APPENDIX 3

Assessment of Available Resources

Grafil Pty Ltd

Justification for the Re-zoning of Lot 220 in DP1049608 at Salt Ash and Lot 218 in DP1044608 at Williamstown, for Sand Extraction

March 2008

Don Reed & Associates Pty Ltd

Grafil Pty Ltd

Justification for the Re-zoning of Lot 220 in DP1049608 at Salt Ash and Lot 218 in DP1044608 at Williamstown, for Sand Extraction

March 2008

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CONTENTS

1. INTRODUCTION

The following is submitted in response to your instructions dated 7th December 2007 requesting independent verification of the regional and state significance of fine sand resources on the subject properties. It is understood that your company, Grafil Pty Ltd (Grafil) proposes to use such advice to justify applications to re-zone part of the properties for sand extraction. In order to confirm and highlight the regional and state significance of the sand resources the following report has been compiled and presented in order to:

- define what the state government deems to be a 'state significant' resource;
- provide a general description of the sand deposits on Worimi land;
- comment on sand quality and potential markets for processed sand products;
- provide an estimate of reserves of sand able to be extracted from the two Lots;
- comment on historical and future demand for Stockton Bight sand products;
- comment on the historical, and future value of Stockton Bight sand products;
- comment on the commercial value of the sand resources to regional economies
- provide expert opinion on the regional and state significance of the fine sand resources located on the two properties on the basis of the quantity and quality of sand reserves and state and regional demand for same

It needs be noted that this report has been prepared without final and definitive technical information in relation to site survey, exploration geology and representative sampling and testing. Conclusions are drawn on the understanding that the quarry operator will finalise requisite technical and planning studies prior to submitting final development applications..

Information, conclusions and recommendations are presented under the following headings:

2. DON REED AND ASSOCIATES

This report has been prepared by the principal of Don Reed & Associates (DRA) in his capacity as an experienced and expert consultant to the extractive industries. Don Reed is a qualified geologist and a Fellow of both the Australasian Institute of Mining and Metallurgy and the Institute of Quarrying. He has 35 years experience within the quarry industry, both in Australia and overseas. That experience has included fifteen years with major corporations Boral and Pioneer International (now Hanson / Hedelberg), in positions ranging from group geologist (Boral) to regional general management (Boral and Pioneer).

Don Reed & Associates (DRA) has acted as a specialist consultancy to the extractive industries since 1987. Clients include Federal, State and local government authorities, merchant and retail banks, multinational accountancy firms, major and independent quarrymasters, earthmoving contractors, mining companies and others. The author's Curriculum Vitae is attached as **Appendix A.**

DRA have undertaken detailed evaluations of sand resources for a wide range of clients including; all major retail banks, the Sydney Stock Exchange, mining and quarrying companies, major accountancy firms and the Land & Environment Court. Valuations

have been undertaken for sand resources located at; Kurnell, Penrith Lakes and Maroota in Sydney, Penrose, Kangaloon and High Range in the Southern Highlands, Dunmore in the Illawarra region, Jugiong and Wagga in Southern NSW, Newnes in the Blue Mountains, Macksville and Dunbogan on the North Coast of NSW, Brisbane & Townsville in Queensland and the Greater Melbourne area in Victoria.

DRA has undertaken and completed major studies of construction sand market supply and demand in 1991 (Sydney Metropolitan Area), 1998 & 1999 (Illawarra region) 2001, 2004, 2005 and 2007 (Sydney Metropolitan and Blue Mountains Areas).

3. SOURCES OF INFORMATION FOR THIS REPORT

As the principal of DRA, I understand that the data and conclusions presented in this report are to be used to help determine the regional and state significance of extractable sand resources on Lots 218 and 220. This report has been prepared for that purposes only and should not be used for any other purpose without the author's prior written consent.

In preparing this report, I have relied heavily on public and private sector information comprising published reports (Department of Mineral Resources and Department of Planning), industry data and anecdotal information from clients and long term colleagues. Despite substantial analysis I have not independently confirmed the accuracy or reliability of all of the information relied upon at the time of writing. As such, I reserve the right to review and amend assumptions, calculations and opinions included or relied upon in this report. Such amendments may become necessary in the light of information made available after the date of this report. .

4. THE DEFINITION OF REGIONAL AND STATE SIGNIFICANT RESOURCES IN NSW

The regional significance of the sand resources on Lots 218 and 220 can be demonstrated by their size and demand for product from local and regional markets. By local markets I mean the Stockton – Williamstown areas and immediate surrounds. By regional markets I refer to the greater Newcastle and Lower Hunter areas. A quarry producing and selling 500,000 tpa of product into local and regional markets at competitive price cannot be regarded as anything other than regionally significant. This significance is compounded within regions where alternative sources of supply are finite and limited.

What where until recently defined by the NSW State Government as 'State Significant' resources are now defined as being 'Major Developments'. The relevant statutory provisions defining what constitutes Major Development are provided within Schedule 1 of the *State Environmental Planning Policy (Major Projects) 2005* – refer Group 2, Item 7 for Extractive Industries. Inter alia, an extractive industry involving a resource of five million tonnes (5Mt) or greater and/or annual production of 200,000 tonnes or more, is deemed to be a Major Development (or being State Significant under the original definition).

Development applications for Major Developments are covered by the new Part 3A process (under the *Environmental Planning and Assessment Act 1979)* and are

required to be assessed by the Minister. The bottom line is that the Department of Planning (DOP) not local Councils becomes the consent authority for Major [State Significant] Developments. For reasons detailed below, both the Lot 218 and/or Lot 220 developments (for extractive industry) must be regarded as Major Developments, ie, as State Significant developments.

5. DESCRIPTION OF THE SAND DEPOSITS ON LOTS 218 & 220

There is a substantial amount of geological information available for the sand deposits located adjacent Stockton Bight and Port Stephens. Whilst I have reviewed location plans and logs for reverse circulation exploration holes drilled over Lot 218, I have principally relied in this report on geological data included (and referred to), in reports published by the NSW Geological Survey / Department of Mineral Resources. In particular, I have obtained and reviewed four reports sourced from senior departmental geologist, John Whitehouse. Reference documents provided by Whitehouse and relied upon in this report are entitled:

- *Sydney Construction Materials Strategy, Port Stephens – Draft Issues Paper* Prepared by the Department of Mineral Resources (DMR) for the Department of Infrastructural Planning and Natural Resources (DIPNR) – 7th September 2005.

- *Resource Assessment & Section 117(2) Direction No.G28Notification, Port Stephens LGA* – Geological Survey Report: GS2004/322 - HN Ray & J Whitehouse, November 2004.

- *Construction and Industrial Sand Resources – Stockton Bight-Port Stephens Area* Geological Survey Report: GS2002/463 - J Whitehouse, January 2003.

- *Sand Resources of the Stockton Bight-Port Stephens Area* – Geological Survey Report: GS1995/164 – J Whitehouse, July 1995.

The Stockton Bight - Port Stephens area has a dual sand barrier system, an *Outer Barrier* of Halocene age and an *Inner Barrier* of Pleistocene age. Lots 218 and 220 are both located within the outer barrier which extends from Stockton in the south to Anna Bay in the north. The sand dunes within this *Outer Barrier* began to form about 6,500 years ago and comprise strandplain, foredune and transgressive dunes. Lot 218 is best described as an active transgressive dune, whilst Lot 220 is described as a vegetated transgressive dune.

Whilst comprising a range of grain sizes, the dune sands of the *Outer Barrier* are well sorted, round to sub-rounded, quartz sands. They are generally free from shell, organics, sulphides and other deleterious materials. Individual sand grains within *Outer Barrier* dunes are all sized smaller than 1mm with 98-100% of grains sized smaller that 0.6mm (600 microns). By construction industry definition, all of the sands are fine grained, however the dune sands are coarsest in the southern dunes and finest in the northern dunes.

According to DMR geologists the dune sands are classified as medium fine grained in the Stockton - Fullerton Cove - Williamtown area and increasingly fine grained from Salt Ash through to Anna Bay. DMR geologists conclude that the medium fine sand is more suitable for concrete manufacture (and other construction material applications), whilst the finer graded sands more suitable as industrial grade sand used in glass manufacture and foundries.

Reference to Table 1, shows that the fine dune sands located along the western portion of Lot 218 are finer graded than the sands being produced by Boral and Tolls at their two quarries located within the southern portion of the Outer Barrier. Tabled results show that the sand proposed to be extracted from Lot 218 has nearly 50% additional particles sized smaller than 300 microns. All of the fine sands being extracted from the Boral and Toll quarries, as well as those proposed to be extracted from Lot 218, are eminently suited for sale as construction sands. Quality Sand and Ceramics have historically extracted and processed both construction and industrial / foundry sands from their pit immediately south of Lot 218.

The conclusion reached by DMR geologists that the fine sands located on Lot 220 would be more suitable for processing and sale as industrial sands is drawn from the fact that finer grained sands are more suitable for glass manufacture and other industrial sand applications. Reference to Table 1 shows sand sampled from Lot 220 having a similar grading to sand extracted by Unimin on adjacent property. Those sands are graded with 39-43% of grains sized smaller than 300 microns. As can be seen this figure compares to 32% on Lot 218 and 22-23% on the dunes being quarried by Boral and Tolls.

It is the difference in sand particle sizing ('gradings') between the fine dune sands deposited on Lot 218 and the finer dune sands located on Lot 220 that primarily differentiate between their end use potential and highlight the need to extract simultaneously from both Lots. The short term demand for separately specified construction and industrial sand products is highlighted later in this report.

Table 1: Fine Sand Product Gradings – Stockton Bight, Kurnell & Penrith Lakes

Sieve Size	**% Passing**				
	Boral & Toll Bulk Sands	**Lot 218 W/town**	**Lot 220 - – Salt Ash**	**Kurnell**	**Penrith Lakes**
1.18 mm	100	100	100	100	100
0.600 mm	98-99	100	100	96 - 100	95 - 97
0.425 mm	78-81	91	96	81 - 99	
0.300 mm	22-23	32	39-43	45 - 70	43 - 52
0.150 mm	0.5-1.0	0.5	1	1 - 10	4 - 6
0.075 mm	0.1-0.2	0.2	0.4	0 - 1	0 - 1

Also shown on Table 1 are gradings for fine grained construction sands quarried and processed at Kurnell and Penrith Lakes in Sydney. Fine sand from these two sources account for more than 85% of fine sand sales in the Sydney Metropolitan area with over 1M tonnes sold annually for ready mixed concrete manufacture. Kurnell has

been the long term source of most of Sydney's construction and industrial sands, however supply is down to a single source with limited reserves – refer detailed comment below..

6. SAND QUALITY AND POTENTIAL MARKETS FOR PROCESSED SAND PRODUCTS

Naturally occurring sands are generally categorised as either:

- medium to coarse grained river sands – derived from stream courses and/or floodplain deposits;
- fine to medium grained dune and estuarine sands – derived mainly from coastal dunes, estuaries and/or floodplain deposits; or
- clayey sands – these being fine to coarse grained sand containing clay and occurring mainly as leached alluvial deposits or deposits of friable sandstone.

As noted above, Lots 218 and 220 comprise fine graded dune sands which are well sorted, rounded to sub-rounded, quartz sands, generally free from shell, organics, sulphides and other deleterious materials. The sands are coloured white to yellow to brown, dependant on the degree of iron oxide staining present. The sands are eminently suitable for processing and sale as a full range of construction and industrial sands.

The principal uses for fine graded **construction sands** are in the manufacture of; ready mixed concrete, concrete tiles, concrete pipes, concrete bricks & pavers, prefabricated concrete, fibre cement and asphalt paving. Fine sand is also used as mortar [brickies] sand, bedding sand, fill sand, plaster, render and grout sand. It is less commonly used as a filter and drainage medium where coarser sands are generally preferred. Fine sand is also used at sporting facilities (golf courses, tennis courts etc) as well as for landscaping, horticulture and nursery propagation.

It needs be noted that almost 50% of total construction sand is supplied to a single market segment – ready mixed concrete manufacture. The principal characteristics of sand sought by ready mixed concrete manufacturers and other major sectors of the construction industry are mechanical not mineralogical. The principal, mechanical / engineering characteristics considered by the construction industry are:

- *size distribution or grading*: generally expressed in terms of percentages of various individual grain sizes passing standard sieve sizes;
- *particle strength, durability, soundness and chemical inertness*; all of which relate to particle composition and freedom from potentially deleterious and/or, unstable materials;
- *particle shape*: generally described as ranging from angular to rounded, ranging through sub-angular to sub-rounded;

- *sand colour:* generally determined by past or present presence of iron, manganese and/or organic compounds.

- *uniformity:* of grading, strength, durability, soundness, chemical inertness, particle shape, and colour.

The Stockton Bight sands are finely graded meaning that they generally need to be blended with coarser sands (generally sized -5 +0.5mm) in the manufacture of ready mixed and other concrete products. The quartz sand particles are strong, durable, sound and generally inert. Their sub-rounded particle shape is ideal for most of the above listed 'construction sand' uses. The range of colours (after processing) is acceptable to nominated uses. Uniformity of colour, grading, etc is achieved via selective extraction, blending and quality assurance.

Sands from existing quarries located adjacent Lots 218 and 220 also have a history of use as industrial sands. Sands from Quality Sand and Ceramics (abutting the NW perimeter of Lot 218 at Williamstown) and Unimin (abutting Lot 220 at Salt Ash) have been extracted, processed and sold principally as foundry sands and amber graded glass sands. They have also been sold:

- into the chemical industry for the manufacture of grouts, adhesives and coatings;
- into the construction industry for the manufacture of roof tiles, brick coatings; and
- for the manufacture of fibre glass

The generally yellowish and/or brownish colour of the Salt Ash sand deposits rules out the use of the sand in the manufacture of clear glass and a range of other products. Unimin extracts the majority of their white sand from Tanilba and Anna Bays for processing and sale to these other market segments.

7. EXTRACTABLE SAND RESERVES – LOTS 218 AND 220

Lot 220

In the absence of detailed geological modelling, topographic survey and/or extraction planning for Lot 220, DRA has relied upon:

- Rule of thumb calculation based on cadastral survey information and assumptions in relation to average depth of extraction, buffer zones, batters, sand yields, etc.

- A quantity survey undertaken by Paul Le Motte Project Management Pty Ltd for Grafil Pty Ltd in February 2004. It is understood that the survey was commissioned at the request of the Department of Planning.

The DRA estimate assumes:

- 1.35M m² total surface area;
- 20m average depth of extraction;
- 60% sand extractable after allowance for roads, buffers, batters, etc;
- in-situ sand density of 1.5 tonnes per m³;
- product yield of 95% after processing..

Using this very preliminary approach I estimated extractable sand reserves of 16.2M bank cubic metres (BCM). This figure compares with Le Mottes estimate of 15.2M bcm. In this report I have adopted the mid point figure of 15.7M bcm. If a more accurate calculation of reserves is required, full topographic survey and 3D computer based modelling will be required. Modelling will have to take account of all planning and environmental restraints.

Lot 218

My calculation of extractable reserves on Lot 218 takes account of assumptions used for detailed modelling completed for part of the Lot 218 resource in December 2003. That modelling was based on detailed topographic survey, reliable geological date and 3D computer based modelling. Principal assumptions were that:

- extraction to be limited to within a 150m wide strip along the northern perimeter of the dune;
- depth of extraction to range 10-30m depth from existing surfaces, down to 2m AHD;
- the excavated batter to be at angle of natural repose, say about 42°.

I have pro-rated previous calculations to conclude an initially extractable resource (along the northern perimeter only) of 8M BCM.

Preliminary estimates of extractable sand reserves and product yields are summarised in the following table.

Table 2 Estimated Reserves of Extractable Sand – Lots 218 & 220

Lot No.	Reserves (m³ in situ)	Product Yield (Tonnes) (bcm x 1.5 x 95%)
Lot 218	8,000,000	11,400,000
Lot 220	15,700,000	22,400,000
Total	**23,700,000 m³**	**33,800,000 tonnes**

Tabled reserve figures represent less than 25% of an estimated 150M tonnes of extractable sand estimated present within the whole of the two Lots.

8. HISTORICAL AND FUTURE DEMAND FOR STOCKTON BIGHT SAND PRODUCTS

A more detailed analysis of market supply and demand is attached as Appendix B. Set out below is a summary of historical and predicted supply of fine dune sand from quarries located in the Stockton Bight area during the periods 2002/03 to present and from 2007/08 through to 2015. The summary also provides a summary of demand from local, regional and Sydney markets during the same periods of time. The summary highlights the shortage of sand currently available from the Stockton Bight area and dire situation facing Hunter Valley and Sydney markets if approvals for further sand extraction at Salt Ash and Williamstown are not forthcoming.

The Situation in 2002/03

- Seven companies operated 10 sand quarries, with Unimin operating four.
- Total sales from the 10 quarries were 1.55M tonnes of which 1.28Mt was sold as construction sand and 0.27Mt was sold as industrial sand.
- A total of 0.93Mt of construction sand was sold into regional markets with the balance sold into Sydney markets.
- Almost all of the 0.27Mt of industrial sand was sold as glass sand into Sydney.

The Situation in 2005/06

- Six companies operated 8 sand quarries, with Unimin operating 3.
- Total sales from the eight quarries were 1.425M tonnes of which 1.15Mt was sold as construction sand and 0.275Mt was sold as industrial sand.
- A total of 0.75Mt of construction sand was sold into regional markets with the balance sold into Sydney markets.
- Almost all of the 0.275Mt of industrial sand was sold as glass and into Sydney.

The Situation Today

- Four companies operate 7 quarries (Unimin x 3).
- Total sales from the seven quarries will be about 1.56Mt of which about 1.05Mt will be sold as construction sand and 0.51Mt will be sold as industrial sand.
- An estimated 0.8Mt construction sand will be available for sale into regional markets with the balance being sold into Sydney markets.
- The three companies producing construction sand (Boral, Tolls & Grafil), have current approvals to extract about 5.65Mt of which about 75% (4.2Mt) is controlled by one company, Boral, who supply the bulk of sand internally, ie, to Boral concrete plants in and outside the Hunter.

- Unimin is understood to control about 2.3Mt of reserves with approval for extraction at its 3 sites, with less than two years reserves at Salt Ash.

The situation today is best summarised in the following Table 3, extracted from Appendix B.

Table 3 Current Regional Quarry Sales, Reserves & Operational Lives

Quarry Operator	Quarry Location	Current Sales (TPA)	Sand Reserves	Potentiall Quarry Life
Boral	Fullerton Cove	400,000	4.2Mt	10 yr
Toll	Williamtown	400,000	1.2Mt	3 yr
Grafil	Salt Ash	250,000	0.25Mt	1 yr
Unimin	Salt Ash	350,000	0.7Mt	2 yr
Unimin	Tanilba Bay	80,000	0.8Mt	10 yr
Unimin	Anna Bay	80,000	0.8Mt	10 yr
	Construction Sand	**1,050,000**	**5.65Mt**	
Totals	**Industrial Sand**	**510,000**	**2.30Mt**	

Note that figures have been calculated for the mid point of the current financial year, 2007/2008.

The Situation in 2010/2011 (With No Additional Reserves Approved)

- Only one operator (Boral), will have any significant remaining reserves of extractable sand in the Stockton Bight region for supply to the construction industries in the Hunter and Sydney regions. It can be expected that Boral (who will have remaining reserves of about 3Mt at Fullerton Cove) will supply up to a maximum 0.5M tpa of fine construction, predominantly to their own ready mixed concrete plants located in the Hunter and surrounding regions.

- At the same time the Penrith Lakes Development Coorporation (PLDC) will have closed down its fine sand processing plant (during financial year 2008/2009), leaving Sydney markets to source an additional 0.6M tpa of fine sand from outside the Sydney Metropolitan area. The two closest sources will be Dunmore (120km south of the Sydney CBD) and the Stockton Bight, 190km north of the Sydney CBD. Reserves at Dunmore are limited to 8Mt (today) and are controlled by Boral. It is understood that Boral will process, blend and sell about 0.4Mtpa of fine sand out of Dunmore. Such policy will allow them to blend their fine sand with hard rock crusher dust (from their adjacent hard rock quarry at a 2:1 ratio) in a balanced operation that will see both their fine sand and hard rock resources exhausted in about 2028.

- Unimin is expected to have exhausted remaining reserves of fine sand at their Salt Ash quarry, as early as 2008/2009, leaving them with less than 1.5Mt of total reserves at their Tenalba and Anna Bay quarries.

The Situation in 2015 (If No Additional Reserves Approved at Stockton)

- By this time reserves at Boral's Fullerton Cove quarry will be limited to about three years supply of construction sands at 0.4M to 0.5M tpa.

- Reserves at Unimin's two remaining pits at Tenalba and Anna Bay will be less than 1M tonnes if no further approvals are forthcoming.

- At the same time Sydney's main source of fine sand, Kurnell, is expected to cease supply leaving Sydney-Metropolitan area markets looking for an additional 1.2M to 1.6M tpa of fine sand.

- As noted above, the only two sources of fine sand with approval for extraction will be located at Dunmore in the south and Fullerton Cove in the north. Even if I am wrong about Boral concentrating supply to vertically integrated concrete plants, the company has approval to extract up to 0.8M tpa at Dunmore and 0.5M tpa at Fullerton Cove. At these rates of extraction they would exhaust remaining reserves of fine sand in 2018 and 2016, respectively.

Thus the situation in about seven years time (2015), will be critical if no further sand becomes available at Stockton. Under these circumstances:

- The Hunter region will be looking for 0.8M to 1.0M tpa fine construction sand;
- The Sydney Metropolitan area markets will be looking for more than 2.0M tpa replacement fine construction sand; and
- Industrial sands markets will be facing a critical shortage of suitable quality sands for use in foundries and in the manufacture of glass, fibre glass, grouts, adhesives and coatings.

Whilst undertaking research for this report I have reviewed files filled with correspondence from end users and suppliers, all of whom are extremely concerned about the current and pending shortages of fine dune sand as deposited at Salt Ash. The contents of those files do nothing but substantiate the critical nature of pending shortages and the awareness of pending shortages amongst suppliers and end users alike. Key issues raised in correspondence include:

- Acknowledgement since 2000 of the regional significance of the glass sand deposits on Lot 220 by the NSW Department of Minerals and Energy (reciprocated by the NSW Department of National Parks & Wildlife Service).

- Enquiries for supply of 70,000 tpa of glass sand to Pilkington Australia and a further 25,000 to 75,000 tpa to Unimin.

- Enquiries for supply of in excess of three million tonnes of fill sand to regional projects over the last 12 months. Projects include; WesTrack Tomago, Kooragang Island sub station, Cormorant Rd Kooragang stages 1 & 2, and the Fern Bay retirement village.

- Letters from current suppliers (Grafil and Tolls) to clients and potential clients, advising of existing shortages and current or pending inability to supply.

- Letters of concern from cartage contractors in relation to current shortages and pending cessation of sand supply. Letter sighted came from Quinlan Bulk Haulage, AH & PJ Snedden, Coast Regional Transport, IA & VP Robertson and Major Metals NSW.

- Letters of concern from current buyers in relation to current shortages and pending cessation of sand supply. Correspondence included letters signed by: AV Jennings, Vieband P/L, Pt Stephens Gardenland, McDonald Jones, Ellerston Pastoral Co, Brookvale Mini Crete, Advantage Aggregates, Bisahawk P/L, Parklea Sand & Soil and Pipe Line Coating P/L.

The 'bottom line' is that replacement fine sand must be made available to end users of fine construction and industrial sands. The most obvious replacement sources of quality fine sands for Hunter Valley and Sydney markets are the fine dune sands such as those located on Lots 218 and 220 at Salt Ash. Again it is stressed that sands from both Lots need to be extracted and processed for separate construction and industrial sands markets.

9. HISTORICAL, CURRENT AND FUTURE VALUE OF STOCKTON BIGHT SAND PRODUCTS

Within the quarrying industry, selling prices are nominated as either:

- 'ex-bin' - loaded on truck at the quarry and before transport; or
- 'delivered' – comprising the ex-bin and transport costs at point of delivery.

The best indicator of the current and future value of Stockton Bight sand products is to analyse recent trends. In 2000/2001 the average ex-bin value of dry screened dune sand was about $6.00 per tonne. By end 2005 this figure had increased 50% to about $9.00 per tonne. At the same time the weighted average sales value of all construction sands (dry screened, washed, etc) was calculated at about $10.80 per tonne with the average price of industrial sand ex Salt Ash calculated at $22.50 per tonne. The current weighted average, ex-bin selling price for construction sand is reported in excess of $12.40 per tonne, an increase of 15% over the last 2½ years.

Price increases over that five year period reflected the strengthening position of Stockton Bight sands within a maturing market increasingly affected by diminishing sources of supply. Stockton Bight quarries now sell fine construction sands into the Hunter Valley, New England, mid north Coast and Sydney Metropolitan area markets.

During the same period of time, prices for fine construction sand at Kurnell in Sydney increased from an average $9.00 per tonne to $15.00 per tonne. The ex-bin price of sand ex Penrith Lakes at end 2005 ranged $19 to $21 per tonne, averaging about $20 per tonne. These figures represent increases of 66% and 33% respectively over the five year period.. Increases in Sydney prices are a direct reflection of diminishing supply into a steady growth market.

The dramatic increases in the ex-bin selling prices of sand in Sydney and the Stockton Bight areas are in my opinion merely a conservative indicator of 'things to come' if alternative resources are not made available for extraction, processing and sale in proximity to both markets, particularly the Sydney Metropolitan area.

Recent increases in ex-bin selling prices are only part of the full cost of sand equation. As replacement sand resources are approved for extractive industry further and further away from end markets, the cost of truck and/or rail delivery increases and in many cases represents more than 50% of delivered costs. It is the increases in delivered costs that affect the end user.

Under normal circumstances, the cost of truck transport from Stockton to Sydney would be expected to cost in the order of $0.12 to $0.15 per tonne, per km, ie, about $23.00 to $28.50 per tonne, delivered. Trucking costs can and have been halved by back-loading with trucks typically delivering scrap metal to Newcastle and returning to Sydney loaded with sand ex Stockton. Resultant delivery costs of $12.00 to $14.00 per tonne are often only marginally higher than equivalent delivery costs ex Kurnell and the PLS into Sydney Metro area markets.

Major increases in ex-bin prices for construction sands from Stockton Bight [quarries] into Sydney will come when shortfalls begin to occur in supply from Penrith Lakes and/or Kurnell. From that time onwards it is quite conceivable that ex-bin prices will escalate rapidly, in current dollar terms.

The ramifications for buyers in Hunter Valley and Sydney markets are obvious. What is also obvious is that even greater increases will be incurred if the sand has to come from an even greater distance than the Stockton Bight. This will be the situation if additional sand is not made available at Salt Ash, Williamstown and/or elsewhere in the Stockton Bight area. Whilst there is no obvious replacement for the fine river and dune sands currently sold out of Penrith Lakes and Kurnell into Sydney markets, there are obvious replacements in the Hunter Valley region, most notably at Salt Ash and Williamstown.

10. THE COMMERCIAL VALUE OF THE SALT ASH & WILLIAMSTOWN SANDS TO REGIONAL ECONOMIES

The following comments are offered on a generalised basis only as it would take a full socio-economic analysis to fully qualify and quantify all of the direct and indirect benefits flowing from the continued quarrying of sand from the Stockton Bight quarries in general and the Salt Ash quarries in particular. Any detailed analysis would need to take into account a range of issues including the following:

- The financial and social impact on the Worimi (under the terms of the negotiated leases), if Lots 220 and 218 are not quarried.

- The number of existing and expanded workforce directly employed by Grafil to extract, process and sell construction and industrial sands from Lots 218 and 220 at Salt Ash and Williamstown respectively.

- The number of company employed truck drivers employed to deliver sand to regional and Sydney markets.

- The number of sub-contracted truck drivers delivering sand into regional and Sydney markets, including those back-loading sand into Sydney after delivering scrap metal and other materials from Sydney to Newcastle.

- The impacts on the cost of delivering scrap to Newcastle if sand is no longer available to subsidise transport costs by back-loading.

- The impact on a number of end-users (including industrial sands users, resellers, horticulturalists, landscapers, independent concrete producers, etc) in the Hunter Valley region if the sand is no longer available.

- The impact on local tradesmen (mechanics, electricians, fitters, etc) and services (consultants, accountants, lawyers, stationery suppliers, computer services, couriers, etc) in the region if the sand is no longer available

11. CONCLUSIONS AND RECOMMENDATIONS

In summary:

- The fine dune sand resources on Lots 218 and 220 at Salt Ash are regionally and state significant by state government and private sector benchmarks.

- The availability of concurrent supply of construction and industrial sand products from Lots 218 and 220 respectively, is critical in the short term to both industry segments and the end users of their products.

- These first two conclusions have been drawn by the Department of Mineral Resources and recognised by other state government departments (including the NSW National Parks and Wildlife Service and the Department of Planning) for at least the last five to eight years.

- The socio-economic downsides of not re-zoning the properties for extractive industry are substantial as detailed on pages 11 to 13 above. Apart from the obvious impact on the Worimi, disadvantages will attach to lost employment, reduced income to local services and substantial increase in costs (to manufacturers and end-users alike) of a significant range of industrial and construction sand products.

- My only recommendation is that re-zoning be formalised as soon as possible so that requisite studies can be undertaken / finalised to determine and confirm the environmental viability of the proposed extractive industries on Lots 218 and 220.

APPENDIX A

Curriculum Vitae - Summary

Donald Kenneth Reed

QUALIFICATIONS: Bachelor of Science (Earth Sciences), Macquarie University, 1972

AFFILIATIONS: Fellow, Institute of Quarrying,
Fellow, Australasian Institute of Mining and Metallurgy

EXPERIENCE:

DON REED & ASSOCIATES PTY LTD (1987 to date)

Consultant to the extractive industries providing a comprehensive package of project analysis, planning and management services encompassing market research; resource evaluation; mine planning; plant design; materials handling; landfill planning; commercial feasibility and project management. Don Reed has significant experience in the Land and Environment Court.

Clients include federal, state and local governments; major and independent quarrymasters; earthmoving contractors; merchant and retail banks; multinational accountancy firms; mining companies; legal firms; rural landowners and others. DRA has acted as specialist consultant to the extractive industries for engineering and planning companies such as Sinclair Knight, Mitchell McCotter, Connell Wagner, Maunsells and Golder Associates.

TNT AUSTRALIA PTY LTD (1985 - 1987)

National Manager - Projects and Development.

PIONEER CONCRETE NSW PTY LTD (1984 - 1985)

State Manager, Quarries. General management of hard rock quarries at Bass Point and Wallgrove, sand and gravel operations at Penrith Lakes and Kurnell and new project development. Member of Quarrymasters Association and the management committee of the Penrith Lakes Development Corporation (PLDC).

PIONEER CONCRETE SPAIN (1980 - 1984)

General Manager - Quarry Division, Spain with operational and developmental responsibilities in Barcelona, Madrid, Seville, Las Palmas, Bilbao, Malaga and elsewhere. Regular travel throughout Europe, UK and USA to observe technological advances within the extractive industries.

PIONEER CONCRETE ISRAEL (1977-1980)

General Manager - Quarry Division with responsibility for existing quarries (Tel Aviv) and greenfields development (Negev and north).

PIONEER - BORHAM LIGHTNING (1977)

Assistant General Manager responsible for concrete and quarries.

BORAL (1974 - 1977)

Assistant, then Group Geologist for NSW and Queensland. Promoted to assistant manager of sand and gravel operations at Richmond-Windsor and Sydney-Metro concrete plants.

Pre 1974

Employed as geologist with Zacuba Brick (1973) and Mining Advisers (1972).

APPENDIX B

CONSTRUCTION & INDUSTRIAL SAND MARKET SUPPLY & DEMAND – STOCKTON BIGHT DUNE SANDS

Historical Demand

A good indication of recent, historical demand is provided in **Table 1** which I prepared for the then Administrator of the Worimi properties in November 2005. Tabled figures were for the financial year 2002 / 2003 and (with the exception of GRAFIL totals) were derived from the annual *NSW Construction Materials* data base compiled by the DMR. Figures for GRAFIL were derived from senior DMR geologist Mr John Whitehouse and confirmed by GRAFIL director, Mr Bruce McKenzie.

Table 1 **Stockton Bight – Port Stephens Regional Quarry Sales, 2002 / 2003**

Quarry Operator	Quarry Location	Product	Tonnes	Tonnes Into Sydney
GRAFIL	Salt Ash	Wet processed construction sand	220,000	110000
		Dry screened construction sand	110,000	
			330,000	
Tolls	Williamtown	Wet processed construction sand	138,000	109,733
		Dry screened construction sand	244,379	
			382,379	
QSC	Williamtown	Loam	3,456	
		Wet processed construction sand	181,280	129,932
		Dry screened construction sand	18,670	
		Foundry sand	35,361	
			238,767	
Boral	Fullerton Cove	Dry screened construction sand	300,000	
			300,000	
Unimin	Salt Ash?	Foundry sand	4,133	
		Glass sand	6,199	
			10,332	
Unimin	Tanilba Bay	Processed construction sand	2,313	
		Glass sand	66,257	66,257
			68,570	
Unimin	Salt Ash	Processed construction sand	2,149	
		Foundry sand	18,927	15,927
		Glass sand	50,631	50,631
			71,707	
Unimin?	Anna Bay?	Foundry sand	6,982	6,700
		Glass sand	66,279	66,279
			73,261	
Robinsons	Anna Bay	Unprocessed construction sand	11,000	
		Processed foundry sand	21,000	
			32,000	
Johnsons		Unprocessed construction sand	**50,000**	
			50,000	

Unimin	**All Sites**	**Processed construction sand**	**4,462**	
		Foundry sand	**23,060**	15,927
		Glass sand	**189,366**	183,167
		Total Unimin	**216,888**	199,094
All Producers	**All Sites**	**Wet processed construction sand**	**543,742**	349,665
		Dry screened construction sand	**734,049**	0
		Foundry sand	**86,403**	22,627
		Glass sand	**189,366**	183,167
		Total – All Producers	**1,553,560**	555,459

The above-tabled figures detail regional sand production and sales by quarry operator, quarry location and product during the financial year 2002/03. The table differentiates between construction and industrial sands and shows tonnes sold into Sydney Metropolitan area markets. Whilst preparing a detailed report for the Worimi Administrator in late 2005 it was determined that the 2002/03 figures were similar to those being reported in 2003/04 and 2004/05.

Thus, the trend in regional production and sales for the period 2002/03 through to 2004/05 could be summarised as follows:

- seven operators produced and sold fine sand from a total of 10 regional quarries, located at Fullerton Cove, Williamtown, Salt Ash, Tanilba and Anna Bays;
- sales from the 10 quarries totalled 1.55M tonnes of construction and industrial sand products, of which 0.56Mt were sold into Sydney markets;
- of the total of 1.55M tonnes, 1.28Mt was sold as construction sand, 0.35Mt into Sydney markets;
- of the 1.28Mt of construction sand produced, 0.55Mt was washed, with the balance (0.73Mt) being dry screened;
- all of the construction sand sold into Sydney markets was washed
- the balance of construction sand sales (ie, 0.93Mt) were made into regional markets
- four of the 10 quarries were operated by industrial sands producers, Unimin;
- Unimin produced a total of about 215,000 tonnes of primarily industrial sand products of which 200,000 was transported to Sydney;
- of the 215,000 tonnes produced and sold, about 190,000 was sold as glass sand;
- the bulk of remaining sales of industrial sands were to foundries;

In his report dated 7th September 2007 *(Sydney Construction Materials Strategy, Port Stephens – Draft Issues Paper),* senior DMR geologist John Whitehouse stated (inter alia), that *'approximately 290,000 tonnes of glass grade sand was extracted from the*

Tanilba Bay-Salt Ash area in 1999-2000'. In the same year he reported that an additional 59,000 tonnes of foundry sand and 16,000 tonnes of other industrial sand was extracted from the Port Stephens area. These figures indicate that industrial sand sales in 2002/03 were down 0.15Mt or 41% on sales from those in 1999/2000.

Aside from that drop in industrial sand sales, the situation in 2002/03 through to 2004/05 appears to have been one where regional sand quarries were producing to meet demand. In other words, regional quarries were able to operate to their full potential, with sufficient reserves available to meet demand from regional and intra-state markets, Sydney in particular.

The situation where regional fine sand quarries were able to meet regional and state demand was slipping markedly by the second half of 2005 when Whitehouse reported:

- *'Approximately 100M tonnes of fine to medium grained sand occur in the [Stockton] Bight area suitable for all construction applications. Reserves under current development consents are in the order of 9M tonnes. At current rates of extraction these reserves are expected to last for less than 10 years[ie, to 2015].*

- *The long term supply of sand for construction purposes to the Sydney and Hunter markets from Port Stephens is dependent on the approval of new sand mining opereations. Several of the present operations in the Port Stephens area are winding down and suitable potential sand extraction sites are becoming scarce, especially for clear glass sand.'*

- *Available sand resources in the area are further constrained by the Stockton Bight Park proposal.'*

In November 2005, I prepared a report for the Administrators for the WLALC that included an analysis of regional quarry reserves, sales and remaining quarry lives. Conclusions from that 2005 study included as follows:

- Six operators were producing and selling fine sand from a total of 8 regional quarries, located at Fullerton Cove, Williamtown, Salt Ash, Tanilba and Anna Bays;

- sales from the 8 quarries totalled 1.425M tonnes of construction and industrial sand products, of which about 0.725Mt were sold into Sydney markets;

- of the total of 1.425M tonnes, about 1.15Mt was sold as construction sand, 0.4Mt of which was sold into Sydney markets;

- the balance of construction sand sales (ie, 0.75Mt) were made into regional markets

- three of the regional quarries were operated by industrial sands producers, Unimin;

- Unimin produced a total of about 275,000 tonnes of industrial sand products, the bulk of which were transported to Sydney.

At the same time I calculated remaing sand reserves at the 8 quarry sites at about 7.5M tonnes. This was a lower figure than that nominated by Whitehouse.

The following Table 2 presents the situation as I understand it today. In summary it shows:

- Three companies operating 3 sand quarries to produce slightly in excess of 1M tpa construction sand products of which about 33% is being sold into Sydney markets.

- Reserves of extractable fine sand of an estimated 5.65M tonnes of which nearly 75% are controlled by a single company, Boral.

- Sufficient approved reserves for another five to six years at currently reduced levels of productionj and sales (1M tpa), or less than four years at historical production levels of ±1.5M tpa, or less than two years at forecast levels of production including rapidly increasing demand from Sydney markets – refer detailed comment below.

- Probably less than two years reserves of industrial grade sands at Unimin's Salt Ash quarry.

Table 2 Current Regional Quarry Sales, Reserves & Operational Lives

Quarry Operator	Quarry Location	Current Sales (TPA)	Sand Reserves	Potentiall Quarry Life
Boral	Fullerton Cove	400,000	4.2Mt	10 yr
Toll	Williamtown	400,000	1.2Mt	3 yr
GRAFIL	Salt Ash	250,000	0.25Mt	1 yr
Unimin	Salt Ash	350,000	0.7Mt	2 yr
Unimin	Tanilba Bay	80,000	0.8Mt	10 yr
Unimin	Anna Bay	80,000	0.8Mt	10 yr
	Construction Sand	**1,050,000**	**5.65Mt**	
Totals	**Industrial Sand**	**510,000**	**2.30Mt**	

Future Demand From Sydney Markets

As noted, sand supply from regional quarries is dictated by demand and availability of competitively priced, quality product. Demand from regional markets has been historically consistent (within well understood parameters) and can be expected remain so. Demand from external markets (particularly from Sydney markets) can be expected to increase dramatically (and without precedent) as existing sources of fine sand are exhausted and/or otherwise sterilised.

Current sources of fine construction sand for sale into Sydney Metropolitan area markets can be simply summarised as:

- 1.2 – 1.4M TPA ex Rocla at Kurnell;
- 0.5 – 0.6M TPA ex Penrith Lakes Scheme (Boral, Hanson and Rinker);
- 0.3 – 0.4M TPA fine sand ex the Stockton Bight; and
- 0.2 – 0.3M TPA ex other sources including Dunmore, Penrose, Maroota, etc
- **2.2 – 2.7M TPA** total excluding fine-medium graded sands ex sandstone quarries.

The biggest question mark has been over future / long term supply from the **Kurnell Peninsula** where Rocla have exhausted remaining reserves on one of two leased properties and lost a 2007 appeal in the Land and Environment Court to extract additional tonnes from their own freehold property. As a result Rocla are restricted to extracting sand from a single property, ie, the Besmaw lease.

In my November 2005 report to the [Woromi] Administrator I concluded that 'given all of the possible alternatives at Kurnell, my own opinion is that Rocla will continue to supply about 1.25 - 1.5M TPA for at least the next three to five years or more, probably through to about 2010. What happens at that time will depend heavily on the availability of fine graded construction sand from alternative sources, the Stockton Bight in particular.' My conclusions at the time were in line with DMR and DOP projections.

Since reaching that conclusion in 2005 I have been involved with two major cases in the Land and Environment Court in relation to fine sand reserves and extraction at Kurnell. As part of this process I have had access to a significant quantity of confidential information and have been able to more accurately project a cessation date for sand supply ex the Kurnell Peninsula. In a report dated March 2007, sand supply ex the Kurnell Peninsula will cease by end 2015 when the only remaining reserves at fine sand on the Besmaw property will be those underlying prime coastal development land that would be substantially devalued by continued sand extraction and VENM backfill operations.'

The reference to **Penrith Lakes** is based on current shareholder projections that supply of fine sand will terminate in about mid 2012, leaving Sydney's construction materials industries to find replacement sources of supply for up to 0.6M tonnes of fine graded construction sand, per annum .

Based on the best available current information, the bottom line today is that current supply of 0.6M tpa fine sand from Penrith Lakes will cease at about mid 2012 and that current supply of 1.2 - 1.4M tpa of fine sand from Kurnell will cease at about end 2015. The compound effect of cessation of supply from these two sources will be that Sydney construction materials markets will need to find alternative sources for supply of 0.6M tpa of fine sand after 2012 and between 1.8M and 2M tpa of fine sand after 2015.

Whilst some of the Penrith Lakes shortfall will be met by supply of fine and fine-medium sands from Kurnell (in the short term) and from regional sandstone quarries, significant quantities can be expected to be imported from outside the Sydney

Metropolitan area. Apart from limited reserves at Dunmore (owned by Boral and located south of Shellharbour), the nearest alternative source of fine sand to Sydney markets is located at Stockton Bight, approximately 190km north of the city. Assuming it is available, demand from Sydney markets for fine sand from Stockton Bight can be expected to increase:

- by up to 0.6M tpa over the next 12 to 18 months;
- by up to an additional 2.0M TPA from 2015;