 mill tonnes
Av. 2.3m thick
92.7% Gypsum
2.0% Salt
STOCKPILE SITE
NORTH MINE SITE
Purdilla Island
AREA C
18 mill tonnes
Av. 2.6m thick
87.0% Gypsum
2.3% Salt
8.9% Carb
SOUTH MINE SITE
MINE SITE
7 mill tonnes
Av. 3.0m thick
92.0% Gypsum
2.0% Salt
6.0% Carb
CW Cons Pi
BARGE LOADING SITE
Paddy's Lake
Lake Purdilla
Seagull Lake
Sceale Bay
AREA B
8 mill tonnes
Av. 1.9m thick
83.6% Gypsum
2.1% Salt
13.0% Carb
AREA D
10 mill tonnes
Av. 1.9m thick
85.9% Gypsum
2.3% Salt
10.7% Carb
Lake Toorna
F
L
H
I
Note: This is an uncontrolled mosaic compiled from DENR aerial photography at 1:40 000. There is distortion and scale is approximate only.
Area A, B, C & D are from Olliver, 1985 & 1988.
H Peripheral Lakes
0 1 2
km
STREAKY BAY GYPSUM
SITE LOCATION
FIG 4



• M DM Holes 1959

• E Elcor Holes 1969

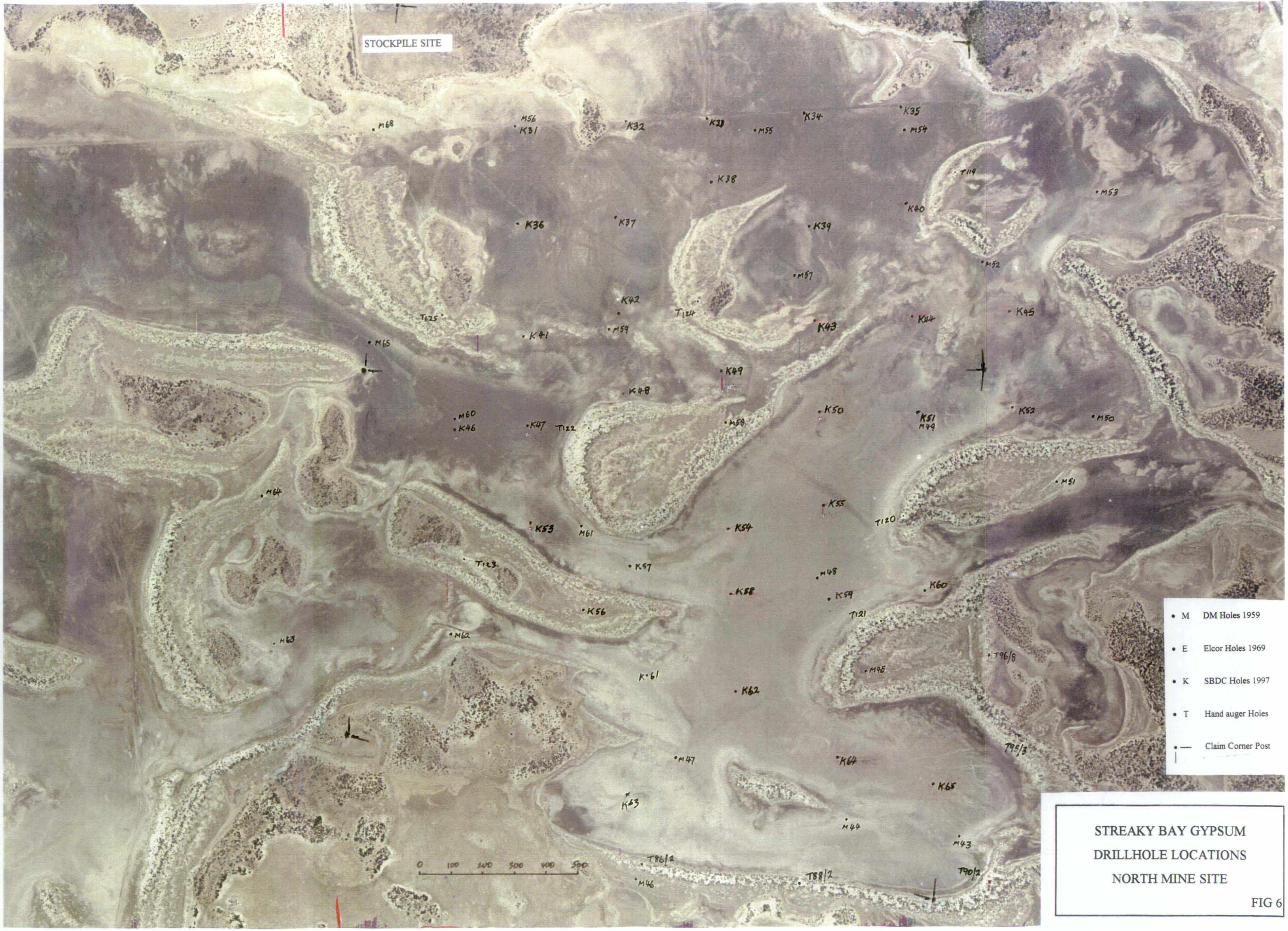
• K SBDC Holes 1997

• T Hand auger Holes

Claim Corner Post

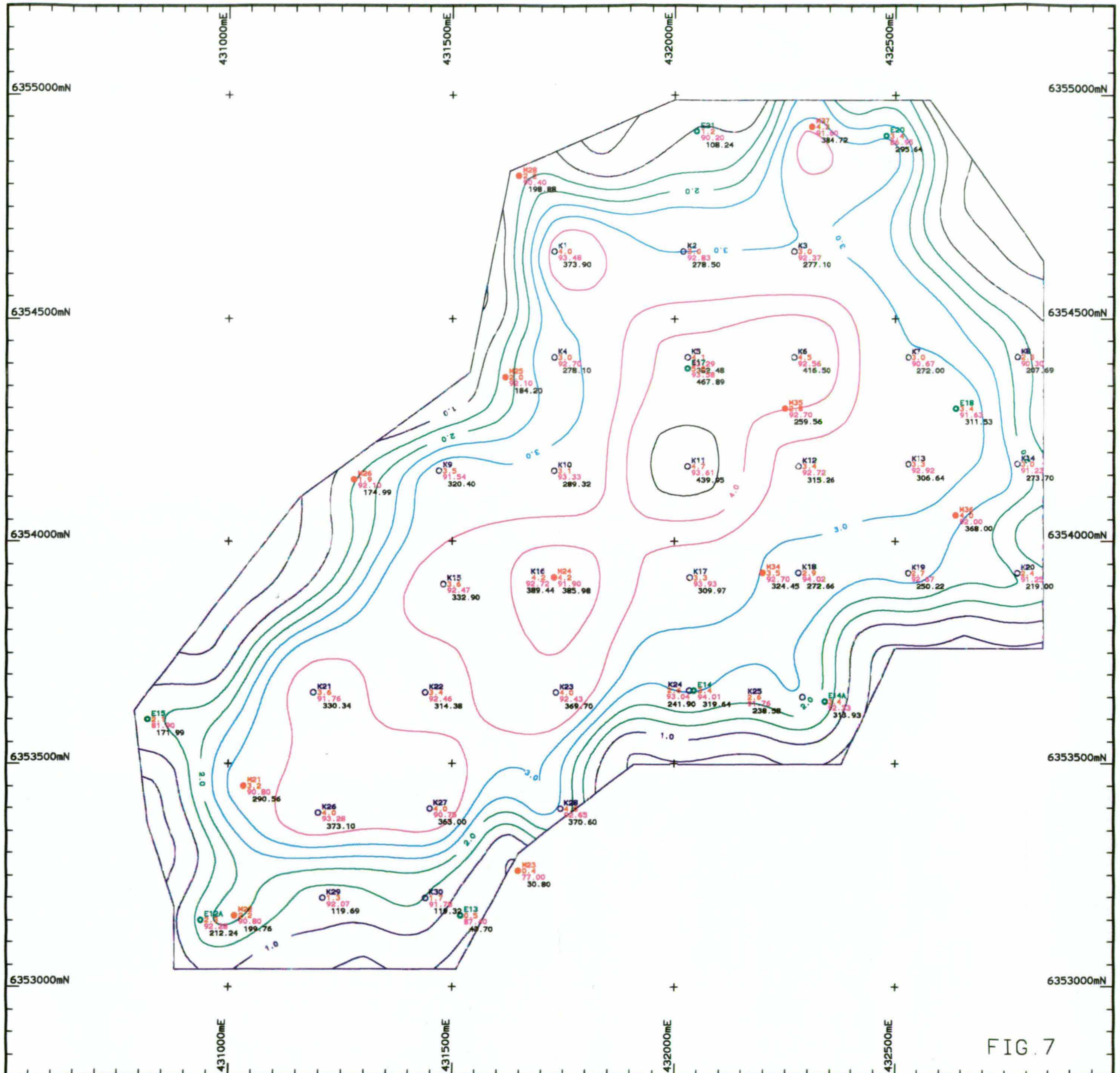
STREAKY BAY GYPSUM
DRILLHOLE LOCATIONS
SOUTH MINE SITE

FIG 5



STREAKY BAY GYPSUM
DRILLHOLE LOCATIONS
NORTH MINE SITE

FIG 6



Scale 1:10000	DATE 18/06/97	SHEET 1 of 1	STREAKY BAY GYPSUM SOUTH MINE SITE TOTAL DEPTH CONTOURS
	REF No. 7	FILE SOUTHTD.PLT	
0 — 500m			

LEGEND

- O K= SCEALE BAY DRILLHOLES
- E= ELCOR 1969 DRILLHOLES
- N= DEPT OF MINES 1959 DRILLHOLES
- CONTOUR INTERVAL 0.5m

- 0m-1m
- 1m-2m
- 2m-3m
- 3m-4m
- 4m-5m
- 5m-6m

- TOTAL DEPTH (m)
- CaSo4(2H2O) (%)
- TOTAL METRE %

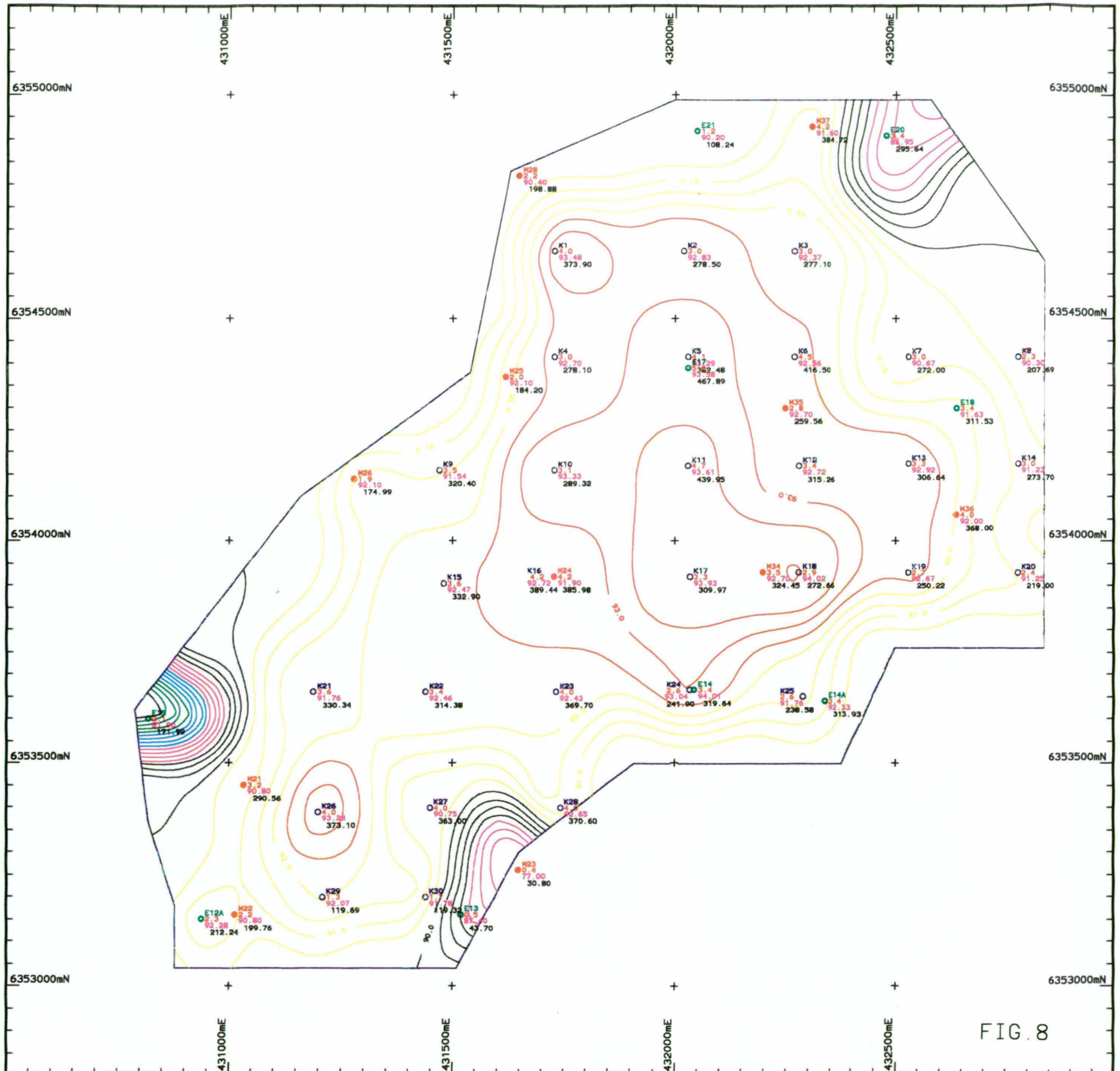


FIG. 8

Scale	DATE 18/06/97	SHEET 1 of 1
1:10000	REF No. 7	FILE STH_GYP.PLT

0 — 500m

LEGEND

- K= SCEALE BAY DRILLHOLES
- E= ELCOR 1969 DRILLHOLES
- N= DEPT OF MINES 1959 DRILLHOLES

- 75-80
- 80-82
- 82-84
- 84-86
- 86-88
- 88-90
- 90-92
- 92-94

- TOATL DEPTH (m)
- CaSo4(2H2O) (%)
- TOTAL METRE %
- CONTOUR INTERVAL 0.5%

STREAKY BAY GYPSUM
SOUTH MINE SITE
WEIGTHED AVERAGED GYPSUM GRADE CONTOURS

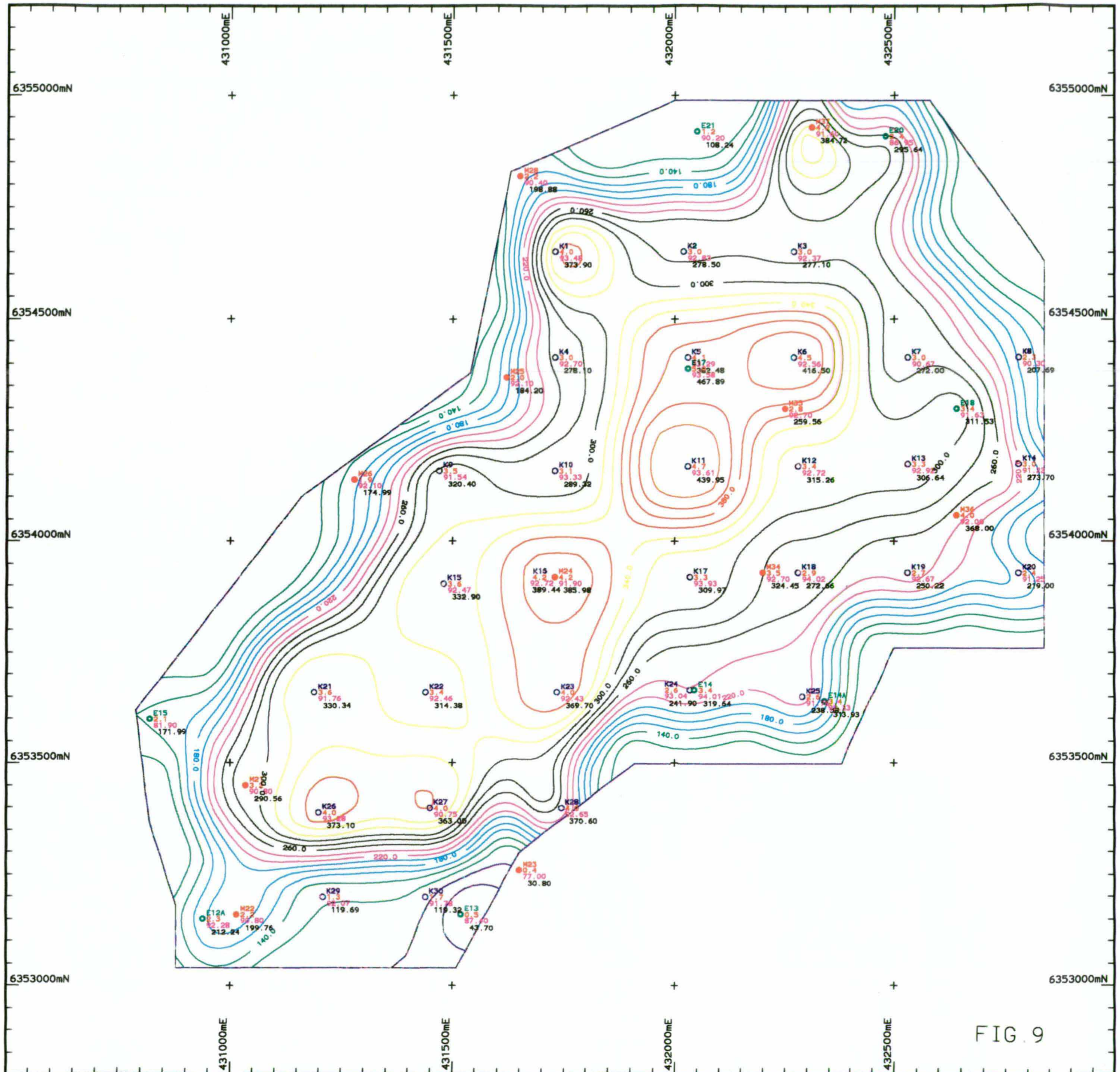


FIG 9

Scale 1:10000	DATE 18/06/97	SHEET 1 of 1
	REF No. 7	FILE STH_%.PLT

0 — 500m

LEGEND

- O K= SCEALE BAY DRILLHOLES
- O E= ELCOR 1969 DRILLHOLES
- ● M= DEPT OF MINES 1959 DRILLHOLES

- 0-50
- 50-100
- 100-150
- 150-200
- 200-250
- 250-300
- 300-350
- 350-400
- 400-450

- TOATL DEPTH (m)
- CaSo4(2H20) (%)
- TOTAL METRE %

CONTOUR INTERVAL 20%

STREAKY BAY GYPSUM
SOUTH MINE SITE
TOTAL METRE % GYPSUM CONTOURS

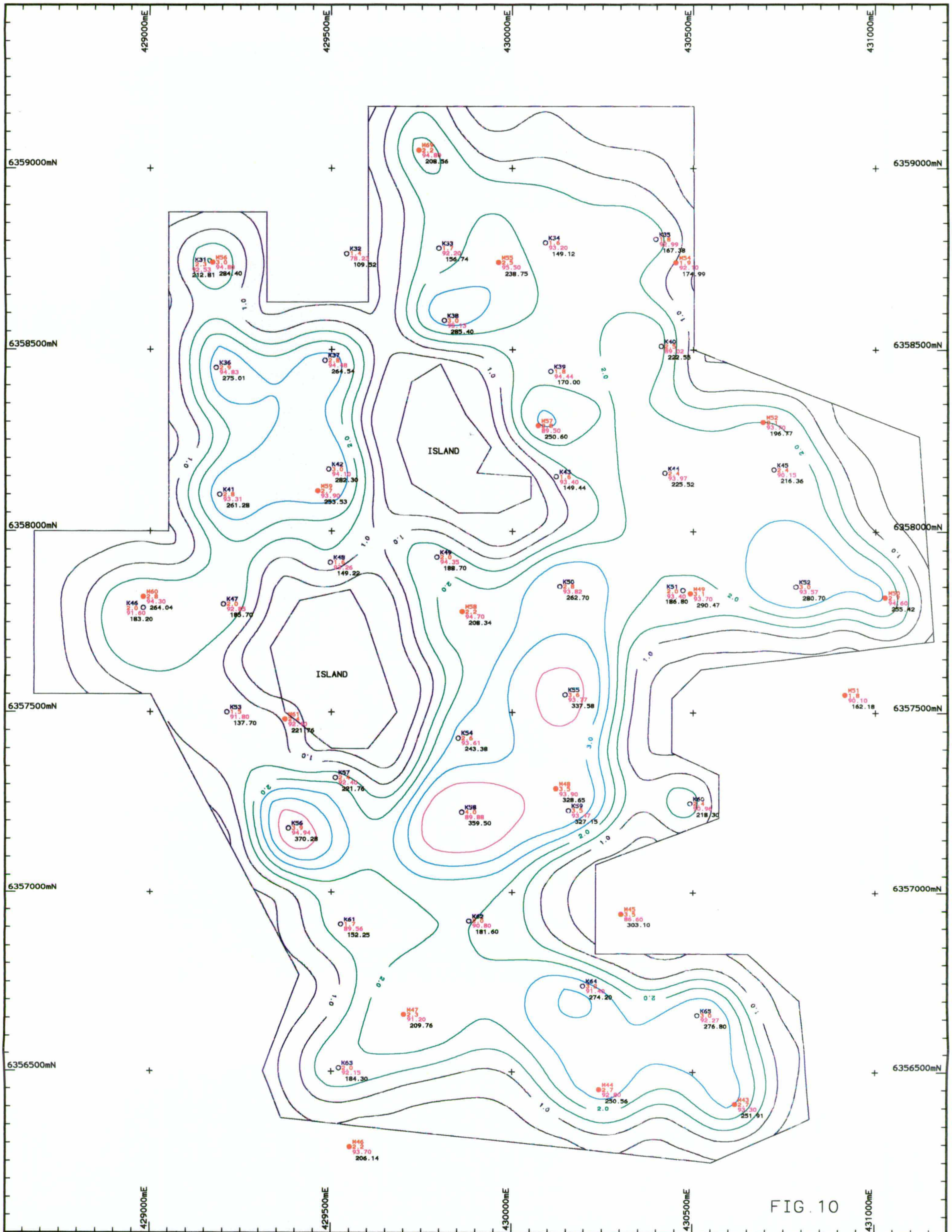


FIG. 10

Scale	DATE 15/06/97	SHEET 1 of 1	LEGEND	STREAKY BAY GYPSUM NORTH MINE SITE TOTAL DEPTH CONTOURS
1:10000	REF No. 1	FILE NORTHTD.PLT		

0 — 500m

LEGEND

- K= SCEALE BAY DRILLHOLE
- E= ELCOR 1969 DRILLHOLE
- M= DEPT OF MINES 1959 DRILLHOLE
- CONTOUR INTERVAL 0.5m

- 0m-1m
- 1m-2m
- 2m-3m
- 3m-4m
- 4m-5m
- 5m-6m

- TOTAL DEPTH (m)
- CaSo4(2H2O) (%)
- TOTAL METRE %

STREAKY BAY GYPSUM
NORTH MINE SITE
TOTAL DEPTH CONTOURS

FIG. 11

Scale 1:10000	DATE 15/06/97	SHEET 1 of 1	LEGEND O K= SCEALE BAY DRILLHOLE ● E= ELCOR 1969 DRILLHOLE ● M= DEPT OF MINES 1959 DRILLHOLE 75-80 80-82 82-84 84-86 86-88 88-90 90-92 92-94 TOATL DEPTH (m) CaSo4(2H2O) (%) TOTAL METRE % CONTOUR INTERVAL 0.5%	STREAKY BAY GYPSUM NORTH MINE SITE WEIGTHED AVERAGED GYPSUM GRADE CONTOURS
0 — 500m	REF No. 1	FILE NTH_GYP.PLT		

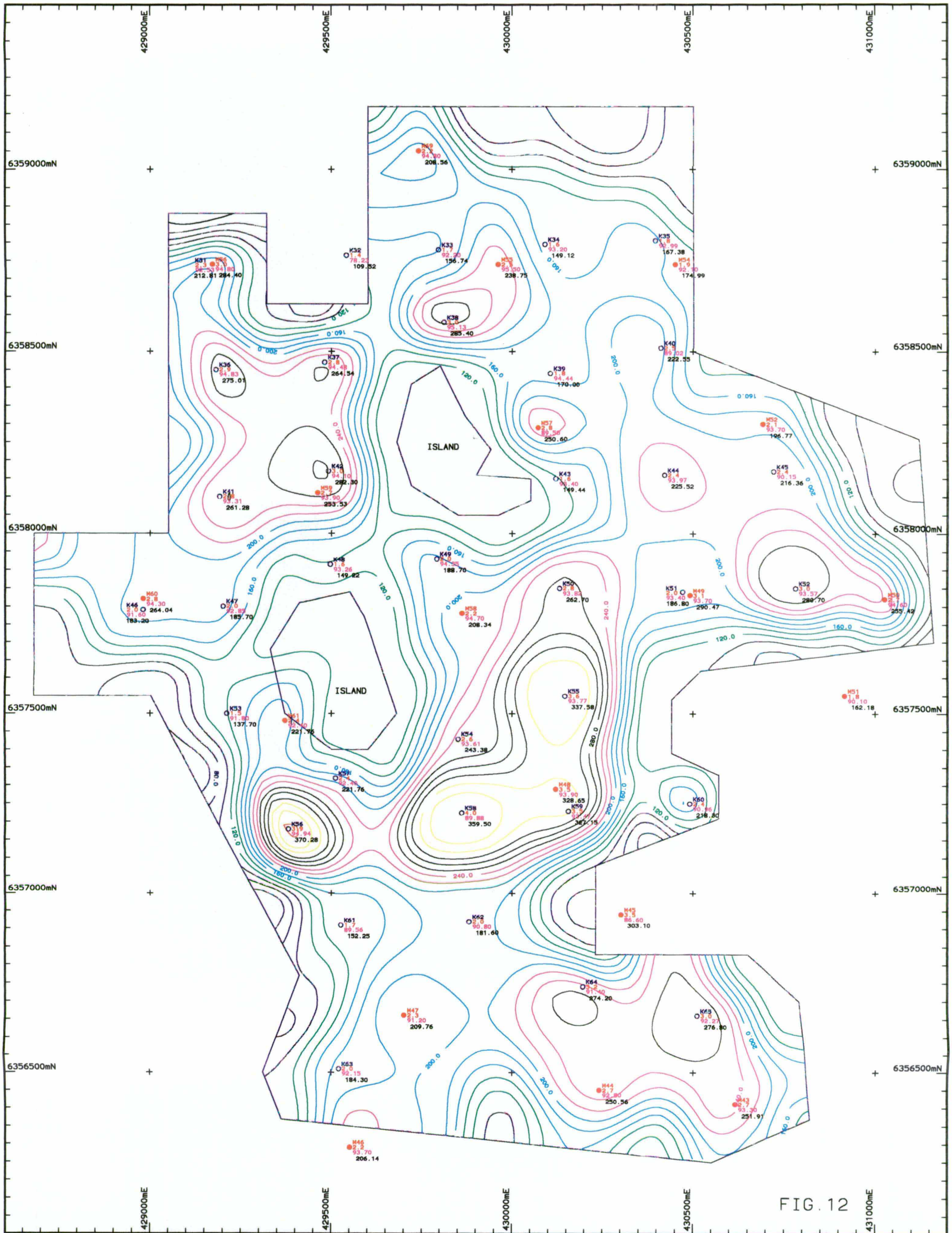


FIG. 12

Scale	DATE	SHEET
	15/06/97	1 of 1
1:10000	REF No.	FILE
	1	NTH_%A.PLT

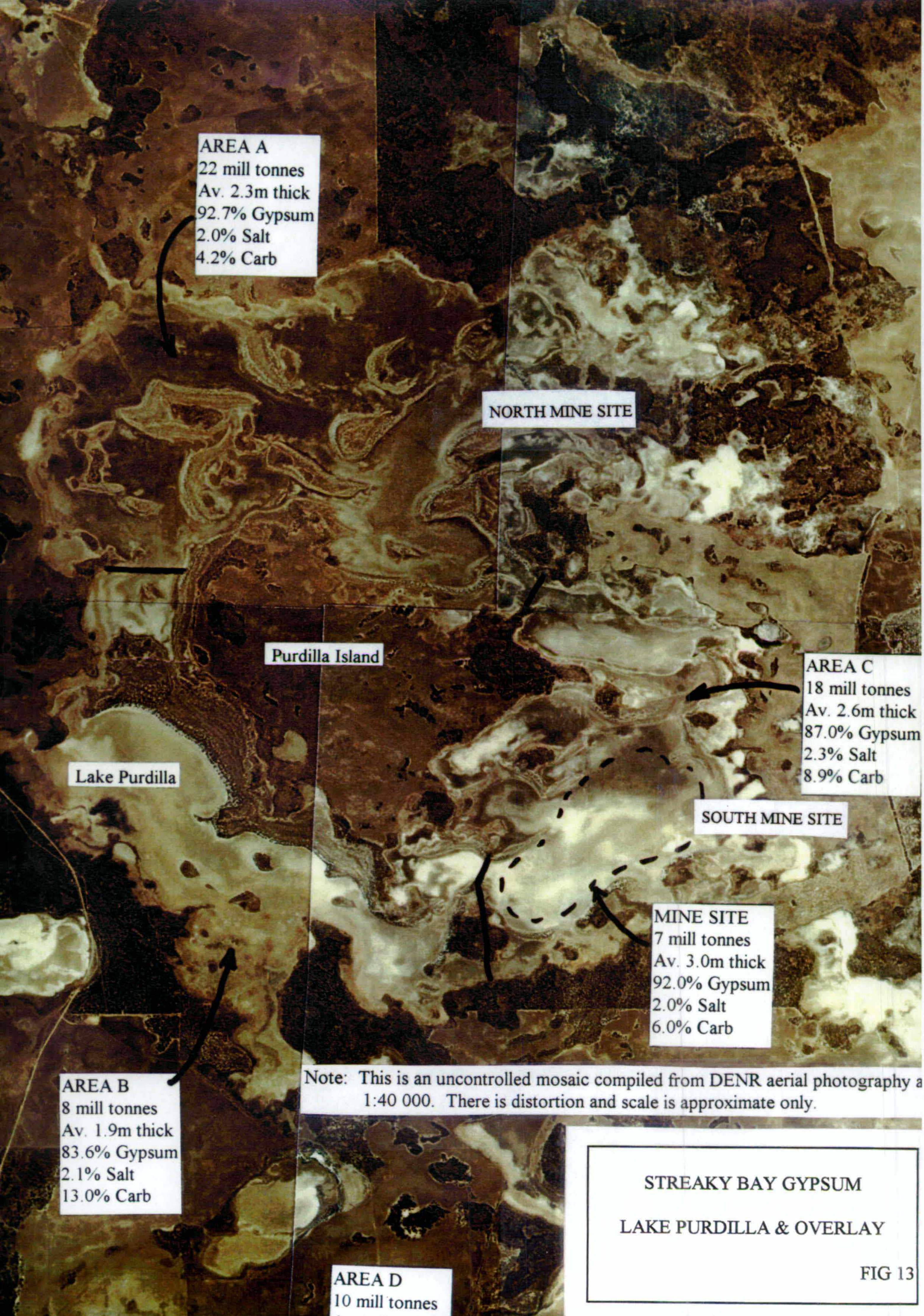
0 500m

LEGEND
- K= SCEALE BAY DRILLHOLE
- E= ELCOR 1969 DRILLHOLE
- M= DEPT OF MINES 1959 DRILLHOLE

0-50
50-100
100-150
150-200
200-250
250-300
300-350
350-400
400-450

TOATL DEPTH (m)
CaSo4(2H2O) (%)
TOTAL METRE %
CONTOUR INTERVAL 20%

STREAKY BAY GYPSUM
NORTH MINE SITE
TOTAL METRE % GYPSUM CONTOURS



STREAKY BAY GYPSUM

LAKE PURDILLA & OVERLAY

FIG 13

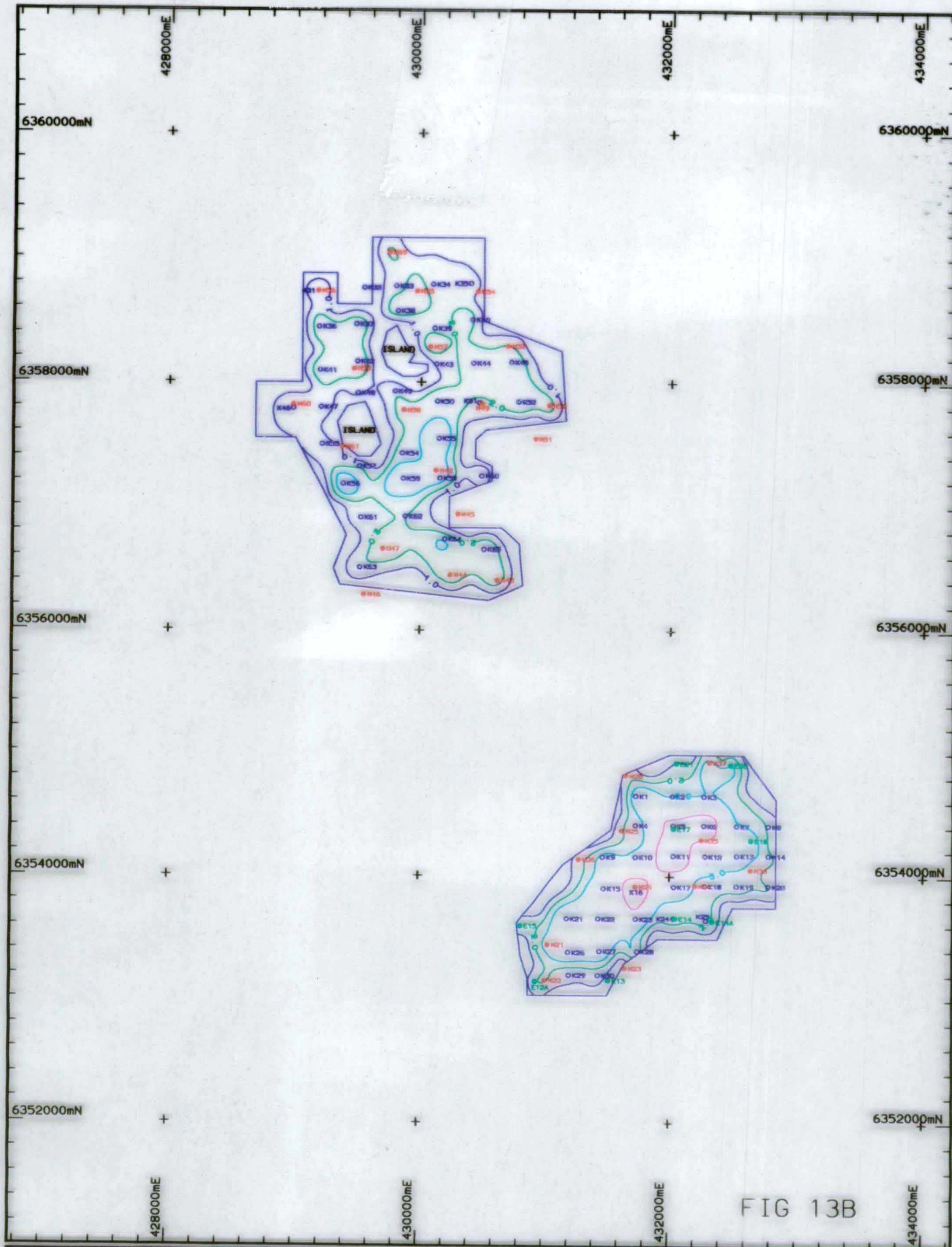


FIG 13B

Scale	DATE	SHEET
1:41622	24/06/97	1 of 1
	REF No.	FILE
	1	SCB_REG.PLT

0 — 1000m

LEGEND

- ○ K* SCEALE BAY DRILLHOLE
- ○ E* ELCOR 1969 DRILLHOLE
- ● M* DEPT OF MINES 1959 DRILLHOLE
- CONTOUR INTERVAL 1.0m

- 0m–1m
- 1m–2m
- 2m–3m
- 3m–4m
- 4m–5m
- 5m–6m

STREAKY BAY GYPSUM
DRILLHOLE LOCATIONS
TOTAL DEPTH CONTOURS
PHOTO OVERLAY

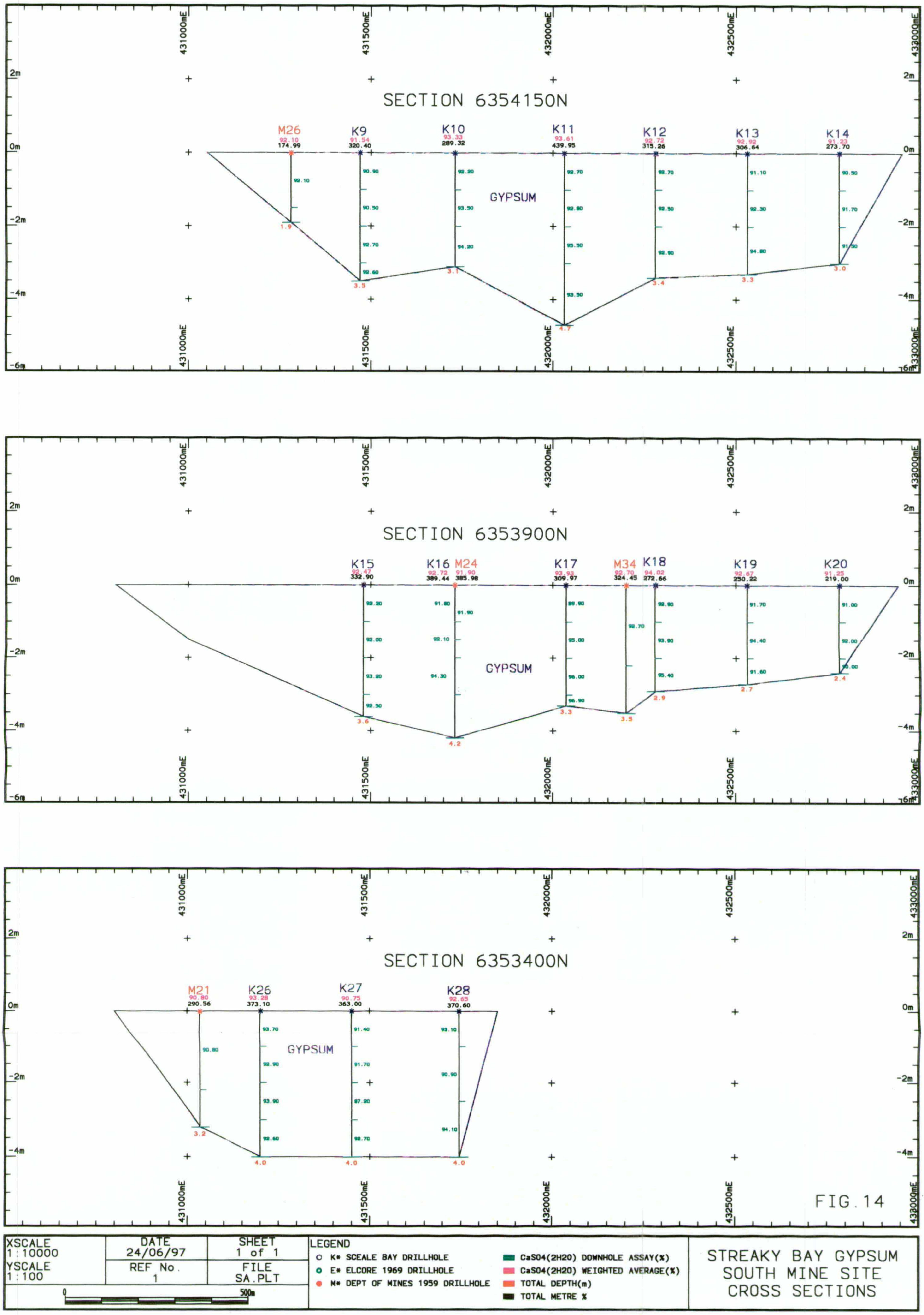

SECTION 6354150N
M26
K9
K10
K11
K12
K13
K14
GYPSUM
SECTION 6353900N
K15
K16
M24
K17
M34
K18
K19
K20
GYPSUM
SECTION 6353400N
M21
K26
K27
K28
GYPSUM
431000mE
431500mE
432000mE
432500mE
433000mE
2m
0m
-2m
-4m
-6m
XSCALE 1:10000
YSCALE 1:100
DATE 24/06/97
REF No. 1
SHEET 1 of 1
FILE SA.PLT
0
500m
LEGEND
K* SCEALE BAY DRILLHOLE
E* ELCORE 1969 DRILLHOLE
M* DEPT OF MINES 1959 DRILLHOLE
CaSO4(2H2O) DOWNHOLE ASSAY(%)
CaSO4(2H2O) WEIGHTED AVERAGE(%)
TOTAL DEPTH(m)
TOTAL METRE %
STREAKY BAY GYPSUM
SOUTH MINE SITE
CROSS SECTIONS

FIG. 14

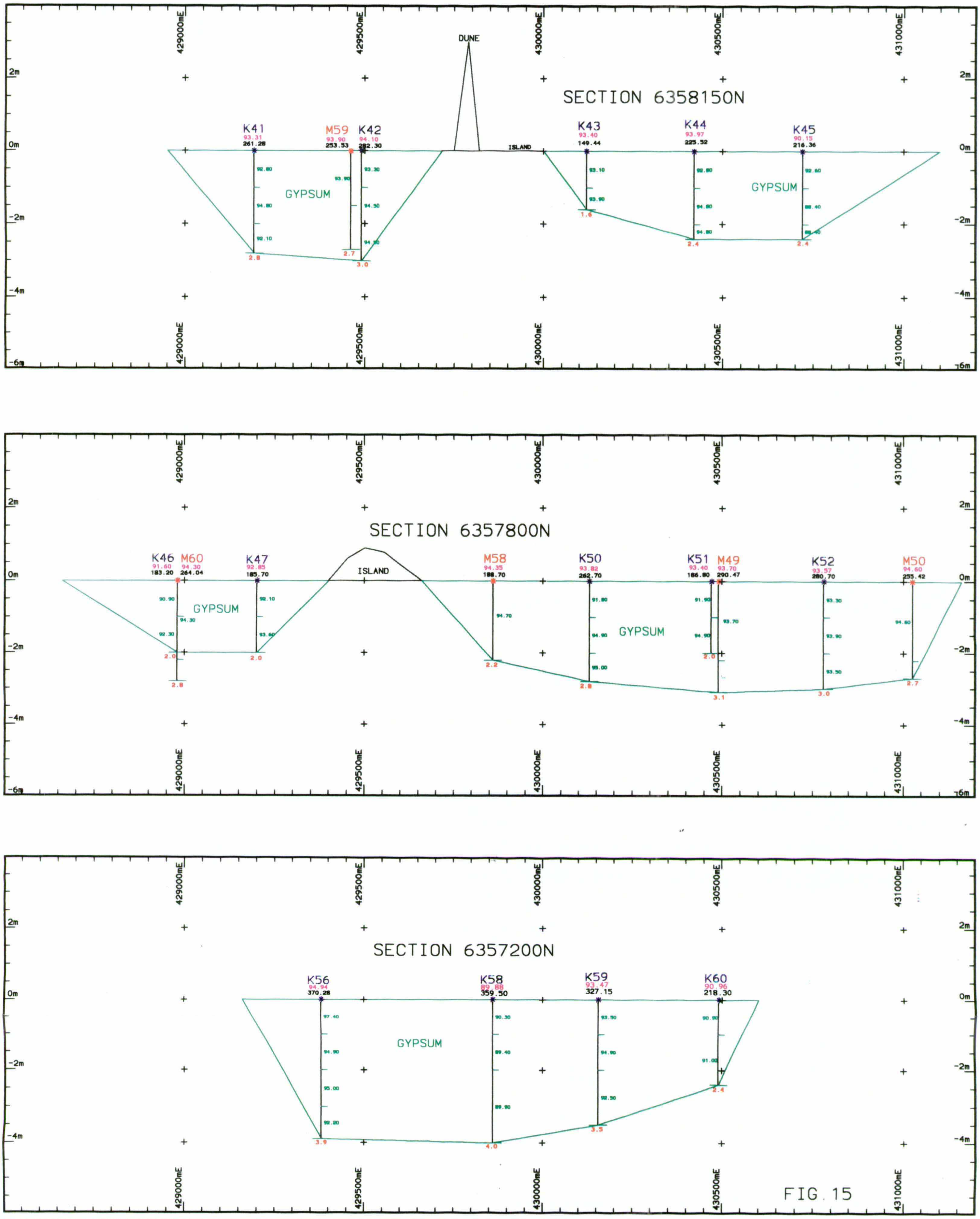


FIG. 15

XSCALE 1:10000 YSCALE 1:100	DATE 24/06/97 REF No. 1	SHEET 1 of 1 FILE NB.PLT	LEGEND O K* SCEALE BAY DRILLHOLE O E* ELCORE 1969 DRILLHOLE ● M* DEPT OF MINES 1959 DRILLHOLE CaSO4(2H20) DOWNHOLE ASSAY(%) CaSO4(2H20) WEIGHTED AVERAGE(%) TOTAL DEPTH(m) TOTAL METRE %
0 — 500m			

STREAKY BAY GYPSUM
NORTH MINE SITE
CROSS SECTIONS

Env 9010

Sceale Bay Development Corp. Pty Ltd
C/- D.H.Mainwood
9 Jarawee Road
KURANDA 4872
13 March 2000

The Chief Executive
Primary Industries and Resources SA
GPO Box 1671
ADELAIDE 5001

Dear Sir,

EXPLORATION LICENCE 2489
ANNUAL REPORT TO 18 FEBRUARY 2000

Exploration Licence 2489 "Sceale Bay", which expires on 18 August 2000, is held by Sceale Bay Development Corporation ("SBDC"). During the year of tenure no field work was undertaken. However, the company has continued evaluating the market potential for the gypsum resources, with a view to establishing an export facility. Since granting of the tenement, a reduction of approximately 50% in area has been completed, and further reductions are planned at the next renewal date.

SBDC plans to continue its gypsum exploration and evaluation during the next year of tenure. The principal objective of this work is to define the best gypsum resources within the tenement. Applications will be lodged for Mineral Claims to cover these resources prior to the end of the next term.

Yours sincerely,

D.H.Mainwood

D.H.Mainwood
Authorised Signatory
Phone (07) 4093-8330
Fax (07) 4093-8324