



EIS 990

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A discussion paper on the status of fine sand resources in
Sydney



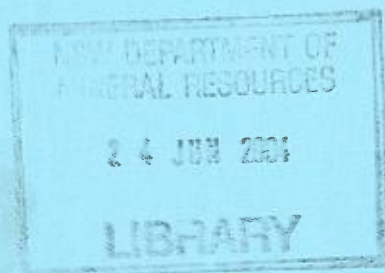
METROMIX PTY LIMITED

A DISCUSSION PAPER

on the

STATUS OF FINE SAND RESOURCES

IN SYDNEY



Prepared by:

R. W. Corkery & Co. Pty Limited

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Prepared by:

R. W. Corkery & Co. Pty Limited
Geological & Environmental Consultants
75 Kite Street
ORANGE N.S.W. 2800

Telephone: (063) 62 5411
Facsimile: (063) 61 3622

On behalf of:

Metromix Pty Limited
144 Marsden Street
PARRAMATTA N.S.W. 2150

Telephone: (02) 689 3011
Facsimile: (02) 635 4816

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PREAMBLE

Sand is used throughout the community for a wide range of purposes. Its use is dependant upon its characteristics such as purity, grain shape, colour and most importantly grain size. Industry generally refers to sands as either fine grained or coarse grained although there is a range of grain sizes in each group. Fine sands have a grain size generally smaller than 0.6 mm whereas coarse sands predominantly have grains generally greater than 0.6 mm in size.

For the past 50 years, suburbs east of Parramatta have been supplied with fine sand from Kurnell, however, extraction in this area is to be phased out by the end of this decade. Only two substantial sand extraction operations remain at Kurnell, the first of which is to close in 1993. The operator of this site, Metromix Pty Limited, has actively been searching for an alternative long term supply of fine sand close to Sydney's CBD. They have identified substantial sources of fine grained sand in two areas offshore south of Sydney within a relict sand body in 25 to 65 m water depth.

Metromix has commissioned the preparation of an Environmental Impact Statement (hereafter referred to as an EIS) to accompany the mining lease applications covering two offshore areas and an application to construct and operate a marine aggregate distribution terminal at Pyrmont. An important component of the EIS for this Proposal or any other extractive industry is the consideration of proposal in the context of alternative sources of supply throughout the proposed life of the operation.

This discussion paper presents the preliminary findings of various studies undertaken on behalf of Metromix to provide the necessary information on the demand for fine sand, alternative fine sand sources and transport-related matters for inclusion in the EIS. Its release prior to the completion of the Draft EIS is consistent with Metromix's intention to provide interim findings of the various studies undertaken for the EIS to the relevant industries and interested community groups.

It is to be noted that whilst this discussion paper considers the status of all fine sand resources, the level of information available on the various sources is variable. Furthermore, there is a need to separately consider the options available to Metromix and other purchasers. For both reasons, it has therefore been considered appropriate to give separate consideration to existing operating sites owned by Metromix and its parent Companies and those of other operators.

Any comments or submissions on the discussion paper can be forwarded either to Metromix Pty Limited or R.W. Corkery & Co. Pty Limited.

Note: Resource size is expressed in million of tonnes = Mt.

Sand production is expressed in millions of tonnes per annum = Mtpa.



1.0 INTRODUCTION

This paper has been prepared to document the investigations undertaken on behalf of Metromix Pty Limited (hereafter Metromix) to examine the status of fine sand resources in Sydney.

The planned closure of Metromix's Kurnell fine sand operation in 1993 and the likely cessation of all fine sand extraction at Kurnell later this decade means the concrete and construction industries, particularly east of Parramatta, will need to obtain their fine sand requirements from either more distant deposits or newly developed sources.

This paper examines the principal factors that collectively determine the need for a fine sand resource. The factors include:

- (i) historical use of fine sand in Sydney;
- (ii) future demand for fine sand in Sydney;
- (iii) capacity of alternative approved sources to supply fine sand;
- (iv) potential sources of fine sand; and
- (v) alternative materials to fine sand.

This paper has been compiled principally with reference to Barnett (in prep) and R W Corkery & Co (in prep) who have respectively examined the supply and demand for fine sand for Sydney and existing and potential fine sand sources that could supply fine sand for Sydney over the longer term. Additional information has been drawn from two further reports currently being prepared to support the EIS for the marine aggregate proposal, namely reports by:

- Colston, Budd, Hunt and Twiney - relating to traffic; and
- Mining Tenement Management - relating to geology and resources in proposed offshore extraction areas.

Relevant information supplied by the Metromix about its current operation at Kurnell is also presented.

For the purposes of this paper the "Sydney market" refers to the "Greater Sydney Metropolitan Area" bounded by the Hawkesbury River to the north, the Nepean River to the west and the southern extremities of the Local Government Areas of Sutherland, Campbelltown and Camden. (See Figure 1). This area is seen as the principal consumer of fine sand.

Since the availability of extractive resources such as sand is inextricably related to planning, this paper references the State Government's regional planning documents for the Sydney Region. Figure 1 shows the location of the Sydney Region, as defined by the Department of Planning. It covers the Greater Sydney Metropolitan Area referred to above and the surrounding Local Government areas of Wollondilly, Blue Mountains, Hawkesbury, Gosford and Wyong.

The production statistics for all construction materials, including sand, have been collected for many years by the Department of Mineral Resources. The statistics have been compiled according to Mining Districts. Figure 1 displays the area covered by the



Sydney Mining District which is essentially the area covered by the Sydney Region excluding Gosford and Wyong Shires. Areas north of the Hawkesbury River are included in the Newcastle Mining District whereas those areas west and south of the Sydney Region are respectively included in the Orange and Wollongong Mining Districts.

The resources external to the Sydney Region considered in this paper reflect the areas from which fine sand is currently transported to Sydney.

2.0 HISTORICAL USE OF SAND

Barnett (in prep) recognises that use of sand (and other aggregates used in the construction industry) is directly related to production given the flexibility of extraction operations to meet demand. Hence, historical statistical production data has been used to demonstrate use of sand. The historical statistical data used by Barnett (in prep) has been drawn from data available from the Department of Mineral Resources for the years ending June 1969 to 1990 for the Sydney Mining District.

Figure 2 presents the total use of all types of sand in Sydney during the period 1969 to 1990. Distinction is made between processed, unprocessed, industrial (usually processed) and sand imported from outside the Sydney Mining District. A breakdown of sand types produced since 1983/84 has established that approximately 57 per cent of the total sand produced is fine sand. Demand for fine sand over that period varied from 52-59 per cent.

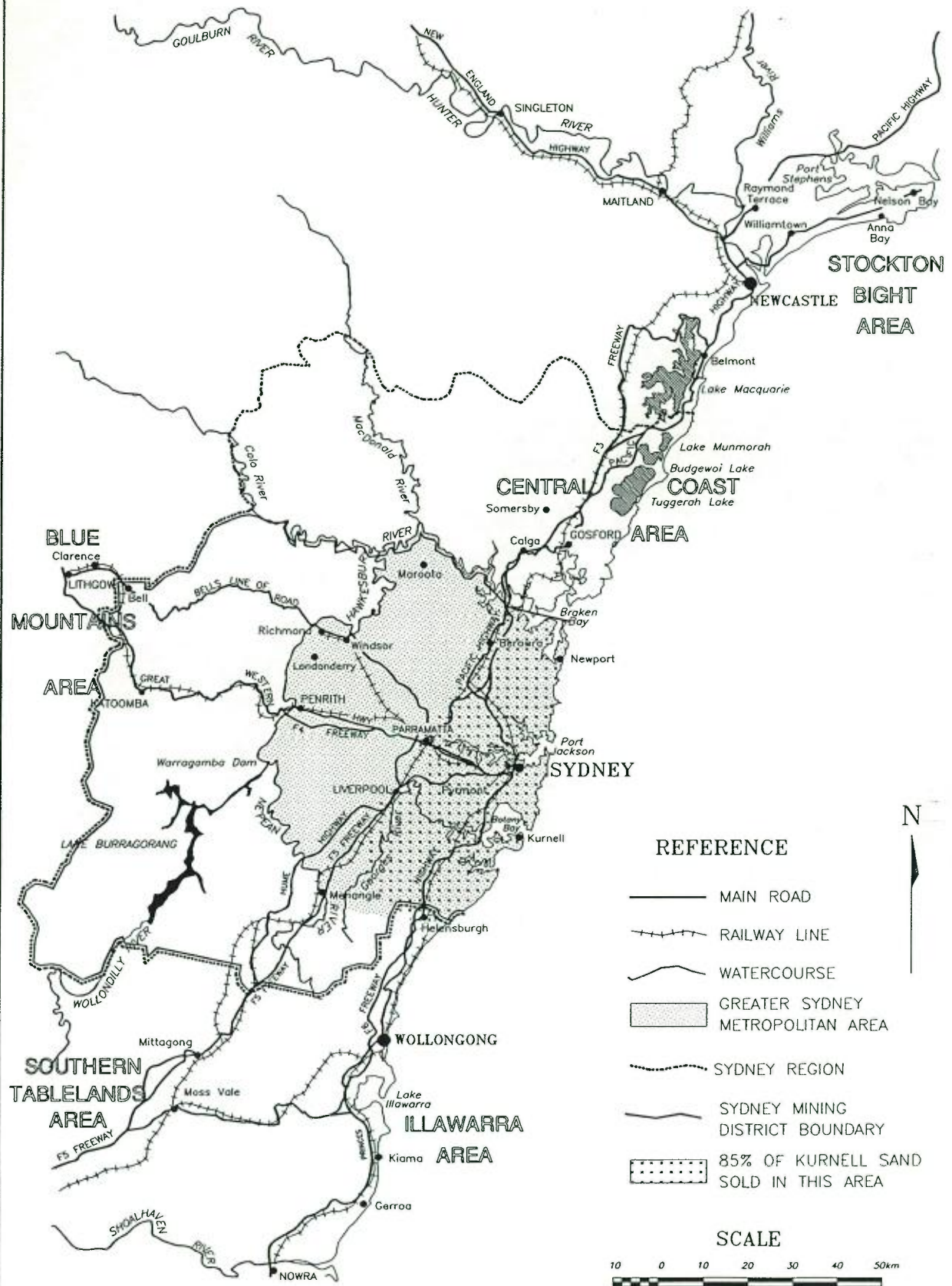
Barnett (in prep) points out that the demand for, or past use of sand, has not been homogenous across Sydney and that it has been heavily concentrated east of Parramatta. As examples, Barnett (in prep) cites 63 per cent of all sand used in ready mixed concrete production and 70 per cent of all sand consumed by asphalt plants in the Sydney market area occurred east of Parramatta in 1989/1990.

Metromix has established through a survey of its customers in 1991 that approximately 85 per cent of the fine sand despatched from their Kurnell operation was consumed east of Parramatta. (Figure 1).

Figure 3 displays the trend in sand consumption during the period 1969-1990. Whilst sand consumption was cyclical during that period, it increased at a rate of 1.2 per cent in the 1970's and 1.0 per cent in the 1980's. The growth in demand during the 1970's and 1980's was not matched by production within the Greater Sydney Metropolitan Area since, as shown in Figure 2, there has been a growth in sand imports into Sydney.

Other factors influencing the use of sand now and in the past are related to quality. Dune sand has preferentially been used in pumped concrete and for plastering and rendering because of its excellent workability attributed to the rounded shape of the sand grains. The absence of charcoal in dune sand and its predominantly fawn colour has also influenced its use by industry. It is noted that historically, there has been greater use of dune sand in Sydney's foundries.





R.W.CORKERY & CO. PTY. LIMITED
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

12th October, 1992

Figure 1
SYDNEY REGION

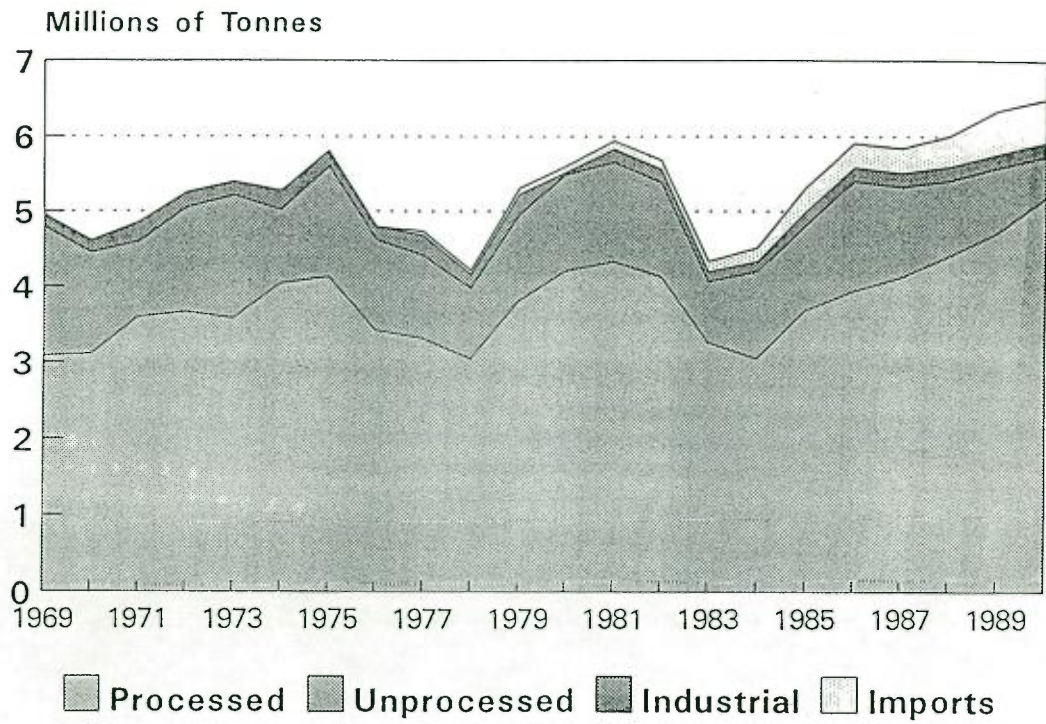


Figure 2
TOTAL SYDNEY SAND USE
1969 - 1990

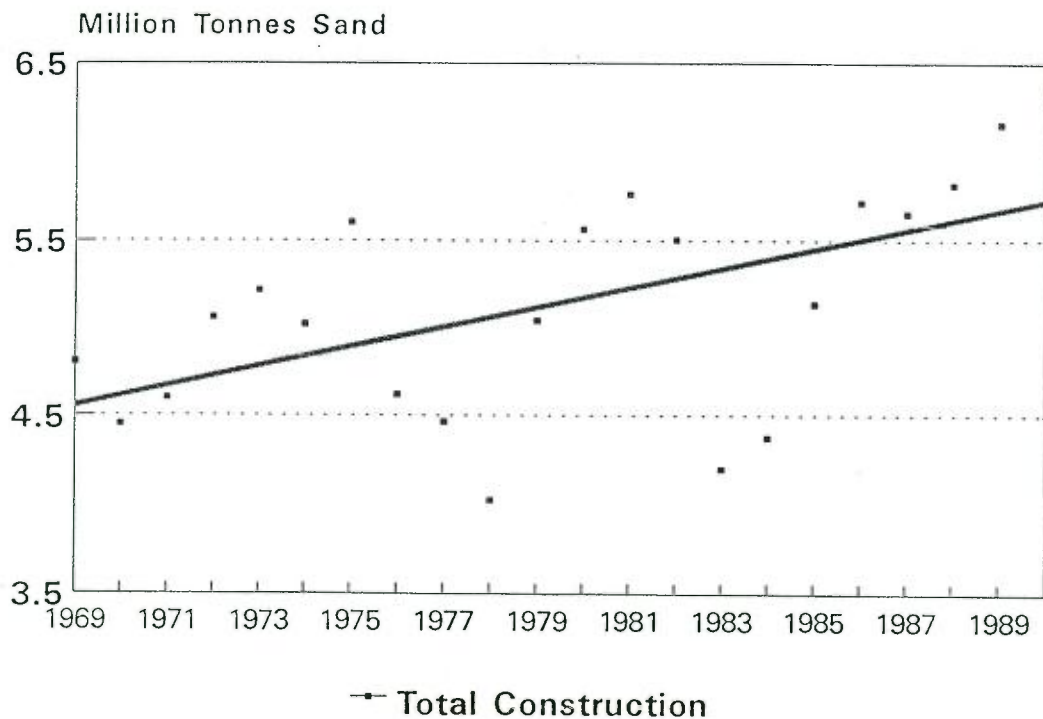


Figure 3
CONSTRUCTION SAND USE
1969 - 1990



3.0 FUTURE DEMAND FOR FINE SAND

The continued growth in the building and construction industries, albeit cyclical, will result in a continued demand for all grades of sand including fine sand. The Department of Environment and Planning (1984) noted that changes in construction sand production are most closely related to the general state of the economy, with an underlying trend reflecting population levels.

Barnett (in prep) examined past production and three indicators that could be used to forecast future demand based on the projections of those indicators. Such forecasts are intended to cover periods of at least one decade since it is not possible, nor necessary, to forecast the sand demand in any particular year. Long term trends are more important when considering and planning for resource availability. Barnett (in prep) established that of the three indicators, population, time, and \$N.S.W. buildings, the \$ value of buildings commenced in N.S.W. most accurately reflected the total sand production levels during the period 1969 to 1990. Figure 4 shows the comparison between the past and forecast demand for sand in Sydney.

Assuming the projected demand for fine sand is 55 per cent of total construction sand, and using the preferred indicator of \$N.S.W. buildings, Barnett (in prep) has forecast the demand for fine sand to increase from 3.1 Mtpa in 1992 to 3.5 Mtpa in 2000 and 4.0 Mtpa in 2010. This is shown graphically in Figure 5. The cumulative demand for fine sand from 1992 to 2000 is estimated to be approximately 29.6 Mt, from 2000 to 2010 it will be in the order of 37.5 Mt, and for the period 1992 to 2010 cumulative demand is estimated to be approximately 67 Mt.

4.0 ALTERNATIVE APPROVED SAND SOURCES

4.1 Introduction

Consideration of alternative approved sources of fine sand and their ability to make up the shortfall in production (either the short or long term) when Metromix's Kurnell operation closes is fundamental when assessing the need for a new resource. Factors that are considered important in this assessment include quality of the products, remaining quantity of the resource, distance from the market, environmental and other implications of increasing production, and resource ownership.

With the closure of Metromix's Kurnell fine sand operation, Metromix's own concrete batching plants and existing consumers are most likely to obtain their fine sand requirements initially from an existing approved operation. Consideration of new sources that could be developed within the next few years and beyond are considered in Section 5. Given Metromix's relationships within numerous companies and operators it is not unrealistic to expect it to endeavour to maintain as many customers as possible, until the marine aggregate proposal is operational (if approved). During this period, to perhaps early 1995, Metromix could supply some of its existing customers with fine sand from other sources owned and operated by its parent companies. This approach is only realistic if the transport costs from such resources



are reasonably competitive. Alternatively, Metromix's existing customers could change their source of supply to another operation.

For the purpose of this paper, Metromix and its parent Companies (Pioneer Concrete (NSW) Pty Ltd and CSR Investments Limited) are collectively referred to as "the Group".

This section is drawn from R.W. Corkery & Co. Pty Limited (in prep), and considers alternative approved sources in terms of whether they are operated by Metromix or its parent companies or by external companies.

4.2 Group's Existing Approved Operations

The Group operates seven sand operations in the areas currently supplying sand to the Sydney market (Figure 6). Five of the seven operations produce fine sand and two produce coarse sand. One of the fine sand operations (at Anna Bay), produces sand which is generally too fine to be considered as a replacement to dune sand produced at Kurnell.

Table A indicates that sources controlled by the Group have a total capacity to produce approximately 50 per cent of the shortfall to be created when Metromix's Kurnell operation closes. Given the comparative transport distances from markets, particularly for the Clarence operation, it is more likely that Group operations would only take up 20 to 25 per cent of the shortfall.



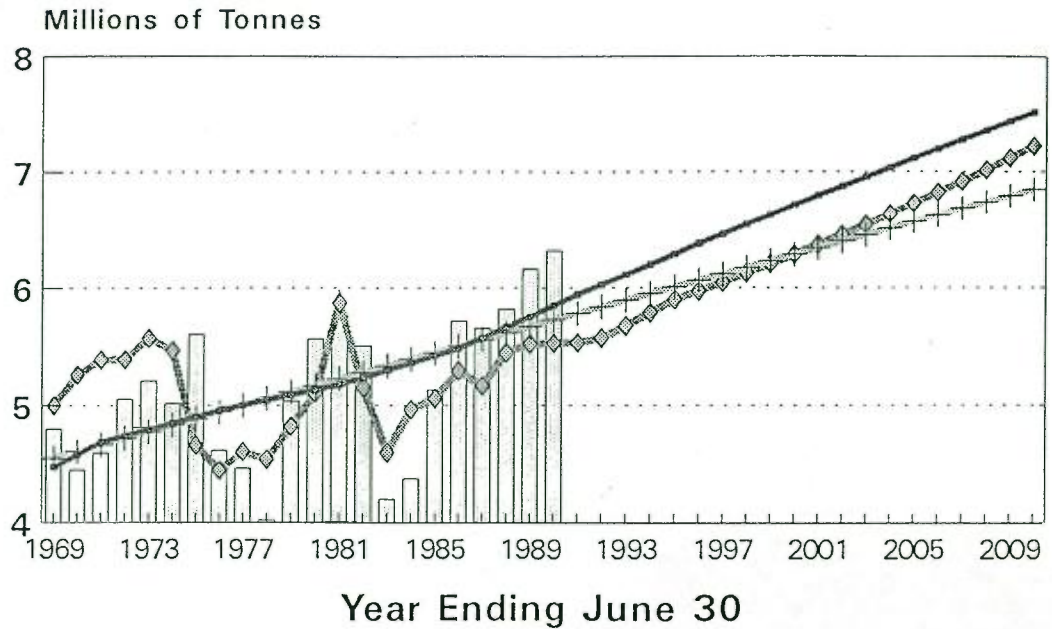


Figure 4
PAST & FORECAST DEMAND FOR
CONSTRUCTION SAND IN SYDNEY

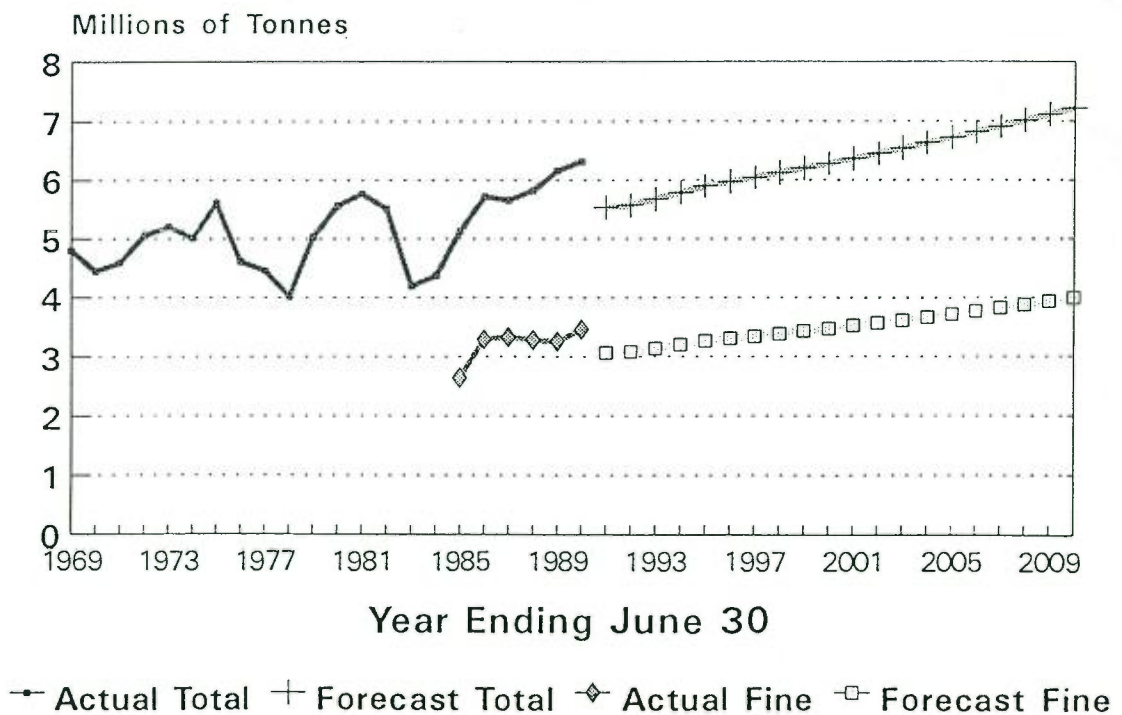


Figure 5
PAST & FORECAST DEMAND
FOR FINE SAND IN SYDNEY



OPERATION

- 1: Pioneer (Kables Transport Pty Ltd) - Newnes Plateau
- 2: CSR Readymix - Londonderry
- 3: Pioneer (Central Coast Sands Pty Ltd) - Somersby
- 4: Pioneer - Kurnell
- 5: Pioneer and CSR Readymix - Penrith Lakes
- 6: Metromix Pty Ltd - Anna Bay
- 7: Pioneer (Bridge Sands Pty Ltd) - North Richmond
- 8: Metromix Pty Ltd - Kurnell

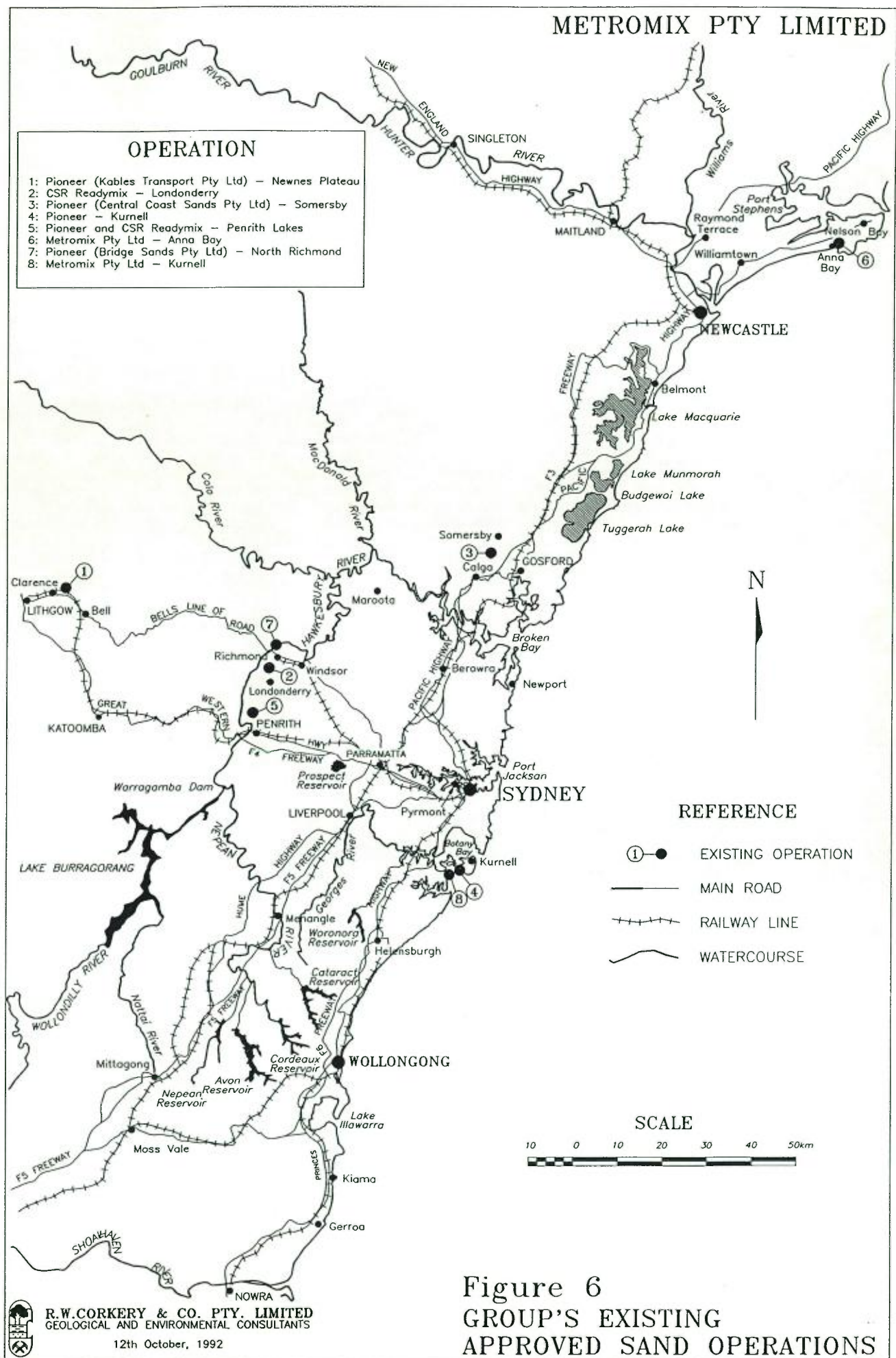


Figure 6
GROUP'S EXISTING
APPROVED SAND OPERATIONS



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TABLE A
Alternative Approved Fine Sand Resources Controlled by the Group

Location	Map Ref.*	Company	Type of Sand**	Distance from Sydney CBD (km)	Current Production (Mtpa)	Potential Increase in Production (Mtpa)	Economic Life (Years)	Capacity as an Alternative Source
Clarence	1	Kables Transport Pty Limited (wholly owned by Pioneer)	Fine to full graded (clean and clayey)	135	0.3-0.4	0.1	> 10	Low to moderate - due to distance and angular grain shape
Londonderry	2	CSR Readymix	Fine sand (clean and clayey)	53	0.25	0.1	5-10	Moderate only in the short term - Area west of Parramatta in particular.
Somersby	3	Central Coast Sands Pty Limited (Pioneer)	Fine sand (clean and clayey)	75	0.25-0.3	0.05	> 10	Moderate - Northern Sydney Suburbs in particular
Kurnell	4	Pioneer	Fine sand	31	0.1	0	< 5	None - this source is used primarily as a filling sand

Source: R. W. Corkery & Co. Pty Limited (in prep)

* See Figure 2

** All sands with the exception of 4 are sub-angular to angular.

4.3 Other Existing Approved Operations

Other existing fine sand operations are reviewed in this section in terms of the natural occurrence of the sand, that is, dune, riverine/estuarine, river terrace or derived from friable sandstone. The use of waste materials as a substitute for fine sand is also covered. Figure 7 shows the location of all significant approved fine sand sources that could potentially contribute to the replacement of the shortfall when Metromix's Kurnell operation closes.

Table B lists the alternative approved natural fine sand sources and their estimated resource size and economic life. Information presented on Table B is based upon the best data available to Metromix. In some cases, assumptions have been made in the absence of appropriate data particularly with respect to limitations imposed by environmental constraints and approval conditions or existing use rights conditions. A summary of the operations in each of the resource types is set out below.



TABLE B
Resource Size of Alternative Approved Natural Fine Sand Resources

Owner/Operator	Location	Map Ref.	Resource Size (Mt)			Economic Life			Source Ref.**
			<1	1-5	>5	<5	5-10	>10	
DUNE SAND OPERATIONS									
Sydney Region Rocla Quarry Products	Kurnell	9		o			x		IS
Stockton Bight Area Quality Sand and Ceramics	Williamtown	10		o				x	IS
Toll Bulk Sands	Williamtown	11		o	-		x		IS
Boral	Stockton	12						x	IS
Rocla Quarry Products	Anna Bay	13		o			x		IS
Illawarra Area Cleary Bros (Bombo)	Gerroa	14		o				x	5
RIVERINE/ESTUARINE SAND OPERATIONS									
Sydney Region Benedict Sands	Chipping Norton	18	x				x		IS
Boral Resources	Lansvale	19	x				x		IS
Illawarra Area Dunmore Sand and Soil	Dunmore	15	x				x		5
Shellharbour Municipal	Dunmore	16		o				x	5
South Coast Equipment	Primbee	17	x				x		5
RIVER TERRACE SAND OPERATIONS									
Sydney Region Readymix Group*	Londonderry	2		o				x	IS
P.B. White	Londonderry	20	x					x	IS
Premium Sand	Elderslie	21	x					x	IS
Benedict Sand	Elderslie	22		o				x	IS
L.S. Martin	Maroota	23	x					x	3
P.F. Formation	Maroota	24		o					x
FRIABLE SANDSTONE OPERATIONS									
Sydney Region Joe Taylor Sands	Appin	25	x				x		IS
P.F. Formation	Maroota	24		o				x	3
Central Coast Area Central Coast Sands*	Somersby	3			-			x	IS
Calga Sands	Calga	26		o				x	4
Hoipo & Son	Somersby	27		o					IS
Rindeen Sands	Somersby	28	x					x	IS
Blue Mountains Area Kable's Transport*	Clarence	1			-				IS
Rocla Quarry Products	Bell	29			-			x	IS
Boral Resources	Clarence	30			-			x	IS
Southern Highlands Area Rocla Quarry Products	Mittagong	31			-			x	IS
Stafford Mining	Penrose	32			-			x	IS

Source: R. W. Corkery & Co. Pty Limited (in prep).

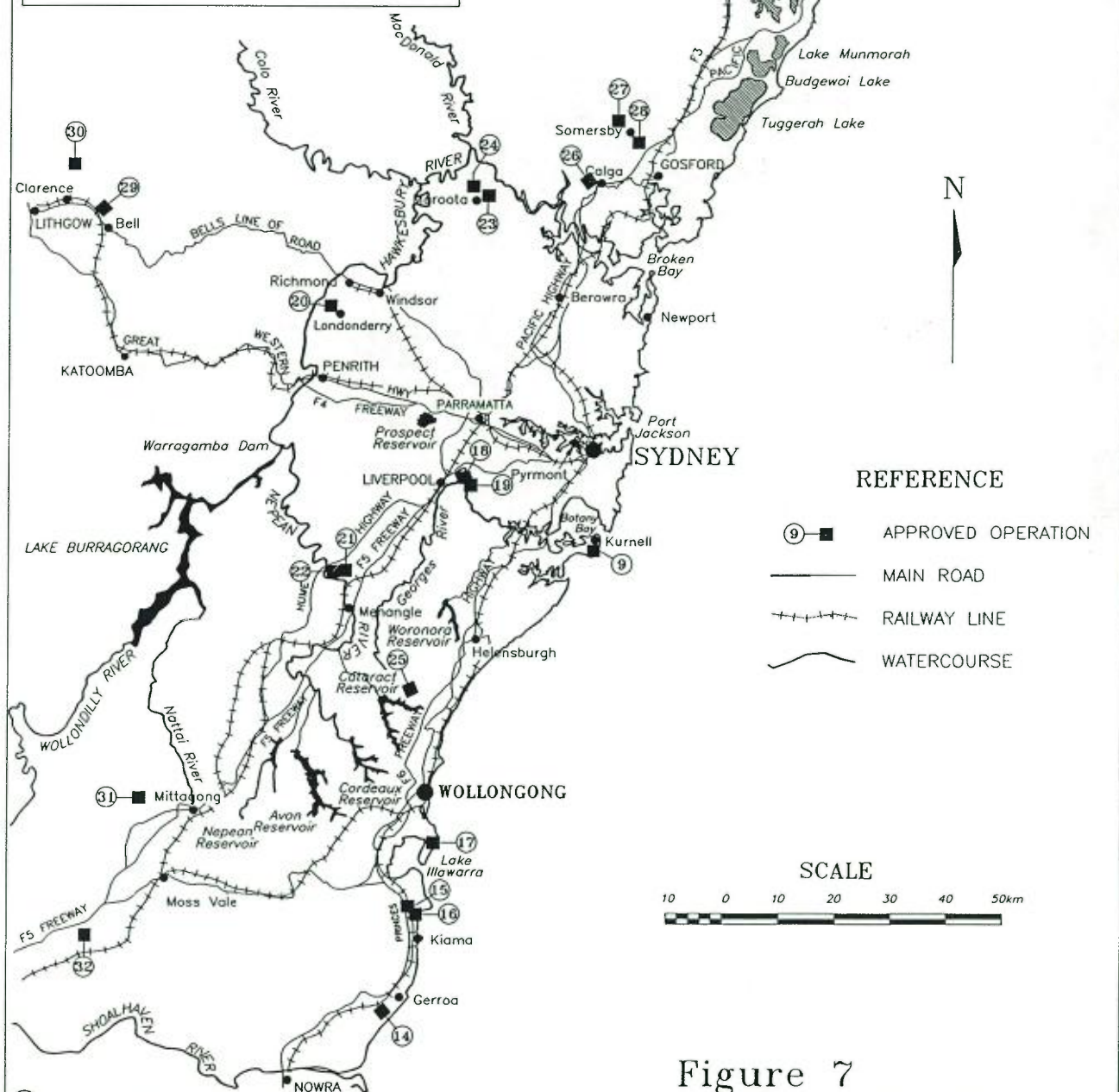
* Controlled by Pioneer/CSR-Readymix/Metromix

** IS - Industry Sources. See References section for other references.



OPERATION

- 9: Rocla Quarry Products - Kurnell
- 10: Quality Sand & Ceramics - Williamtown
- 11: Toll Bulk Sand - Williamtown
- 12: Boral Resources - Stockton
- 13: Rocla Quarry Products - Anna Bay
- 14: Cleary Bros (Bombo) Pty Ltd - Gerroa
- 15: Dunmore Sand and Soil - Dunmore
- 16: Shellharbour Municipal Council - Dunmore
- 17: South Coast Equipment - Primbee
- 18: Benedict Sands - Chipping Norton
- 19: Boral Resources - Lansvale
- 20: P.B. White - Londonderry
- 21: Premium Sand - Elderslie
- 22: Benedict Sand - Elderslie
- 23: L.S. Martin - Maroota
- 24: P.F. Formation - Maroota
- 25: Joe Taylor Sands - Appin
- 26: Calga Sands Pty Ltd - Calga
- 27: Hoipo & Son Pty Ltd - Somersby
- 28: Rindeen Sands Pty Ltd - Somersby
- 29: Rocla Quarry Products - Bell
- 30: Boral Resources - Clarence
- 31: Rocla Quarry Products - Mittagong
- 32: Stafford Mining - Penrose



REFERENCE

- ⑨ ■ APPROVED OPERATION
- MAIN ROAD
- - - RAILWAY LINE
- ~ WATERCOURSE

SCALE

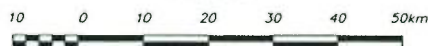


Figure 7
ALTERNATIVE APPROVED
FINE SAND OPERATIONS



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Dune Sand Operations

Rocla Quarry Products operates a dune sand operation at Kurnell producing comparable sand products to Metromix. Although resources under the control of Rocla Quarry Products are thought to be in the order of 5 Mt, it is possible that Rocla's lease will be extended beyond the end of 1998 because of the owner's intention to develop the site. Irrespective of development plans for the area, the estimated date of 1998 for Rocla to cease operations at Kurnell is also considered realistic given the likely increase demand for Kurnell dune sand after Metromix's operation closes in 1993.

The only other significant approved dune sand operations are considerably more distant from Metromix's existing markets served from the Kurnell sand dunes. These are at Stockton Bight (190 km from Sydney) and Gerroa (120 km from Sydney). The Stockton Bight operations are only able to economically provide sand to the Sydney markets because the sands are not processed and a significant proportion (up to 50 per cent) of the sand is transported as backloads in trucks transporting scrap metal and other materials to Newcastle. The availability of back loads limits the amount of competitively priced fine sand that can be imported to Sydney from the Stockton Bight area to between its current estimated level of 0.05 Mtpa and an upper level of about 0.2 Mtpa. The total approximate approved extractable resource in the Stockton Bight area is thought to be in the order of 12 to 13 Mt. It is likely that the bulk of the resources in the Stockton Bight area would be marketed in the Newcastle/Lower Hunter area.

The dune sand deposit at Gerroa extracted by Cleary Bros (Bombo) Pty Ltd is not considered to be a replacement for the Kurnell sand since the method of extraction (dredging) blends the upper fine dune sands with lower coarser sands to produce a well graded concrete sand. It is intended for use in the local area where construction sand resources are also comparatively scarce.

Riverine Sand Operations

The principal riverine sands that are currently supplying fine sand to the Sydney market are located within or near the Georges River. Sands in the Nepean-Hawkesbury River are medium to coarse grained.

The two operations in the Sydney Region listed in Table B collectively have a total resource of approximately 2.5 Mt and therefore a short economic life. Some of the sands have a higher proportion of charcoal, silts and clays and are not useful for concrete making.

Negligible quantities of sand from the three operations in the Illawarra Area are transported to Sydney because of local demand. In fact, substantial quantities of sand are imported to the Illawarra area annually.



River Terrace Sand Operations

The Londonderry/Agnes Banks area, Maroota area and the Elderslie area are the principal river terrace sand provinces in the Sydney district. The resources approved for extraction in these areas are estimated to be approximately 13 Mt. The bulk of the approved deposits in these areas are likely to be fully extracted in the next 5 to 10 years.

Friable Sandstone Operations

The abundance of sandstone occurrences within and surrounding the Greater Sydney Metropolitan Area provides an opportunity for the recovery of sand from units within the sandstone that are either deeply weathered or poorly cemented.

These operations are limited in the Greater Sydney Metropolitan Area to operations at Maroota and a minor operation near Appin. The principal friable sandstone operations are to the north in the Calga/Somersby area, to the west on the Newnes Plateau and to the southwest in the Southern Highlands area.

The approved operations in the Calga/Somersby area collectively have a resource size of approximately 5 Mt of fine construction sand. A considerable proportion of the materials from these deposits is suited to, and approved for, the production of mortar sand. In fact, limitations are placed on the volume of sand washed. The three approved sources on the Newnes Plateau collectively have approved total resources in excess of 40 Mt of which approximately 25 to 30 Mt would be fine sand. The bulk of these resources have an economic life well in excess of 10 years.

All sand products from friable sandstone deposits are different to dune sand products since the grains are more angular which according to some industry sources improves strength of concrete products (e.g. blocks and pipes). However, the more angular grains reduce the workability and pumpability of concrete manufactured with that type of sand.

Waste Materials

The use of waste materials produced during industrial processes or recycling has long been recognised as having a dual benefit with disposal costs being saved and the useful life of natural resources being extended. It is important when considering waste materials as raw materials for the construction industry that their value as an alternative material be based upon quality, the intended use and price. Waste materials are used in some applications, such as filling purposes, because specifications are not so stringent. Conversely, specifications or market preference for some sand types results in waste materials being overlooked in preference to sands available from more distant sources.

Table C lists the principal waste materials that are already used or have potential as a substitute for sand and summarises matters relating to their source, characteristics, range of uses and use as an alternative to fine sand.



The principal waste materials successfully used in concrete are crusher dust (from hard rock) and granulated blast furnace slag. Both by-products are extensively sought for other more valuable products and their availability for other uses is limited. Coarser slag products are achieving a greater degree of acceptance in the concrete industry.

The bulk of waste products are more suited for coarse aggregate or mixed grainsize products such as roadbase. It is difficult to economically achieve a uniform fine grainsize, and since crushing is often involved, the sand grains are angular which restricts its use, compared with dune sand.

4.4 Economic Life of Approved Deposits

Reference to **Table B** reveals that the bulk of the operations within the Sydney Region would be closed before the year 2000. Barnett (in prep) forecasts significant changes to Sydney's sand supply during the 1990's resulting from these closures. **Figure 8** presents the forecast reductions in fine sand production within the Sydney Region. The productive capacity lost as a result of these closures would amount to approximately 2.3 Mt of fine sand per year. Barnett (in prep) recognises that it is not only the fact that there is lost production capacity but there would be no producing extractive sites east of Parramatta, where the demand for fine sand is largely located. He also concludes that unless new sources, such as some of these discussed in Section 5, are developed in areas east of Parramatta, the higher cost of construction sand will affect the cost of residential, commercial and industrial developments.



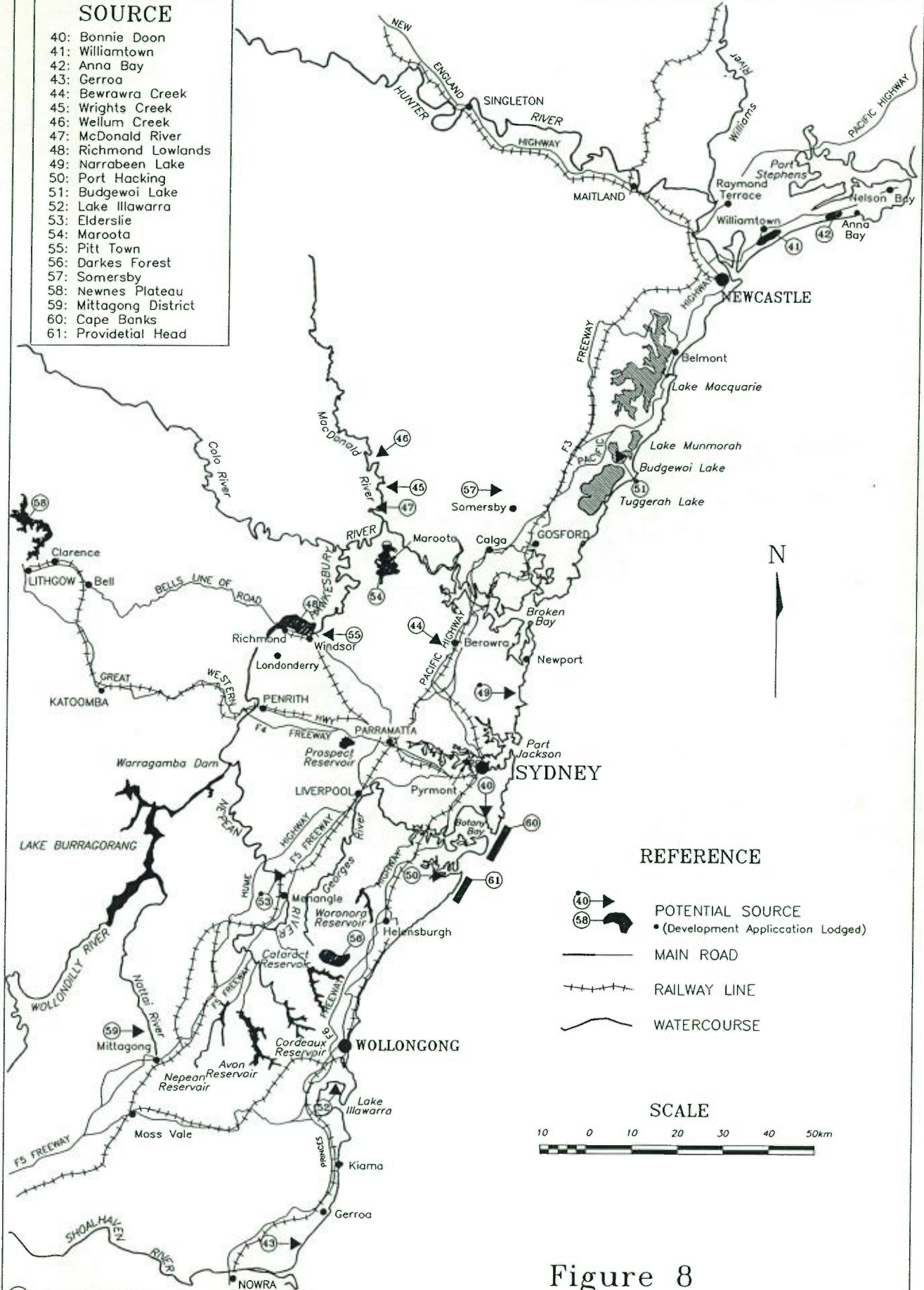
TABLE C
Waste Materials as Alternatives to Sand

Material	Source	Characteristics	Range of Uses	Use as an Alternative to Fine Sand
Crusher Dust	Finest product produced from crushing of hard rock (essentially a by-product)	Well graded material generally <6 mm in size	Prepared road base, bedding for pavers etc, filling, concrete	Limited because of: i) grainsize not appropriate; ii) its use/demand in other products; iii) limited availability (as a by-product); and iv) remoteness of sources.
Blast Furnace Slag	By-Product of iron making. Slag when quenched with water forms granulated slag. Produced only in Wollongong and Newcastle.	Glassy, angular, off-white to golden, coarser than fine sand and full graded.	Ground slag is used in cement, coarse aggregate and coarse sand in concrete. (Note: Fine sand is still required when ground slag is used in concrete).	Limited because: i) grainsize not appropriate; ii) greater economic returns when used for cement; iii) limited use as fine sand because of its grain size, angular and abrasive nature iv) remoteness of sources.
Building Materials	Recycling centres crush concrete from old buildings producing a range of products including crusher dust.	Variable quality - dependent on source/age of concrete. Well graded, generally <6 mm in size ("dust").	Bedding for pavers etc, filling between footpaths, slabs.	Very limited because: i) grainsize not appropriate; ii) variable quality; iii) greater economic return when coarse aggregate is produced; and iv) small quantities crushed (<0.5 Mtpa - yielding <0.1 Mtpa "dust")
Excavated Materials	Building foundations, excavations for swimming pools or other structures in sand. (Generally Eastern Suburbs).	Variable quality generated in small quantities, grading acceptable (unless contaminated).	Filling	Very limited because: i) varied availability; and ii) small quantities produced (<0.1 Mtpa).
Foundry Sand	Discarded moulds from foundries - often available through recycling companies.	Various colours and strengths, chemical binders soluble and leach out.	Filling or re-use as foundry sand.	Not suitable except for fill because of: i) presence of chemical binders; and ii) limited availability.



SOURCE

- 40: Bonnie Doon
- 41: Williamtown
- 42: Anna Bay
- 43: Gerroa
- 44: Bewrawra Creek
- 45: Wrights Creek
- 46: Wellum Creek
- 47: McDonald River
- 48: Richmond Lowlands
- 49: Narrabeen Lake
- 50: Port Hacking
- 51: Budgewoi Lake
- 52: Lake Illawarra
- 53: Elderslie
- 54: Maroota
- 55: Pitt Town
- 56: Darkes Forest
- 57: Somersby
- 58: Newnes Plateau
- 59: Mittagong District
- 60: Cape Banks
- 61: Providetial Head



REFERENCE

- (40) → POTENTIAL SOURCE
- (Development Application Lodged)
- MAIN ROAD
- ++++ RAILWAY LINE
- WATERCOURSE

SCALE

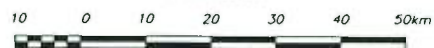


Figure 8
ALTERNATIVE POTENTIAL
FINE SAND SOURCES



R.W.CORKERY & CO. PTY. LIMITED
GEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

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5.0 POTENTIAL FINE SAND RESOURCES

This section reviews the occurrences of sand within and surrounding the Greater Sydney Metropolitan Area and discusses those areas where potential fine sand resources have been identified or are likely to occur.

The potential resources are considered in terms of whether there are current proposals to extract fine sand or whether they are simply potential sources for which no proposals have yet been formulated. Each proposal or potential source has been reviewed in terms of the size of the resource (if identifiable), the quality of the sand, whether extraction is feasible, and the potential environmental issues that would influence any proposal for sand extraction (R W Corkery & Co Pty Limited, in prep).

It is important to recognise that whilst the resources are reported as "potential", there is no certainty that all of the approvals necessary to permit development of all or part of these deposits would be obtained.

Apart from Metromix's proposal to extract marine aggregate from two offshore areas south of Sydney, the potential fine sand resources reviewed in this section are restricted to onshore locations. Whilst there are other marine aggregate deposits present off the New South Wales coast (Mining Tenement Management, in prep), they are not considered as potential alternatives at this stage since they

- (i) have a different grainsize to Kurnell sand (finer or coarser);
- (ii) occur in different types of geomorphological environments;
- (iii) require substantial study and evaluation before any proposals for extraction are considered; and
- (iv) are commonly remote (100 km+) from Sydney.

Table D presents a summary of the current proposals and potential sources of fine sand within the Greater Sydney Metropolitan Area and beyond. The location of each of these is presented on **Figure 8**.

A summary of each resource type and the major resources within each type is set out on the following pages.



TABLE D
Potential Fine Sand Resources

Type of Deposit/District	Location	Map Ref.	Estimated Resource (Mt)	Status*	Source Ref. **
DUNE SAND					
<i>Sydney</i>	Kurnell	4/8	Large #	NPUC	IS
	Bonnie Doon	40	1.5-5.0	PUC	20
<i>Stockton Bight Area</i>	Williamstown	41	Large #	PUC	IS
	Anna Bay	42	Large #	PUC	IS
<i>Illawarra Area</i>	Gerroa	43	3.6	NPUC	5
RIVERINE/ESTUARINE SAND					
<i>Sydney</i>	Berrowa Creek	44	1.35	PUC	1
	Wrights/ Wellum Creeks	45/46	40	NPUC	6
	McDonald River	47	20	NPUC	6
	Richmond Lowlands	48	115	NPUC	13
	Narrabeen Lake	49	1.1	DAL	22
	Port Hacking	50	2.2	PUC	21
<i>Central Coast Area</i>	Budgewoi Lake	51	7	DAL	24
<i>Illawarra Area</i>	Lake Illawarra	52	1.5	PUC	5
RIVER TERRACE SAND					
<i>Sydney</i>	Elderslie	53	0.6	DAL	27
	Maroota	54	42	PUC	3
	Pitt Town	55	7	PUC	11
FRIABLE SANDSTONE					
<i>Sydney</i>	Darkes Forest	56	15	NPUC	IS
	Maroota	54	36	PUC	3
<i>Central Coast Area</i>	Somersby	57	16	NPUC	IS
<i>Blue Mountains Area</i>	Newnes Plateau	58	16	NPUC	IS
<i>Southern Highlands Area</i>	Mittagong Area	59	35	NPUC	IS
MARINE AGGREGATE					
<i>Sydney</i>	Cape Banks	60	50	PUC	10
	Providential Head	61	68	PUC	10

Source: R. W. Corkery & Co. Pty Limited (in prep)

* Status: D.A.L. - Development Application Lodged (not yet determined)
P.U.C. - Proposal Under Consideration.
N.P.U.C. - No Proposal Under Consideration.

** IS - Industry Sources. See References section for other references.

Resource Size not quantified but considered to be at least 25 Mt.



Dune Sand Deposits

Substantial quantities of fine sand still remain at Kurnell. However, Local and State Governments have directed that no new sand extraction operations should be commenced and that existing operations on Kurnell Peninsula should be phased out (Sydney REP 17).

A remnant sand dune beneath the Lakes Golf Club at Bonnie Doon with reserves of between 1.5 and 5.0 Mt could yield a high quality fine sand which would principally serve the requirements of the CBD and, eastern and western suburbs for a short period. The size of the resource is such that it would not be a long term replacement for Kurnell. It is noted the optimum use for this sand is for glass manufacture and foundry use. Given the level of opposition already marshalled against extraction, obtaining approvals to extract sand on the site would be difficult.

Riverine/Estuarine Deposits

Five of the eight potential riverine/estuarine deposits listed in Table C are comparatively small and could not be considered as long term alternatives to Kurnell. The remaining three deposits, all located on Sydney's northwestern outskirts are unlikely to be approved for extraction in the foreseeable future should proposals be developed for their extraction. These are located at Wrights/Wellum Creeks (Ref.No 45/46), McDonald River (Ref.No 47) and Richmond Lowlands (Ref.No 48).

Neither the Wrights/Wellum Creeks nor McDonalds River deposits have been the subject of any substantive proposals primarily because important issues such as truck transport across the Hawkesbury River (currently by ferry only) and the upgrading of the road network from the Hawkesbury River to the deposits have not yet been resolved. Extraction of these deposits would most likely involve disturbance to the existing drainage system since the deposits are located within the river and creek systems and not elevated above them.

It is possible that limited extraction could occur from time to time within the channel of the Hawkesbury/Nepean River System to maintain navigable waterways along the river or to assist in general environmental enhancement programmes. Given that the bulk of the sand in areas likely to be the subject of this type, in extraction of coarse sand, production of sand from these sources would not assist generally in supply of the shortfall created as production progressively ceases at Kurnell.

The fine sand resource identified at Richmond Lowlands is part of a large undeveloped deposit of fine and coarse sand and gravel beneath the alluvial flats of the Hawkesbury Nepean River systems to the north of Richmond. It is noted that the fine sand grains at Richmond Lowlands are more angular than the Kurnell sand grains.

Geological investigations by Oakes (1980) revealed that the deposit contains an estimated 115 Mt of fine sand, 114 Mt of coarse sand, 61 Mt of river gravel, and some soil. A substantial proportion of the fine sand identified in the Richmond Lowlands deposit occurs in the upper section, and would be amongst the first materials removed.



Extraction of sand and gravel from the Richmond Lowlands would be the subject of a wide range of environmental issues including:

- (i) occurrence of substantial areas of prime agricultural land used for growing vegetables for Sydney's increasing population. Richmond Lowlands contains 46 per cent of the Class 1 agricultural land in the Sydney Region (Sydney REP 20). Turf production is also important in this area;
- (ii) heritage aspects relating to early agricultural production;
- (iii) occurrence of important freshwater wetlands;
- (iv) flooding and the effects downstream;
- (v) occurrences of small pockets of forest red gum;
- (vi) the inadequacy of the local road network; and
- (vii) close proximity of residential properties.

Sydney REP 9 suggests that any delineation of potential sand extraction areas would require consultation between the Departments of Agriculture, Planning and Mineral Resources. The 1984 Regional Environmental Study recognised the similarity of the Richmond Lowlands deposit and the deposit currently being extracted at Penrith Lakes. Before extraction is contemplated, the need for a second "Penrith Lakes" system would need to be evaluated.

Sydney REP 9 recommended that gravel extraction should be undertaken in conjunction with sand extraction. That approach is to ensure that the more valuable gravel deposits were not extracted leaving the separated sand for later extraction and use. The same policy would no doubt apply to the selective extraction of the fine sand. Standard industry practice (enforced or encouraged by consent conditions) is to operate in one area until extraction is completed and then move on to subsequent areas while rehabilitation proceeds. If extraction were permitted at Richmond Lowlands, it is likely to require the joint production of fine and coarse sand and gravel, that is the production of fine sand would be inhibited by the overall rate of extraction and the location of the fine sand within the overall deposit.

Sydney REP 9 has been amended to ensure that future extraction from the Richmond Lowlands is only permitted after Council has made an assessment of the range of issues directly associated with potential extraction e.g. life of existing extractive operations and agricultural, heritage, tourist and environmental values. (Sydney REP 20, 1989).

The likely timing of extraction at Richmond Lowlands, if it were approved or partly approved, is considered unlikely before the approaching completion of the Penrith Lakes extraction (2005-2010). Furthermore, the wide range of environmental issues would need to be resolved and an overall framework developed for extraction before any individual applications for extraction approval could be considered. Given these requirements, it is unlikely that extraction could commence within 15 years, that is well beyond the period when Kurnell ceases as a source of fine sand to Sydney.



River Terrace Deposits

The two main potential river terrace deposits within the Sydney Region are located at Maroota (Ref.No 54) and Pitt Town (Ref.No 55). By far, the largest resource is at Maroota where in a Plan of Management for the resources at Maroota, Resource Planning (1991) estimates approximately 45 Mt of poorly sorted sand is present. The quantity of fine sand that could be produced from this resource is not known. Land containing 27 Mt of the defined reserves has already been purchased by potential operators although only small quantities (<2.6 Mt) are currently approved for extraction.

The principal environmental issues that need to be addressed in future applications at Maroota include:

- (i) conflicts with horticulture and orcharding interests;
- (ii) impacts upon the existing groundwater regime;
- (iii) visual quality of the area;
- (iv) trucking of products on local roads; and
- (v) proximity of local residents, particularly with respect to noise.

Given the comparatively close proximity of the resource to the Sydney CBD (65 km), there is likely to be considerable effort undertaken during the 1990's to overcome or sufficiently ameliorate the potential impacts of the ongoing sand extraction in the Maroota area. It is however, difficult to estimate what proportion of the 45 Mt would become available for extraction over the next 25 years.

The Pitt Town deposit is a clayey sand capable of producing mortar sand and fine concrete sand, when washed. Considerable opposition to extraction of this deposit is already evident. A Plan of Management prepared jointly by the Departments of Mineral Resources and Planning (1990) for the extraction of the remaining resources at Pitt Town has been rejected by the Hawkesbury City Council. Almost 50 per cent of the defined deposit has been sterilised by competing land uses to date.

Friable Sandstone Deposits

The friable sandstone deposits on the fringe of and beyond the Sydney Region are likely to become a major source of fine (and coarse) sand supplying the Sydney market throughout the 21st Century and beyond. These deposits are 65 to 140 km from Sydney's CBD and each has its own set of environmental constraints. These constraints generally relate to water quality in nearby, often undisturbed, catchments, visibility, ecological and archaeological aspects, and traffic related matters.



The closest potential resources occur at Maroota where Resource Planning (1991) has defined in excess of 40 Mt of friable sandstone resources, 2.4 Mt of which is on land controlled by Industry, but not yet approved for extraction. The environmental issues that need to be addressed should any proposals proceed are similar to those outlined above for the river terrace sand deposits at Maroota.

It is again noted that the angular nature of this type of sand is noticeably different from the rounded nature of the Kurnell dune sand.

Marine Aggregate

Extensive exploration along the coast off Sydney has defined two areas containing sand comparable in grain size and shape to Kurnell dune sand. Metromix Pty Limited proposes to extract 50 Mt and 68 Mt respectively from the Cape Banks (No. 60) and Providential Head (No. 61) Extraction Areas. Almost half of the sand in each area is ideally suited for use in concrete. An EIS is currently being prepared for the proposal addressing a wide range of issues including: shoreline stability, marine ecology, maritime archaeology, sea water and sediment chemistry, professional/recreational uses of the area, visibility and shipping related matters.

6.0 EVALUATION OF FINE SAND SOURCES

6.1 Introduction

The forecast changes in the availability of fine sand discussed in this section highlight two periods when alternative fine sand sources will be needed. Firstly, after Metromix's Kurnell operation closes in 1993 and secondly, later this decade, possibly in about 1998, when all sand extraction ceases at Kurnell and at other sites within the Sydney Region (eg Londonderry/Georges River).

The evaluation of alternative fine sand sources is undertaken in the context that the replacement of the Kurnell fine sand source is both an industry and community problem. The industry needs to obtain the necessary raw materials required for the products upon which their businesses are based and the community requires the products at a reasonable price for the maintenance of the standard of living considered appropriate for Sydney. Underlying both requirements is the need for raw materials to be extracted and delivered in an environmentally responsible manner.

The principal issues that need to be considered in the evaluation of alternative sources, are as follows:

1. Quality

The issue of quality of fine sand is dependent upon a range of factors. When used in concrete, the important characteristics are grading, composition, uniformity of grain size and grain roundness. For uses such as rendering and tiling, factors such as colour and grain roundness are important. The ability to pump concrete particularly within highrise buildings is enhanced through the use of rounded sand grains.



2. Availability

The availability of sand is a function firstly of whether the deposit has all the necessary approvals for extraction and secondly whether the markets for the sand are tied to a particular customer or in-house use.

3. Distance from Markets

Transportation is a significant factor in the delivered cost of sand. Historically, sand has been sourced locally for most uses, however, reduced availability and dwindling reserves has resulted in sand (and other raw materials) being transported greater distances to markets, making transport costs a major component of delivered prices.

4. Environmental Impact

It is not possible simply to consider potential alternative sources in terms of the size and type of the resource since every resource has its own set of environmental constraints which may partially or fully restrict the extraction of that resource.

In broad terms, extraction of onshore sand deposits can involve a change in land use (e.g. Penrith Lakes), and pose potential environmental problems relating to loss of vegetation, siltation of streams, disposal/management of clay tailings and the wide range of issues involved with transportation such as noise, road damage, pollution, health and safety.

5. Price

The choice of raw materials is very dependent upon price since it remains fundamental that products manufactured using sand must be cost competitive in the market place. The principal factors that influence price relate to:

- (i) the quality of the sand, (sands with more preferred characteristics and fewer impurities command higher prices);
- (ii) reliability of sources (e.g. dependence on backloads);
- (iii) extent of processing required, and most importantly;
- (iv) transportation costs (see 3 above).

6.2 Alternative Sources after 1993

The shortfall required by industry immediately after Metromix closes their Kurnell operation could be satisfied from existing approved operations in the short term.

Table E lists the estimated capability of each type of operation to increase production to satisfy that shortfall. It is emphasised that it is often difficult with operations that produce both brickies sand and fine washed sands to estimate the proportion of fine washed sands as this varies from operation to operation and from year to year.



TABLE E
Potential Capacity of Existing Approved Fine Sand Operations

Type of Operations	Potential Maximum Increase (t)*
Dune	450 000
Riverine	Nil
River Terrace**	100 000
Friable Sandstone**	650 000

* Above existing average capacity

** Production estimate of washed sand (that is, excluding mortar sand)

Given that the shortfall after the Metromix Kurnell operation closes is likely to be in the order of 0.5 Mt, the type of operations listed in Table E will no doubt be able to supply the market requirements for at least five years.

The principal operation, external to those operated by the Group, likely to have the capacity to supply the fine sand shortfall would be Rocla Quarry Products at Kurnell given its comparable product and proximity to markets. The other more distant operations that could for example contribute to satisfying the shortfall could be P.F. Formation Pty Ltd at Maroota and Calga Sands Pty Ltd at Calga.

It is recognised that production of additional quantities of sand at the Rocla Kurnell operation would only be of short term duration and would serve to shorten the remaining life of the operation.

The approach taken above is somewhat simplistic when considering supply and demand for a market as large as Sydney since it is important to consider other factors that will change principally because of the geographical structure of the market. These factors relate mainly to the additional truck transportation that will occur since it is most unlikely that the full shortfall would be satisfied entirely by Rocla Quarry Products at Kurnell.

A further problem in considering the supply and demand in this manner is the issue of continuity of supply. It is essential that new sources of fine sand are developed and brought up to projected market levels well before other sources are depleted.



6.3 Alternatives Sources after 1998

The consideration of alternatives beyond 1998 is intended to coincide with the closure of the Kurnell operation of Rocla Quarry Products. The actual year of closure is uncertain and will no doubt be influenced by the increased sales that are likely to occur when Metromix's operation closes at Kurnell.

In the absence of approvals for extraction at any of the major sources listed in **Table D**, by 1998, the number of existing approved operations within the Greater Sydney Metropolitan Area will have decreased with the only major sources being at Elderslie and Maroota, 60 and 65 km respectively from Sydney's CBD. The approved resources at both these locations would be limited, unless, in the case of Maroota existing resources are approved for extraction in the meantime.

If one closely examines the alternative potential sources that could have reasonable potential to be developed within the Greater Sydney Metropolitan Area, east of Parramatta, all of these only offer a short term solution to the need for fine sand in Sydney, particularly the CBD and inner suburbs, currently serviced from Kurnell.

In the longer term, and in the absence of marine aggregate, Sydney's fine sand would be drawn principally from friable sandstone deposits at Maroota, Central Coast, Blue Mountains and Southern Highlands. For uses such as rendering and tiling where the sand grains need to be rounded, the industry would most likely obtain its supplies from the Stockton Bight Area.

Colston Budd Hunt and Twiney (in prep) indicates that this scenario (without marine aggregate) would result in a traffic level six times greater than the level if marine aggregate is extracted and distributed from Pymont. That is, for a production level of 1 Mtpa, trucks would travel 8.8 million km more per year, a level which would potentially increase accidents and no doubt increase road damage.

7.0 CONCLUSION

A review of past production rates and forecasts of demand for fine sand to at least the year 2010 reveals that Sydney, and its CBD and inner suburbs in particular, will continue to require sand at continually increasing rates. With the depletion of fine sand resources at traditional sites and potential for only a few small new sources (in areas east of Parramatta), it is forecast that existing sources could continue to supply the shortfall to about 1998 although there would be some increase in transportation of fine sand from more distant sources than Kurnell. Beyond 1998, one or more sources of fine sand would be required to satisfy Sydney's fine sand requirements particularly for suburbs east of Parramatta. It is imperative that whatever source(s) are developed to satisfy market requirements, commence well before 1998 to ensure they are able to achieve a production level of at least 1.0 Mtpa by that time.



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