DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 83/52
PRODUCTION AND SOURCES OF FILTER SAND AND GRAVEL IN SOUTH AUSTRALIA

GEOLOGICAL SURVEY

by

D.C. SCOTT

JULY, 1983

DME.168/83

CONTENTS

PLATES

Number	Description	Slide(S) or Neg(N) No.
1	Murbko sand deposit - view eastwards	S22835
2	Murbko sand deposit - pit face	S22836
3	Loxton council sand pit looking eastwards	S22837
4	Loxton council sand pit - washing plant	S22838
5	Filtsan plant, Tanunda - rotary drying kiln	N33321
6	Filtsan plant, Tanunda - large gas flame at end of drying kiln	S22839
7	Filtsan plant, Tanunda - dried sand from elevator feeds into trommel screens	N33322
8	Filtsan plant, Tanunda - inside view of trommel	S22840
9	Filtsan plant, Tanunda - vibrating screen	N33323
10	Filtsan plant, Tanunda - overall view of filter sand treatment plant	N33324
11	Filtsan plant, Tanunda - filter gravel screening plant	N33325
12	Filtsan plant, Tanunda - stored filtration media on palletts	S22841

PLANS

Figure	Title	Plan No.
1	Location of deposits	S16221
2	Murbko sand deposit - location and regional geology	S16222
3	Murbko sand deposit - geological plan	S16223
4	Murbko sand deposit - geological plan and sections	82-268
5	Loxton deposits - locality map	S16501
6	Naracoorte sand deposit - locality and regional geology	S16224

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 83/52
DME NO. 168/83
DISK NO. 117

PRODUCTION AND SOURCES OF FILTER SAND AND GRAVEL IN SOUTH AUSTRALIA

ABSTRACT

Since 1970, recorded production of filter sand in South Australia totalled 26 641 tonnes, with 25 018 tonnes being recorded since 1978. The two main producers are Filtsan Pty. Ltd. of Tanunda, the only South Australian producer of standard sized filter sand and gravel meeting rigid Engineering and Water Supply Department (E. & W.S.) specifications for the filtration of metropolitan water and Santos Ready Mixed Concrete Pty. Ltd. of Berri who supply washed coarse sand for filtration of irrigation water.

Raw material is mined from deposits of Tertiary sand and gravel at Rowland Flat, Tertiary sand at Loxton and Berri and Quaternary sand at Murbko.

Filtsan produces filter sand by blending and dry screening material, mainly from Murbko and Loxton, and filter gravel by wet screening Rowland Flat gravel. Santos wash and partly screen sand from Spring Cart Gully, near Berri.

The BHP Co. Ltd. and Paterson Bros. Pty. Ltd. produce small tonnages of filtration sand from Quaternary deposits at Baird Bay and Langhorne Creek respectively. The BHP sand is used at Whyalla steelworks whilst Patterson's sand is used by the E. & W.S. for sewerage sludge drying beds. The Naracoorte sand deposit of rounded, medium to very coarse Quaternary sand, at present used for construction purposes, could produce the full range of filter sand with appropriate treatment.

INTRODUCTION

Filtsan Pty. Ltd. of Tanunda produces five standard sizes of filter sand and four of gravel. The Engineering and Water Supply Department (E. & W. S.) reports that this company is the only South Australian filter sand producer to meet rigid specifications for sand used in the filtration of Adelaide's water supply.

Raw materials for the Tanunda plant are obtained from deposits at Murbko, Loxton and Rowland Flat. Murbko deposit was mapped, using a plane table, by S.J. Ewen (Field Assistant) and the author on 1 May 1980 (Figs. 2-4). Sand from Loxton is mined from a District Council pit, which was inspected and sampled on 2 May 1980 (Fig. 5). Samples of treated material from Rowland Flat, and other filtration media, were collected during an inspection of the Filtsan plant by J.G. Olliver (Supervising Geologist), A.M. Pain and L.C. Barnes (Senior Geologists) and the author on 3 July 1980.

Samples were submitted to the Australian Mineral Development Laboratories (AMDEL) for sizing, mineralogical and chemical analyses, results are detailed in Appendices B, C and D. Specifications and analyses of filter sand and gravel (samples E1-E6) used in the Barossa Filtration Plant were supplied by A. Sommerville and T. Thompson (Technical Officers, E. & W.S.) and are included in Appendix B.

Three other deposits with recorded filter sand production are described in this report as well as a potential deposit near Naracoorte (Fig. 6). Locations are shown on Figure 1.

SPECIFICATIONS

E. & W.S. filter sand and gravel specifications are based on American Water Works Association (AWWA) Standard B100-72 for filtering material and summarised below:-

FILTER SAND

Quality: Shall consist of hard, durable, uncoated grains free from deleterious materials with specific gravity (sp. gr.) between 2.60 to 2.65 inclusive.

The grains shall be rounded, not angular, and contain not more than 5 per cent of flat or elongated particles where the largest dimension exceeds three times the smallest.

Acid solubility shall not be more than 5 per cent by weight, determined on a crushed and powdered sample, immersed without stirrring in 40 per cent hydrochloric acid solution which is kept between 18 and 24 degrees C for 24 hours.

Size: Size distribution shall be determined using sieves conforming to Australian Standard (AS) 1152-1973 and sieve data plotted graphically.

The sand shall have effective size within a range of sizings between 0.31 to 2.36 mm inclusive and uniformity coefficient of less than 1.45. Effective size (D10) is the size opening in mm, that will pass 10 percent of a sample. Uniformity coefficient is the ratio of size opening that will pass 60 per cent of a sample (D60) divided by D10.

SLUDGE DRYING BED SAND

Quality: As for filter sand.

Size: The sand shall have effective size between 0.30 and 0.50 and uniformity coefficient less than 3.5

FILTER GRAVEL

Quality: Shall consist of hard rounded stones, free of deleterious materials and with specific gravity not less than 2.5.

Filter gravel shall not contain more than 25 per cent fractured or angular stones and contain no more than 2 per cent thin, flat or long pieces in which the largest dimension exceeds five times the smallest.

Acid solubility shall not exceed 5 per cent for sizes smaller than 9.5 mm and 10 per cent for larger sizes.

Size: Size distribution shall be determined and plotted as for filter sand. Not more than 8 per cent shall be finer or coarser than designated size limits in the range 2.36 to 37.5 mm.

SOURCES OF FILTER SAND AND GRAVEL

South Australian sources and a potential source of raw sand and gravel for filtering media are listed in Table 1 and described below:-

Materials from deposits 1-3 are used by Filtsan Pty. Ltd. to produce nine differently sized filtering media in the range 0.33 to 37.5 mm inclusive. Deposits 4-6 are mined for construction sand and/or lower grade filtering media, such as sand for sewerage sludge drying beds but could produce material meeting filter sand specifications with additional screening. Deposit 7 is used only for construction sand, but with appropriate screening the full filter sand range could be obtained.

TABLE 1

SOURCES OF FILTER SAND AND GRAVEL

No.	1	2	3	4	5	6	7
Deposit	Murbko	Loxton	Rowland Flat	Baird Bay	Langhorn Ck	Berri	Naracoorte
Sec.	10,11,38	23	1620	12,13	349	Pastoral Blk 988, 1003	Blk. 108
Hd.	Murbko	Gordon	Nuriootpa	Wrenfordsley	Freeling	-	Hynam
Co.	Albert	Alfred	Gawler	Robinson	Hindmarsh	Hamley	MacDonnell
Council	Waikerie	Loxton	Freeling	Streaky Bay	Strathalbyn	Berri	Naracoorte
Planning Area	Upper Murray	Upper Murray	Outer Metro.	Eyre	Outer Metro.	Upper Murray	South East
1:250 000 Sheet	Renmark	Renmark	Adelaide	Elliston	Barker	Renmark	Naracoorte
Owner	Estate of E.O. Hoffman	Filtsan Pty Ltd	Monier Sands	The BHP Co.	Patterson Bros. Pty Ltd	Santos Ready Mixed Concrete Pty Ltd.	D.G. Pitt V.A. Pitt
Tenure	EML 4784	MC1645	PM93,192	EML 4034-4036	EML 3078	EML 3374, 4085	EML 3394 EML 3395
Material*	M-C sand	C-VC sand	F-C gravel F-M sand	C-VC sand	M-C sand	C-VC sand	M-VC sand

*Abbreviations

F fine
M medium
C coarse
V very

1. MURBKO

This deposit is currently the State's main source of specification filter sand, accounting for approximately 70 per cent of Filtsan's annual production (Plates 1 and 2).

Pale brown quartz sand is part of Coonambidgal Formation, which comprises clay, silt and sand in and adjacent to present stream channels within the Murray River tract (Firman, 1973) and shown on Figure 2 which is based on Firman (1971).

Within these generally fine grained, grey sediments are occasional zones of coarser white to pale yellow brown sand, as in the Morgan Council pit (Scott, 1981).

Indicated reserves, totalling 450 000 tonnes have been determined within EML 4784, based on a specific gravity of 1.7 for sand and areas outlined in cross-sections in Figure 4. These reserves as classed as indicated due to the approximate southern and eastern boundaries.

An additional 2 million tonnes are inferred outside EML 4784 in the area outlined in Figure 3, which had been tested with 30 drill holes by the late Mr. E.O. Hoffmann (former Managing Director, Filtsan Pty. Ltd.) who reported that uniform, medium to coarser grained sand extends below the flood plain to river level.

2. LOXTON

Coarse sand is mined from a pit, 1.5 km northeast of Loxton by Filtsan, under an agreement with the District Council of Loxton (Plates 3 and 4 and Pit 2, Fig. 5).

Up to 25 m of yellow, micaceous quartz sand of upper Loxton Sands (Firman, 1973) of late Tertiary age are exposed adjacent to the Murray River tract. These fluvio-lacustrine sediments are

underlain by fossiliferous, fine, estuarine sands of lower Loxton Sands.

Washing and screening removes fines on site before transport to Tanunda. Sand from this pit is used mainly for construction purposes in the Loxton area. Reserves have not been determined but are extensive, with other nearby pits, in sections 23 and 172 (Ludbrook, 1961).

3. ROWLAND FLAT

Washed and screened, fine to coarse gravel is obtained from this construction materials deposit, which provides after further screening, four filter gravels in the 2.36 to 37.5 mm range.

Rounded quartz and quartzite gravel is part of a Tertiary basinal sequence of interbedded gravel, sand, silt and clay deposited in the Gawler-Lyndoch area (Pain, 1976). At Rowland Flat, cross bedded sand and basal gravel, reaches total thickness of approximately 15 m. Lenses of paler fine to medium sand are also utilised by Filtsan.

4. BAIRD BAY

Unconsolidated, coarse grained, well sorted, rounded, quartz sand is mined from a beach, 3.5 km south of Baird Bay settlement on the western coast of Eyre Peninsula. The sand is derived from offshore granite knolls (Johnson, 1980).

The material is used by The BHP Co. Ltd. as a soakage pit lid sealer at Whyalla and is well sized for the production of coarse filter sand. Inferred reserves within EML 4034, 4035 and 4036 total 120 000 tonnes.

5. LANGHORNE CREEK

Medium to coarse grained sand has been mined on the shore of Lake Alexandrina, 11 km southeast of Langhorne Creek, since 1957. The material has been used for sewerage sludge drying beds

at Mount Barker, Strathalbyn and Victor Harbour by the E. & W.S. Department, as well as plaster, mortar and packing sand in the area. Annual production approximates 600 tonnes.

The deposit comprises an old beach ridge, up to 3 m high, similar to, but coarser than foundry sand deposits at Nalpa, 14 km eastwards (Scott, 1975 and 1980).

Reserves have not been determined, but based on an inspection by A.M. Pain and the author in October 1981, an estimated 10 000 tonnes of mineable sand remain.

6. BERRI

Partly consolidated Loxton Sands are mined from a pit adjacent to the Murray River, 5 km northeast of Berri, near Spring Cart Gully (Keeling, 1982). Coarse grained sand is similar to that obtained from Loxton with construction and filtration sand produced by washing on site.

7. NARACOORTE

Medium to very coarse sand, mined 12 km north of Naracoorte, is washed and screened in Naracoorte to produce construction sand. The bulk of coarser sand is in the 0.6 to 2.36 mm size range with finer sand in the 0.3 to 1.18 mm range.

The sand is part of a beach and foredune deposit of Bridgewater Formation, derived from Loxton Sands, during formation of the East Naracoorte Dune in lower Pleistocene times (Fig. 6 and Keeling et al., 1981).

Mineable reserves of 210 000 tonnes are present within EML 3394 and 3395, with large additional reserves inferred below overburden and outside lease boundaries.

TREATMENT, PRODUCTION AND USAGE OF FILTERING MEDIA

FILTSAN PRODUCTS

At present, Filtsan is the State's only producer of filter sand and gravel able to meet E. & W.S. specifications. Filtsan retails the following range of standard sizes (in mm)

Filter Sand	Filter Gravel
0.31-0.48	2.36-4.75
0.48-0.55	4.75-9.50
0.55-0.80	9.50-19.0
0.80-1.18	19.0-37.5
1.18-2.36	

SAND PROCESSING

Raw material from Loxton, Murbko and Rowland Flat is dried in a gas fired rotary kiln (Plates 5 and 6), then raised in an elevator to trommel screens (Plates 7 and 8) which remove fines less than 0.31 mm. Screened sand descends for final sizing with removal of over sized material by vibrating screen (Plate 9). Screened sand feeds into hoppers before bagging and storage (Plates 10 and 12).

GRAVEL PROCESSING

Partially sized and washed material from Rowland Flat is placed in an over-head hopper which feeds into standard sized trommel screens (Plate 11). The wet screened product is bagged directly from hoppers under the screens.

PRODUCTION

Recorded output of filtration sand since 1970, including sludge drying bed sand, but excluding filter gravel, is detailed in Table 2.

TABLE 2

S.A. FILTER SAND PRODUCTION (tonnes)

1970	104
1971	223
1972	138
1973	124
1974	129
1975	143
1976	396
1977	201
1978	165
1979	5 120
1980	10 833
1981	9 065
TOTAL	26 641

The considerable increase since 1978 is due to start of production by Filtsan and Santos R.M.C. Filtsan's products have been used mainly in filtration plants for Adelaide's water supply and for similar interstate schemes. Most of the material used is in the 0.48-0.55 mm size range, obtained by blending sand from Murbko and Loxton. Mr. R.E. Rohrlach (Plant Manager) stated that Filtsan also produces sludge drying bed sand and is capable of producing sand sizes, other than those listed, to meet customer's requirements.

Santos' sand is used for filtration of irrigation water to remove debris, fine sand and silt. Mr. W. Santos (Proprietor) reported that the washed sand is partially sized to remove most of the -0.600 mm fraction.

Sand from the other deposits is used only for sewerage sludge drying beds or construction sand after screening and/or washing. With additional screening, each deposit could produce material to meet filter sand specifications, especially the Naracoorte deposit, which is capable of producing the full range of standard sizes.

RESULTS OF TESTING

Samples submitted to AMDEL for analyses are listed in Tables 3 and 4 and include six E. & W.S. samples (prefixed E). Results of sizing and mineralogical testing of treated material are detailed in Appendix B with chemical analyses in Appendix C. Sizings of untreated sand are shown in Appendix D. Appendix A contains Australian Standard particle size classifications (A.S. 1152-1973) used in this report.

Results are summarised below in two sections: treated materials mainly from Filtsan's Tanunda plant and untreated material from deposits listed in Table 4.

PROCESSED SAND AND GRAVEL

TABLE 3

SAMPLES AND TESTING OF TREATED MATERIALS

Sample No.	Type/size(mm)	Size analysis	Chemical analysis & mineralogy	Filter media tests
Tanunda Plant	Filter sand			
A1134/80	0.80-1.18	+	+	+
A1135/80	0.55-0.80	+	+	+
A1136/80	0.48-0.55	-	+	-
E6	0.48-0.55	+	-	+
A1137/80	<0.48	+	+	+
A1138/80	0.31-0.48	+	+	+
Rowland Flat				
A1139/80	Washed sand	+	+	-
Loxton				
A1140/80	Washed sand	-	+	-
Langhorne Ck				
E5	Sludge drying bed sand	+	-	+
Tanunda Plant	Filter gravel			
E1	19.0-37.5	+	-	+
E2	9.5-19.0	+	-	+
E3	4.75-9.5	+	-	+
E4	2.36-4.75	+	-	+
A1131/80	19.0-37.5	-	+	-
A1132/80	4.75-9.5	-	+	-
A1133/80	2.36-4.75	-	+	-

\+ tested

\- not tested

All 16 samples have high SiO_2 content, ranging from 95.0 to 99.2 per cent and averaging 98.0 per cent (Appendix C). Quartz is the dominant mineral with minor feldspar up to about 10 per cent in sample A1137/80, in 'sugary' grains (Appendix B). Fe_2O_3 is the main impurity averaging 0.30 per cent.

Filter sand. Samples of four of the five filter sands produced at Tanunda were tested as the 1.18 to 2.36 mm sand was not available. Sample A1137/80 represents residual material from production of coarser sands.

Subangular to subrounded quartz sand has some iron staining as a coating or fracture filling, particularly in the coarser filter sand produced from washed Loxton sand (sample A1140/80). The two finer filter sands (A1136/80 and A1137/80) have less iron staining as the main constituent is Murbko sand.

The four filter sands from Tanunda meet all requirements detailed under SPECIFICATIONS and listed with analyses in Appendix B. Sample E5 meets less demanding specifications for sludge drying bed sand.

Filter gravel. Comprised quartzite with some clean vein quartz, coarser stones are subrounded to well rounded grading to subangular for finer material.

Samples E2 to E4 contain more than the specified 25 percent of angular and fractured stones, varying from 38.4 to 79 per cent as detected in the morphology examination in Appendix B. However, many fractures outlined by iron staining have 'healed' as confirmed by L.A. abrasion tests. Samples E3 and E4 have 77 and 79 percent fractured stones respectively but L.A.'s are below the maximum 45 percent specified. Samples E1 and E2 are slightly above the L.A. limit with 52.5 and 50.0 percent respectively due mainly to minor softer, weathered quartzite stones.

All other specifications are satisfied easily and Filtsan gravel has been used successfully in the Anstey Hill and Barossa Filtration Plants.

UNTREATED SAND

TABLE 4

SAMPLES AND TESTING OF UNTREATED SAND

Sample No.	Location	Sizing	Chemical Analysis
A463-478/80	Murbko	+	-
A477-479/80	Loxton	+	-
A5492/78	Baird Bay	+	+
A11018/81	Naracoorte	-	+
A3771/81	Naracoorte	+	-
A391/81	Naracoorte	+	-
A393/81	Naracoorte	+	-

Murbko. Samples from 3 auger holes shown on Figure 4, are mainly in the 0.30 to 1.00 mm range, suitably sized for production of the finer filter sands. Except for the top metre which contains some fine, drift sand, and intervals at 4 to 5 m and 3 to 4 m in holes M1 and M3 respectively which represent occasional finer zones, overall the deposit is uniformly sized.

Loxton. The following three samples were tested:

A478/80 - Pit 2 - lower 2 m of face

A479/80 - Pit 2 - stockpile

A477/80 - Pit 1 - up to 3 m of face

Coarse to very coarse sand, mostly in the size range 0.710 to 1.40 mm provides the bulk of coarse filter sand and is blended with Murbko and Rowland Flat sand for the remaining sizes.

Baird Bay. Very coarse grained, rounded to well rounded sand, represented by sample A5492/78, contains 90 to 95 per cent quartz, 5 to 10 per cent feldspar and traces of carbonate as shell fragments. More than 99 per cent of the sand is sized between 0.850 and 3.35 mm, mostly in the 0.850 to 1.70 mm range, ideally suited for production of coarser filter sands.

Naracoorte. Composite sample A1101B/81 of coarse to very coarse sand with fines removed, is mainly quartz (99.4 % SiO_2) with minor alumina and iron oxide.

Orange-brown to pale brown, well sorted sand is rounded to well rounded, with occasional aggregates loosely cemented by iron oxides. The following three samples were selected from Keeling et al (1981) to show the wide range of sizes available (Appendix D).

- A377/81 - 66 per cent between 0.30 and 1.18 mm,
- A391/81 - 64 per cent between 0.60 and 2.36 mm
- A393/81 - 80 per cent between 1.18 and 4.75 mm.

With appropriate screening and blending, the full range of filter sands could be produced from this deposit.

Berri. Although not sampled, sizing and composition is expected to be similar to Loxton.

CONCLUSIONS

Tertiary sand and gravel at Rowland Flat, very coarse Tertiary sand at Loxton and Berri and Quaternary sand at Murbko, Baird Bay and Langhorne Creek provide raw material for the production of water filtration media in South Australia.

Recorded production of filter sand from 1970 totals 26 641 tonnes. Annual output has increased sharply from 165 tonnes in 1978 to 9 065 tonnes in 1981 owing to production by Filtsan Pty. Ltd. at Tanunda and Santos R.M.C. Pty. Ltd. at Berri.

Filtsan produces a range of filtration media that conform to tight E. & W.S. size and quality specifications required for the treatment of Adelaide's water supply. Sand sizings are obtained by blending and dry screening material from deposits at Murbko,

Loxton and Rowland Flat. Gravel sizings are obtained by wet screening Rowland Flat material.

Santos produces by washing and partial removal of the finer fraction, coarse filtration sand to extract debris and silt from irrigation water.

Other minor producers of filtration sand are The BHP Co. Ltd. at Baird Bay and Paterson Bros. Pty. Ltd. at Langhorne Creek. Large reserves of Quaternary medium to very coarse sand near Naracoorte have the potential to produce the full range of filter sand sizings after suitable treatment.

D. C. Scott

DCS/GU

D.C. SCOTT
GEOLOGIST

REFERENCES

Firman, J.B., 1971. RENMARK map sheet, Geological Atlas of South Australia, 1: 250 000 series. Geol. Surv. S. Aust.

Firman, J.B., 1973. Regional stratigraphy of surficial deposits in the Murray Basin and Gambier Embayment. Rept. Invest., geol. Surv. S. Aust., 39: 68 pp.

Johnson, P.D., 1980. Baird Bay beach sand, Eyre Peninsula South Australia. Mineral Resour. Rev., S. Aust., 149: 54-56.

Keeling, J.L., Rosier, C.M. and Ewen, S.J., 1981. Naracoorte sand deposit. Results of geological investigations and auger drilling, 1981. S. Aust. Dept. Mines and Energy report 81/88 (unpublished).

Keeling, J.L., 1982. Review of high grade lump silica sources in South Australia. S. Aust. Dept. Mines and Energy report 82/16 (unpublished).

Ludbrook, N.H., 1961. Stratigraphy of the Murray Basin in South Australia. Bull. geol. Surv. S. Aust., 36: 67, 75-76.

Pain, A.M., 1976. Sand, gravel and clay resources of the Barossa District, Gawler to Rowland Flat. S. Aust. Dept. Mines and Energy report 76/109 (unpublished).

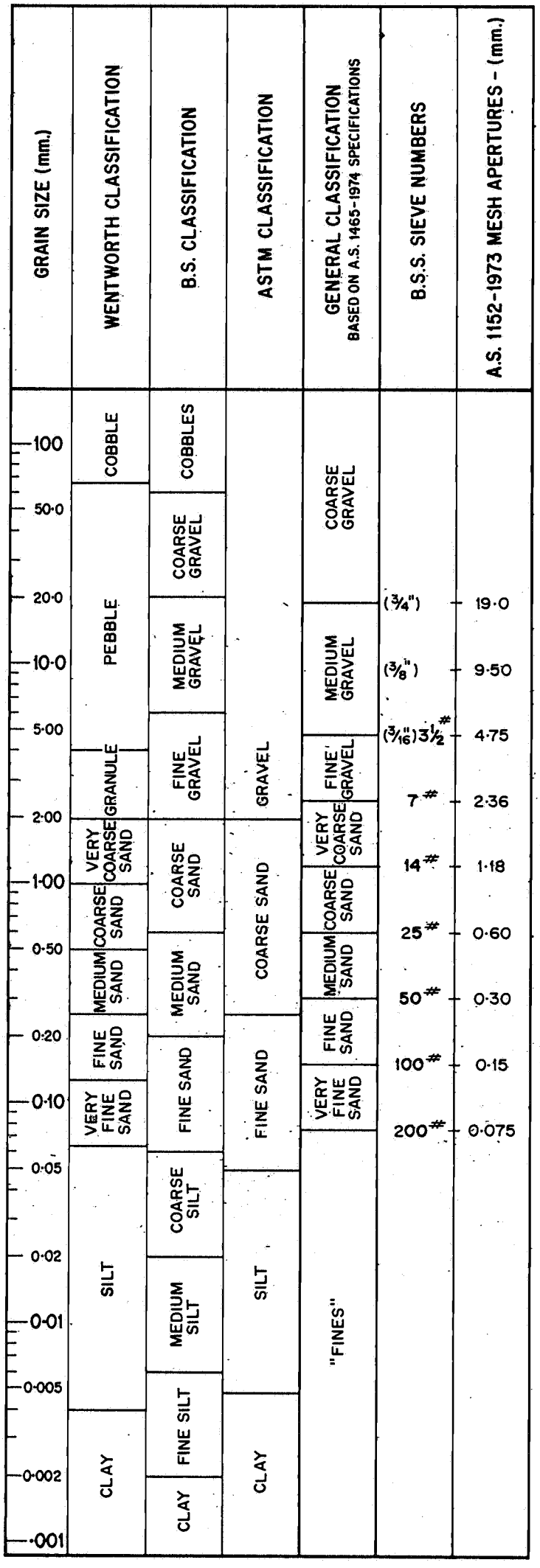
Scott, D.C., 1975. Reconnaissance survey - foundry and glass sand project. Report No. 2. S. Aust. Dept. Mines report 75/81 (unpublished).

Scott D.C., 1980. Foundry and glass sand project. Production and usage of foundry sand in South Australia. Report No. 3. S. Aust. Dept. Mines and Energy report 80/94 (unpublished).

Scott, D.C., 1981. Construction sand survey. Morgan area. S. Aust. Dept. Mines and Energy report 81/36 (unpublished).

APPENDIX A

Particle size classifications and equivalent sieve sizes



AUSTRALIAN STANDARD 1152-1973		BRITISH STANDARD 410-1969		U.S. STANDARD (1924), AND ASTM (E11-61) DESIGNATION			U.S. TYLER (1910)	
DESIGNATION	SIEVE APERTURE mm.	MESH Nº	SIEVE APERTURE mm.	MESH Nº	ASTM DESIGNATION microns	SIEVE APERTURE mm.	MESH Nº	SIEVE APERTURE mm.
19·0mm	19·0	(3/4")	19·0					
16·0 "	16·0		16·0					
13·2 "	13·2		13·2					
11·2 "	11·2		11·2					
9·50 "	9·50	(3/8")	9·50					
8·00 "	8·00		8·00				2·5	7·925
6·70 "	6·70		6·70				3	6·680
5·60 "	5·60	3	5·60	3·5	5,660	5·66	3·5	5·613
4·75 "	4·75	(3/16")3½	4·75	4	4,760	4·76	4	4·699
4·00 "	4·00	4	4·00	5	4,000	4·00	5	3·962
3·35 "	3·35	5	3·35	6	3,360	3·36	6	3·327
2·80 "	2·80	6	2·80	7	2,830	2·83	7	2·794
2·36 "	2·36	7	2·36	8	2,380	2·38	8	2·362
2·00 "	2·00	8	2·00	10	2,000	2·00	9	1·981
1·70 "	1·70	10	1·70	12	1,680	1·68	10	1·651
1·40 "	1·40	12	1·40	14	1,410	1·41	12	1·397
1·18 "	1·18	14	1·18	16	1,190	1·19	14	1·168
1·00 "	1·00	16	1·00	18	1,000	1·00	16	0·991
850 µm	0·850	18	0·850	20	841	0·841	20	0·833
710 "	0·710	22	0·710	25	707	0·707	24	0·701
600 "	0·600	25	0·600	30	595	0·595	28	0·589
500 "	0·500	30	0·500	35	500	0·500	32	0·495
425 "	0·425	36	0·425	40	420	0·420	35	0·417
355 "	0·355	44	0·355	45	354	0·354	42	0·351
300 "	0·300	52	0·300	50	297	0·297	48	0·295
250 "	0·250	60	0·250	60	250	0·250	60	0·246
212 "	0·212	72	0·212	70	210	0·210	65	0·208
180 "	0·180	85	0·180	80	177	0·177	80	0·175
150 "	0·150	100	0·150	100	149	0·149	100	0·147
125 "	0·125	120	0·125	120	125	0·125	115	0·124
106 "	0·106	150	0·106	140	105	0·105	150	0·104
90 "	0·090	170	0·090	170	88	0·088	170	0·089
75 "	0·075	200	0·075	200	74	0·074	200	0·074
63 "	0·063	240	0·063	230	63	0·063	250	0·061
53 "	0·053	300	0·053	270	53	0·053	270	0·053
45 "	0·045	350	0·045	325	44	0·044	325	0·043
38 "	0·038	400	0·038	400	37	0·037	400	0·038

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

PARTICLE SIZE CLASSIFICATIONS AND EQUIVALENT SIEVE SIZES

S-11511

APPENDIX B

Processed sand and gravel

sizing and mineralogy

Extracted from AMDEL report

MD2469/81

by

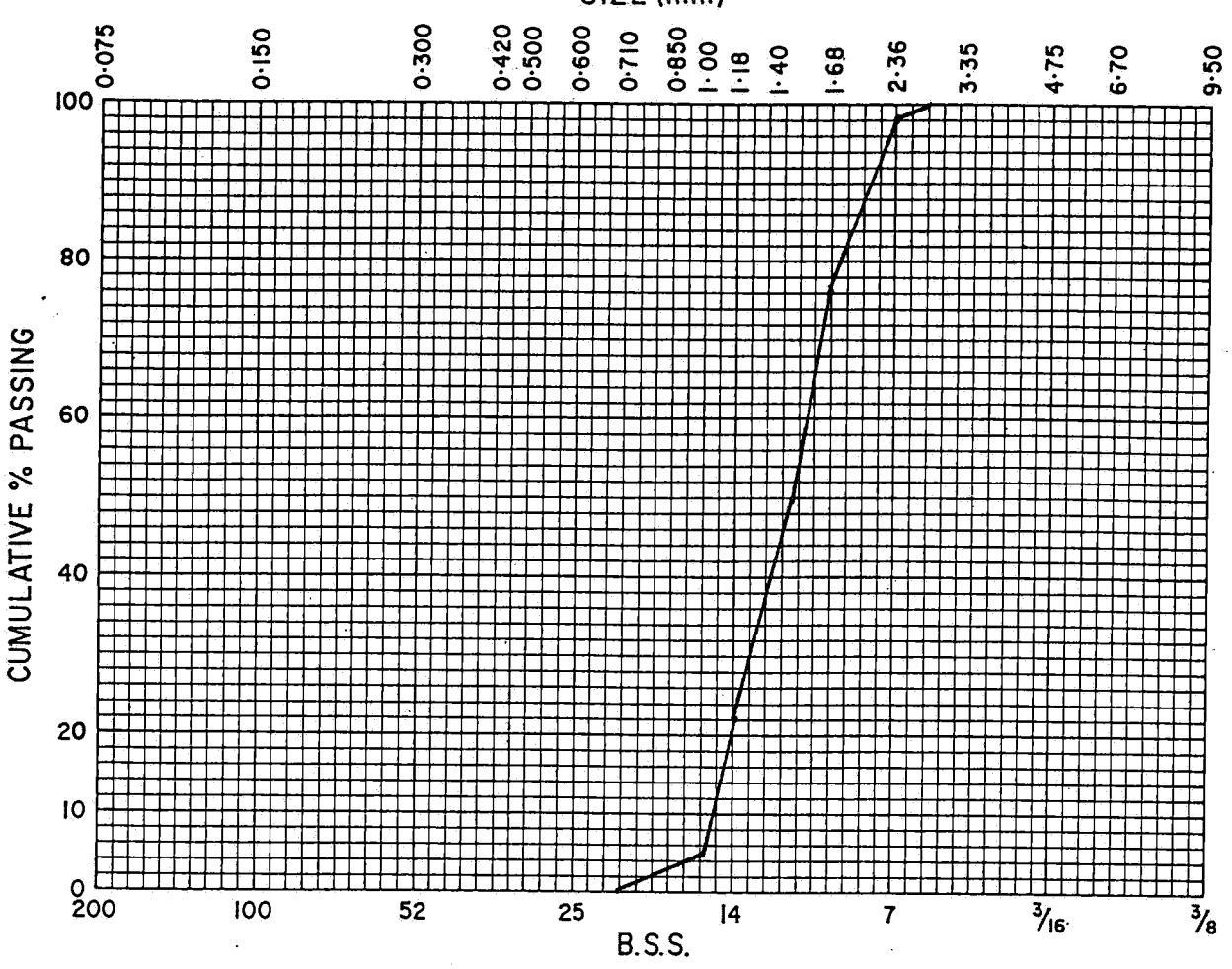
L.J. Day

and

E.&W.S. Dept. analyses (prefixed E).

DEPARTMENT OF MINES AND ENERGY — SOUTH AUSTRALIA

SAND SIZE ANALYSIS



SAMPLE N°: A1134/80

LOCATION: Filtsan-Tanunda plant

TYPE: Filter sand	SPECIFIED
EFFECTIVE SIZE [D10]: 1.09	0.80-1.18
SIZE PASSING 60% [D60]: 1.55	
UNIFORMITY COEFFICIENT $\left[\frac{D60}{D10}\right]$: 1.42	<1.45
SPECIFIC GRAVITY: 2.65	2.60-2.65
ACID SOLUBILITY (%): 0.35	⩽5

MINERALOGY

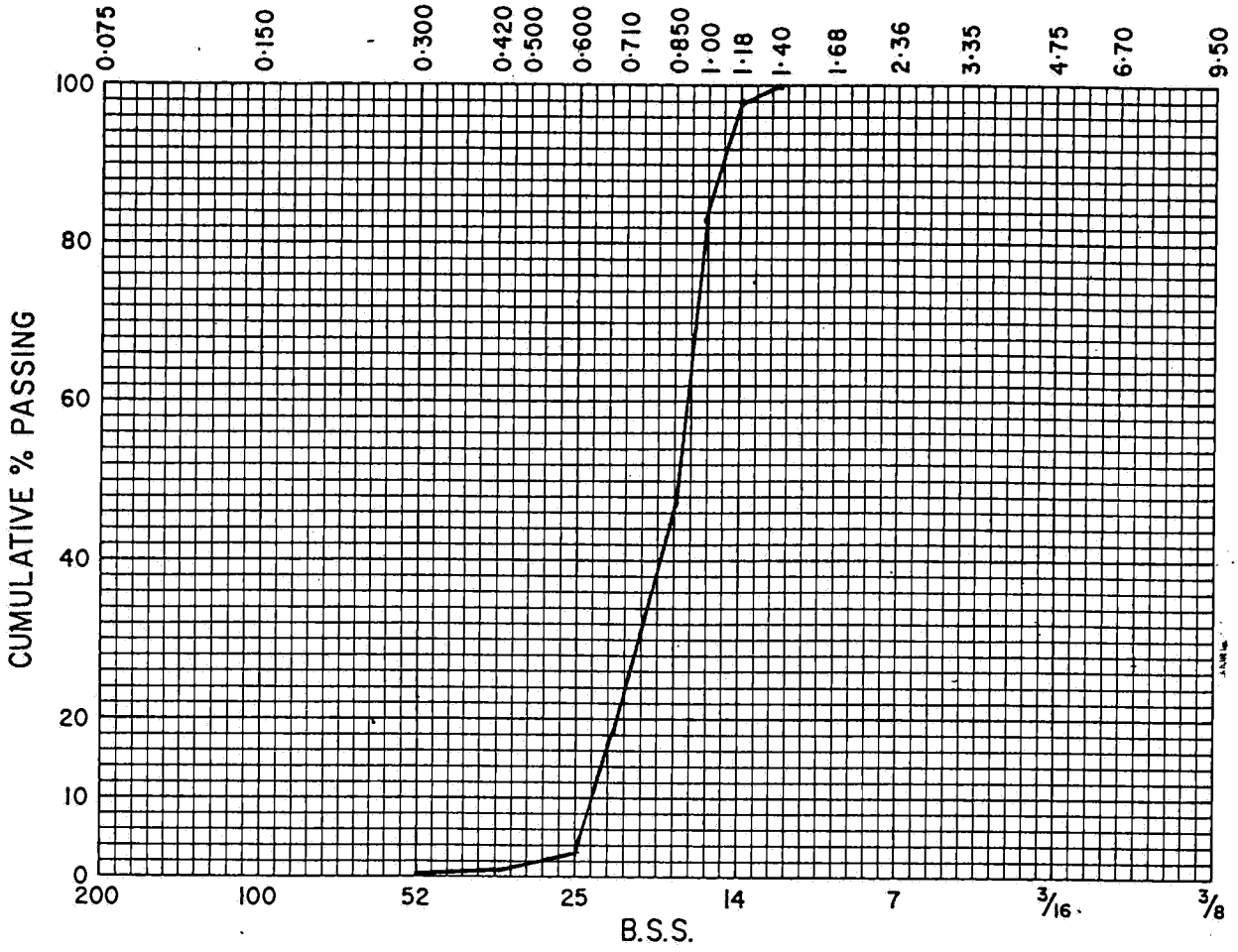
COLOUR: Yellow-brown

SHAPE: Subangular to subrounded.

DESCRIPTION: Unconsolidated, moderately well sorted very coarse quartz sand, approx. 1-2 mm diameter average, heavily iron-stained hence the overall colouration. Iron-staining appears to be mainly surficial or confined to fine fracturing within the quartz grains. Overall, the quartz grains have a "polished" appearance. Some "sugary" grains are present. Non-calcareous. Trace of iron oxides.

DEPARTMENT OF MINES AND ENERGY — SOUTH AUSTRALIA

SAND SIZE ANALYSIS



SAMPLE N°:	A1135/80	
LOCATION:	Filtsan-Tanunda plant	
TYPE:	Filter sand	SPECIFIED
EFFECTIVE SIZE [D10]:	0.660	0.55-0.80
SIZE PASSING 60% [D60]:	0.900	
UNIFORMITY COEFFICIENT $\left[\frac{D60}{D10}\right]$:	1.36	<1.45
SPECIFIC GRAVITY:	N.D.	2.60-2.65
ACID SOLUBILITY (%):	0.29	⩽5

MINERALOGY

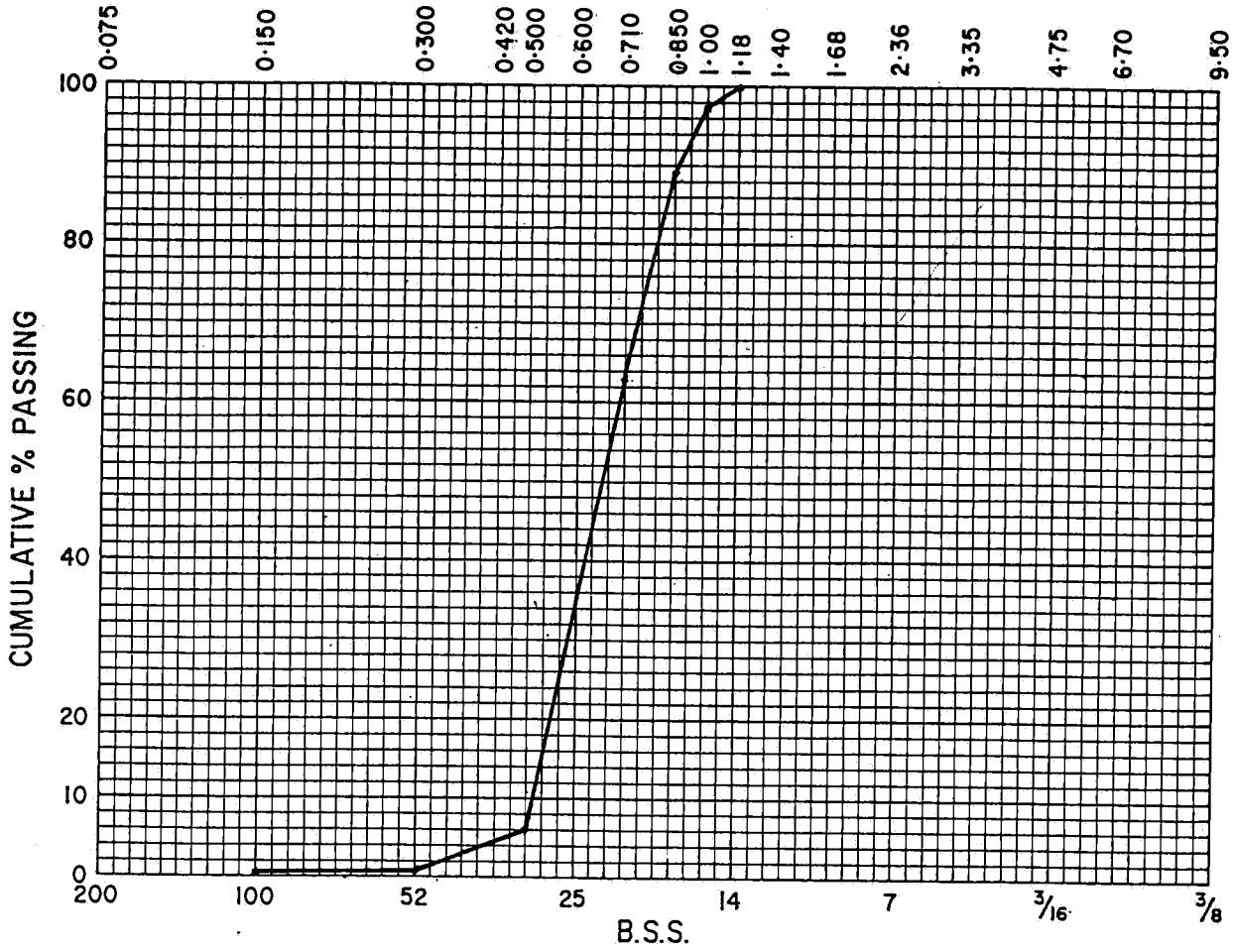
COLOUR: Brown to yellow-brown

SHAPE: Subangular

DESCRIPTION: Unconsolidated well sorted coarse quartz sand showing moderate iron-staining. Iron-staining is confined mainly to the more weathered, fractured, "sugary" grains. Approximately 40-50% are clean "glassy" unfractured quartz grains. Traces of organics. Non-calcareous. Trace of tourmaline(?).

DEPARTMENT OF MINES AND ENERGY — SOUTH AUSTRALIA

SAND SIZE ANALYSIS



SAMPLE N°: E6

LOCATION: Filtsan - Tanunda plant

TYPE: Filter sand

		SPECIFIED
EFFECTIVE SIZE [D10]	0.510	0.48 - 0.55
SIZE PASSING 60% [D60]	0.690	
UNIFORMITY COEFFICIENT $\left[\frac{D60}{D10}\right]$	1.35	< 1.45
SPECIFIC GRAVITY	2.62	2.60 - 2.65
ACID SOLUBILITY (%)	0.80	± 5

Sample No
A1136/80

MINERALOGY

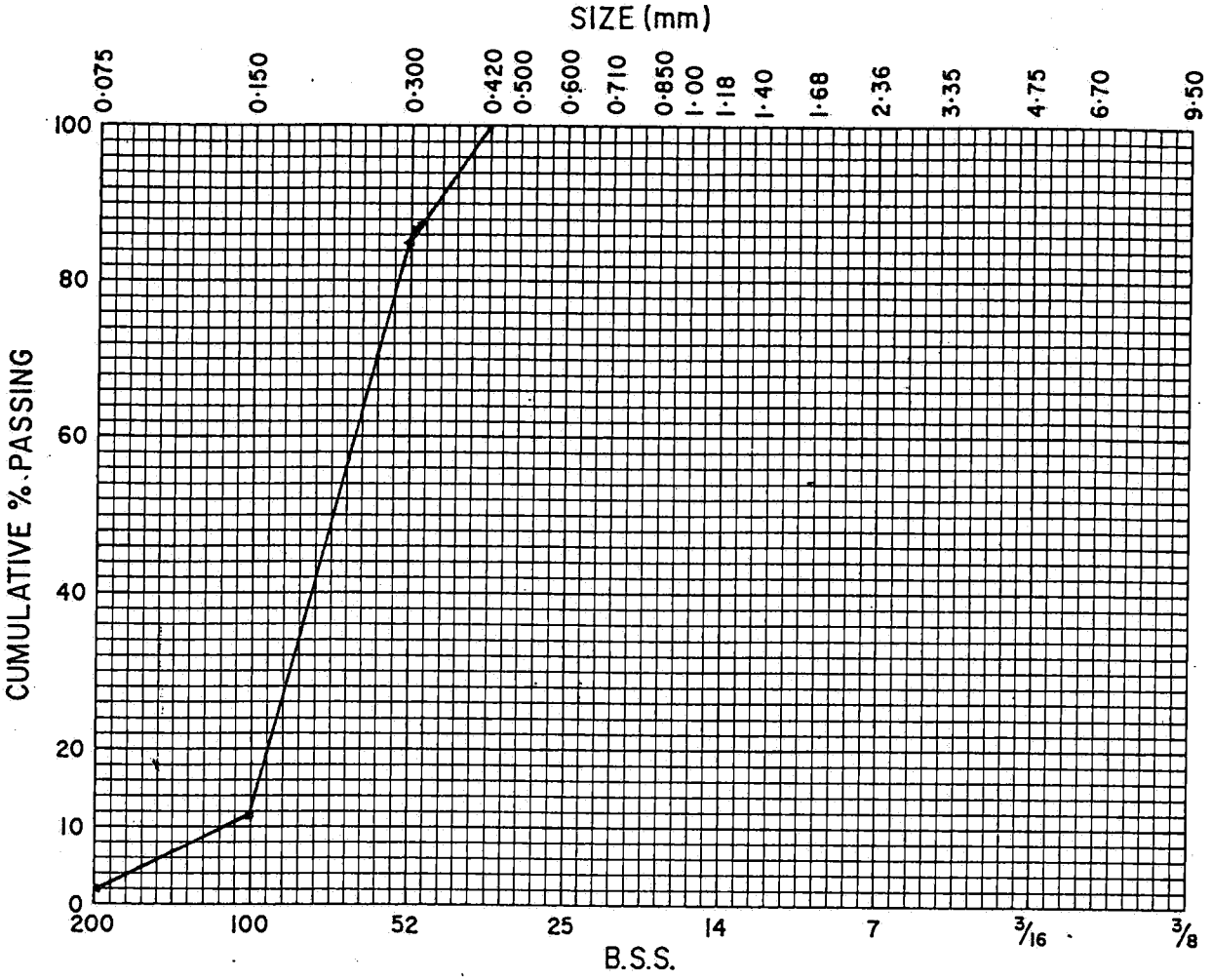
COLOUR: Grey-brown

SHAPE: Subangular to subrounded

DESCRIPTION:
Unconsolidated, well sorted, medium grained quartz sand, consisting of some 50% "glassy" fracture-free quartz grains and some 50% fractured and/or "sugary" quartz grains which contain the majority of the iron-staining, either as surface coatings or along fractures. A very minor amount of ?clay may be present as coatings on some grains. Noncalcareous. Trace of iron oxide, garnet (?)

DEPARTMENT OF MINES AND ENERGY — SOUTH AUSTRALIA

SAND SIZE ANALYSIS



SAMPLE N°: A1137/80

LOCATION: Filtsan - Tanunda plant

TYPE: < 0.48 fraction SPECIFIED

EFFECTIVE SIZE [D10]: ..-.....

SIZE PASSING 60% [D60]: .-.....

UNIFORMITY COEFFICIENT $\left[\frac{D60}{D10}\right]$: -.....

SPECIFIC GRAVITY: ..-.....

ACID SOLUBILITY (%): ...-.....

MINERALOGY

COLOUR: Yellow-brown

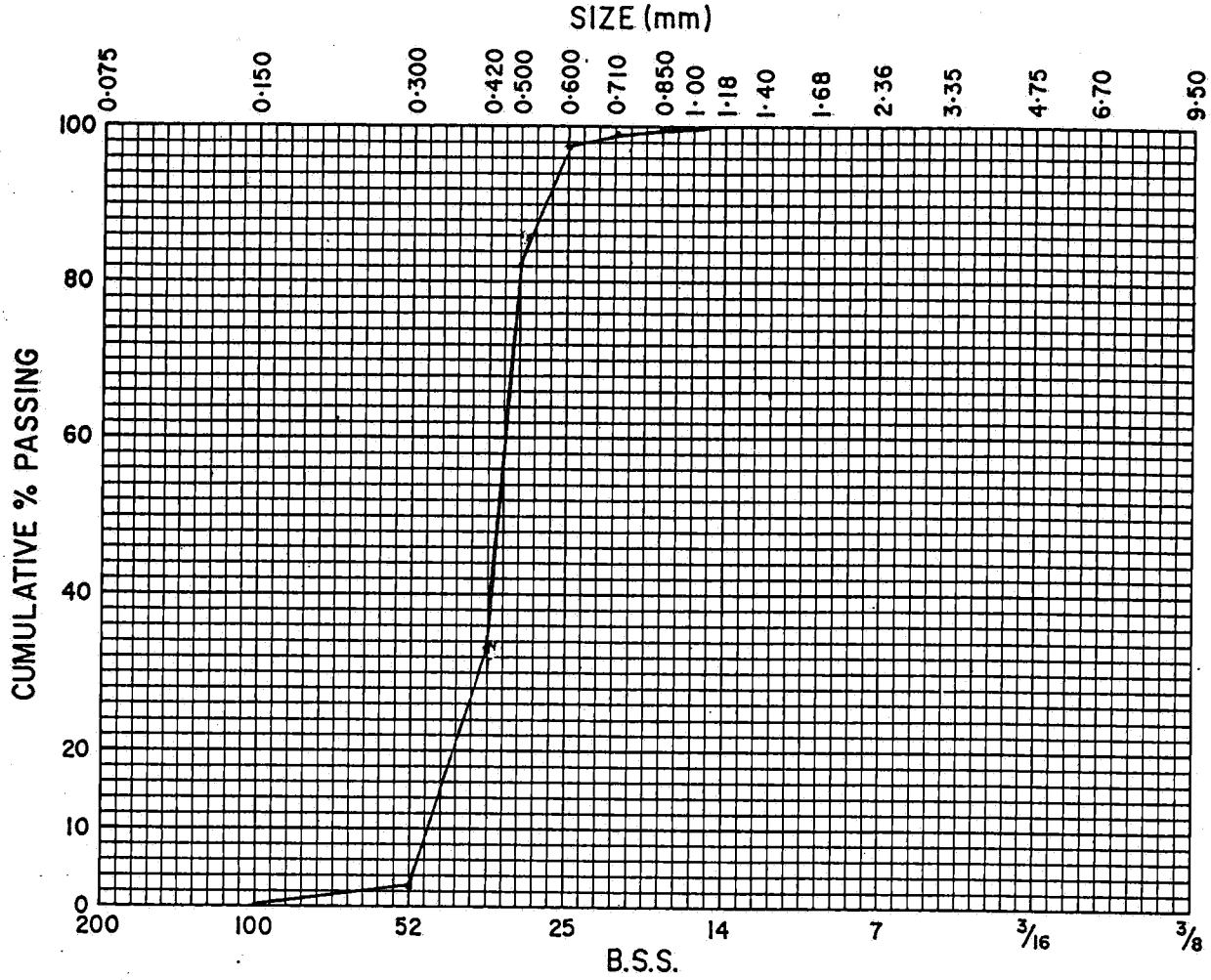
SHAPE: Subangular

DESCRIPTION:

Unconsolidated, well sorted, fine-medium grained quartz sand, of some 50% "glassy" fracture-free quartz grains and some 50% fractured and/or "sugary" quartz grains which contain the majority of the iron-staining, either as surface coatings or along fractures. A very minor amount of?clay may be present as coatings on some grains. Noncalcareous. Contains minor muscovite and traces of iron oxides and silicates (amphibole and tourmaline?).

DEPARTMENT OF MINES AND ENERGY — SOUTH AUSTRALIA

SAND SIZE ANALYSIS



SAMPLE N°: A1138/80

LOCATION: Filtsan-Tanunda plant

	SPECIFIED
TYPE: Filter sand	
EFFECTIVE SIZE [D10]: ....0.325.....	0.31 - 0.48
SIZE PASSING 60% [D60]: ...0.465...	
UNIFORMITY COEFFICIENT $\left[\frac{D60}{D10}\right]$: ..1.43	< 1.45
SPECIFIC GRAVITY: ...2.59.....	2.60 - 2.65
ACID SOLUBILITY (%): ..... 0.64.....	≯ 5

MINERALOGY

COLOUR: Orange-brown

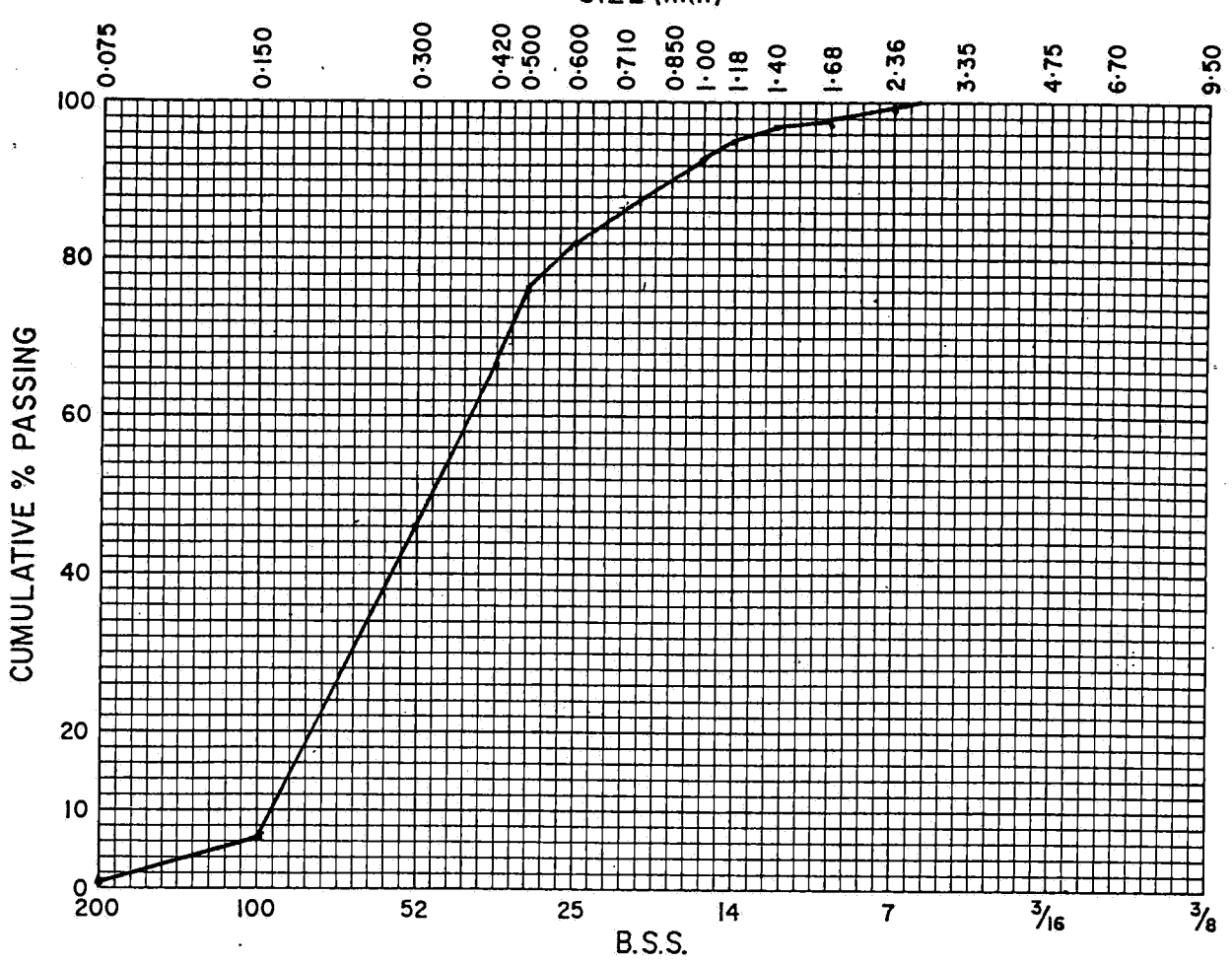
SHAPE: Subangular

DESCRIPTION:

Unconsolidated, poorly sorted fine quartz sand moderately to v. heavily iron stained. Ratio of clean glassy fracture-free grains to iron-stained fractured and/or "sugary" grains estimated at 25% vs 75%. Muscovite mica is present in minor amounts. Noncalcareous. Traces of iron oxides and some silicates (garnet?).

DEPARTMENT OF MINES AND ENERGY — SOUTH AUSTRALIA

SAND SIZE ANALYSIS



SAMPLE N°: A1139/80

LOCATION: Filtsan-Tanunda plant

TYPE: Washed sand from Rowland Flat SPECIFIED

EFFECTIVE SIZE [D10]: -

SIZE PASSING 60% [D60]: -

UNIFORMITY COEFFICIENT $\left[\frac{D60}{D10}\right]$: -

SPECIFIC GRAVITY: -

ACID SOLUBILITY (%): 0.40

MINERALOGY

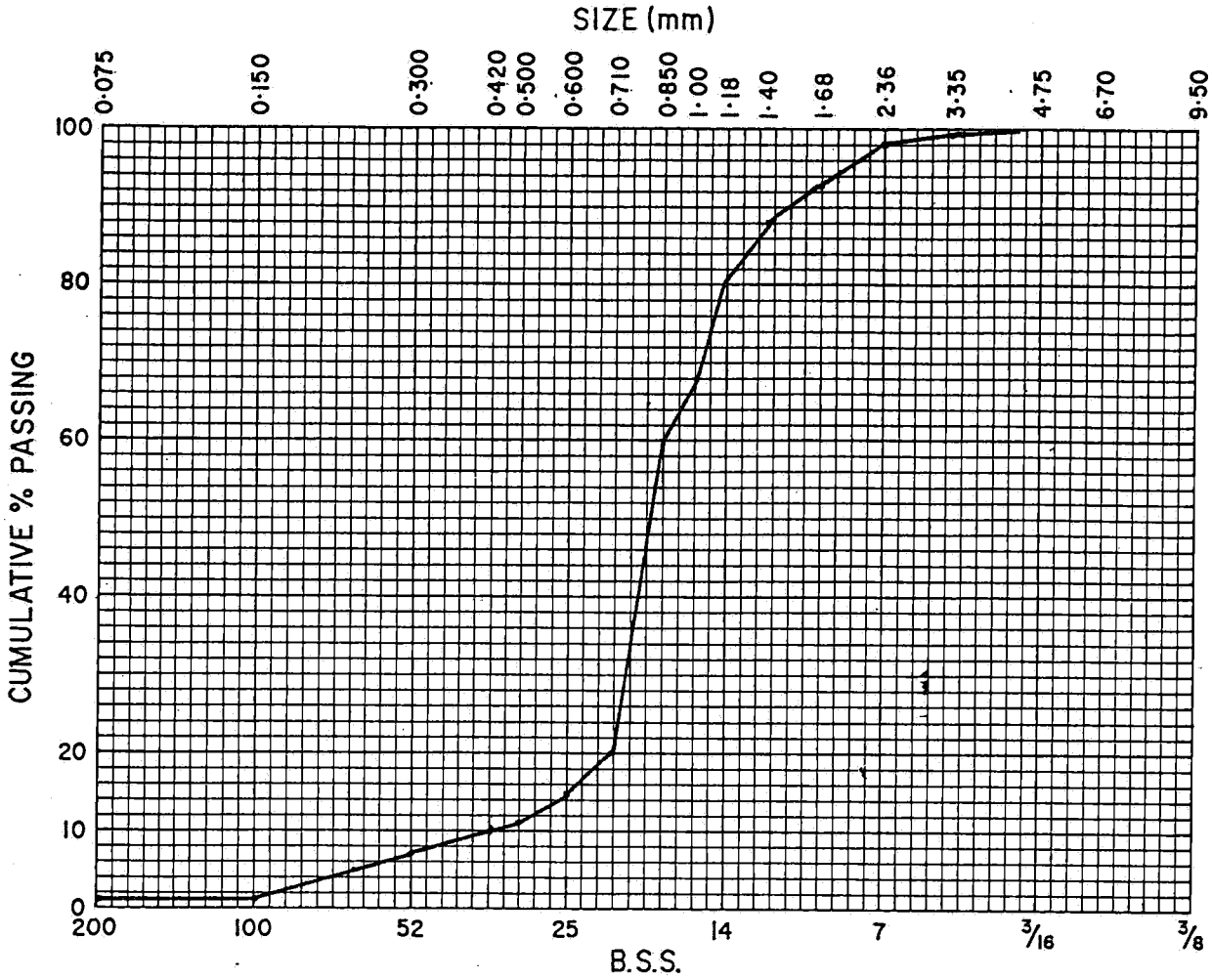
COLOUR: Light brown to fawn

SHAPE: Subangular

DESCRIPTION:
Unconsolidated, very poorly sorted, fine to medium grained quartz sand with moderate iron-staining. Some 60% of the sample consists of friable "sugary" and/or fractured quartz grains containing the bulk of the iron-staining. Muscovite mica is present in minor amounts. Trace of iron oxide.

DEPARTMENT OF MINES AND ENERGY — SOUTH AUSTRALIA

SAND SIZE ANALYSIS



SAMPLE N°: A1140/80

LOCATION: Filtsan - Tanunda plant

TYPE: Washed sand from Loxton SPECIFIED

EFFECTIVE SIZE [D10]: ..-.....

SIZE PASSING 60% [D60]: ..-.....

UNIFORMITY COEFFICIENT $\left[\frac{D60}{D10}\right]$: ..-...

SPECIFIC GRAVITY: ....-.....

ACID SOLUBILITY (%): ..0.41.....

MINERALOGY

COLOUR: Yellow-brown

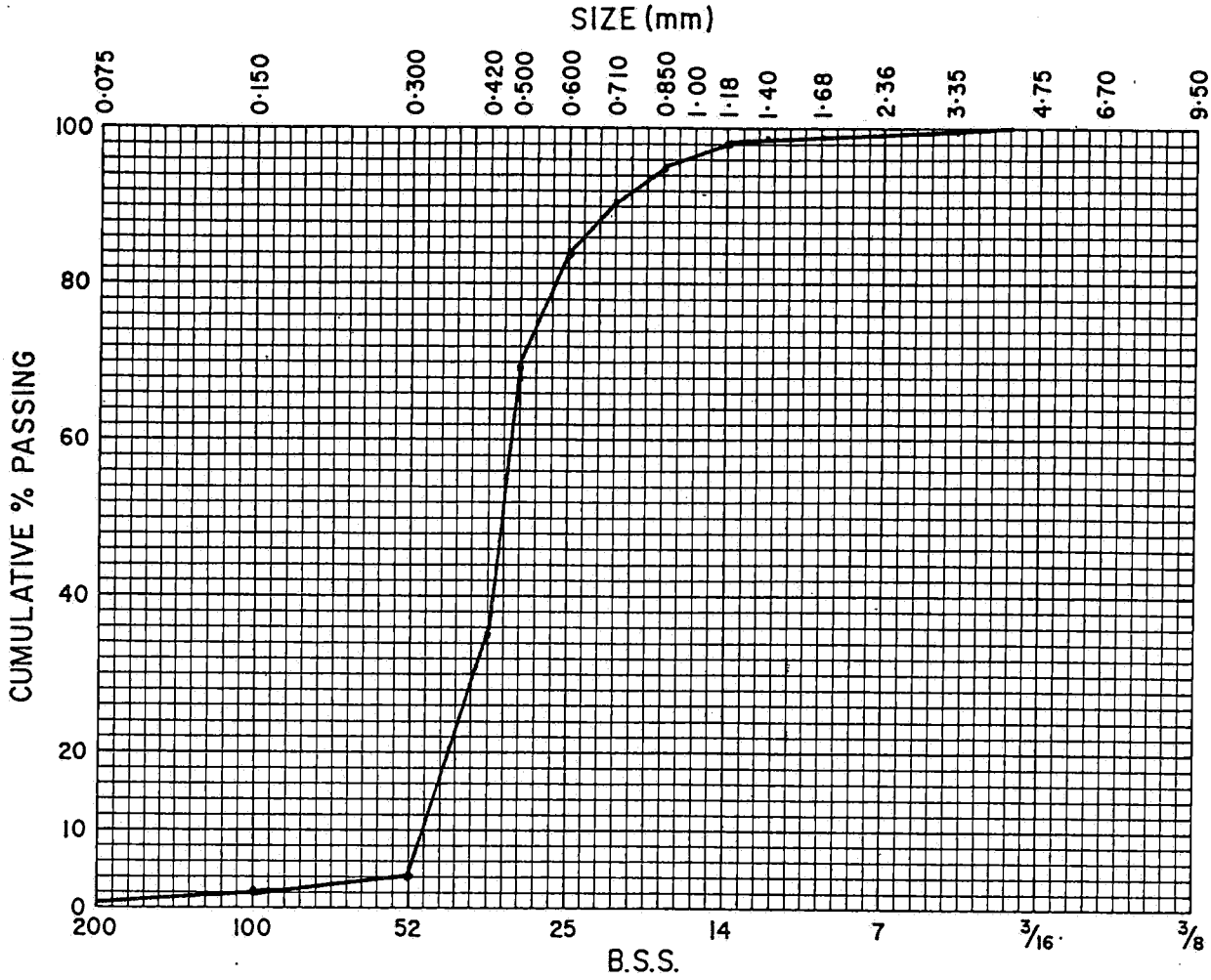
SHAPE: Subangular

DESCRIPTION:

Unconsolidate, moderately to poorly sorted, very coarse quartz sand of 1-2 mm diameter average grain size. Iron-staining heavy. A few granule to pebble size quartz to 4 mm diameter are also present. The majority of the iron-staining appears to be as surface coatings and/or fracture films. Noncalcareous. No heavy minerals.

DEPARTMENT OF MINES AND ENERGY — SOUTH AUSTRALIA

SAND SIZE ANALYSIS



SAMPLE N°: E 5

LOCATION: Paterson Bros. - Langhorne Creek

TYPE: Sand for sludge drying beds	SPECIFIED
EFFECTIVE SIZE [D10]: 0.320	0.30 - 0.50
SIZE PASSING 60% [D60]: 0.475	
UNIFORMITY COEFFICIENT $\left[\frac{D60}{D10}\right]$: 1.48	< 3.5
SPECIFIC GRAVITY: 2.67	2.60 - 2.65
ACID SOLUBILITY (%): 0.0	≯ 5

MINERALOGY

COLOUR: Pale grey

SHAPE: Subrounded

DESCRIPTION:
Unconsolidated, medium to coarse grained quartz sand.
Minor impurities.

FILTER GRAVEL TESTS

Sample No.	E 1	E 2	E 3	E 4
Size (mm)	19.0-37.5	9.5-19.0	4.75-9.5	2.36-4.75
Acid solubility (%)	0.0	0.1	0.01	0.09
Specified ≯*	10	10	5	5
Angular and Fractured stones (% by wt.) Specified ≮25%	22	38.4	77	79
Shape 5 : 1 (%) (largest-smallest) Specified ≯2%	0.0	0.0	0.0	0.0
Specific gravity Specified ≮2.5	2.52	2.55	2.54	2.56
L.A. abrasion (%) Specified ≯45%	52.5	50.0	38.0	39.5
Water absorption	0.9	1.1	1.0	1.1
	Size analysis (% passing)			
Sieve size (mm)				
37.5	100			
26.5	61			
19.0	1	100		
13.2		74	100	
9.5		4	97	
6.7		0.3	33	
4.75			3	100
3.25				34
2.36				0.5
%outside limits	1	4.3	6	0.5
Specified ≯8%				

* ≯ not greater than
≮ not less than

MINERALOGICAL DESCRIPTIONS

Sample No. & Size (mm)	Colour	Shape	Morphology, Constituent Minerals etc.
A1131/80 19.0-37.5	Brown to white	Subrounded to well rounded	Discrete quartz and/or quartzite pebbles averaging 25-30 mm diameter. Some are massive "bull quartz" and some are composed of fine granular quartz grains. The quartzite pebbles are weathered and are breaking down to "sugary" quartz grains and a whiteish? clay mineral. Iron staining is minor and the pebbles are noncalcareous.
A1132/80 4.75-9.5	Brown to white	Subangular to subrounded	Discrete quartz pebbles averaging 8-10 mm diameter with moderate iron-staining, particularly along fractures and grain boundaries. Some pebbles consist of friable quartz grains and these generally contain the bulk of the iron-staining. All pebbles appear to have incipient fracturing to varying degrees. Noncalcareous.
A1133/80 2.36-4.75	Predom. white with some brown	Subangular	Discrete quartz granule averaging some 3-4 mm diameter. All granules show fracturing, and some consist of small quartz grains cemented together (?quartzite). The more friable (?weathered) granules contain most of the iron-staining which overall is moderate. Minute amounts of ?clay material may be present also. Noncalcareous.

APPENDIX C

Chemical Analyses

Extracted from AMDEL reports

MD2469/81 and 4295/78

by

L.J. Day

CHEMICAL ANALYSIS

Sample No.	A1131*	A1132	A1133	A1134	A1135	A1136	A1137	A1138	A1139	A1140	A5492/78	A1101+
SiO_2	98.5	99.2	98.8	98.6	98.5	98.5	95.0	97.0	97.7	98.5	96.01	99.4
TiO_2	0.02	0.03	0.04	<0.01	0.01	<0.01	0.10	0.05	0.18	<0.01	0.04	0.05
Al_2O_3	0.43	0.19	0.36	0.27	0.41	0.47	2.18	0.95	0.87	0.42	1.76	0.26
Fe_2O_3	0.38	0.13	0.16	0.29	0.22	0.21	0.55	0.48	0.29	0.31	0.15	0.16
MnO	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
MgO	0.07	0.04	0.05	0.04	0.04	0.03	0.08	0.06	0.11	0.04	0.03	<0.01
CaO	0.04	0.04	0.06	0.07	0.05	0.15	0.15	0.13	0.06	0.06	0.26	0.09
Na_2O	0.06	0.05	0.05	0.03	0.05	0.04	0.35	0.13	0.03	0.08	0.42	<0.02
K_2O	0.13	0.10	0.10	0.14	0.35	0.29	1.07	0.48	0.19	0.20	0.86	0.01
P_2O_5	0.02	0.02	<0.02	0.07	0.02	<0.02	0.02	0.02	<0.02	<0.02	0.01	<0.02
L.O.I.	0.30	0.14	0.24	0.16	0.14	0.24	0.38	0.35	0.33	0.18	0.27	0.28
Total	99.9	99.9	99.9	99.7	99.8	99.9	99.9	99.7	99.8	99.8	100.06	100.03
Acid Solubility	0.50	0.18	0.23	0.35	0.29	0.49	0.64	0.63	0.40	0.41	0.24	N.D.

* Full sample no. A1131/80 - A1140/80.

\+ Full sample no. A1101B/80. Composite coarse to very coarse sand, after washing to remove fines. Extracted from Keeling et al. (1981).

APPENDIX D

Size analyses of untreated sand

Extracted from reports listed with data

Murbko deposit

Hole No.	M 1						M 2				M 3			
Depth (m)	0-1	1-2	2-3	3-4	4-5	5-6	0-1	1-2	2-3	3-4	0-1	1-2	2-3	3-4
Sample No.*	A463	A464	A465	A466	A467	A468	A469	A470	A471	A472	A473	A474	A475	A476
Sieve Size (mm)	% Passing													
1.40	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1.18	100	99	99	100	100	100	100	99	99	99	100	100	99	100
1.00	100	98	96	99	99	99	100	97	98	98	99	99	97	99
0.850	100	97	94	98	99	99	99	96	97	97	98	98	95	99
0.710	96	91	77	89	95	95	97	86	89	89	94	89	82	95
0.600	93	87	69	83	92	91	95	80	83	83	89	83	75	91
0.500	85	78	53	69	85	83	89	68	70	68	76	70	60	82
0.425	73	66	41	56	75	71	77	53	58	52	62	52	45	71
0.300	46	39	21	28	49	41	48	28	31	28	33	25	23	47
0.150	3	3	1	2	7	3	3	3	5	4	2	2	2	9
0.075	1	1	0	0	3	1	1	1	2	2	1	2	1	4

Loxton deposit

Sieve Size (mm)	Sample No.* A477	A478	A479
	% Passing		
4.75	100	100	100
2.36	99	99	98
1.70	95	95	93
1.40	88	91	88
1.18	63	86	81
1.00	40	72	68
0.850	36	58	60
0.710	31	22	20
0.600	30	18	15
0.500	28	14	11
0.425	27	12	10
0.300	22	9	7
0.150	2	2	1
0.075	1	1	1

Extracted from AMDEL report MD5238/80 by L.J. Day.
* Full sample no. A477/80 etc.

Baird Bay deposit

Sieve Size(mm)	Sample No. A5492/78
	% Passing
4.00	100.0
3.35	99.8
1.70	56.8
0.850	0.1
0.600	0.0

Extracted from Johnson (1980)

Naracoorte deposit

Sieve Size (mm)	Sample No.* A377	A391	A393
	% Passing		
4.75	100.0	100.0	100.0
2.36	100.0	100.0	99.2
1.18	97.5	68.0	20.4
0.600	58.2	35.6	14.0
0.300	31.3	26.2	11.5
0.150	18.0	13.2	9.6
0.075	14.8	6.3	7.7

* Full sample no. A377/81 etc.

Extracted from Keeling et al. (1981)

PLATE 1. MURBKO SAND DEPOSIT, July 1980

View eastwards across river flat towards the pit on EML4784. Medium to coarse grained sand extends approximately 150 m beyond tank, centre left.

PLATE 2. MURBKO SAND DEPOSIT, July 1980

Pit face, about 3.5 m high, shows gentle westwards dip of bedding.

PLATE 3. LOXTON COUNCIL SANDPIT, May 1980

Looking eastwards at pit face which is up to 15 m high, with water tower above. A silcrete horizon, up to 1 m thick, crops out in parts of this pit directly above the partly consolidated sand.

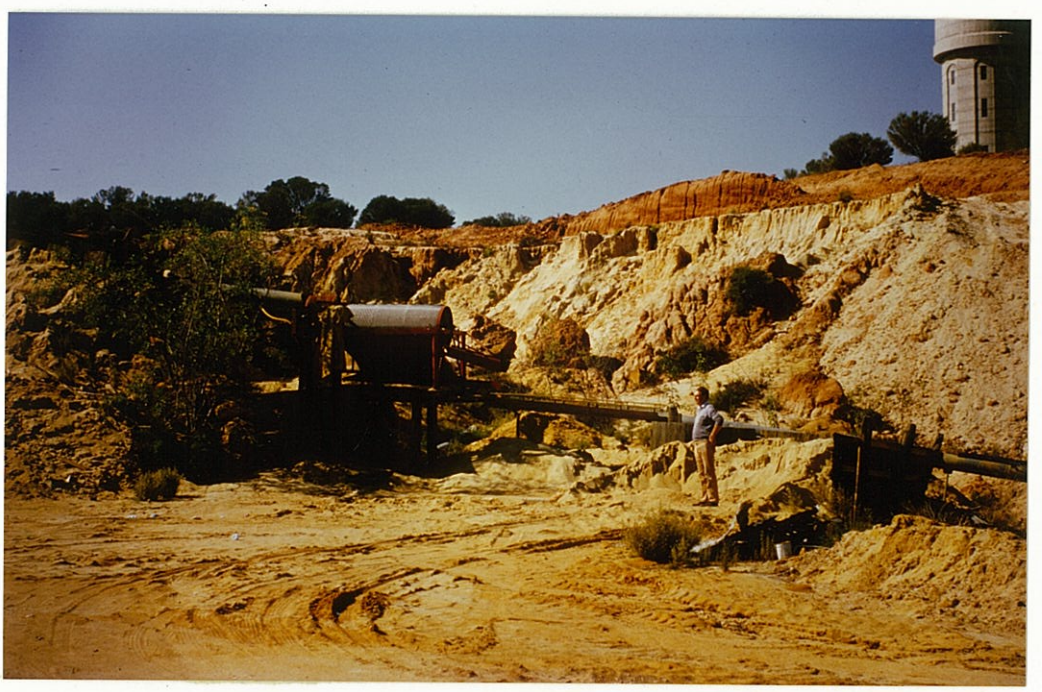


PLATE 4. LOXTON COUNCIL SANDPIT, May 1980

Washing plant used at this deposit to remove clay and finer sand. Fines are piped to a small tailings dam at right, out of picture.

PLATE 5. FILTSAN PLANT, TANUNDA, July 1980

Rotary drying kiln, raw sand is fed into blue-grey hopper at left and travels along the sloping kiln.

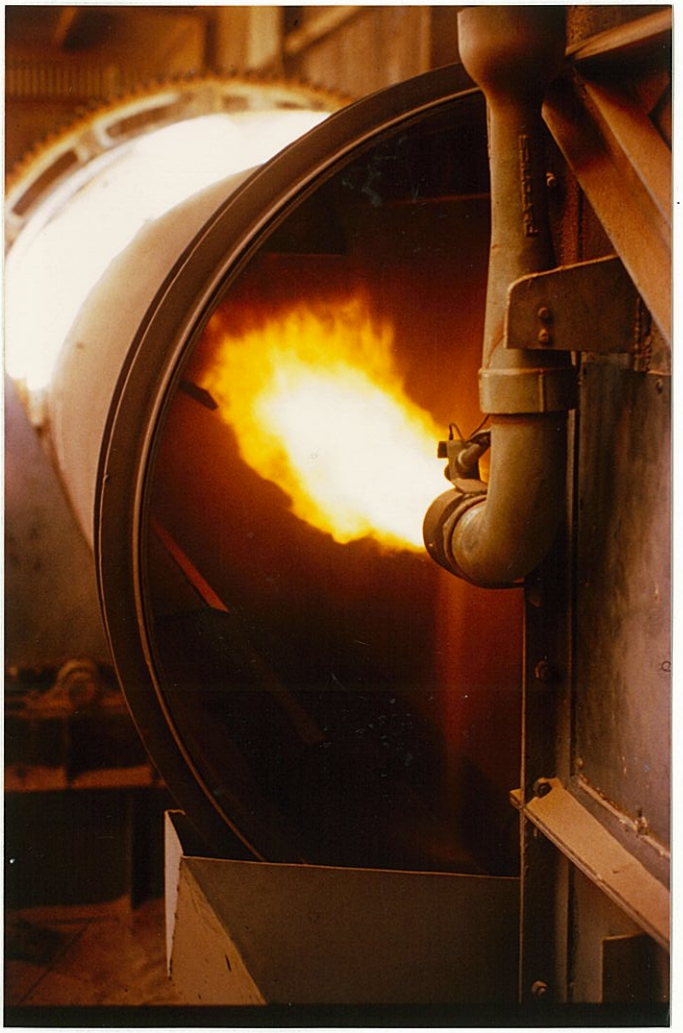


PLATE 6. FILTSAN PLANT, TANUNDA, April 1981

Large gas flame at end of drying kiln, dried sand falls into base of elevator at right and raised to screens in Plate 7.

PLATE 7. FILTSAN PLANT, TANUNDA, July 1980

Dried sand from elevator feeds into trommel screens at far end. Detachable nylon screen is fitted over the perforated trommels to provide a variety of sand sizings.

PLATE 8. FILTSAN PLANT, TANUNDA, April 1981

Inside view of trommel, large slots were cut in the perforations to permit greater exposure of the screen.

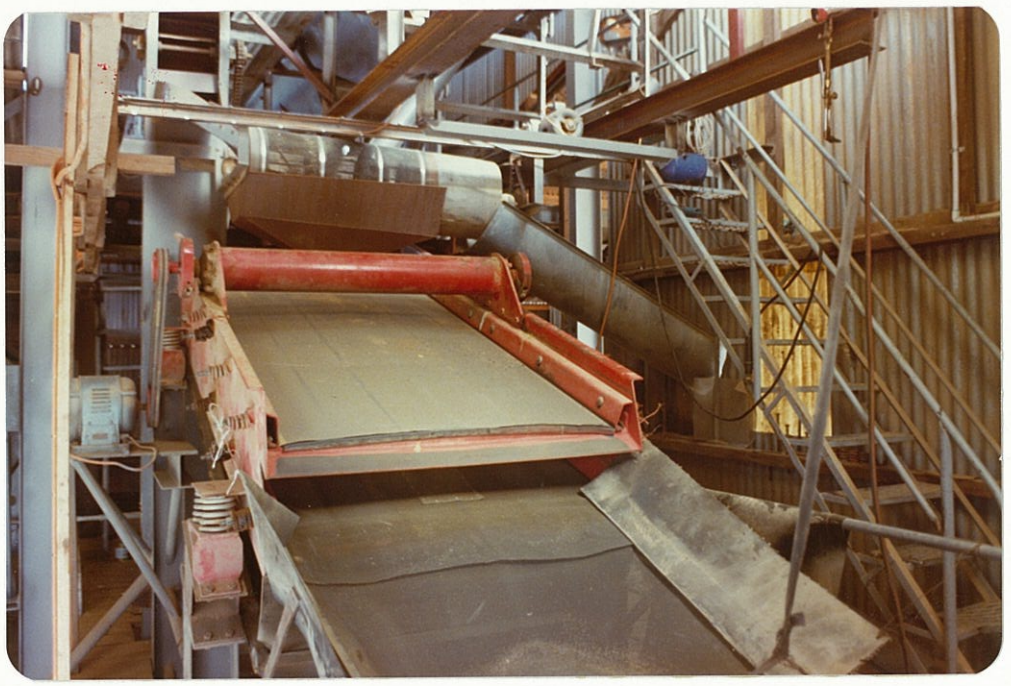


PLATE 9. FILTSAN PLANT, TANUNDA, July 1980

Vibrating screen used for final screening and removal of oversized material.

PLATE 10. FILTSAN PLANT, TANUNDA, July 1980

Overall view of filter sand treatment plant, rotary kiln is on the left. Trommel screens are located above and behind red vibrating screen right of centre with two hoppers below this screen.

PLATE 11. FILTSAN PLANT, TANUNDA, July 1980

Filter gravel screening plant, partially sized gravel on the left is wet screened to standard sizes in these trommels. The material is bagged directly from the blue-grey hoppers below the screens.

PLATE 12. FILTSAN PLANT, TANUNDA, April 1981

Stored filtration media on palletts, each bag contains 45 kg of material with 36 bags on each pallett.

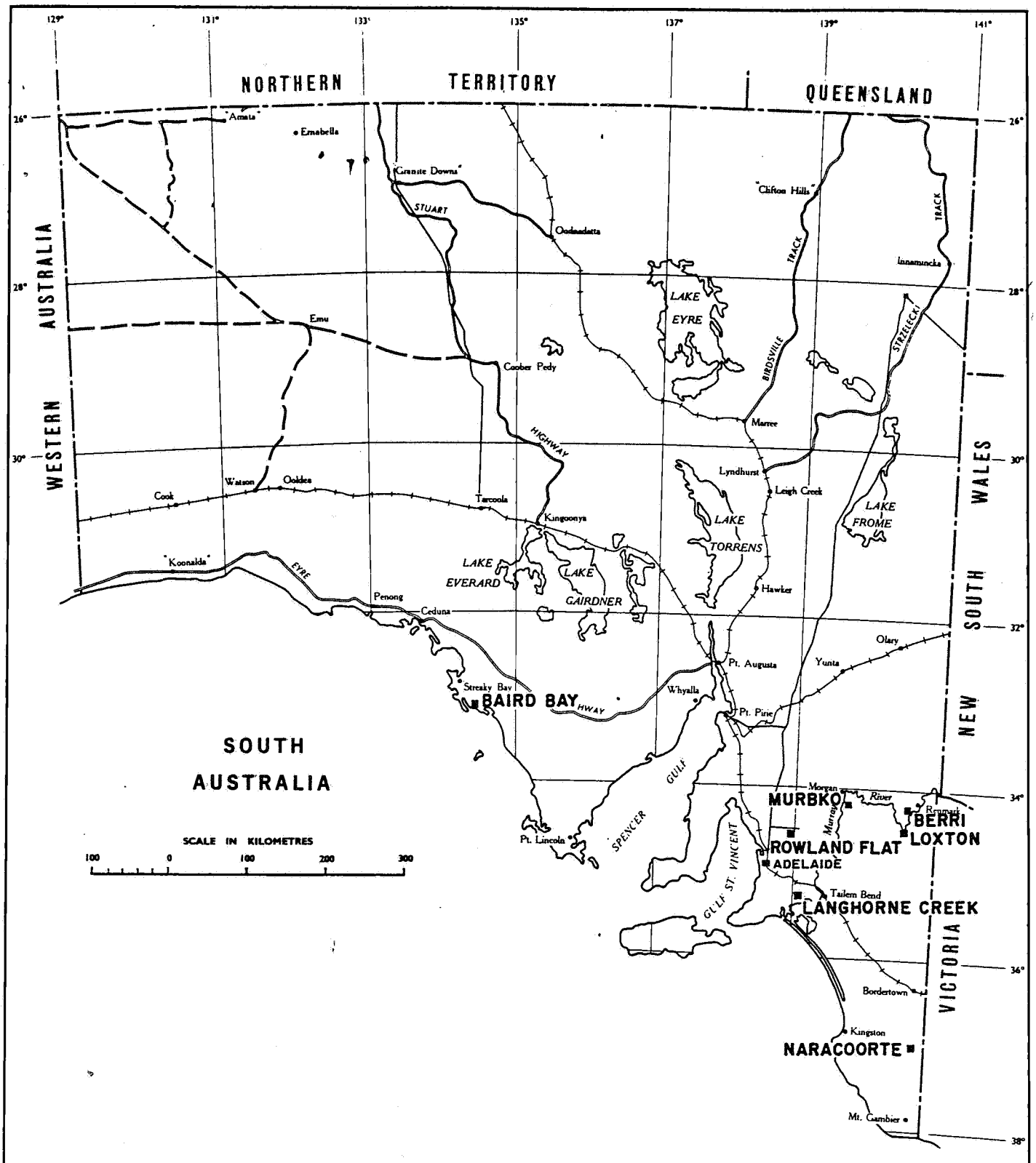


FIG. 1

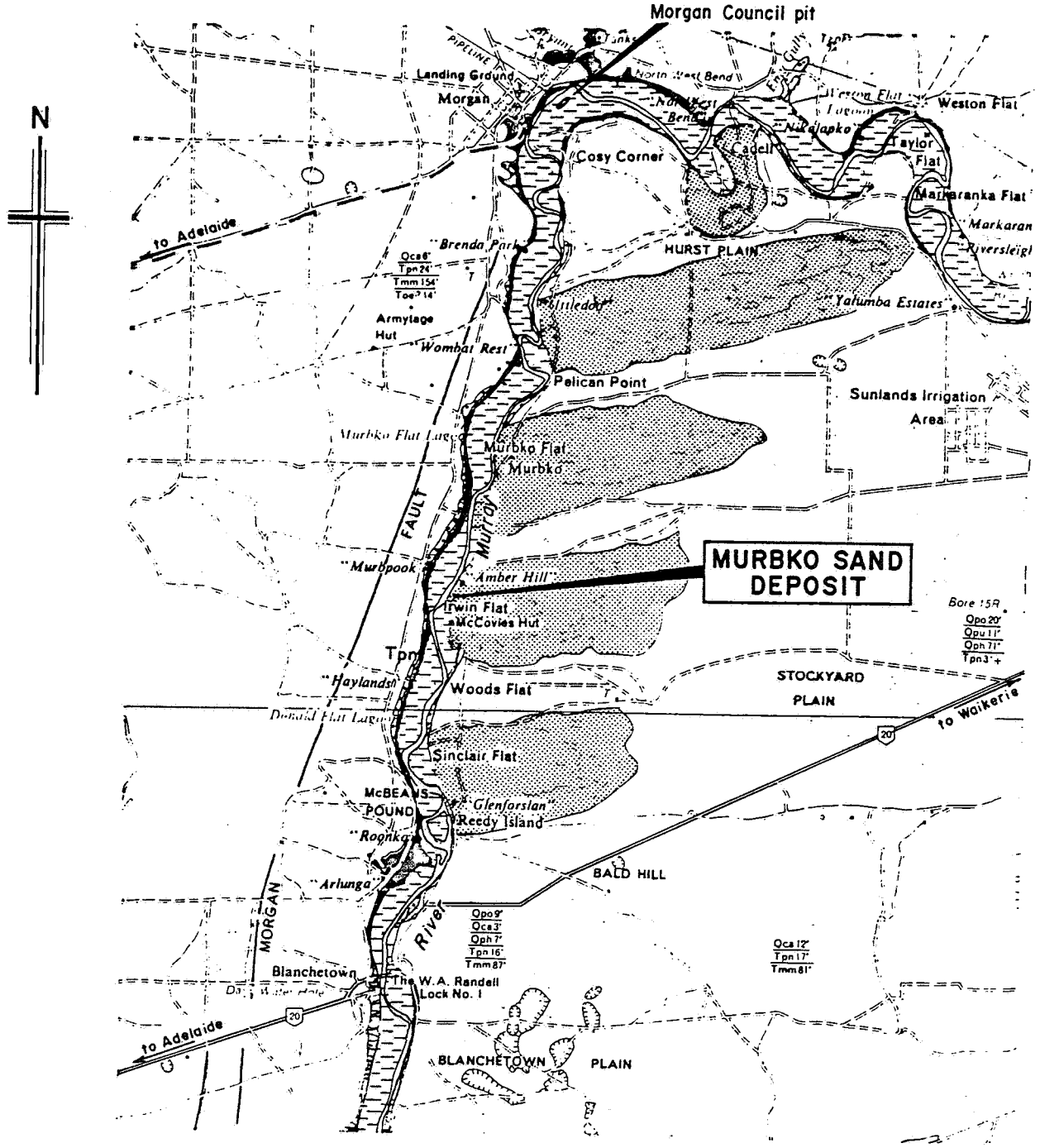
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED D. C. S.	CDO 25·7·83 DATE
DRAWN A.F.	SCALE 1:7000000
DATE 26-5-82	PLAN NUMBER S16221
CHECKED	

FILTER SAND AND GRAVEL
LOCATION OF DEPOSITS

2837

P.F. No. 55850 994 2



LEGEND

QUATERNARY — HOLOCENE

COONAMBIDGAL FORMATION: Grey alluvium of the Murray River system, clay, silt and sand.

BUNYIP SAND: Aeolian red-brown quartz sand. Occurs as dunes or spread.

PLEISTOCENE

Undifferentiated fossil soil, sand and clay.

TERTIARY

Undifferentiated oyster beds with interbedded quartz sand, sandy limestone and calcarenite.

Kilometres 5 0 5 Kilometres

SCALE

Main road.

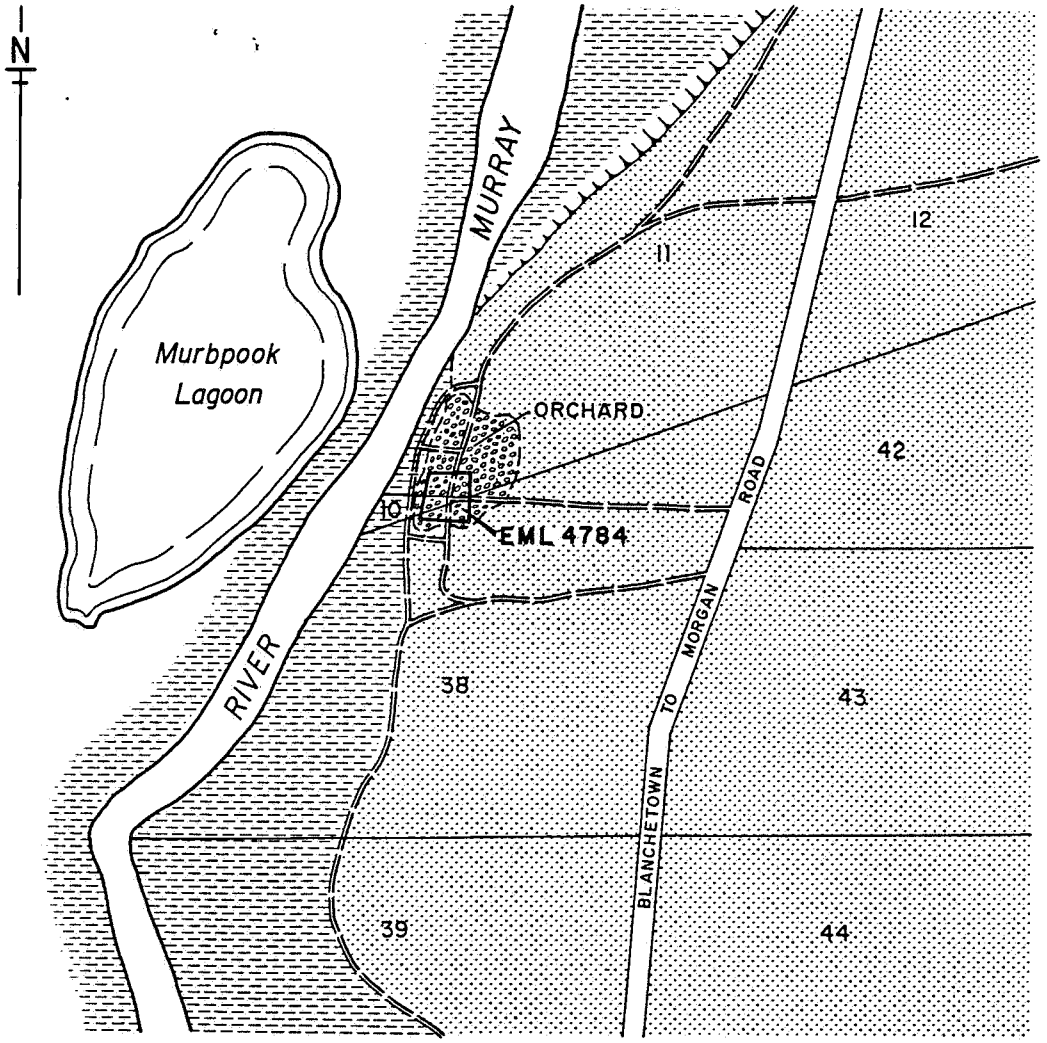
Secondary road.

Geological boundary.

FIG. 2

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED D.C.S.	25 · 7 · 83 CDO DATE
FILTER SAND AND GRAVEL MURBKO SAND DEPOSIT LOCATION AND REGIONAL GEOLOGY	DRAWN S.R.	SCALE 1:250 000
	DATE 27/5/82	PLAN NUMBER S16222
	CHECKED	

2837



SCALE IN METRES

1000 0 1000

Grey clay, silt and sand
Medium to coarse pale brown sand

Fine, red-brown aeolian sand

Geological boundary

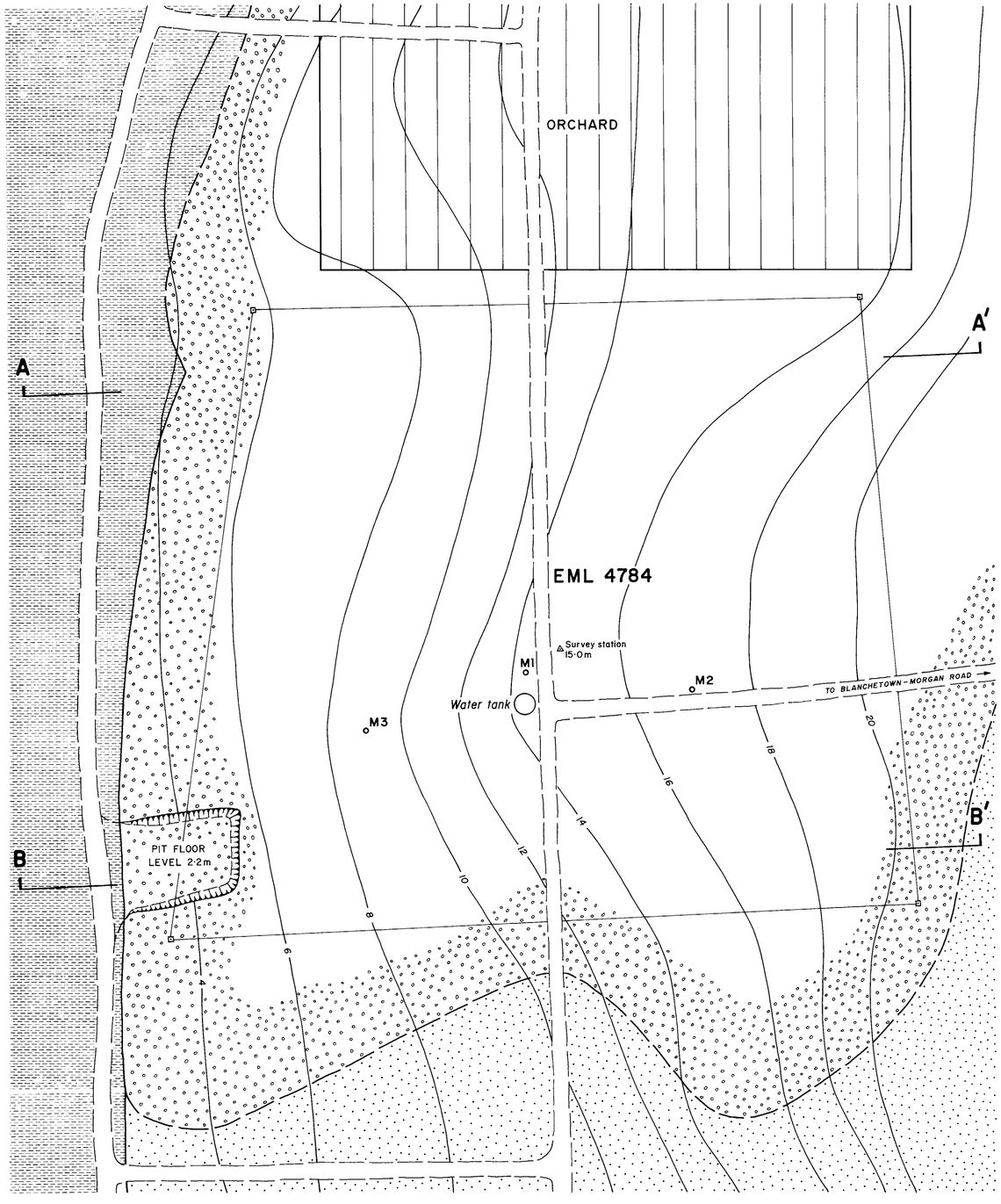
Track

12 Section boundary

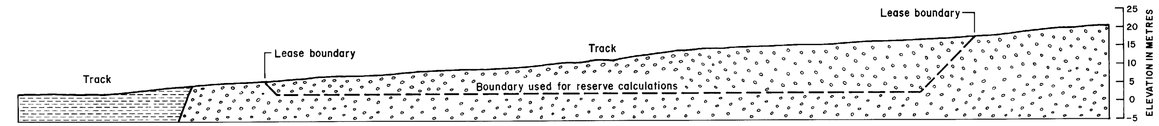
FIG. 3

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED D.C.S.	CDO 25·7·83 DATE
FILTER SAND AND GRAVEL MURBKO SAND DEPOSIT EML 4784 – PT. SECS. 10, 11, 38 HD. MURBKO GEOLOGICAL PLAN	DRAWN A.F.	SCALE 1:25000
	DATE 27-5-82	PLAN NUMBER S16223
	CHECKED	

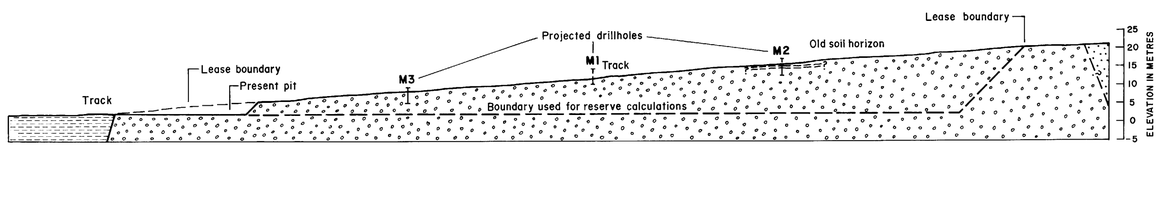
2937



SECTION A – A′



SECTION B – B′



LEGEND

- Grey clay, silt and sand
  Medium to coarse pale brown sand
- Fine, red-brown aeolian sand
- Geological boundary
  Observed
  Approximate, inferred
- M2 — Auger drillhole location
- 18 — Topographic contour in metres
- Track
- Lease boundary and corner post

SCALE IN METRES

50 0 50 100

FIG. 4

Plane table survey by S.J. Ewen – Datum AHD approx.

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

FILTER SAND AND GRAVEL
MURBKO SAND DEPOSIT
EML 4784 – PT. SECS. 10, 11, 38 HD. MURBKO
GEOLOGICAL PLAN AND SECTIONS

COMPILED	D.C.S.
DRAWN	A.F.
DATE	2-6-82
CHECKED	
C.D.O	25-7-83 DATE
SCALE	1:1000
PLAN NUMBER	82-268

2837

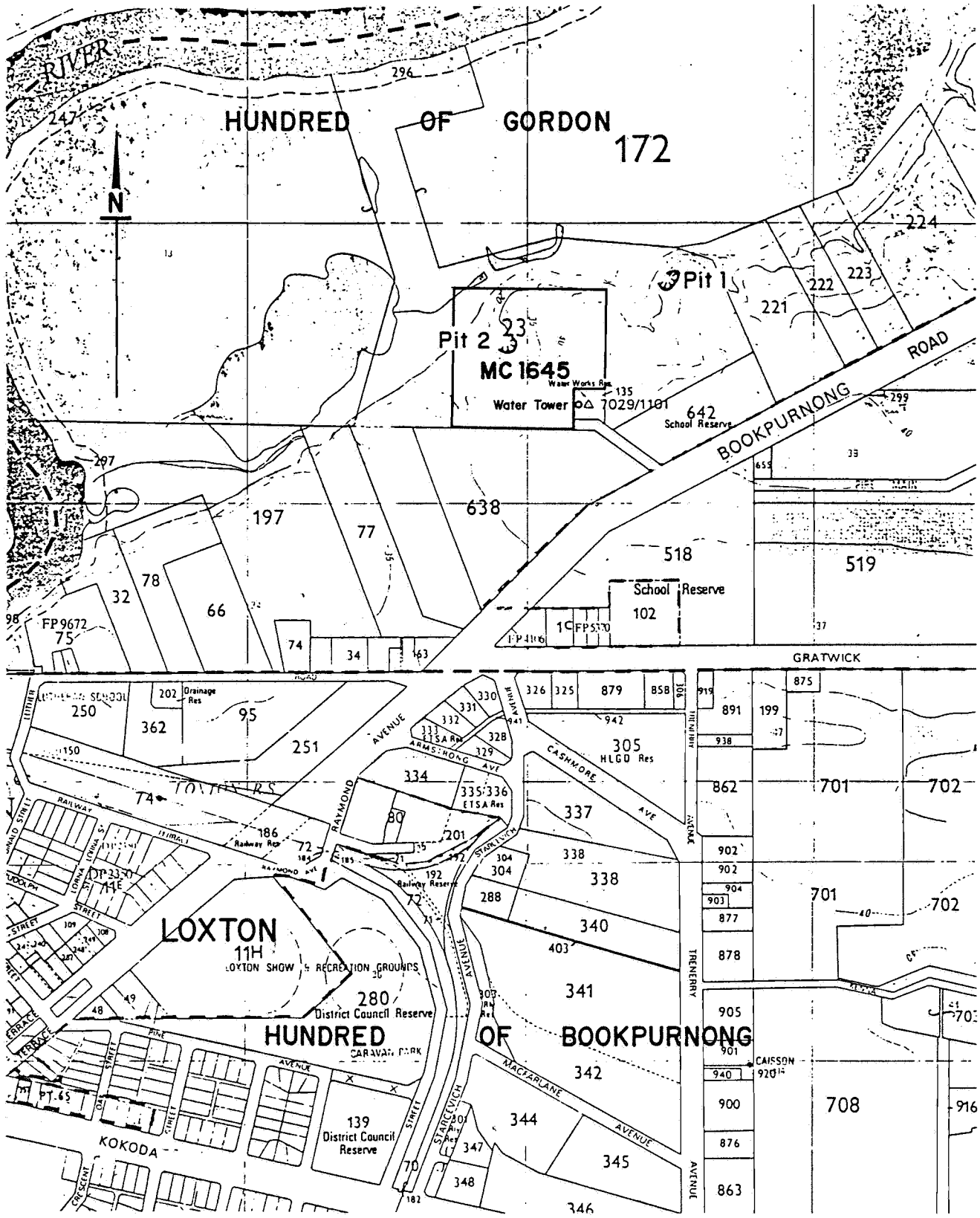
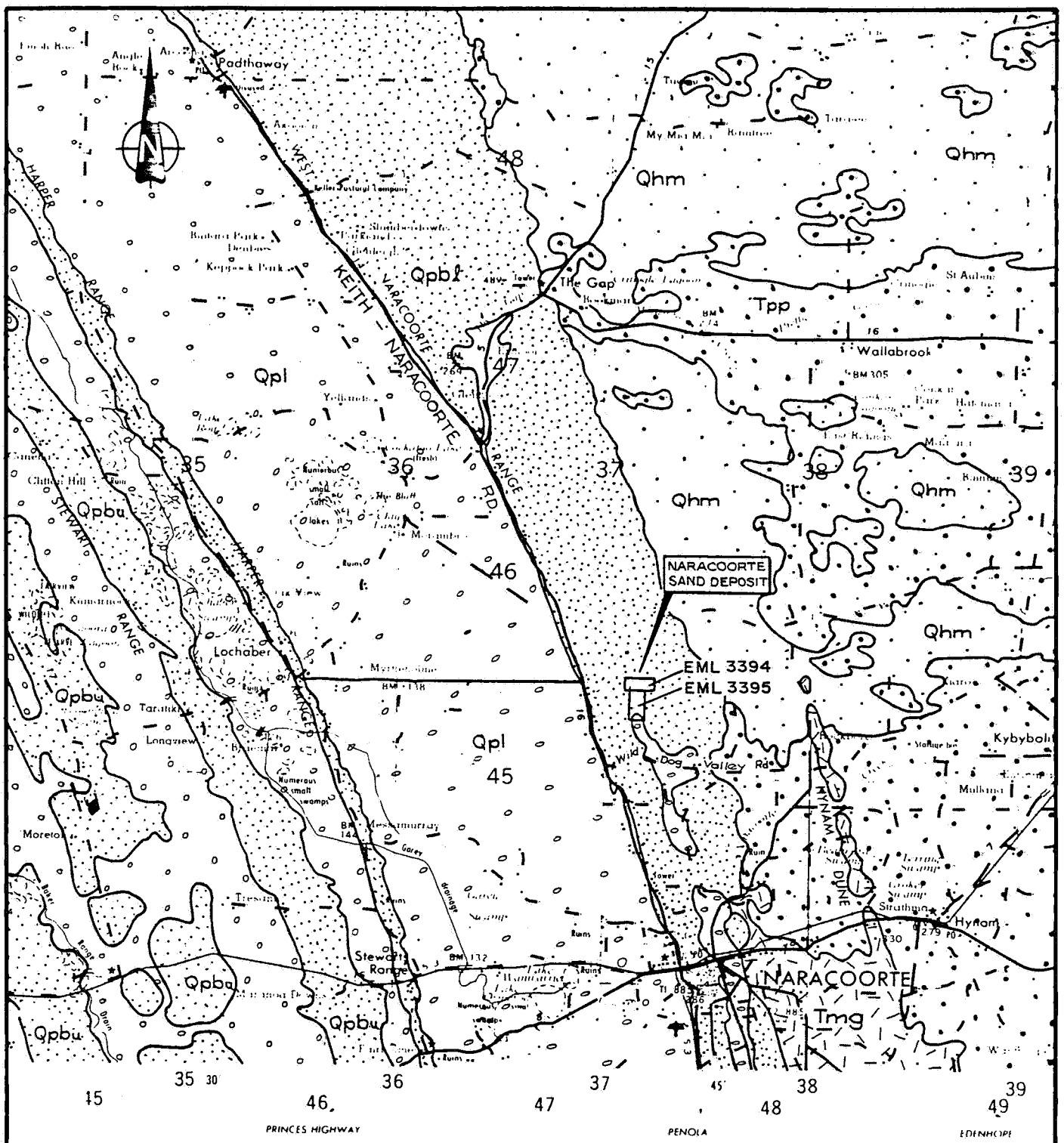


FIG. 5

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED D.C.S.	C.D.O 25·7·83 DATE
FILTER SAND AND GRAVEL	DRAWN A.F.	SCALE 1:10 000
LOXTON DEPOSITS – MC 1645	DATE 3-12-82	PLAN NUMBER
LOCALITY MAP	CHECKED	S16501

2837



LEGEND

QUATERNARY

- Qhm — MOLINEAUX SAND: Pale yellow sand of inland dunes and spreads. Thin overlays on older units not shown.
- Qpl — PADTHAWAY FORMATION: Lagoonal fine grained dolomite and clay.
- Qpbu — BRIDGEWATER FORMATION: Calcarenite of stranded coastal dune and beach deposits. Upper member (≤690,000 yrs.).
- Qpbl — Lower member (≥690,000 yrs.).

TERTIARY

- Tpp/Tpl — PARILLA SAND: Fluvial fine to medium quartz sand. LOXTON SAND (Tpl) fine to coarse calcareous sand underlying Parilla Sand.
- Tmg — GAMBIER LIMESTONE: Pale bryozoal limestone.

Main road.
Secondary road
Railway.

SCALE
0 5 10 KILOMETRES

FIG. 6

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED D.C.S.	CDO 25-7-83 DATE
DRAWN J.W.	SCALE 1:250,000
DATE 27-5-82	PLAN NUMBER S16224
CHECKED	

FILTER SAND AND GRAVEL
NARACOORTE SAND DEPOSIT
BK 108 HD. HYNAM
LOCATION AND REGIONAL GEOLOGY

2837