URR994-10

TASMANIA
DEVELOPMENT
AND RESOURCES

Mineral Resources Tasmania
REPORT 1994/10

A review of sand resources in the Hobart area

by W. L. Matthews and R. C. Donaldson

CONTENTS

FIGURES

TABLES

INTRODUCTION

Sand is an important natural resource for the building, construction and glass making industries, and a ready supply close to existing markets needs to be maintained.

There is some concern in the building and construction industries that the sand reserves of the currently operated pits around Hobart are becoming depleted, in particular sand used as fine aggregate for concrete production. There is clearly a need to appraise current reserves and delineate potential sources for future requirements.

As sand is a low-cost product, transport is a major factor in the cost of supply. A source of sand close to the point of use is therefore highly desirable.

A large proportion of Hobart's sand supply is currently extracted from the South Arm peninsula, with smaller supplies being obtained from the Penna (Shark Point Road), New Norfolk and Huonville areas (fig. 1, 2). There is some minor production from other areas. Almost all of the sand used in concrete production comes from Hope Beach near South Arm, while sand for glass making is mined at Sandford.

MAJOR SOURCES OF SAND

The major sand deposits mined in the Hobart area are derived from the following sources:

1. Quaternary age dune or windblown deposits, mainly located near shorelines.

2. Tertiary–Quaternary age marine or freshwater deposits. These are generally located in near-shore areas or old river valleys.

3. The weathering of Triassic age sandstone. These deposits can occur at any location where the resultant accumulation of sand has not subsequently been removed by erosion processes.

Windblown sand and Tertiary–Quaternary sand deposits can occur together (i.e. the former overlying the latter), while all three types can occur in close proximity to each other. Figure 1 shows the distribution of Triassic and Quaternary age sediments in the Hobart area and their relationship with known worked sand deposits.

Most of the sand deposits around Hobart are considered to have been originally derived from the weathering of Triassic sandstone, as other rock types in the area are not particularly sand rich. The Permian age sedimentary rocks have sandy horizons throughout the sequence which, on weathering, could provide an additional source of sand. Weathering and transport of the sand by wind or water action have resulted in the formation of the first two types of deposits, while the third type is a result of the *in situ* accumulation of sand.

USES OF SAND

Sand is used for a large variety of purposes in the construction industry and very pure grades of sand have metallurgical uses. In determining the possible end uses of a sand product both the chemical composition and the grainsize of the sample must be ascertained.

Various building and construction commodities have size specifications to determine what is, and what is not, suited to a particular use.

Potential uses for sand include:

1. *Bedding sand:* used in the laying of pavements etc. The sand should not contain an excessive amount of fines and should not be gap-graded (i.e. lacking some grainsizes within the grading envelope). The grains should preferably be angular (sharp), not rounded. Such sand should not contain any soluble salts and should have a uniform (low) moisture content in the range 4–8%.

2. *Joint-filling sand:* used to fill the small gaps or joints between paving units, which are usually 2–4 mm wide and must be filled with a relatively fine sand. This sand should pass a 2.36 mm sieve and be well graded.

   A small proportion (not more than 5–10%) of fine material (passing 75 μm sieve) may be added to the sand. These fines help restrict the penetration of water into the cracks or joints of a pavement. Joint-filling sand should not contain any soluble salts.

3. *Sharp sand (fine aggregate):* used in the making of concrete, having only a small proportion of or no fine material.

4. *Fat sand:* used in the making of mortar, and having a proportion of fine material, usually clay, which helps in the binding of the mortar. Not more than 10% of material should be finer than 75 μm, and not more than 1% of material should be larger than 2.36 mm. Many Australian sands used to make mortar are in fact finer than this.

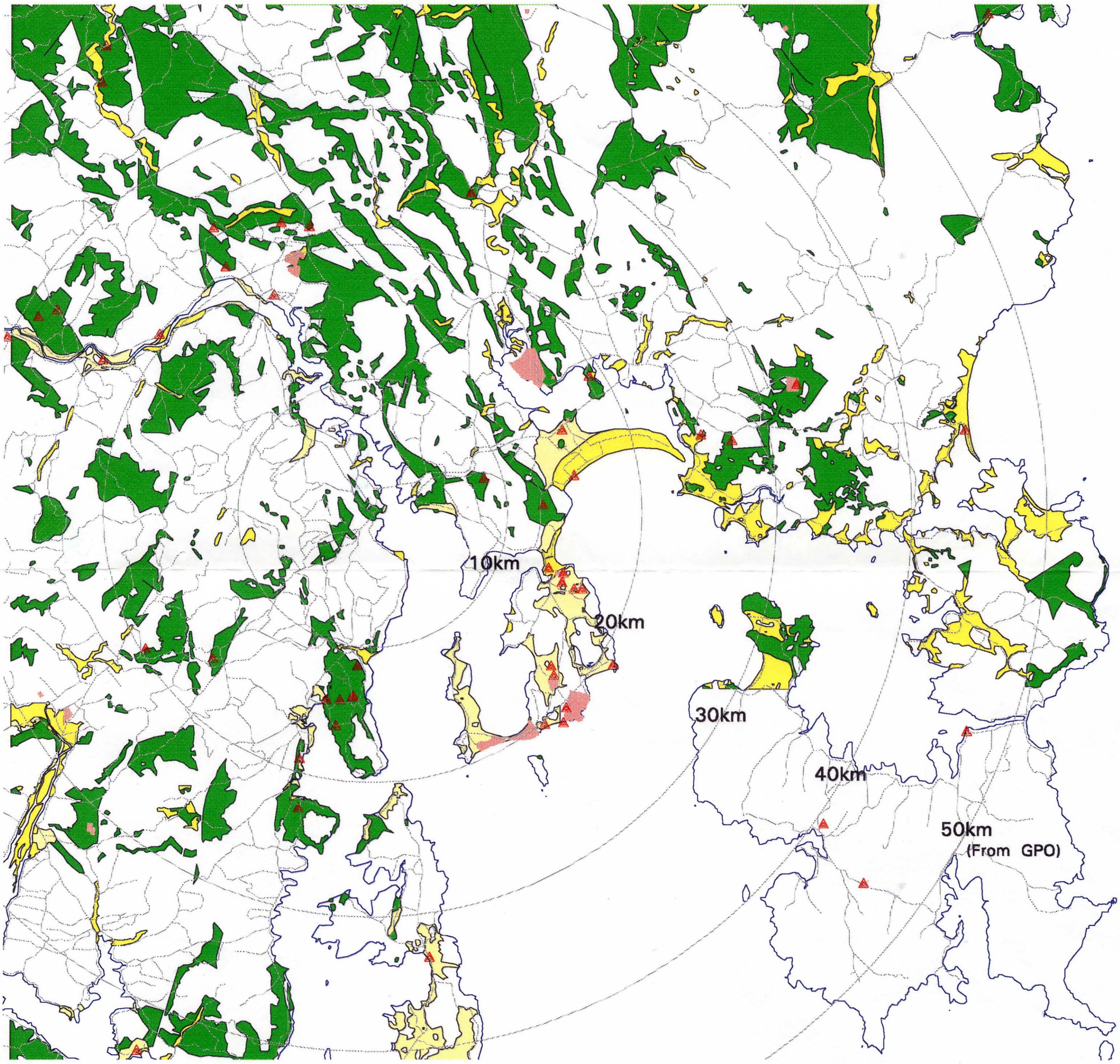
5. *Foundry sand:* must have a very high silica (SiO_2) content (>99.6%) with low aluminium, iron and titanium content. Is generally finer than bedding sand and joint-filling sand.

6. *Glass making:* grades also vary, however even for coloured glass the silica content must be quite high (at least 99%) with not too much iron. For better quality types of glass, from colourless glass and to lead crystal to lenses and optical fibres, progressively better quality material is needed. Generally a fine sand is used, with the majority of sand grains being between 150–600 μm. For the top end of the market (optic fibres, etc.) the sand must be exceptionally pure (>99.9% SiO_2).

The Triassic sandstones in the Hobart area comprise fine to medium-grained quartz sand fragments which on weathering produce sand deposits in the finer size range. As a result a large proportion of the sand deposits are of a finer grain size than the general specifications for a number

MINERAL RESOURCES TASMANIA

HOBART AND ENVIRONS - DISTRIBUTION OF TRIASSIC AND QUATERNARY SEDIMENTS



Current Mining Lease (Sand)

Known Sand Production Site (Historic & Current)

Quaternary Sediments

Triassic Sediments

Figure 1

of uses. For example, the sand used as a fine aggregate for concrete production, a major use, is too fine to be used on its own and requires the addition of coarser material (basalt or dolerite crusher dust) to produce a suitable grading. The specifications for glass sand and bedding sand also require coarser fractions than are generally present in sand from the Hobart area, although local sand has been successfully used for these purposes. Specifications for mortar sand and joint-filling sand are for fine-grained sand, and the sand available in the Hobart area generally fits these requirements.

Sand for most uses requires a clean, relatively clay-free material and the reworked sand deposits such as the windblown sand and a large proportion of the utilised Tertiary–Quaternary deposits have these properties. Deposits derived from *in situ* weathering of Triassic sandstone tend to have some clay component and would need to be washed to be used for most purposes. Mortar sand, however, requires a significant clay content and it is for this purpose that much of the sand from these deposits is used.

The main uses of sand in the local market are as a fine aggregate in concrete production, as a bedding material for pavements, pipelines etc., for mortar production, and as a joint filling material. Some sand from the Hobart area is suitable for glass making.

SAND SPECIFICATIONS

Some specifications for various sands are given in Table 1. These should only be taken as a rough guide; particular projects may require further specifications. Sand used in metallurgy must be of appropriate quality.

SAND PRODUCTION AND RESERVES

Total sand reserves in the Hobart area are difficult to assess. Threader (1974) suggested that available Quaternary dune sand reserves are of the order of 1.3 million cubic metres, and Tertiary sand reserves on the Sandford–Lauderdale area are about 34 million cubic metres. Threader suggests that the estimates are based on insufficient data to be very reliable.

Accurate figures for the resource remaining on existing leases do not exist. No detailed resource evaluation has been conducted in most cases in order to determine this important figure. There is a need to conduct investigations to determine accurate figures in order to plan for further resource requirements. Future potential sources can then be investigated.

Reserves of offshore sand in areas such as Ralphs Bay, D'Entrecasteaux Channel, Frederick Henry Bay, and Norfolk Bay are unknown.

Seven Mile Beach is the largest body of sand close to Hobart from which sand has not been extracted. Large reserves of sand suitable for dry-pit and wet-pit mining are present in this area. Currently one exploration licence (EL 20/90) over this area has been granted to the Northwest Bay Co P/L, while an application for an exploration licence (EL 29/89) by CSR Readymix is pending.

There are currently thirteen mining leases for sand within a 20 km radius of Hobart (fig. 2). These are:

Name	Lease No.	Location
G. L. Males P/L	784 P/M	South Arm
D. G. B. Calvert	800 P/M	South Arm Neck
P. H. & A. H. Calvert	1436 P/M	Lauderdale
Tasmania Golf Club	1142 P/M	Barilla Bay
Flexmore Park P/L	1297 P/M	Penna
R. E. Stanton	940 P/M	Penna
A. P. Watson	864 P/M	Cape Contrariety
L. B., M. L. & G. L. May	807 P/M	Sandford
ACI Operations P/L	813 P/M	Sandford
R. M. Lazenby	1454 P/M	Sandford
R. M. Lazenby	1455 P/M	Sandford
T. J., B. C. & R. H. Morrisby	1511 P/M	Sandford
A. G. Atkinson & Sons P/L	1391 P/M	South Arm

Table 1

Sand specifications (from Bacon, 1992)

Use	Bedding*	Joint filling*	Mortar+	Foundry# (fine)	Foundry# (coarse)	Glass
Sieve size	% passing	% passing	% passing	% passing	% passing	% passing
9.52 mm	100					
4.75 mm	95–100					
2.36 mm	80–100	100	99–100			
1.18 mm	50–85	90–100	30–100	100	100	100
600 µm	25–60	60–90	15–100	96	70	98
300 µm	10–30	30–60	5–50	45	8	47
150 µm	5–15	15–30	0–15	3	<1	3
75 µm	0–10	5–10	0–10	0.1		0.1

* recommended by the Cement and Concrete Association
\+ draft SAA Mortar Standard BD/34/74-459
\# typical industrial specifications

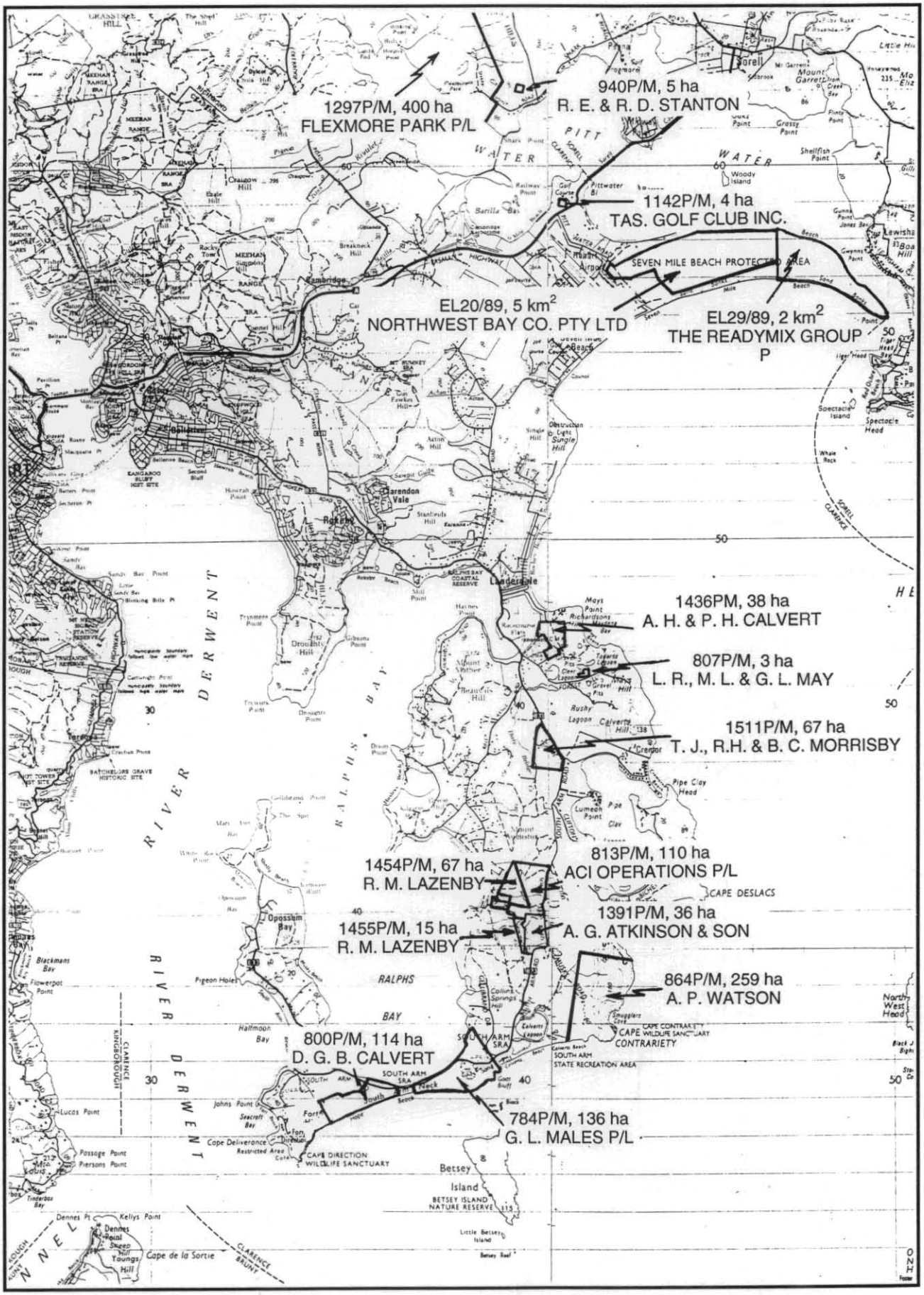


Figure 2

Sand mining leases within 20 km of Hobart

5 cm

The first three producers, located in the Sandford–South Arm area, produce approximately 80% of the total production for the Hobart area. ACI Operations Pty Ltd produce silica sand for the glass making industry.

Figure 1 shows the location of recorded sand production sites in the Hobart area. Many of these sites only produced minor quantities of sand and have not been operated for some time. The current mining leases for sand production are also indicated. Not all leases are currently operated on a continuous basis.

Sand production figures for Tasmania and southern Tasmania from 1960 are shown in Table 2 and are graphically illustrated in Figure 3. Although the annual use of sand varies widely because of various influences on the building and construction industries, a projected average overall yearly increase of about 3 per cent has been determined from these figures.

Previous estimates for South Arm (Hope Beach area)

Estimates of reserves at South Arm were made in 1972. Again they were regarded as approximate only because no subsurface investigations were undertaken, and various areas of possible sand were not included in the estimates, such as a 90 metre wide foreshore reserve and other areas of environmental sensitivity (Threader, 1974).

These preliminary estimates totalled 972 000 m^3 in the areas east and west of the South Arm Neck. Since that time, however, about 1.1 million m^3 have been removed, mostly from the Hope Beach area (a conversion factor of 1.6 has been used in converting tonnes to m^3 for available production figures from 1988 to 1993). Production appears to have extended outside the area used in the 1972 reserve estimates and would include some production from the South Arm Neck.

Table 2

Sand production in the Hobart area

Year	State total (m^3)	South total (m^3)
1960		
1961		
1962		
1963	80 725	44 230
1964	86 640	46 819
1965	112 434	36 967
1966	174 847	58 820
1967	144 990	51 824
1968	162 118	63 191
1969	181 922	51 318
1970	179 364	69 410
1971	111 244	69 377
1972	124 855	54 816
1973	105 350	70 287
1974	128 214	53 320
1975	108 675	21 762
1976	292 409	115 355
1977	262 867	128 404
1978	204 347	80 065
1979	269 244	114 837
1980	212 170	73 805
1981	210 844	84 456
1982	166 954	87 716
1983	229 566	93 056
1984	203 311	80 718
1985	218 771	115 335
1986	415 148	162 793
1987	240 529	81 462
1988	289 251	103 263
1989	323 813	149 513
1990	311 399	131 428
1991	267 274	104 481
1992	280 091	109 642
1993	309 828	104 981

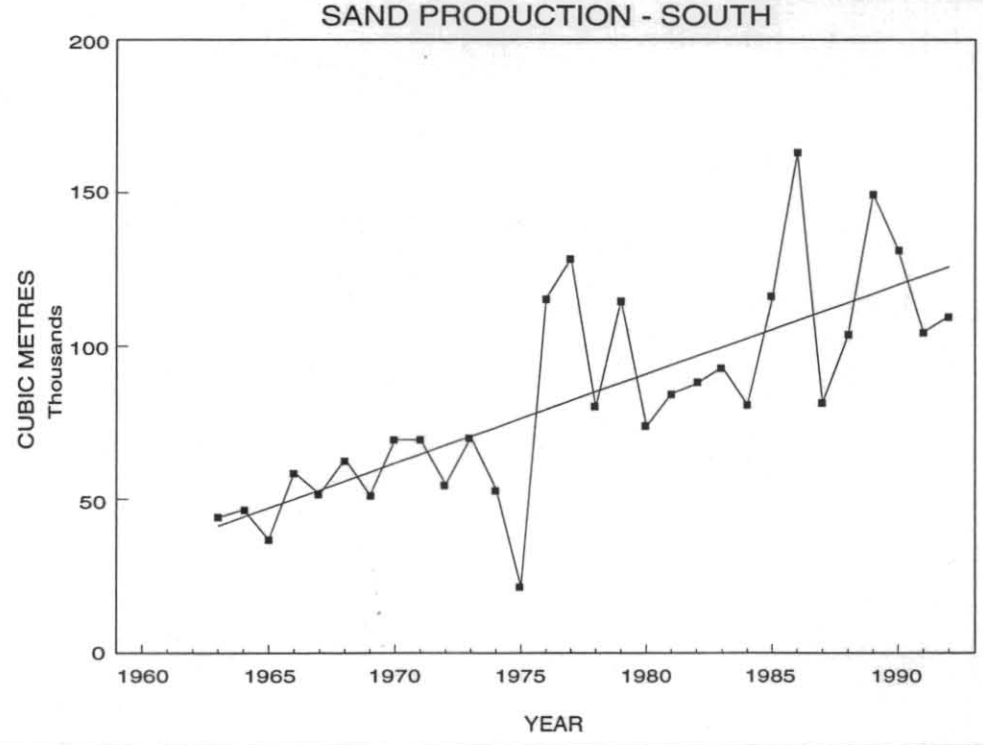


Figure 3

5 cm

Current reserves on operational leases

From available production figures, Sloane and Weldon (1993) deduced that sand production was increasing by about 3200 m^3 per annum for the Hobart area. They estimated that the required total sand production for the Hobart area between 1990 and the year 2000 would be approximately 1.5 million m^3 and 3.2 million m^3 by the year 2010.

New estimates of the resources available on current leases have been made for this study (Table 3). Note that these are, at best, only rough estimates. In most cases the estimates have been determined without subsurface information, and not all the resources may be able to be extracted due to environmental or planning constraints.

The estimates in Table 3 indicate that the industry, as a whole, has only 15 to 20 years of reserves at projected production rates. However the life of reserves remaining on individual leases is less in some cases and reportedly as little as 5–7 years.

The areas available for sand extraction may be limited by future environmental and land use decisions, and reserves may run out in less than the projected time estimates.

Table 3

Estimated reserves of sand in the Hobart area

Sand type	Estimated reserves (m^3)	Current production (m^3)	Reserves at projected production rates (years)
Concrete	1 950 000	62 500	15–20
Glass	130 000	12 500	10
Sharp	290 000	30 000	20–25
Fat and sharp	940 000		
Total	3 310 000	105 000	15–20

AREAS FOR FUTURE SAND PRODUCTION

The sand resources on some of the currently operated leases appear to be somewhat limited, and new areas with long-term potential for extraction need to be identified to meet the future requirements of industry. An important aspect of this is to ensure that further significant sand resources are not locked up and lost forever as a result of planning decisions. Potential resources in areas such as Dodges Ferry, Clifton and Marion Bay have already been lost because of residential development and the creation of reserves.

Significant potential sand reserves for Hobart's future requirements are likely to be sourced from:

- Undeveloped coastal sand areas
- Undeveloped dune, Tertiary–Quaternary deposits and weathered Triassic sandstone areas
- Offshore areas around Hobart
- Importation of sand from areas beyond the Hobart region.

Coastal Sand Areas

Seven Mile Beach

This is by far the largest known undeveloped on-shore resource of sand in Hobart area (fig. 4) and if developed could supply the basis for Hobart's needs for sand for the foreseeable future. An estimate in 1972 (Threader, 1974) put reserves in a 5 km^2 area at Seven Mile Beach at about 45 million m^3 (allowing for a 90 m foreshore reserve) to a depth of about nine metres. There is an estimated 9 million m^3 of sand occuring above the water table which could be extracted by dry-pit mining.

There are some coarser zones within the Seven Mile Beach deposit, as also occurs at Hope Beach (South Arm), which makes the sand more suitable for concrete production than the finer dune sand. To put the sand reserves in perspective, Hobart's present annual sand requirements (say 110 000 m^3) would occupy a volume with a surface area of 1.0 ha and a depth of 11 metres. In practice however, the actual surface area affected would be greater, being dependent on the depth of extraction and the rate of production which would determine the final pit design. It is not anticipated that Hobart's total sand requirements would be sourced from this area, which would further reduce the volume extracted each year.

Seven Mile Beach is a Protected Area and a number of issues would require consideration and resolution before development would be possible. This aspect is discussed later in the report.

Dune, Tertiary–Quaternary and Triassic sandstone

It is expected that with further evaluation and assessment additional sites with reserves of Tertiary–Quaternary and weathered Triassic sandstone sand type deposits will be identified around Hobart. As in the areas where extraction has taken place to date, the majority of future potential areas are likely to have relatively small reserves with few having potentially moderate reserves. These will generally be located in areas more remote from Hobart than the presently developed or already mined areas and transport may be a factor in the cost of supply. Such deposits are likely to be mainly in the finer size range and suited to use in mortar, and if sufficiently clean, as joint filling sand. If washing of some of these deposits is undertaken, it may be possible to widen the use, again at increased cost. Reconnaissance field inspections have indicated that potential sand resources occur at Dodges Ferry (fig. 6) and behind Sloping Main beach (fig. 7). Other areas may also be identified with further investigation but in every case a firm figure on reserves could only be obtained from an exploration programme involving subsurface work.

Offshore Sand

Considerable offshore sand deposits almost certainly occur around the coastline in the Hobart region and could provide an alternative to Hobart's sand requirements for the foreseeable future. Areas such as Roches Beach, D'Entrecasteaux Channel, Storm Bay, Frederick Henry Bay and Norfolk Bay all have potential for large reserves.

Environmental issues would need very careful consideration before any extraction from these sources could take place.

Importation of sand

There are large reserves of sand outside the Hobart area, in particular in the Scottsdale area. These extensive deposits are generally coarser than most of the sand in the Hobart area, and the size range (grading) generally fits the specifications for fine aggregate used in concrete production. In addition, the Scottsdale sand also fits the specifications for bedding sand better than most of Hobart's sand.

The estimated cost of freighting sand from Scottsdale is of the order of $15–$20 per tonne, although backloading may reduce this cost. Whether sand importation is a viable economic proposition is for industry to determine.

PLANNING SCHEMES AND RESOURCE AVAILABILITY

Land use planning decisions are increasingly alienating potential sand resource areas with prohibition or restrictions on extractive industry activities such as sand mining. It is important for the industry and the community at large that these deposits be made accessible and available for future generations. A prime example occurs at Seven Mile Beach.

The exploitation of the extensive sand resource at Seven Mile Beach raises a number of concerns relating to land use and environmental issues that need to be addressed if sand mining operations were to proceed. The land at Seven Mile Beach (fig. 4) is owned by the Crown and is proclaimed as a Protected Area under Section 8 of the *Crown Lands Act*. Special conditions apply with respect to exploration and mining procedures.

However, under the *City of Clarence Planning Scheme (1986)* the area is zoned Active and Passive Recreation in which extractive industry is a prohibited use. In effect this means the planning scheme would require amendment in order to carry out sand mining activities within this zone.

The major issue that requires consideration and resolution at all levels of Government and in the community is the possible land use conflict between sand mining and recreation uses of the area. With controlled planning and careful management, the two need not necessarily be mutually exclusive. Any sand mining operation would require a management plan which would aim to minimise the impact on other natural resources and environmental aspects that have importance in the area.

From an environmental point of view, potential issues to be addressed include:

- the effect of mining on the large potable groundwater resource that underlies the area;
- the disturbance of the main foreshore dune system fronting onto Seven Mile Beach;
- the effects of traffic, noise and dust associated with mining operations and associated cartage of material from the area;
- the visual impact of mining operations adjacent to a recreational area;
- the establishment of buffer zones;
- rehabilitation guidelines and long-term land use options.

It is not the intention of this report to provide an exhaustive list or discuss in detail the potential issues that inevitably arise in such situations.

Similar issues and constraints affect the availability of other potential sand reserves in neighbouring areas such as Carlton Beach, Sloping Main, Marion Bay, Ralphs Bay and South Arm. The extent of the loss of resource or restrictive measures imposed by planning decisions on these areas is indicated in Figures 4–8.

In the case of the South Arm area (fig. 5), attempts have been made to gain an Exploration Licence over a potential large offshore sand deposit in Ralphs Bay but the licence was not granted on environmental grounds. A Wildlife Sanctuary now exists over the southernmost end of the bay.

In the Dodges Ferry–Carlton area (fig. 6) the vast majority of an extensive sand resource has been lost to residential development, leaving only a fraction of the resource potentially available for sand extraction. At Sloping Main (fig. 7), part of the potential sand resource lies within the Lime Bay Nature Reserve. The entire Quaternary sand deposit at Marion Bay (fig. 8) is zoned as Landscape Protection Area under the Sorell Planning Scheme. In general terms, the availability of, and the conditions applied to mining tenements in all these areas would be subject to local issues.

Clearly there needs to be considered and reasoned discussion both within Government agencies and the community to allow for resource evaluation and assessment before the resource is lost forever.

CONCLUSIONS

The available sand resources remaining on some of the currently operated mining leases in the Hobart region appear to be approaching exhaustion within the next few years. To ensure the long term viability of the industry, new reserves need to be identified as a matter of urgency.

The Seven Mile Beach area appears to be the largest body of on-shore sand close to Hobart which has not been exploited. The main advantages of the deposit are that it can be easily mined, is located close to Hobart and is adjacent to a major transport route, and the potential reserves are large.

The issues surrounding the development of this sensitive area are complex and require careful consideration and consultation with various agencies in order to integrate sand extraction with the overall management of the Protected Area.

There is potential for large offshore sand reserves in the Hobart region, however there has been no resource assessment of these deposits to date.

RECOMMENDATIONS

It appears essential to obtain accurate estimates of available remaining reserves of sand on existing leases in order to determine the working life of the resource. An investigation programme is required to provide these estimates.

A resource appraisal of land-based sand deposits should be undertaken, while offshore exploration is required to determine the potential in areas such as Ralphs Bay, D'Entrecasteaux Channel, Storm Bay and Frederick Henry Bay.

In the meantime, planning decisions should accommodate, in so far as is possible, the need to provide for unencumbered access to sand resources for the benefit of Hobart and surrounding communities. If this is not done southern Tasmanian sand users will soon be facing increased building and construction costs because of the unavailability of this fundamental commodity.

ACKNOWLEDGEMENTS

This report was compiled with the assistance of Ms C. A. Bacon and W. Grun of Mineral Resources Tasmania.

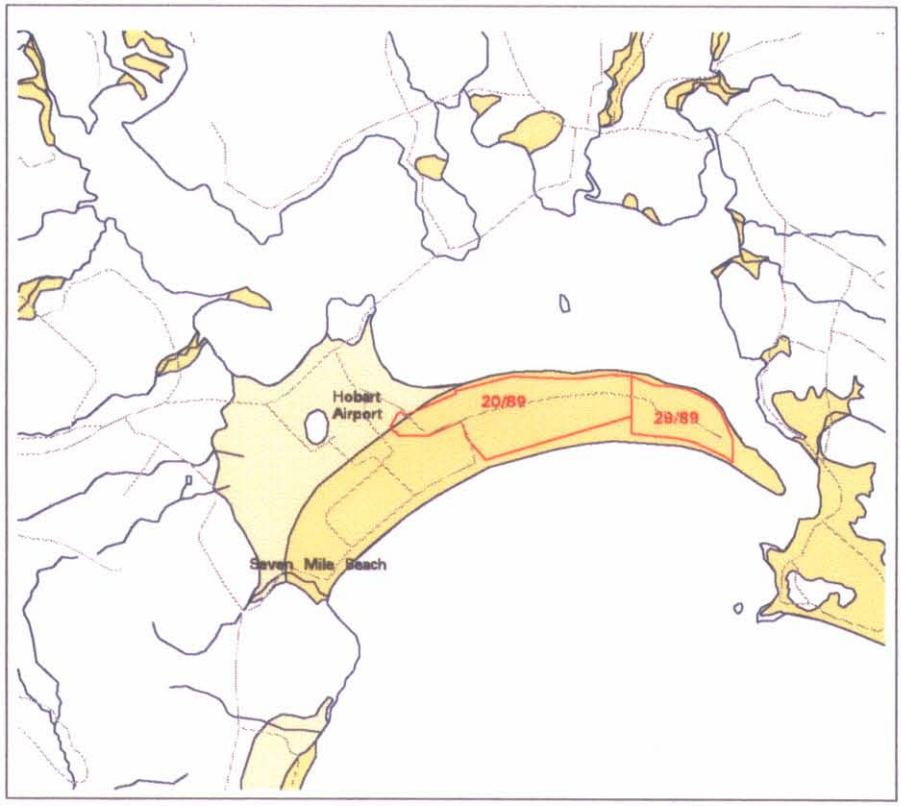
REFERENCES

BACON, C. A. 1992. Sand at Dysart. *Report Department of Mines Tasmania.* 1992/05.

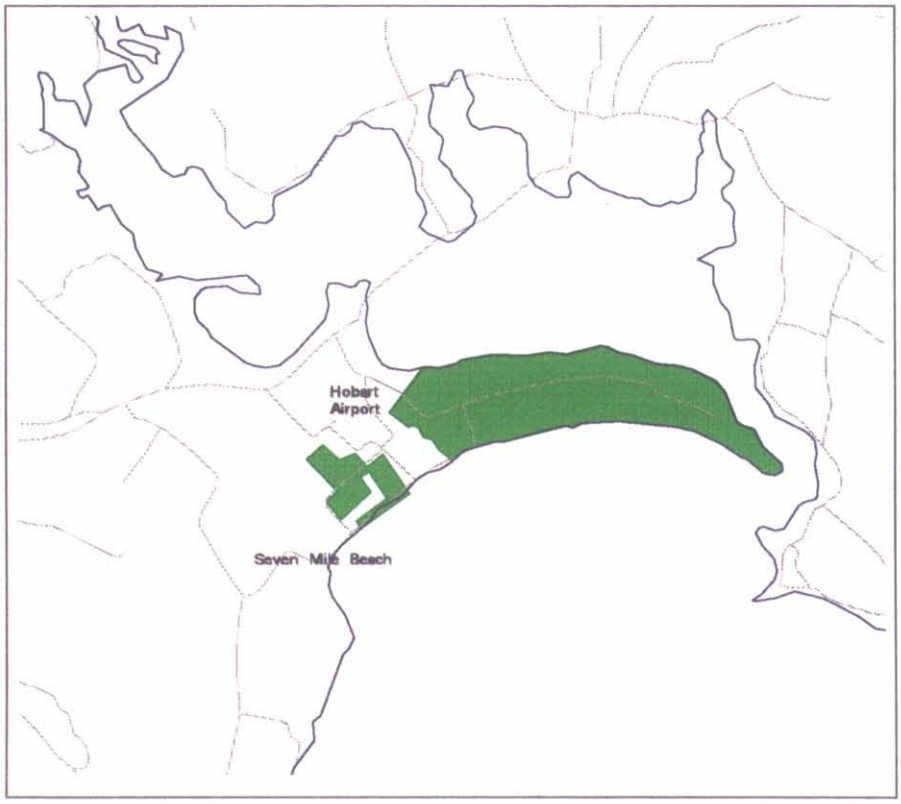
SLOANE, D. J.; WELDON, B. D. 1993. Sand resources in the Hobart area (Revision 1). *Report Division of Mines Tasmania.* 1993/01.

THREADER, V. M. 1974. Sand resources, Sandford – South Arm Peninsula. *Technical Report Department of Mines Tasmania* 17:49–54.

[13 May 1994]



Quaternary sediments — potential sand deposits and Exploration Licences



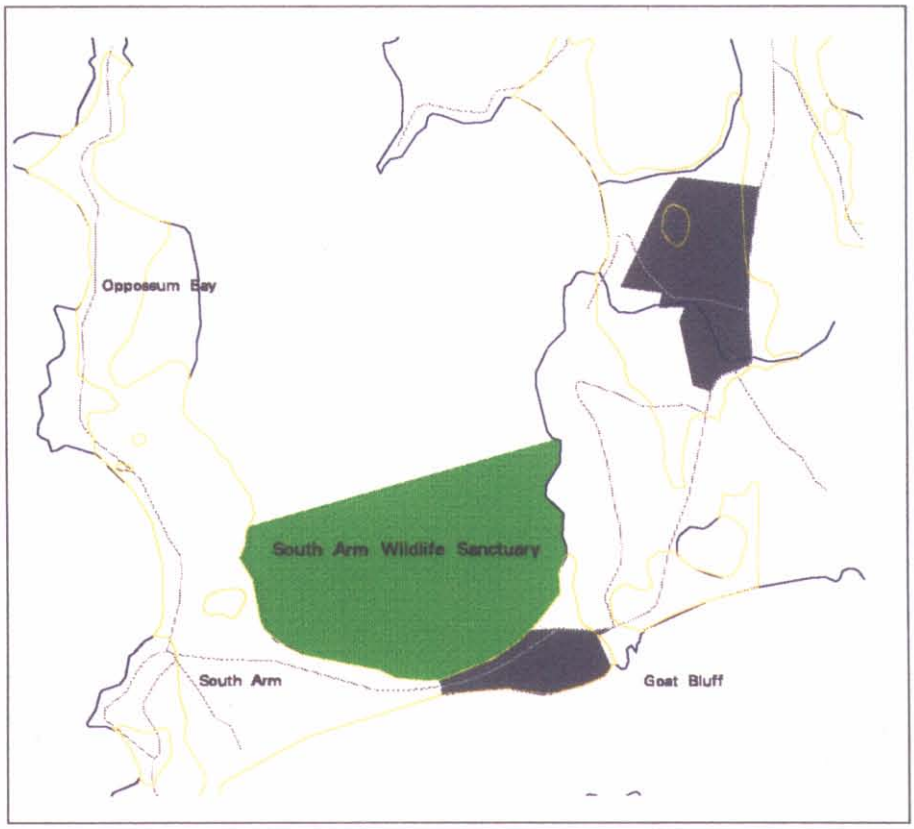
Seven Mile Beach Protected Area

5 cm

Figure 4

Sand deposits and alienated areas, Seven Mile Beach

Quaternary sediments — potential sand deposits

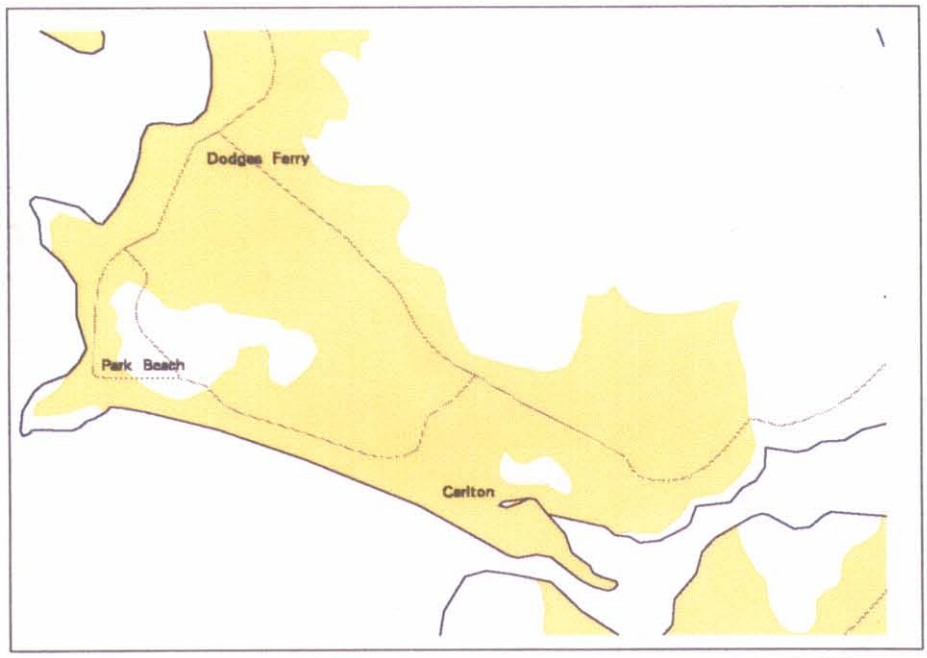


Extractive Industry Zones and South Arm Wildlife Sanctuary
Grey shaded areas are Extractive Industry Zones under Clarence Planning Scheme

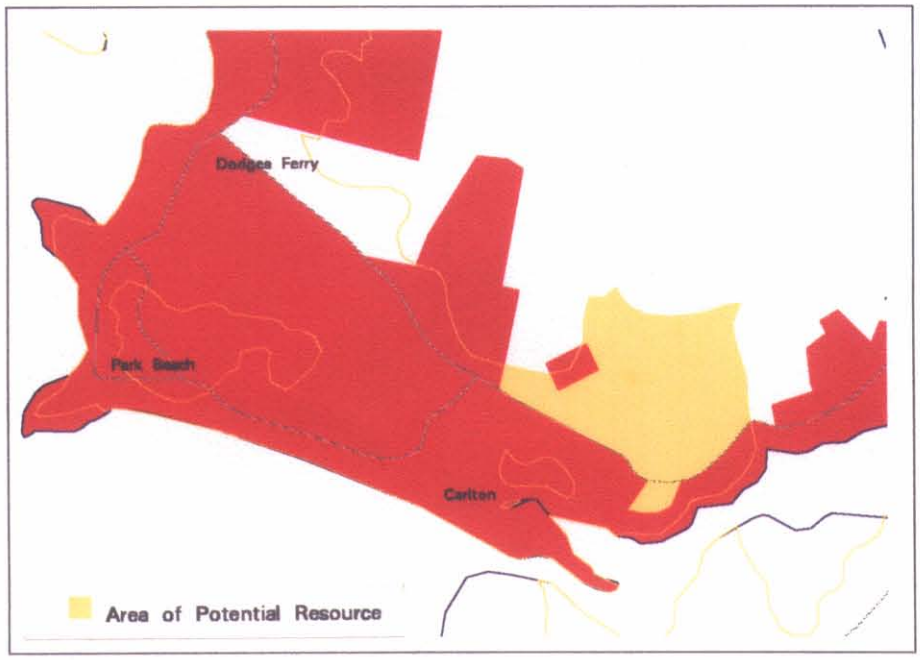
5 cm

Figure 5

Sand deposits and alienated areas, South Arm area



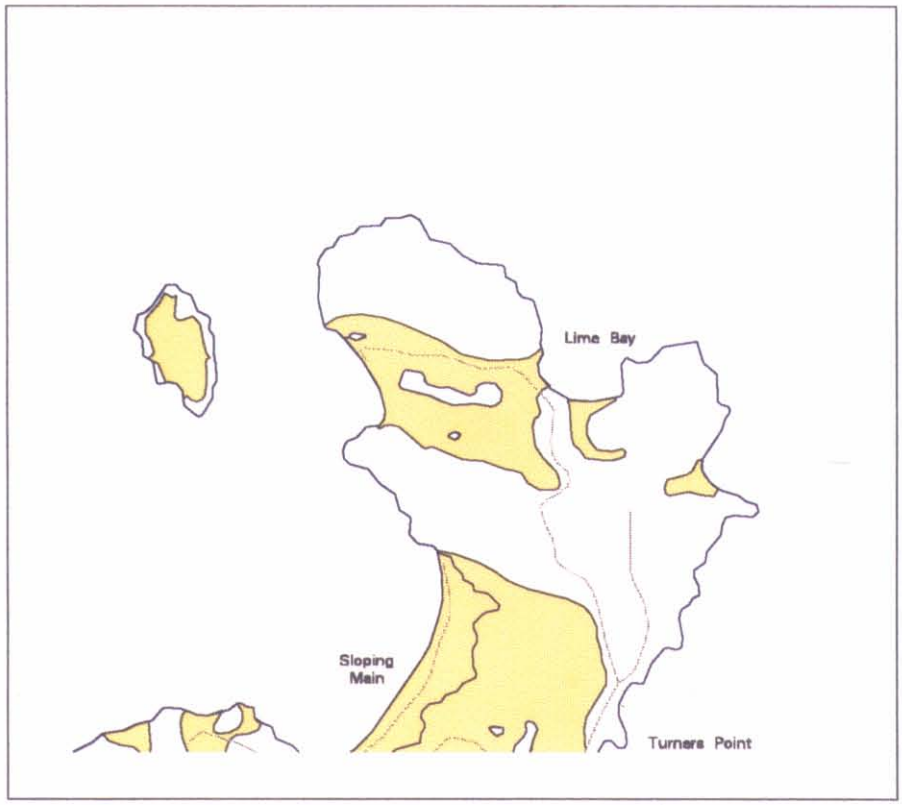
Quaternary sediments — potential sand deposits



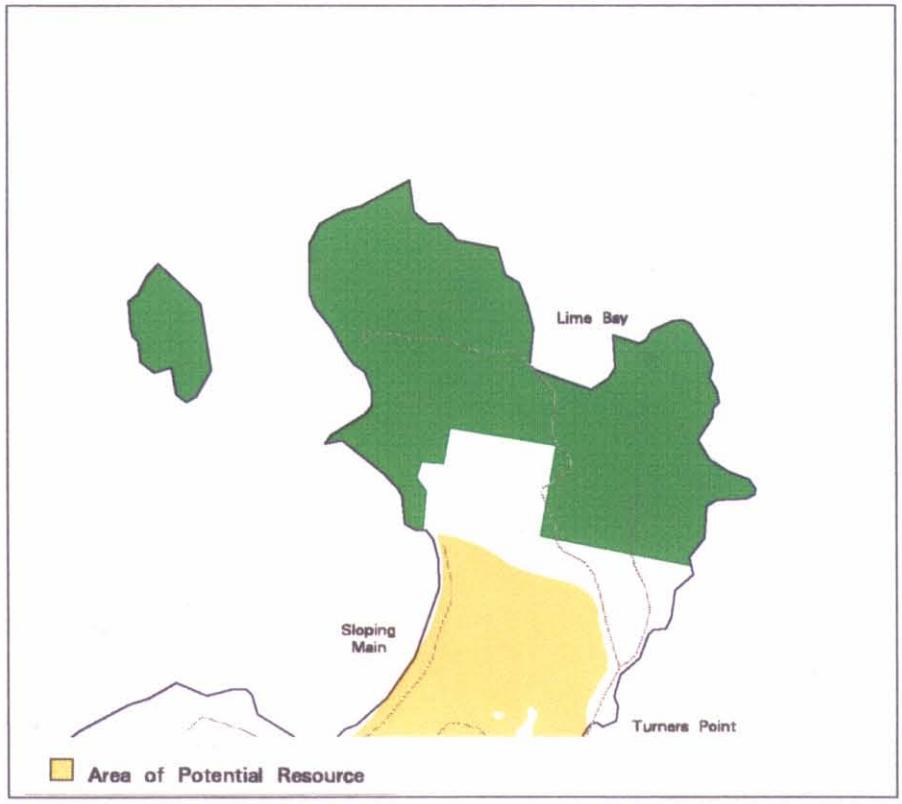
Residential, open space and Special Purpose Zones under Sorell Planning Scheme

Figure 6

Sand deposits and alienated areas, Carlton Beach area



Quaternary sediments — potential sand deposits

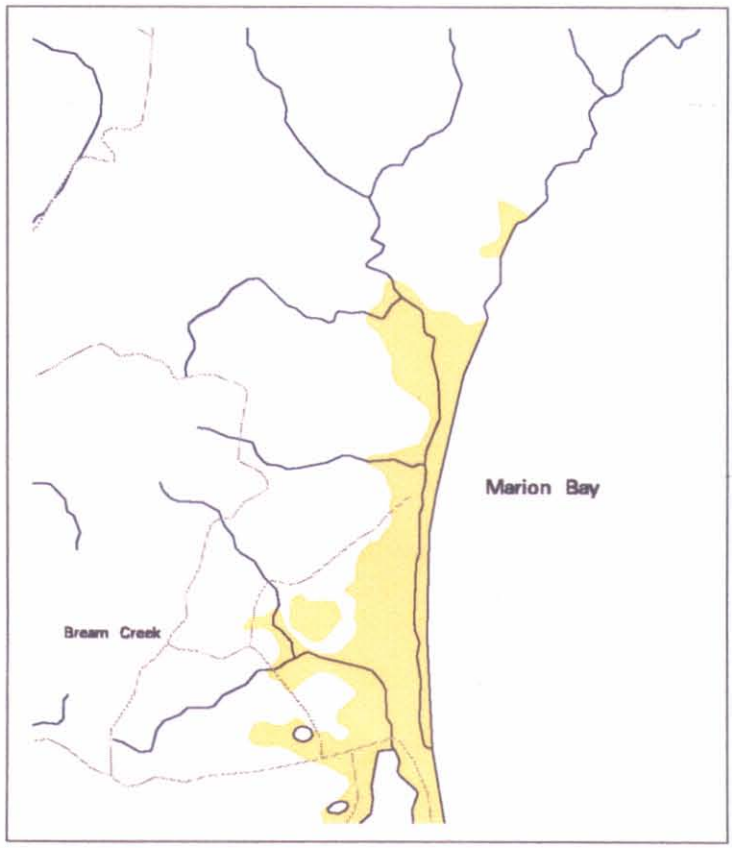


Lime Bay Nature Reserve

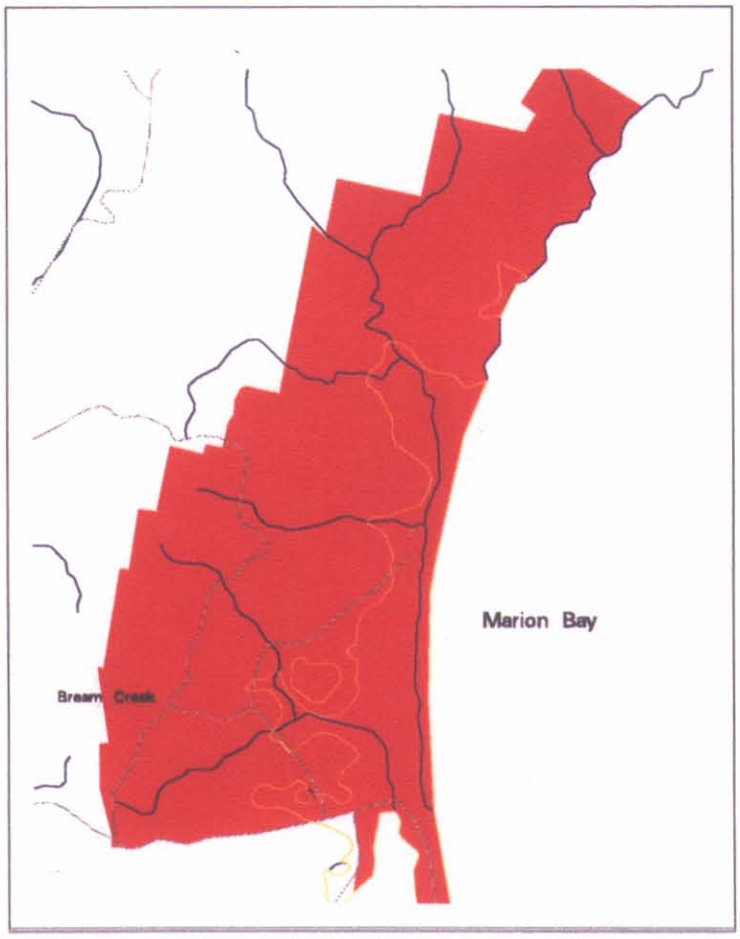
5 cm

Figure 7

Sand deposits and alienated areas, Sloping Main area



Quaternary sediments — potential sand deposits



Landscape Protection Area under Sorell Planning Scheme

Figure 8

Sand deposits and alienated areas, Marion Bay

5 cm

1297P/M, 400 ha
FLEXMORE PARK P/L

940P/M, 5 ha
R. E. & R. D. STANTON

1142P/M, 4 ha
TAS. GOLF CLUB INC.

SEVEN MILE BEACH PROTECTED AREA

EL20/89, 5 km^2
NORTHWEST BAY CO. PTY LTD

EL29/89, 2 km^2
THE READYMIX GROUP P

1436PM, 38 ha
A. H. & P. H. CALVERT

807P/M, 3 ha
L. R., M. L. & G. L. MAY

1511P/M, 67 ha
T. J., R.H. & B. C. MORRISBY

813P/M, 110 ha
ACI OPERATIONS P/L

1454P/M, 67 ha
R. M. LAZENBY

1391P/M, 36 ha
A. G. ATKINSON & SON

1455P/M, 15 ha
R. M. LAZENBY

864P/M, 259 ha
A. P. WATSON

800P/M, 114 ha
D. G. B. CALVERT

784P/M, 136 ha
G. L. MALES P/L

5 cm